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EXPECTATIONS AND MONETARY POLICY SHOCKS

DOCTOR OF PHILOSOPHY DISSERTATION

SNEZANA S. EMINIDOU

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SNEZANA S. EMINIDOU

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Examination Committee:

Research Supervisor: Marios Zachariadis, Professor, University of Cyprus

Committee Member: Morten O.Ravn, Professor, University College London

Committee Member: Peter Karadi, Senior Economist, European Central Bank

Committee Member: Andros Kourtellos, Associate Professor, University of Cyprus

Committee Member: Ioannis Kasparis, Associate Professor, University of Cyprus

Declaration of Doctoral Candidate

The present doctoral dissertation was submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy of the University of Cyprus. It is a product of original work of my own, unless otherwise mentioned through references, notes, or any other statements.

Snezana S. Eminidou

Abstract

The present dissertation is comprised of three interrelated chapters which investigate the impact of monetary policy shocks on economic agents' expectations.

The first chapter is entitled "Inflation Expectations and Monetary Policy Surprises". This chapter examines how monetary policy surprises affect consumers' inflation expectations in euro area economies. A novel feature of our empirical approach is the estimation of monetary policy surprises based on changes in monetary policy that were unanticipated according to consumers' stated beliefs about the economy. We find such monetary policy surprises have the opposite impact on inflation expectations to those obtained under the assumption that consumers are well-informed. Relaxing the latter assumption by focusing on consumers' stated beliefs, unanticipated increases in the interest rate raise inflation expectations before the Crisis consistent with imperfect information theoretical settings where interest rate hikes are interpreted as positive news about the state of the economy by consumers that know policymakers have relatively more information.

The second chapter is entitled "Firms' Expectations and Monetary Policy Shocks in the Eurozone". This chapter investigates the impact of monetary policy shocks on firms' selling price and production expectations utilizing a panel structural vector autoregressive (SVAR) model for ten euro-area economies for 1999:1 to 2018:6. To identify monetary policy shocks, I utilize narrative and high frequency instruments taking into account ECB announcements regarding its policy decisions. Our estimated impulse responses indicate that firms typically revise their expectations in a manner consistent with imperfect information theoretical settings, e.g., increasing their production and selling price expectations after an unanticipated interest rate hike. Interestingly, we observe an overshooting pattern where following the initial surprise that leads firms to raise (reduce) their production and selling expectations after an unanticipated interest rate hike (M1 expansion), firms gradually come to expect contractionary (expansionary) monetary policy shocks to eventually decrease (increase) production and then inflation, thus revise their expectations accordingly by decreasing (increasing) first their production expectations and then their selling price expectations in accordance with this learning experience over time.

Finally, the third chapter is entitled "Inflation Expectations and Monetary Policy Shocks in the US". In this chapter we continue our analysis on this field by focusing on consumers' inflation expectations in the United States. We use quantitative Survey data from the University of Michigan, instead of the qualitative data that is available for the Eurozone countries. Here, we find that consumers increase their inflation expectations after an unanticipated increase in federal funds rate irrespective of the assumption that we make regarding their information set. Moreover, in the case of the US, types of individuals that are likely to be less-informed such as low income (or low educated) or with a shorter horizon (those over 54 years of age),

respond more on impact to an unanticipated increase in the interest rate as compared to more informed ones, in a manner consistent with an imperfect information setting.

Περίληψη

Η παρούσα διατριβή αποτελείται από τρία αλληλένδετα κεφάλαια τα οποία διερευνούν τον αντίκτυπο των διαταραχών της νομισματικής πολιτικής στις προσδοκίες των καταναλωτών και επιχειρήσεων.

Το πρώτο κεφάλαιο με τίτλο "Οι Προσδοκίες Για Πληθωρισμό Και Οι Εκπλήξεις Της Νομισματικής Πολιτικής". Αυτό το κεφάλαιο εξετάζει πώς οι μη-αναμενόμενες αλλαγές (εκπλήξεις) της νομισματικής πολιτικής επηρεάζουν τις προσδοκίες των καταναλωτών όσον αφορά τον πληθωρισμό στις οικονομίες της ζώνης του ευρώ. Το νέο χαρακτηριστικό της εμπειρικής μας προσέγγισης είναι η εκτίμηση των αλλαγών της νομισματικής πολιτικής που βασίζονται στις μεταβολές της νομισματικής πολιτικής που ήταν απρόβλεπτες σύμφωνα με τις δηλωμένες προβλέψεις των καταναλωτών. Βρίσκουμε ότι αυτές οι εκπλήξεις της νομισματικής πολιτικής έχουν την αντίθετη επίδραση στον προσδοκώμενο πληθωρισμό με εκείνες που προκύπτουν υπό την προϋπόθεση ότι οι καταναλωτές είναι καλά ενημερωμένοι για την κατάσταση της οικονομίας. Χαλαρώνοντας την τελευταία υπόθεση και εστιάζοντας στις δηλωμένες προσδοκίες των καταναλωτών, οι απροσδόκητες αυξήσεις του επιτοκίου αυξάνουν τον προσδοκώμενο πληθωρισμό πριν από την Κρίση. Αυτό το αποτέλεσμα συνάδει με την θεωρία της ατελής πληροφόρησης, όπου οι αυξήσεις των επιτοκίων ερμηνεύονται ως θετικά νέα για την κατάσταση της οικονομίας από τους καταναλωτές που γνωρίζουν ότι οι υπεύθυνοι χάραξης πολιτικής έχουν σχετικά περισσότερες πληροφορίες.

Το δεύτερο κεφάλαιο με τίτλο "Προσδοκίες Επιχειρήσεων και Μη-Αναμενόμενες Αλλαγές Νομισματικής Πολιτικής στην Ευρωζώνη". Το παρόν κεφάλαιο διερευνά τον αντίκτυπο των διακυμάνσεων της νομισματικής πολιτικής στις προσδοκίες των επιχειρήσεων για τις τιμές πώλησης και παραγωγής, χρησιμοποιώντας ένα μοντέλο το οποίο ονομάζεται "*panel SVAR*" για δέκα οικονομίες της ζώνης του ευρώ για την περίοδο 1999: 1 έως 2018:6. Για να εντοπίσω την "μη-αναμενόμενη" αλλαγή της νομισματικής πολιτικής, χρησιμοποιώ κάποιες επιπλέον μεταβλητές (*external instruments*), οι οποίες κατασκευάζονται με βάση τις πληροφορίες που έχει η Κεντρική Τράπεζα από τις προβλέψεις που κάνει για την οικονομία και με βάση των αλλαγών στις τιμές των επιτοκίων λαμβάνοντας υπόψη τις ανακοινώσεις της Ευρωπαϊκής Κεντρικής Τράπεζας (ΕΚΤ) σχετικά με τις αποφάσεις της. Τα αποτελέσματα τις εκτίμησης μας, δείχνουν ότι οι επιχειρήσεις αναθεωρούν συνήθως τις προσδοκίες τους κατά τρόπο συνεπή με την θεωρία της ατελής πληροφόρησης, π.χ. αυξάνοντας τις προσδοκίες τους για το επίπεδο παραγωγής και την τιμή πώλησης μετά από μια απρόβλεπτη αύξηση των επιτοκίων. Το ενδιαφέρον αποτέλεσμα που βρίσκουμε είναι ότι μετά την αρχική "έκπληξη" που οδηγεί τις επιχειρήσεις να αυξήσουν (μειώσουν) τις προσδοκίες για το επίπεδο παραγωγής και τιμής πώλησης τους μετά από μια απροσδόκητη αύξηση των επιτοκίων (επέκταση του M1), οι επιχειρήσεις σταδιακά φτάνουν στο

συμπέρασμα ότι η περιοριστική (επεκτατική) νομισματική πολιτική θα μειώσει (αυξήσει) την παραγωγή και στη συνέχεια τον πληθωρισμό, αναθεωρώντας έτσι τις προσδοκίες τους μειώνοντας (αυξάνοντας) πρώτα τις προσδοκίες για το επίπεδο παραγωγής τους και έπειτα τις προσδοκίες το επίπεδο τιμών πώλησης σύμφωνα με αυτή την εμπειρία μάθησης με την πάροδο του χρόνου.

Τέλος, το τρίτο κεφάλαιο έχει τίτλο "Προσδοκίες Πληθωρισμού και Σοκ Νομισματικής Πολιτικής Στις ΗΠΑ". Σε αυτό το κεφάλαιο συνεχίζουμε την ανάλυση μας στον τομέα νομισματικής πολιτικής και της επίδρασης της πάνω στις προσδοκίες, εστιάζοντας στις προσδοκίες των καταναλωτών για τον πληθωρισμό στις Ηνωμένες Πολιτείες. Σε αυτή την περίπτωση χρησιμοποιούμε ποσοτικά δεδομένα από το Πανεπιστήμιο του Μίσιγκαν, αντί για τα ποιοτικά στοιχεία που είναι διαθέσιμα για τις χώρες της Ευρωζώνης. Σε αυτό το κεφάλαιο διαπιστώνουμε ότι οι καταναλωτές αυξάνουν τον προσδοκώμενο πληθωρισμό μετά από μια απροσδόκητη αύξηση του επιτόκιο, ανεξάρτητα από την υπόθεση που κάνουμε σχετικά με την πληροφόρησή που έχουν στην διάθεση τους. Επιπλέον, στην περίπτωση των ΗΠΑ, οι κατηγορίες ατόμων που ενδέχεται να είναι λιγότερο ενήμεροι , όπως οι χαμηλόμισθοι ή τα άτομα με χαμηλή μόρφωση ή τα άτομα με μικρότερο χρονικό ορίζοντα (ηλικίας άνω των 54 ετών), ανταποκρίνονται περισσότερο στον αντίκτυπο σε μια μη αναμενόμενη αύξηση του επιτοκίου σε σχέση με αυτούς που είναι πιο ενήμεροι, κατά τρόπο συνεπή με την θεωρία ατελής πληροφόρησης.

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To my family

Svetozar, Kyriaki, Erlandis and Anna-Salomi

Contents

Validation Page i
Declaration of Doctoral Candidate ii
Abstract iii
Acknowledgements vii

Introduction **1**

1 Inflation Expectations and Monetary Policy Surprises **4**
1.1 Introduction 4
1.2 Data and preliminary analysis 7
1.2.1 Description of data 7
1.2.2 Preliminary analysis and testing 11
1.3 Estimating monetary policy surprises 13
1.3.1 Surprises for well-informed agents 16
1.3.2 Surprises for potentially less-informed consumers 17
1.4 The impact of monetary surprises on inflation expectations 21
1.4.1 The Estimation Model 21
1.4.2 Estimation Results 24
1.5 Conclusion 36

2 Firms' Expectations and Monetary Policy Shocks in the Eurozone **39**
2.1 Introduction 39
2.2 Data and preliminary analysis 43
2.2.1 Description of the data 43
2.2.2 Preliminary Analysis 46
2.3 Estimation of the panel proxy structural VAR model 46
2.3.1 Mean-group estimator of the panel VAR model 46
2.3.2 Construction of Instruments for the Euro Area 50
2.3.3 Identification of monetary policy shocks 54
2.4 Estimation Results 57
2.5 Robustness Analysis 65
2.6 Conclusion 75

3 Inflation Expectations and Monetary Policy Shocks in the US **77**
3.1 Introduction 77
3.2 Data and preliminary analysis 81
3.3 Estimation of monetary policy shocks 84
3.3.1 Structural VAR model 85
3.3.2 Proxy SVAR model 91
3.4 Conclusion 104

Bibliography **106**

Appendices **111**
.1 Appendix A 112
.2 Appendix B 151
.3 Appendix C 164

List of Tables

1.1 Results of a unit root and serial correlation test for monetary policy surprises derived in equation (1.1) and equation (1.2). 21
1.2 Explaining inflation expectations with the variables in equation (1.3) without regime change. 25
1.3 Estimation results of equation (1.3) with the monetary policy surprise obtained from equation (1.1). 27
1.4 Explaining inflation expectations with the variables in equation (1.4) without regime change. 28
1.5 Estimation results of equation (1.4) with the monetary policy surprise obtained from equation (1.2). 29
1.6 Estimation results of equation (1.3) with panel VAR-implied surprise. . . . 31
1.7 Estimation results of equation (1.4) with panel VAR-implied surprise based on consumers' stated beliefs. 32
1.8 Estimation results of equation (1.3) with surprise based on augmented form of equation (1.1). 34
1.9 Estimation results of equation (1.4) with surprise based on augmented form of equation (1.2). 35

2.1 Estimation results of equation (2.10) 51

3.1 Estimates of external instruments on structural monetary policy shocks derived under the assumption that consumers are well informed. 94
3.2 Estimates of external instruments on structural monetary policy shocks derived under the assumption that consumers are less informed. 95
A1 Estimation results for equation (1.1) whole sample. 112
A2 Estimation results for equation (1.1) before the Crisis. 113
A3 Estimation results for equation (1.1) since the Crisis. 114
A4 Estimation results for equation (1.2) whole sample. 115
A5 Estimation results for equation (1.2) before the Crisis. 116
A6 Estimation results for equation (1.2) since the Crisis. 117
A7 The relation of forward and backward-looking Beliefs variables with macroeconomic variables leads and lags. 118

A8 t test for equality of means for pre-Crisis versus post-Crisis period inflation expectations. . . . 118
A9 Test on the equality of variances for pre-Crisis versus post-Crisis period inflation expectations. . . . 119
A10 Kolmogorov-Smirnov test for equality of distribution functions of pre-Crisis period versus post-Crisis period inflation expectations. . . . 119
A11 Estimation results for augmented form of equation (1.1) whole sample. . . . 120
A12 Estimation results for augmented equation (1.1) before the Crisis. . . . 121
A13 Estimation results for augmented equation (1.1) since the Crisis. . . . 122
A14 Estimation results for augmented form of equation (1.2) whole sample. . . . 123
A15 Estimation results for augmented equation (1.2) before the Crisis. . . . 124
A16 Estimation results for augmented equation (1.2) since the Crisis. . . . 125
A17 Estimation results of equation (1.3) using PVAR-implied surprise based on equation (1.1) without regime change. . . . 126
A18 Estimation results of equation (1.4) using PVAR-implied surprise based on equation (1.2) without regime change. . . . 126
A19 Estimation results of equation (1.3) with surprise based on augmented equation (1.1) without regime change. . . . 127
A20 Estimation results of equation (1.4) with surprise based on augmented equation (1.2) without regime change. . . . 127
A21 Kolmogorov-Smirnov test for equality of distribution functions of pre-Crisis versus post-Crisis surprises. . . . 128
A22 Results of a Wald test for equality of coefficients of monetary policy surprises pre-Crisis versus post-Crisis. . . . 128
A23 Kolmogorov-Smirnov test for equality of distribution functions of monetary policy surprises derived in baseline model versus panel VAR model. . . . 129
A24 Kolmogorov-Smirnov test for equality of distribution functions of monetary policy surprises derived in baseline model versus panel VAR model. . . . 130
A25 Estimation results for equation (1.1) whole sample with country-specific interest rates on deposits. . . . 131
A26 Estimation results for equation (1.1) before the Crisis using country-specific interest rates on deposits. . . . 132
A27 Estimation results for equation (1.1) since the Crisis using country-specific interest rates on deposits. . . . 133
A28 Estimation results for equation (1.2) whole sample with country-specific interest rates on deposits. . . . 134
A29 Estimation results for equation (1.2) before the Crisis using country-specific interest rates on deposits. . . . 135
A30 Estimation results for equation (1.2) since the Crisis using country-specific interest rates on deposits. . . . 136

A31 Estimation results for equation (1.1) whole sample using real-time data. . . 137
A32 Estimation results for equation (1.1) before the Crisis using real-time data. . 138
A33 Estimation results for equation (1.1) since the Crisis using real-time data. . 139
A34 Estimation results for equation (1.2) whole sample using real-time data. . . 140
A35 Estimation results for equation (1.2) before the Crisis using real-time data. . 141
A36 Estimation results for equation (1.2) since the Crisis using real-time data. . 142
A37 Estimation results of equation (1.3) with monetary policy surprises obtained from equation (1.1) using country-specific interest rates on deposits, without regime change. 143
A38 Estimation results of equation (1.3) with monetary policy surprises obtained from equation (1.1) using country-specific interest rates on deposits. 144
A39 Estimation results of equation (1.4) with monetary policy surprises obtained from equation (1.2) using country-specific interest rates on deposits, without regime change. 145
A40 Estimation results of equation (1.4) with monetary policy surprises obtained from equation (1.2) using country-specific interest rates on deposits. 146
A41 Estimation results of equation (1.3) with monetary policy surprises obtained from equation (1.1) using real-time data, without regime change. 147
A42 Estimation results of equation (1.3) with monetary policy surprises obtained from equation (1.1) using real-time data. 148
A43 Estimation results of equation (1.4) with monetary policy surprises obtained from equation (1.2) using real-time data, without regime change. 149
A44 Estimation results of equation (1.4) with monetary policy surprises obtained from equation (1.2) using real-time data. 150
B1 Changes in three official ECB's interest rates at Governing Council Meetings. 152
C1 Changes in the federal funds rate around FOMC meetings (Δ ff) and level of the federal funds rate before any changes made in meeting m (ff_b) 164

List of Figures

1.1 12-month forward-looking inflation expectations balances for total consumers. 9
1.2 Distribution of inflation expectations balances of total consumers for the Euro Area, before and after Crisis. 12
1.3 Distribution of short term interest rates for the Euro Area as a whole, before and after the incidence of the recent crisis. 12

2.2 The constructed instrument for the Euro Area based on a narrative measure of monetary policy. 52
2.4 Selling price expectations' responses 59
2.5 Production expectations' responses 60
2.6 Selling price expectations' responses to interest rate hike innovation 62
2.7 Selling price expectations' responses to M1 expansion 63
2.8 Production expectations' responses to interest rate hike innovation 64
2.9 Production expectations' responses to M1 expansion 65
2.10 Selling price expectations' responses to Divisia monetary growth rates. . . . 66
2.11 Production expectations' responses to Divisia monetary growth rates 67
2.12 Selling price expectations' responses using current Euribor instrument. . . . 68
2.13 Production expectations' responses using current Euribor instrument. 69
2.14 Selling price expectations' responses using 3-month Euribor instrument. . . 70
2.15 Production expectations' responses using 3 month Euribor instrument. . . . 70
2.16 Selling price expectations' responses using as external instrument the "Pure Policy" shock. 72
2.17 Selling price expectations' responses using as external instrument the "Information" shock. 73
2.18 Production expectations' responses using as external instrument the "Pure Policy" shock. 74
2.19 Production expectations' responses using as external instrument the "Information" shock. 75

3.1 Expected change in prices during the next year for total consumers. 83
3.3 Impulse response functions based on macro variables. 89
3.4 Impulse response functions based on consumers' type-specific beliefs. . . . 90

3.6 Impulse response functions based on macro variables. 97
3.7 Impulse response functions based on type specific beliefs. 98
3.8 Impulse response functions based on macro variables for the sample 1983:1-2018:12. 100
3.9 Impulse response functions based on type specific beliefs for the sample 1983:1-2018:12. 101
3.10 Impulse response functions based on macro variables using the one year government bond rate as monetary policy indicator. 102
3.11 Impulse response functions based on type specific beliefs using the one year government bond rate as monetary policy indicator. 103
3.12 Impulse response functions to Monetary Base expansion (2007:8-2018:12). 104
B1 Selling price and Production expectations balances. 153
B2 Selling price and Production expectations balances. 154
B3 Selling price and Production expectations balances. 155
B4 Selling price expectations' responses to interest rate hike innovation for firms producing durable goods. 156
B5 Selling price expectations' responses to M1 expansion for firms producing durable goods. 157
B6 Production expectations' responses to interest rate hike innovation for firms producing durable goods. 158
B7 Production expectations' responses to M1 expansion for firms producing durable goods. 159
B8 Selling price expectations' responses to interest rate hike innovation for firms producing non-durable goods. 160
B9 Selling price expectations' responses to M1 expansion for firms producing non-durable goods. 161
B10 Production expectations' responses to interest rate hike innovation for firms producing non-durable goods. 162
B11 Production expectations' responses to M1 expansion for firms producing non-durable goods. 163

Introduction

Expectations play a central role in the macroeconomy. Monetary policymakers consider both the direct impact of their policies on economic activity or inflation as well as the indirect effect via private-sector expectations responding to changes in monetary policy, while economic agents' current economic decisions are affected by their expectations of future economic developments. Because of the resulting self-fulfilling effects on realized inflation and economic activity, expectations of economic agents should thus be seriously taken into account especially in periods where uncertainty is relatively high.

This dissertation focuses on consumers' inflation expectations, and firms' selling price and production expectations in euro area economies. In particular,in the first chapter "Inflation Expectations and Monetary Policy Surprises", we estimate monetary policy surprises for European consumers over time, based on monetary policy changes that were unanticipated according to consumers' stated beliefs. We investigate how these surprises affect consumers' inflation expectations. We find that such monetary policy surprises can have the opposite impact on inflation expectations to those obtained under the assumption that consumers are well-informed about a set of macro-economic variables describing the state of the economy. When we relax the latter assumption and focus instead on consumers' stated beliefs about the economy, unanticipated increases in the interest rate raise inflation expectations before the Crisis. This is consistent with imperfect information theoretical settings where unanticipated increases in interest rates are interpreted as positive news about the state of the economy by consumers that know policymakers have relatively more information. This impact changes sign since the Crisis and varies, e.g., across low versus high-income consumers in a manner consistent with the latter becoming rationally attentive in a period during which signal extraction is presumably more difficult and the incentive to extract information greater.

The question of how monetary policy affects inflation expectations addressed in this dissertation is an important one from a policy and theory perspective alike. On the policy side, both the European Central Bank (ECB) and the Federal Reserve (Fed) have repeatedly stated publicly over the past few years that their policies were intended to raise inflation expectations in line with its inflation objective, so as to boost current consumption and avoid a deflationary spiral.[1] Consistent with this, Yellen et al. (2016) makes the point that "theory and evidence

[1]They have both repeatedly stated their goal of achieving a two percent inflation rate in line with their

suggest that the inflation trend is strongly influenced by inflation expectations that, in turn, depend on monetary policy" and that "the broader question of how expectations are formed has taken on heightened importance."

The importance of the question regarding how monetary policy affects inflation expectations from the theory perspective is reflected in the attention it has received in a number of recent papers. Cochrane (2016a), Garcia-Schmidt (2015), Garcia-Schmidt and Woodford (2019), Del Negro, Giannoni, and Patterson (2012), and Campbell et al. (2012) suggest different theory-implied impact of monetary policy on inflation expectations depending on the theoretical model being considered. While "textbook channels" and a neo-Keynesian approach like that in Garcia-Schmidt and Woodford (2019) would associate expansionary monetary policies with a rise in inflation and inflation expectations, imperfect information-based approaches such us the abovementioned ones and the neo-Fisherian approach of Cochrane (2016b) associate lower interest rates with a fall in inflation expectations.[2] In focusing on economic agents expectations from survey data, my study fits closely into a new and growing literature studying how people process macroeconomic developments with survey data (see, for example, Coibion and Gorodnichenko (2012),Carvalho and Nechio (2014), Dräger, Lamla, and Pfajfar (2016), and Geiger and Scharler (2016)).

The second chapter, entitled "Firms' Expectations and Monetary Policy Shocks in the Eurozone". Here, we investigate the impact of exogenous monetary policy shocks on firms' selling price and production expectations, using the methodology developed by Stock and Watson (2012) and Mertens and Ravn (2013) and applying it in the context of estimating a panel VAR model. Building on the existing literature and methodologies used so far, this chapter delivers new insights both on the identification of monetary policy shocks and on the econometric framework used. In identifying monetary policy shocks, we do not make direct assumptions on structural parameters as is sometimes done in the literature, but we impose covariance restrictions from instruments that we construct for the Euro Area. I proxy the monetary policy innovations with external instruments that include additional information regarding monetary policy beyond the information contained in the estimation of the panel VAR model. Thus, following the narrative based approach of Romer and Romer (2004) and the high frequency identification approach from Gurkaynak, Sack, and Swanson (2004) and Gertler and Karadi (2015), I construct external instruments for the euro area based on ECB announcement dates. In our analysis, we find that firms typically revise their expectations in a manner consistent with imperfect information theoretical settings, e.g., increasing their production and selling price expectations after an unanticipated interest rate hike. In-

mandate. To the extent that inflation expectations have not been revised upwards in line with the stated goal and monetary policies, this would then reflect lack of credibility and absence of anchoring of inflation expectations.

[2]The latter positive link between interest rates and inflation expectations is an equilibrium outcome where the Central Bank changes rates in a manner compatible with a (rational expectations) long-run sustainable equilibrium. This rules out the possibility that the Central bank can merely fool people into increasing their inflation expectations by raising rates temporarily in a non-sustainable manner incompatible with economic fundamentals.

terestingly, I observe an overshooting pattern where following the initial surprise that leads imperfectly informed firms to raise (reduce) their production and selling expectations after an unanticipated interest rate hike (M1 expansion), firms gradually come to expect contractionary (expansionary) monetary policy shocks to eventually decrease (increase) production and then inflation, thus revise their expectations accordingly by decreasing (increasing) first their production expectations and then their selling price expectations in accordance with this learning experience over time.

Finally, my third chapter, entitled "Inflation Expectations and Monetary Policy Shocks in the US" examines the impact of monetary policy shocks on inflation expectations of consumers in the United States. The survey data we use for consumers' inflation expectations in the United States is quantitative, unlike the qualitative European survey data. In this third chapter, I estimate a structural VAR model and identify the impact of monetary policy shocks on different demographic consumer types. First, the identification of monetary policy shocks is based on the standard Cholesky identification approach. Second, given that our sample period includes the zero lower bound where the Fed adopted alternative transmission mechanisms (such us forward guidance), I estimate a proxy SVAR using the new methodology developed by Stock and Watson (2012) and Mertens and Ravn (2013) taking into account any information beyond the information contained in the VAR model. That is, I proxy monetary policy innovations with external instruments as in my second chapter. I update the Romer and Romer (2004) measure of monetary policy surprises by constructing a narrative monetary policy shock as a deviation from the policy rule, given the information set of the Central Bank as reported by internal forecasts of the Fed. I also construct a high frequency identified instrument using changes in the current federal funds futures rate around FOMC meetings dates, as in Gertler and Karadi (2015). The impulse response functions indicate that an unanticipated increase in the federal funds rate increases consumers' inflation expectations. But, the monetary policy shock has a stronger effect on impact and is more persistent for types of consumers that are likely to be less informed (low income, low educated) as compared to those who are more informed.

Chapter 1

Inflation Expectations and Monetary Policy Surprises

1.1 Introduction

An unexpected rise in the monetary policy rate can have two different effects on inflation expectations. First, if individuals view this as an unexpectedly contractionary policy, they will revise inflation expectations downward. Second, an unanticipated increase in interest rates could be interpreted by consumers as positive news about the state of the economy if they are aware that the policymaker has relatively more information[1], resulting in higher inflation expectations. In this case, the latter's action merely reveals that she is no longer worried about deflation. That is, if individuals initially possess less information than the policymaker then they learn something new about economic fundamentals by observing the realization of the Central Bank's monetary policy and revise inflation expectations accordingly. Thus, while "textbook channels" and a neo-Keynesian approach like that in Garcia-Schmidt and Woodford (2019) associate contractionary monetary policies with a fall in inflation and inflation expectations, imperfect information-based approaches such us Campbell et al. (2012), Del Negro, Giannoni, and Patterson (2012), and Melosi (2016) associate higher interest rates with a rise in inflation expectations.[2]

Distinguishing between the two theoretical mechanisms via which monetary policy might affect inflation expectations is important since the latter drive inflation realizations.[3] As Yellen

[1]For example, Gurkaynak, Sack, and Swanson (2004) find that market participants believe Central Bank announcements contain not previously known or anticipated information about future monetary policy actions, and Campbell et al. (2012) find that market participants infer that unexpected policy adjustments by the Central Bank are responses to non-public information about the future state of the economy.

[2]Campbell et al. (2012) discuss how monetary policy (forward guidance) may influence economic agents in the "Delphic" case, where it affects inflation expectations by enabling individuals to predict economic activity based on the policymaker's superior information set revealed after the latter undertakes action rather than by its anticipated direct impact on the economy.

[3]For example, the first theoretical mechanism above suggests that a higher policy rate can have an indirect

et al. (2016) points out "theory and evidence suggest that the inflation trend is strongly influenced by inflation expectations that, in turn, depend on monetary policy", noting also that "the broader question of how expectations are formed has taken on heightened importance" in recent times. This chapter empirically investigates the above-described theoretical propositions by examining directly how monetary policy surprises affect inflation expectations. This is what Cochrane (2016a) describes as "the big question".[4] In order to answer this question, we will use monthly data across fifteen euro-area economies for 1985:1-2015:3 to obtain estimates of monetary policy surprises under different assumptions, and then use these to explain inflation expectations of different types of consumers before and since the recent Crisis. In an imperfect information setting, the impact of monetary policy surprises could be different for consumers with potentially different abilities in processing information, particularly so in Crisis periods during which both the incentive to obtain information and the ability needed to obtain it are greater as compared to tranquil periods.

Furthermore, if consumers have incomplete information they might be surprised by a broader set of monetary policy changes as compared to agents that have more information about macroeconomic fundamentals. An important focus of our study will be to assess whether monetary policy surprises obtained under the assumption that consumers are well-informed about the state of the macroeconomy have different impact on inflation expectations than surprises obtained under the assumption that consumers are only as informed as revealed by their stated beliefs about the economy. Allowing for the individuals' information set to be revealed by their stated beliefs about the macroeconomy rather than assume they observe the complete set of macroeconomic variables' histories, provides fertile ground within which to further assess the empirical relevance of imperfect information-based theoretical mechanisms discussed in the above mentioned papers. Thus, surprises will be estimated as changes in monetary policy that were unanticipated according to the consumers' type-specific stated beliefs about the economy, without assuming they necessarily observe past values of a large set of macroeconomic variables. This approach to estimating monetary policy surprises has not, to our knowledge, been previously considered in the literature.

We define the unpredictable change in interest rates as a monetary policy surprise. The unpredictability of monetary policy changes and their subsequent interpretation as monetary surprises depends on how much information we assume individuals to have. A change in monetary policy is a surprise to the extent that individuals have not observed the information

negative effect on the economy to the extent that inflation expectations affect economic activity and future prices: lower inflation expectations can lead to a fall in consumption of households that postpone purchases in anticipation of lower prices and can also affect expected wage rates and real interest rates, where if a given hike in the nominal interest rate is not followed by a similar movement in inflation expectations going in the same direction in a neo-Fisherian manner, the expected real interest rate rises increasing the real cost of borrowing and acting as a demand for loans suppressant adversely affecting investment and consumption decisions.

[4]In his words "the big question is expectations. Will people read higher interest rates as a warning of inflation about to break out, or as a sign that inflation will be even lower,"and similarly **schmidt2015low** ask "is there reason ... that a commitment to keep nominal interest rates low ... will be deflationary...?" answering "there is one way in which such an outcome could easily occur, and that is if the announcement of the policy change were taken to reveal negative information (previously known only to the central bank) about the outlook for economic fundamentals" so that individuals change their inflation expectations accordingly.

set based on which they could have forecasted it prior to its arrival.[5] We will thus consider monetary policy surprises that allow for individuals to have imperfect information in addition to surprises obtained under the traditional assumption that individuals have an information set comparable to that of the policymaker.[6] In the first case, estimated residuals can be regarded as unexpected surprises to the extent that individuals' stated economic expectations leave that part of interest rate changes unexplained and implicitly unexpected. One might want to consider monetary policy surprises pertaining to individuals that are less-informed than policymakers when the goal is to explain inflation expectations of consumers rather than those of professional forecasters.[7] We note that there is no strong theoretical argument for focusing on professional forecasters' rather than consumers' inflation forecasts. As Yellen et al. (2016) recently points out, "an unresolved issue concerns whose inflation expectations-those of consumers, firms, or investors-are most relevant for wage and price setting, a point on which theory provides no clear-cut guidance." In focusing on consumers' expectations from survey data, my study fits closely into a new and growing literature studying how people process macroeconomic developments with survey data (see, for example, Coibion and Gorodnichenko (2012), Carvalho and Nechio (2014), Dräger, Lamla, and Pfajfar (2016) and Geiger and Scharler (2016)).

Having estimated conventional monetary surprises based on macro-variables' realizations and beliefs- based surprises based on consumers' expectations, we then investigate in the second stage of our empirical analysis how these impact upon inflation expectations of different types of consumers depending on their income, employment status and age, before and after the Crisis. We find that surprises based on the assumption that individuals are well-informed about the state of the macroeconomy and surprises obtained allowing for consumers to face costs in obtaining or processing information reflected in their stated beliefs about the economy, have different impact on inflation expectations. The latter typically have a positive impact on inflation expectations before the Crisis. That is, an unanticipated increase in the interest rate raises inflation expectations. This is consistent with imperfect information mechanisms where individuals have less information than the policymaker prior to an unanticipated monetary policy change. The estimated impact of these beliefs-based surprises is often negative after the arrival of the Crisis in line with "textbook" or Neo-Keynesian channels. This reversal suggests that in a Crisis period where the incentive to pay

[5]Moreover, it is a surprise relevant to particular types of individuals to the extent that these also have the incentive and ability to pay attention to the shock once it arrives, a point we do not pursue further in our current study.

[6]The often-used assumption that individuals are as informed as the CB and can thus only be surprised by monetary policy changes that also surprise the policymaker (see, e.g., Christiano, Eichenbaum, and Evans (1999), is questionable as the CB has more information about the state of the economy than private agents, e.g., it has private information about its policy goals and access to confidential data.

[7]The latter has been the focus of the recent literature on inflation expectations, including work by Campbell et al. (2012), Andrade and Le Bihan (2013) and Coibion and Gorodnichenko (2015a). While consumers' forecasts might be less accurate than professionals' forecasts, consumers' expectations provide a useful angle from which to understand the impact of monetary policy surprises on the economy, given the important role consumers play in the economy. Geiger and Scharler (2016) find professional forecasters process monetary shocks differently than households.

attention to the macroeconomy is greater, individuals become rationally attentive so that their response to surprises becomes more consistent with them observing the full set of macroeconomic variables' histories. As the ability needed to decipher macroeconomic information during the Crisis is presumably also greater, it is striking that in the period since the Crisis we find consumer types we would a priori expect to have higher ability to extract signals from a given realization such us high-income individuals, react more to monetary policy surprises than those with potentially lower ability to extract signals since the Crisis and in a manner consistent with them being well-informed.

In the next section we describe the data and make a preliminary analysis. Section 1.3 describes how we obtain our monetary policy surprises. Section 1.4 describes how we investigate the impact of these on inflation expectations for a panel of 15 Eurozone economies and presents estimation results thus obtained. The last section briefly concludes.

1.2 Data and preliminary analysis

1.2.1 Description of data

Inflation expectations

Data for inflation expectations are from the Joint Harmonized EU Programme of Business and Consumer Surveys database, which is published monthly by the European Commission (Economic and Financial Affairs) for 28 member countries. The inflation expectations for consumers used in our study are obtained from the answers of this consumer survey. The sample size of the survey varies across countries and is generally positively related to their respective population size. The consumer survey is mainly qualitative although, as of 2003, two quantitative questions are asked concerning perceived and expected price changes. In our analysis, we concentrate on qualitative data that come from around 40.000 consumers who are currently surveyed every month across the Europe. Quantitative EU data are not currently publicly available.

The database categorizes inflation expectations data according to respondents income, education, occupation and age, and we will be considering two subcategories for each of these categories. We will thus be using monthly data across fifteen euro-area economies[8] for the period 1985:1-2015:3 and potentially 5445 observations for each of the eight consumer subcategories. Given that for some countries these data are only available at a later starting date, in practice we will have less than 5445 observations for each consumer subgroup.[9] The consumer subgroups (abbreviations to be used in the tables) we focus on are: low-income

[8]These are the 19 euro-area countries minus Cyprus, Malta, Latvia and Lithuania, for reasons related to data availability.

[9]We have 4532 observations for total consumers, 4219 observations for low income and high income consumers, 4316 observations for low and high educated consumers and for full time workers, 3970 observations for unemployed consumers, and 4291 observations for consumers of ages 30-49 and ages 50-64.

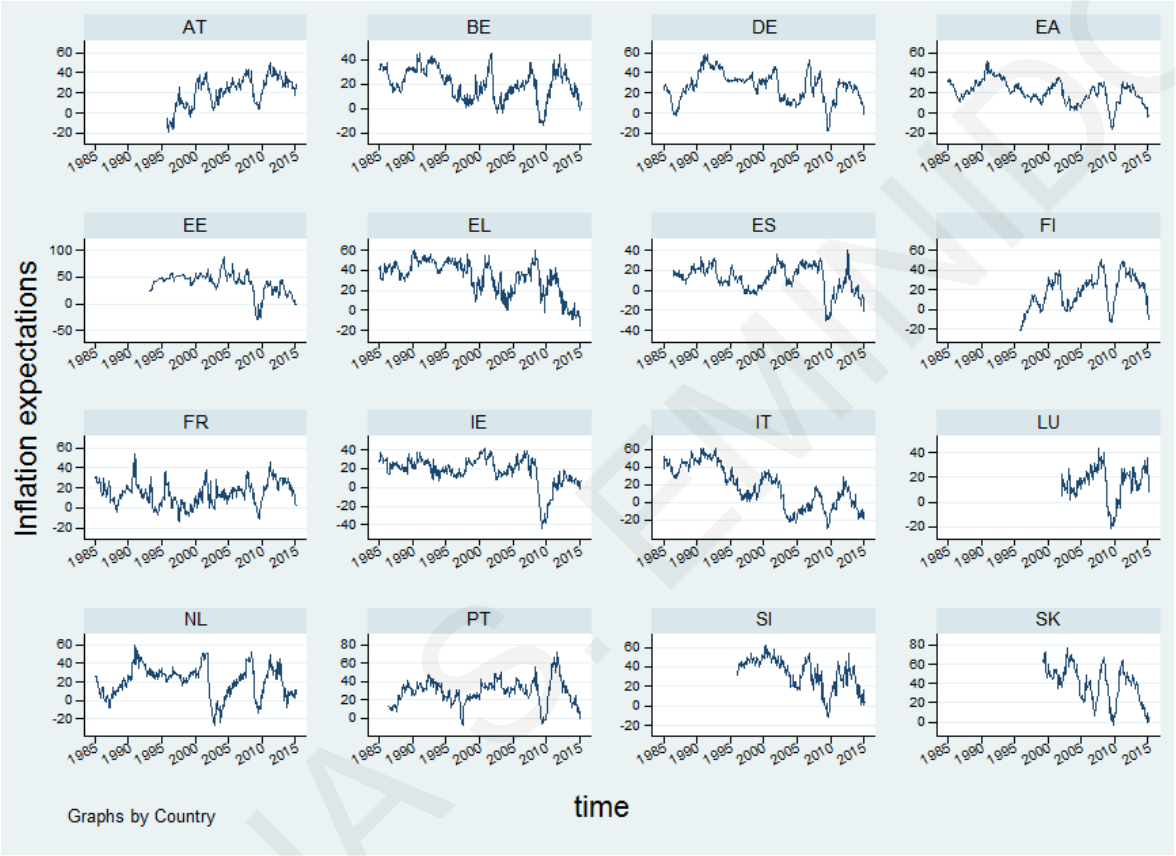
consumers (Low inc), high-income consumers (High inc), low-educated consumers (Low edu), high-educated consumers (High edu), unemployed consumers (unem), full-time working consumers (full-time), consumers with ages between 30 and 49 (30-49), and consumers with ages between 50 and 64 (50-64). Moreover, we examine the inflation expectations of total consumers (total con). The latter category includes some other subcategories that we do not examine in detail (e.g. the 2nd and 3rd quartile of income, ages between 16 - 29, secondary education, etc.). We compare expectations of consumers based on their income (or education), given that the formation of inflation expectations might well depend on the ability of the respondents to gather and interpret information. We also consider occupation status and age of consumers since the economic situation and particular point in their life cycle might lead to differences in the formation of inflation expectations.

As mentioned above, the data that the European Commission uses for inflation expectations are qualitative and are obtained from the question "By comparison with the past 12 months, how do you expect that consumer prices will develop in the next 12 months? They will..." Consumers have six options to answer this question as follows: prices will increase more rapidly (PP), increase at the same rate (P), increase at a slower rate (E), stay about the same (M), fall (MM), and don't know (N). Since the data obtained from the consumer questionnaire is qualitative, they have to be quantified. To quantify these qualitative data, we obtain the simple balance statistic defined as the difference between the proportions of respondents considered, e.g., in Nielsen (2003) and Lyziak (2009). The simple balance statistic is given as the difference between positive and negative answering options measured as percentage points of total answers, and is calculated as $B = (PP + 1/2P)(1/2M + MM)$ on the basis of weighted averages that add up to 100, $PP + P + E + M + MM + N = 100$. Thus, values range from -100, when all respondents choose the negative option to +100, when all respondents choose the positive option. The Commission calculates and seasonally adjusts the balance series that we use in our analysis.

A similar procedure is followed to calculate balances for responses to other questions that form our set of consumer type-specific beliefs. The following questions are considered for each of which consumers are given six response options. Q1: "How has the financial situation of your household changed over the last 12 months? It has ... " got a lot better (PP), got a little better (P), stayed the same (E), got a little worse (M), got a lot worse (MM), don't know (N). Q2: "How do you expect the financial position of your household to change over the next 12 months? It will ... " get a lot better (PP), get a little better (P), stay the same (E), get a little worse (M), get a lot worse (MM), don't know (N). Q3: "How do you think the general economic situation in the country has changed over the past 12 months? It has ... " got a lot better (PP), got a little better (P), stayed the same (E), got a little worse (M), got a lot worse (MM), don't know (N). Q4: "How do you expect the general economic situation in this country to develop over the next 12 months? It will ... " get a lot better (PP), get a little better (P), stay the same (E), get a little worse (M), get a lot worse (MM), don't know (N). Q5: "How do you think that consumer prices have developed over the past 12 months? They

have ... ” risen a lot (PP), risen moderately (P), risen slightly (E), stayed about the same (M), fallen (MM), don’t know (N). Finally, we consider question Q7: “How do you expect the number of people unemployed in this country to change over the next 12 months?” and responses to it “The number will ... increase sharply (PP), increase slightly (P), remain the same (E), fall slightly (MM), fall sharply (M), don’t know (N)”.

Figure 1.1: 12-month forward-looking inflation expectations balances for total consumers.



Notes: Inflation expectations balances for the euro area (EA) as a whole along with 15 euro area economies. Countries included are: Austria (AT), Belgium (BE), Germany (DE), Estonia (EE), Greece (EL), Spain (ES), Finland (FI), France (FR), Ireland (IE), Italy (IT), Luxembourg (LU), the Netherlands (NL), Portugal (PT), Slovenia (SI) and the Slovak Republic (SK).

Figure 1.1 presents the time series for expected inflation balances of total consumers over the period 1985:1-2015:3 across 15 euro area countries and the euro area as a whole. These are the 12- month forward-looking inflation expectations derived from the European Commission’s Business and Consumer Surveys database. Although expected inflation over the next 12 months varies considerably in each country, we can see from Figure 1.1 that the recent Crisis arrival has a similar impact on inflation expectations for the countries in our sample.

Inflation rates, short-term interest rates and other data

Inflation rates were obtained from OECD Stat.[10] The OECD calculates four area totals for

[10]Data available at https://data.oecd.org/price/inflation-cpi.htm.

the following product groups: all items, food (excluding restaurants), energy (Fuel, electricity & gasoline) and all items excluding food and energy. Energy refers to items "electricity, gas and other fuels" as defined under the classification of individual consumption according to purpose (COICOP 04.5) and "fuel and lubricants for personal transport equipment" (COICOP 07.2.2).

Data for short term interest rates is taken from OECD's Monthly Monetary and Financial Statistics.[11] Short term interest rates are usually either the 3-month interbank offer rate attached to loans given and taken amongst banks for any excess or shortage of liquidity over several months, or the rate associated with Treasury bills, Certificates of Deposit or comparable instruments, each of three month maturity. For all Euro Area countries, the 3-month "European Interbank Offered Rate" is used as of the date the country joined the euro. We note that short term interest rates are identical for all 15 euro area countries that we examine as of January 2011, and identical for 11 of the 15 countries (i.e., excluding Estonia, Greece, the Slovak Republic and Slovenia) as of January 1999.[12] Comparing the averages of short term interest rates before and since the Crisis for the euro area, we find that the average decreased substantially from 6.36 to 0.91. Short term interest rates have realizations of less than one percent for the first time on July 2009 and continue decreasing taking very low values up until May 2010. From May 2010, interest rates are increasing from a low of 0.7 percent until March 2012. From March 2012, short term interest rates have been decreasing gradually from values slightly less than one percent to values very close to zero. By April 2015, short term interest rates are exactly equal to zero, and they take negative values since that date. Our empirical analysis focuses on the sample 1985:1 until 2015:3, thus, the negative short term interest rates regime is excluded from our analysis.

Other variables used in our analysis are the harmonized unemployment rate for all persons, and industrial production. Both are available monthly in seasonally adjusted form from the OECD's Short-Term Economic Indicators.[13] The Food Price Index used includes Cereal, Vegetable Oils, Meat, Seafood, Sugar, Bananas and Oranges Price Indices. The data for commodity prices were obtained from the IMF's Primary Commodity Prices.[14] We also utilize the Europe Brent Spot Price FOB (Dollars per Barrel) from the THOMSON REUTERS database.[15]

[11] The link is https://data.oecd.org/interest/short-term-interest-rates.htm

[12] As of January 2001 short term interest rates become identical for 12 countries including Greece. As of January 2007 these were identical for 13 of the countries including Slovenia, and since January 2009 they were identical for 14 of the 15 countries excluding Estonia.

[13] Available respectively at https://data.oecd.org/unemp/harmonised-unemployment-rate-hur.htm and https://data.oecd.org/industry/industrial-production.htm

[14] Available at http://www.imf.org/external/np/res/commod/index.aspx

[15] Available at https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RBRTE&f=M

1.2.2 Preliminary analysis and testing

In this subsection we analyze the statistical properties of main variables we use in our estimations. We begin by examining the distribution of inflation expectations. Figure 1.2 presents the Gaussian kernel density estimates of inflation expectations' balances for the euro-area as a whole for the period before the Crisis (1985:1 - 2008:6) and for the period since the Crisis (2008:10 - 2015:3) separately.[16] Moreover, Tables A8, A9,A10 in the Appendix A, report the results of tests that we implemented for inflation expectations of different consumers' types that we examine. Particularly, implementing a t-test for equality of means and for equality of variances for pre-Crisis versus post-Crisis period, we reject the null hypothesis. Moreover, implementing a Kolmogorov-Smirnov test for equality of distribution functions of pre-Crisis versus post-Crisis period inflation expectations, we reject the null hypothesis almost for all countries and consumers' types that we examine. The choice of regimes was determined by the Andrews (1993) sup Wald test results, based on which the estimated time of the break is found to be related to the chronology of the crisis events in Europe. Details on this structural break test analysis are discussed in the next section. Comparing the kernel densities for the period before and since the recent Crisis, we see that there has indeed been a large change after the Crisis arrived. Before the Crisis the mass of the distribution is concentrated to the right, indicating that the distribution of inflation expectations is positively skewed, while since the Crisis the distribution ranges from (-20) to (+40) suggesting that the number of consumers that believe prices will decrease in the next 12 months increased considerably.

Figure 1.3 illustrates the distributions of short term interest rate for the period before the Crisis (1985:1 - 2008:6) and for the period since the Crisis (2008:10 - 2015:3) separately. Comparing these densities we find that since the Crisis, short term interest rates for the Euro Area have not only decreased substantially but that the shape of the probability distribution has also changed considerably.

[16]The aggregated balance series for the euro area are calculated by the European Commission. In particular, the Commission services (DG ECFIN) produce aggregate survey results for the EU and the euro area on the basis of the results received from the Member States. Euro-area aggregate replies to the questionnaires are calculated as weighted averages of the country aggregate replies. The weights are the shares of each of the Member States in euro-area reference series, and are smoothed by calculating a two-year moving average. The weights are usually updated every year in January. The reference series are extracted from AMECO and for the most recent period, where yearly reference series are not available, the Commission forecast is used.

Figure 1.2: Distribution of inflation expectations balances of total consumers for the Euro Area, before and after Crisis.

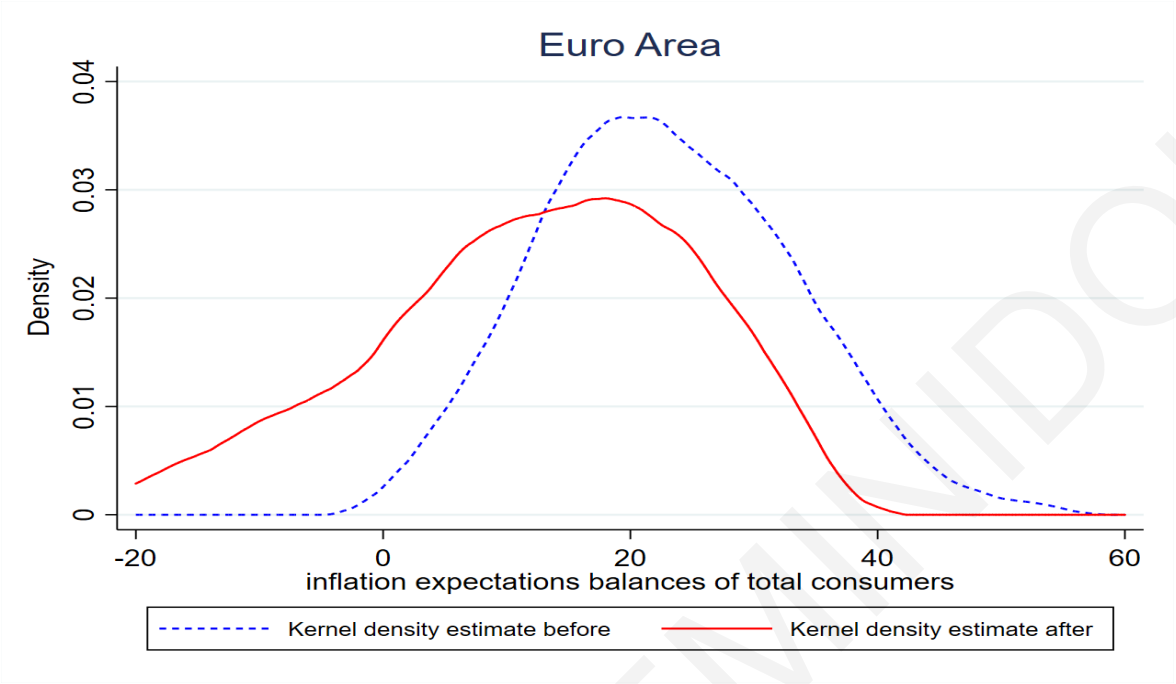
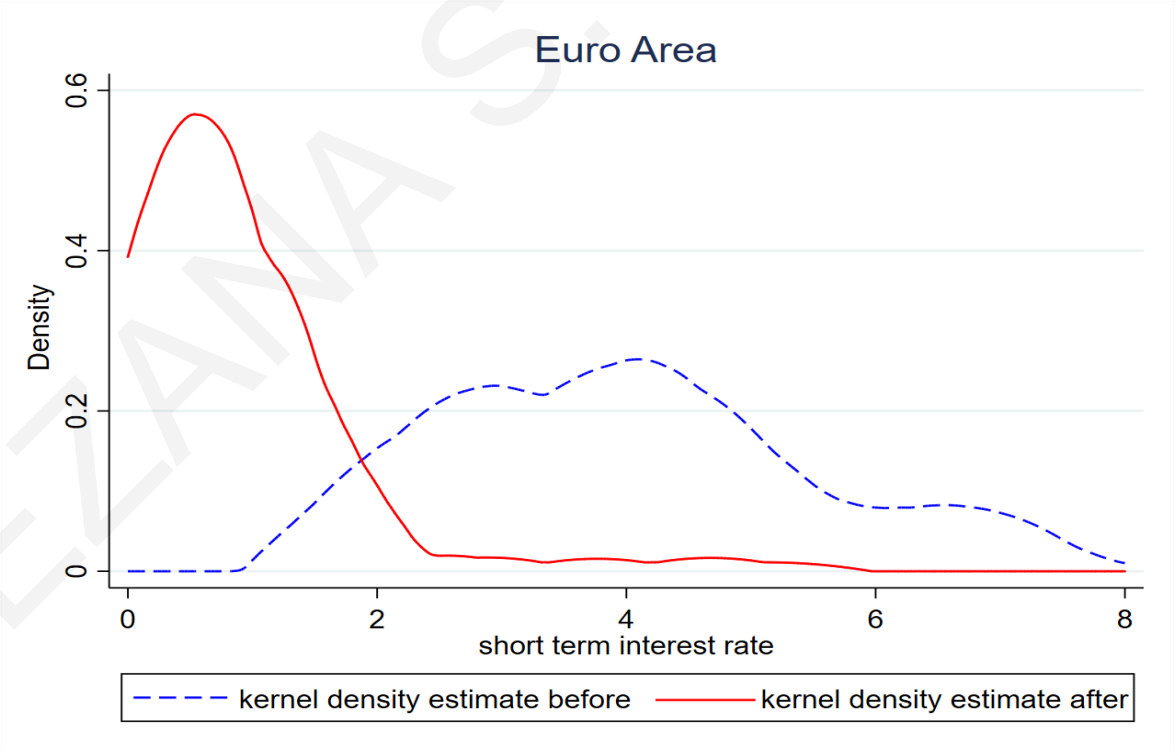


Figure 1.3: Distribution of short term interest rates for the Euro Area as a whole, before and after the incidence of the recent crisis.



To correctly specify our first and second stage regression models, we evaluated the unit root hypothesis for the variables involved in our models. Performing the Im-Pesaran-Shin (2003) panel unit root test, we find that industrial production, the unemployment rate, and commodity prices (oil and food) contain unit roots. For industrial production and unemployment

this holds for the whole sample and for the sub-sample prior to the Crisis, but not since the arrival of the Crisis. We thus take first differences of the log of industrial production and the unemployment rate for estimating our models pertaining to the whole sample and the period before the Crisis, but use these in levels in the models applied to the period after the Crisis. The Im-Pesaran-Shin (2003) panel unit root test implies that commodity prices (oil and food) contain unit roots in all different subsamples.

Thus, in line with previous related research (e.g. Christiano et al.(1999)), we smooth the log of commodity prices by removing the trend using a Hodrick-Prescott time-series filter. We take the smoothed change of these commodity prices as an explanatory variable in our first stage model estimation exercise described in the next section. For the inflation rate and for inflation expectations of different consumer types we performed panel unit root tests and strongly reject the null of a unit root for these variables, irrespective of the subsample being considered. The same holds for the short-term interest rate for which the Im-Pesaran-Shin panel unit-root test rejects the unit root null in favor of trend stationarity in all cases.

1.3 Estimating monetary policy surprises

We use a panel regression model to estimate the monetary policy surprises for each consumer type separately. Similar to Christiano, Eichenbaum, and Evans (1999), we assume that the instrument of monetary policy is the short term interest rate and that monetary policy is based on a set of macroeconomic variables that determine the policy stance. Assuming that the Central Bank controls the short term interest rate and sets it according to a reaction function which depends on a set of macroeconomic variables, then the monetary policy surprise is a deviation from the usual reaction based on the policymaker's information about macroeconomic conditions. One also needs to make some assumption about the nature of the interaction of the policy surprise with the variables in the feedback rule. Following Christiano et al.(1999) and a number of other authors before us, we assume that the monetary surprise is orthogonal to the information set and that time t variables in the information set do not respond to time t realizations of the monetary policy surprise. The recursiveness assumption along with the linearity of the feedback rule allow us to estimate monetary policy surprises from the fitted residuals of the ordinary least squares regression of the short term interest rate on the variables in the policymaker's information set. But, given that the Central Bank not only affects but it also responds to economic agents' expectations, an issue that arises estimating monetary policy surprises is endogeneity. For example, Romer and Romer (2004) derive a new measure of monetary policy shocks that is free of endogenous and anticipatory movements using the information contained in internal forecasts of the Central Bank. Kuttner (2001), Gurkaynak et al.(2005) and others use high frequency data around the Central Bank's announcement dates to capture any information around that announcement day. Hall et al. 2009 suggest that general method of moments (GMM) model and instrumental

variables can correctly deal with the standard problem of measurement error and endogeneity. In our current analysis, we take into account that the Central Bank might be responsive to inflation expectations, and thus in our robustness section we include the inflation expectations of consumers in the policy reaction function. Due to the fact that we estimate two stages least squares regression, we include only lagged values of inflation expectations but not the current values. It would be worthwhile to include current inflation expectations as well, but this could be done using other econometric methods such as GMM based on a specific theoretical model (see, for example, Stock and Watson 2018, Nakamura and Steinsson 2018. The data that we use for the monthly surveys are performed in the first two to three weeks of each month and the deadline for the delivery of consumer survey results is generally seven working days before the end of the month. While the short term interest rates are released in the second week of the month following the reference month. This indicates that the policy maker observes consumers' inflation expectations when setting its policy rate that we use in our analysis. But, it is well known that the Central Bank devotes a huge amount of resources in order to predict inflation expectations and other macroeconomic variables. In our analysis, we include current macroeconomic variables in the equation (1.1) assuming that those capture any information regarding consumers' expectations observed on that month. In future work, we will use a theoretical model to examine further the interaction between monetary policy reaction function and inflation expectations by capturing contemporaneous response of the Central Bank to current inflation expectations.

The monetary policy surprise identified from our first specification is based on the assumption that consumers are "well-informed" in that they have access to information about macroeconomic conditions comparable to the policymaker's information set, i.e., they are assumed to have the econometrician's or Central banker's information set based on the set of macroeconomic variables that describe the state of the economy. As what is deemed to be a surprise will depend on the information an individual agent has, to understand the effect of monetary policy on the economy it is important that we allow for individuals' information sets to correspond to their stated beliefs, however imperfectly measured, rather than to the econometrician's assumptions. Consistent with this rationale, we thus also estimate monetary surprises for individual consumer types relaxing the assumption that they have the complete set of macroeconomic information over time available to, say, the Central Bank, so that they can be subject to surprise by a broader set of events as compared to the set of events that can surprise a policymaker with full information about the state of the macroeconomy. In this case of potentially imperfectly or "less-informed" consumers, our estimated residuals can be described as unexpected surprises to the extent that individuals' economic expectations (beliefs) leave that part of interest rate changes unexplained.[17]

We will identify monetary policy surprises with the disturbance term from an equation like

[17]While focusing on monetary policy surprises allows us to consider consumers that might be subject to surprise by a broader set of events than well-informed agents, we note that recent monetary policy has been shifting towards forward guidance and other instruments which relate to anticipated rather than unanticipated monetary policy changes. This is thus an important current issue outside the scope of this analysis.

$r_{t,i} = f(\mathbf{X}_{t,i}) + \sigma_i v_{t,i}$, where $r_{t,i}$ is the short term interest rate at time t in country i, f is a linear function representing a feedback rule, and $\mathbf{X}_{t,i}$ is the monetary authority's information set at time t in country i which may coincide with the individual's. The random variable $v_{t,i}$ is a monetary policy surprise. We assume that $v_{t,i}$ is orthogonal to the information set $\mathbf{X}_{t,i}$ i.e. at time t, $v_{t,i}$ does not affect the elements of this information set. The set $\mathbf{X}_{t,i}$ will differ depending on whether we assume individuals to be as informed or potentially less-informed than the policy-maker. We analyze each of these two cases separately for each type and period in the next two subsections.

We will consider the total sample 1985:1 - 2015:3 and refer to this as the "model without regimes" but will also distinguish between the period before and since the Crisis in what we label as the "model with regimes". Due to the fact that our sample begins from 1985, it may include any other structural changes that occurred during that period. For example, in January 1999 national currencies were replaced with the single currency and thus the introduction of common monetary policy could cause have led to structural change in their economies. Moreover, countries that we examine joined the common monetary policy in different time periods. Thus, treating January of 1999 as the single structural break date would not be valid for countries such as Greece, Slovenia, Slovakia and Estonia, which joined the Eurozone later on. Also, those country specific changes are not picked up by the multiple break test implemented for panel data (e.g. Chow test). The only major structural change was due to the recent financial crisis. In future work we can incorporate any other structural changes that could differ across countries or focus only on the period since the introduction of a common monetary policy, something that I do in the second chapter. In my current analysis, I consider only the major structural change observed during the recent financial crisis. We define the period before the Crisis from the beginning of the sample, January 1985 until June 2008. The period since the incidence of the Crisis is from October 2008 until March 2015. We split the sample in this way for the following reasons. First, the Eurozone Crisis started around 2009 with some European economies e.g. Ireland, having already faced difficulties since 2008, especially after the Lehman brothers collapse in September of that year. Second, we performed a sup Wald test for an unknown break date (Andrews (1993)) for each country which, as expected, estimated break points in the summer and autumn months of 2008 for the different EU countries in our sample. For Euro area inflation expectations, the Andrews (1993) test estimated the endogenous date to be in August 2008. Moreover, estimating the reaction function of monetary policy, the break date for most countries is November 2008. Taking all the above results into account, we consider that the pre-Crisis period ends in the first semester of 2008. Finally, we terminate our sample in March 2015 to avoid negative values for the short-term interest rate and a potentially third regime with a very small sample. Our analysis thus concentrates on the period where short term interest rates take positive values across the euro area, to alleviate potential problems associated with the zero lower bound.

In our context, a change in monetary policy is considered a surprise to the extent that indi-

viduals have not observed the information set based on which they could have forecasted it prior to its arrival. However, there are potentially other and perhaps preferable approaches to estimating unexpected surprises or exogenous shocks. These could involve the use of narrative interest rate shocks available for the US from Romer and Romer (2004). While such narrative monetary and fiscal measures have been treated as exogenous by a number of authors, Mertens and Ravn (2014) go a step further and use (fiscal policy) narrative measures for the US in a SVAR framework that arguably does a better job towards obtaining shocks that may be treated as exogenous.

1.3.1 Surprises for well-informed agents

First, we consider that $\mathbf{X}_{\text{t,i}}$ contains a number of macroeconomic variables that proxy for the information set that policymakers and informed individuals observe at time t in country i. We assume that these are industrial production, the unemployment rate, inflation for all items, and commodity prices. This resembles the information set of Christiano et al.(1999). We also include all survey-based variables contained in vector **B** so that the less-informed agents' information set is a subset of the policymaker's or well-informed individuals' one.[18] Based on this information set, we will obtain monetary surprises relevant to well-informed consumers.

We first estimate equation (1.1) below for the whole sample period 1985:1-2015:3 to obtain the monetary policy surprise $\hat{u}_{k,t,i}^{period}$ implied by the unpredicted component of a policy reaction function. We estimate the interest rate policy reaction function given by the panel regression equation below separately for each type k

$$r_{\text{t,i}} = a_{0,\text{k}} + a_{\text{i,k}} + a_{\text{t,k}} + \sum_{j=1}^{n_{\text{k}}} a_{1\text{k,j}} r_{\text{t-j,i}} + \sum_{j=0}^{\mathbf{n}_{\text{k}}} \mathbf{a}_{2\text{k,j}} \mathbf{X}_{\text{t-j,i}} + \sum_{j=0}^{\mathbf{n}_{\text{k}}} \mathbf{a}_{3\text{k,j}} \mathbf{B}_{\text{k,t-j,i}} + u_{k,t,i}^{period} \qquad (1.1)$$

where $r_{\text{t,i}}$ is the short term interest rate for month t for country i, a_i and a_t are country and period dummies respectively, j is the lag length, and $\mathbf{n}_{\text{k}}$ is the vector with the number of time lags [19] corresponding to each variable in the information set vector $\mathbf{X}_{\text{t-j,i}}$ at time $t-j$ in country i, inclusive of the individual types' economic beliefs $\mathbf{B}_{\text{k,t-j,i}}$ described in detail in the next subsection. Consumer types k = [total con, Low inc, High inc, Low edu, High edu, unem, full-time, 30-49, 50-64] are as described in the data section. The information set includes both contemporaneous and lagged values of the following variables in addition to consumers' economic beliefs: the differenced log of Industrial Production, the differenced unemployment rate, the inflation rate, the smoothed change in the log of the price of crude

[18] The exclusion of survey-based variables contained in vector **B** from the information set of well-informed individuals does not change our results.

[19] Estimation of the above equation differs for each consumer type and time period. In this case, for both periods (and for the whole period) the number of lags used is two for all consumer types.

oil, and the smoothed change in the log of the price of food.[20] In all cases, here and in what follows, the lag length for each type was optimally chosen in the context of a panel model following the sequential approach of General to Specific (GS) by Han, Phillips, and Sul (2017).[21] We estimate the monetary policy surprise, $\hat{u}_{k,t,i}^{whole}$, implied by the unpredicted component of the short-term interest rate $u_{k,t,i}^{period}$ for the whole sample period (in Appendix A, Table A1).

We also estimate equation (1.1) separately for the period before (1985:1-2008:6) and since (2008:10-2015:3) the Crisis to obtain monetary policy surprises for the period before ($\hat{u}_{k,t,i}^{pre}$) and for the period since ($\hat{u}_{k,t,i}^{post}$) the incidence of the recent Crisis for each consumer type. Here, we allow for the general structural change hypothesis where all parameters may change across the two regimes. Noting that the recent Crisis caused a structural change in major macroeconomic variables typically found in the policy reaction function and a structural shift downwards for the short-term interest rate, we deem it essential to estimate monetary policy surprises for separate subsamples/regimes in this manner. This is supported by the evidence of a structural break discussed in section 1.2.2. While the analysis centers on dynamic panel models, which are directly related to the VAR equations[22], the robustness section shows that our results are robust to estimating a panel VAR. Panel estimation results from equation (1.1) for each consumer type (in appendix tables A2 and A3) imply that the contemporaneous impact as well as the sum of lagged variables in the information set, are more often significant since as compared to before the Crisis, suggesting that the instrument of monetary policy is affected more by the state of the macroeconomy since the Crisis.

1.3.2 Surprises for potentially less-informed consumers

Consumers are more likely than other economic agents to face some cost in obtaining information. For example, they are often simply unable to have access to the same information set as a Central Banker. We allow for such a possibility by considering that specific consumer types will be surprised by monetary policy changes which are unrelated to their type-specific beliefs about the macroeconomy. Thus, in our second specification we allow for the fact

[20] By including contemporaneous values of the variables in the information set we are assuming the policymaker observes current values of industrial production, the unemployment rate, inflation, and commodity prices. This is consistent, with Christiano, Eichenbaum, and Evans (1999) and Bernanke and Mihov (1998) but is in contrast to Sims and Zha (1995) where only lagged values are included. For our country sample, contemporaneous variables are often statistically significant and thereby constitute relevant information for estimating the unpredictable component of monetary policy. Our results in the second stage are robust to excluding the contemporaneous values of all macro variables (and the first lag of the unemployment rate and industrial production released with a two months lag by Eurostat) in estimating the monetary surprise in the first stage.

[21] This general to specific sequential testing method with a data-determined critical value has good finite sample properties, and leads to a consistent lag selection method as compared to the BIC which is inconsistent and over estimates the lag length. We allow the significance level of the test to depend on the sample size following the rule proposed by Han, Phillips, and Sul (2017) with kmax=6.

[22] This same point is made by Christiano, Eichenbaum, and Evans (1999) who note the direct mapping of the two-step procedure we use here to their VAR-based procedure. As noted there, the two procedures are asymptotically equivalent.

that individuals may have a smaller information set than that of the policymaker due to costs associated with collecting and identifying information. More specifically, we include in the consumers' information set type-specific beliefs about the economy along with lagged interest rates and the current and lagged inflation rate, rather than the complete set of past realizations of the variables in the Central Bank's reaction function. The monetary policy surprise identified in this case will be relevant for potentially less-informed consumers surprised by a wider set of monetary events as compared to agents that are well-informed about macroeconomic fundamentals.

Thus, we estimate again a panel regression equation for each type separately as follows

$$r_{\text{t,i}} = a_{0,\text{k}} + a_{\text{i,k}} + a_{\text{t,k}} + \sum_{j=1}^{n_{\text{k}}} a_{1\text{k,j}} r_{\text{t-j,i}} + \sum_{j=0}^{n_{\text{k}}} a_{2\text{k,j}} \pi_{\text{t-j,i}} + \sum_{j=0}^{\mathbf{n}_{\text{k}}} \mathbf{a}_{3\text{k,j}} \mathbf{B}_{\text{k,t-j,i}} + u_{k,t,i}^{period} \qquad (1.2)$$

where $\mathbf{B}_{\text{k,t-j,i}}$ denotes a set of individual beliefs regarding the economy based on the information set of consumer type k at time $t-j$ in country i, $\pi_{\text{t-j,i}}$ is the inflation rate at time $t-j$ for country i, $\text{r}_{\text{t,i}}$ the short term interest rate at time t for country i, a_{i} and a_{t} are country and period dummies respectively, j is the lag length and $\mathbf{n}_{\text{k}}$ is the vector with the number of time lags corresponding to each variable in the beliefs vector B.[23] The set of type-specific beliefs $\mathbf{B}_{\text{k,t,i}}$ contains balances based on the responses to the following questions: "Q1 How has the financial situation of your household changed over the last 12 months?", "Q2 How do you expect the financial position of your household to change over the next 12 months?", "Q3 How do you think the general economic situation in the country has changed over the past 12 months?", "Q4 How do you expect the general economic situation in this country to develop over the next 12 months?", "Q5 How do you think that consumer prices have developed over the past 12 months?", and "Q7 How do you expect the number of people unemployed in this country to change over the next 12 months?".

Interestingly, model (1.2) involves variables that can be considered as leads of certain macroeconomic variables. We argue that these are relevant not only because they capture the household's beliefs about the current and future state of the macroeconomy but also because our objective is to estimate the unpredictable component of interest rates. We obtain the beliefs-based monetary policy surprises $\hat{u}_{k,t,i}^{whole}$ specific to each consumer type and country i for the whole sample period 1985:1-2015:3 (in Appendix A, Table A4), but also estimate equation (1.2) for the period before (1985:1-2008:6) and since (2008:10-2015:3) the Crisis separately to obtain beliefs-based monetary policy surprises for the period before ($\hat{u}_{k,t,i}^{pre}$) and since ($\hat{u}_{k,t,i}^{post}$) the recent Crisis. The panel regression estimates from equation (1.2) (in Appendix A, Tables A5 and A6) imply that beliefs do a comparable job to macroeconomic variables in terms of relevance to the interest rate. This comes as no surprise given the close relation between these beliefs and the respective macroeconomic variables in Appendix A,

[23] The optimal number of lags based on the sequential GS approach is one for the whole sample period and for the period before the Crisis for each variable and consumer type. Since the Crisis the optimal lag length is two.

Table A7.

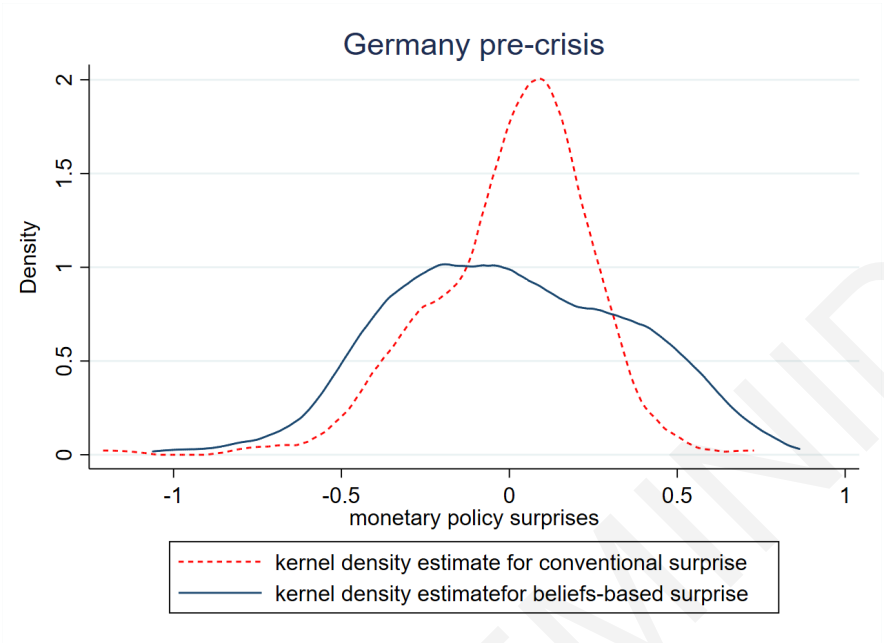
In Figures 1.4a and 1.4b, we show kernel densities of the conventional and beliefs-based monetary surprises (only for total consumers for the sake of brevity) before and after the incidence of the Crisis for the indicative case of Germany, noting that these densities resemble those of most other euro-zone economies. These kernel densities of the estimated surprises present evidence that their distribution deviates from Normality, mainly due to kurtosis and long tails.[24] Particularly, these two figures show the probability density functions of monetary policy surprises over the time period. As we can see in Figure 1.4a, the distribution of monetary policy surprises derived based on the assumption that consumers are well informed about the state of the economy differs from the distribution of beliefs-based surprises, since the latter are characterized by greater variance as compared to the former. Figure 1.4b indicates that since the crisis, the distribution of monetary policy surprises derived using two different assumptions have similar distribution. In this case, values seem to be more concentrated over the time period, with a peak at 7.5 for beliefs-based surprise, and a peak at 6.5 for conventional monetary policy surprises. Comparing Figures 1.4a and 1.4b we observe that the variance of the estimated surprises before and since the crisis differs. For example, in pre-crisis period for beliefs-based surprises we had a platykurtic distribution, while since the crisis it becomes leptokurtic. Moreover, for the pre-crisis period the highest value was 1, while since the crisis it becomes 7.5. Table 1.1 reports the null hypothesis of equality of the variances of monetary surprises before and after the arrival of the crisis, which is rejected for all consumer types irrespective of the assumptions of the consumers' information set made for estimating these surprises. Testing for panel level heteroscedasticity using the LR test for our first stage dynamic panel model rejects the null of homoscedasticity for the whole sample and subsamples, revealing two different regimes, pre- and post-crisis, in the volatility of the estimated idiosyncratic error of the first stage panel models for all consumer types.[25] Moreover, using a Smirnov-Kolmogorov test for the null of equality of the surprises' distribution before versus since the Crisis, we reject this null for almost all countries and consumer types (Appendix A, Table A21).

[24]The Jarque Bera test rejects the null hypothesis of Normality in all cases for all types of consumers in all countries.

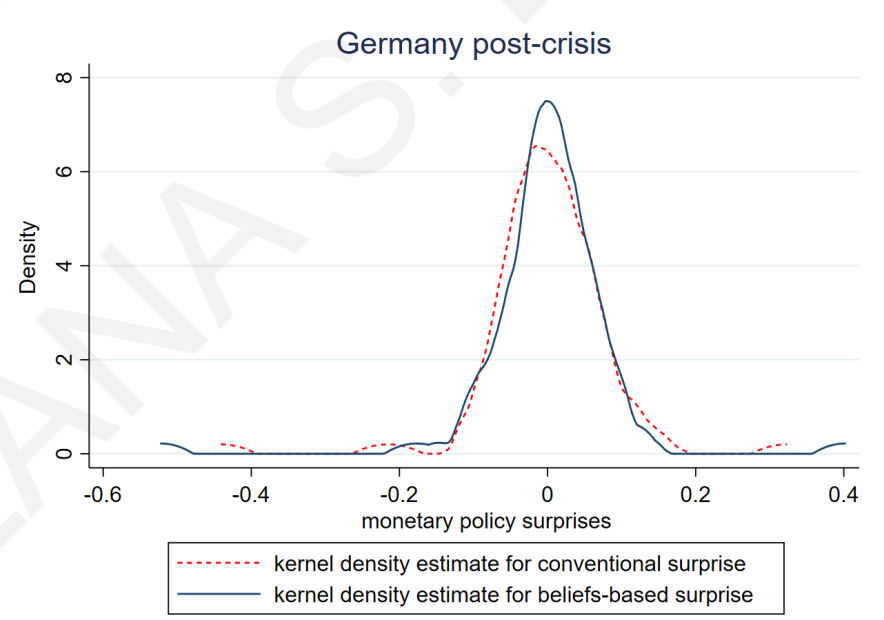
[25]Hence we report heteroskedastic robust standard errors in all first stage dynamic panel models.

Figure 1.4

(a) Kernel density estimates for conventional versus beliefs-based total consumers' surprises for pre-Crisis period.



(b) Kernel density estimates for conventional versus beliefs-based total consumers' surprises for post-Crisis period.



We examine further the properties of the residuals from models (1.1) and (1.2) used as generated regressors in our second stage models, in Table 1.1. First, we implemented the Im-Pesaran-Shin (2003) panel unit root test for these monetary policy surprises. We strongly rejected the null hypothesis for the existence of a unit root as shown in Table 1.1. Examining the serial correlation hypothesis in the residuals of the first stage panel models using the Wooldridge (2010) test, we find that the null of no serial correlation is never rejected for the

Table 1.1: Results of a unit root and serial correlation test for monetary policy surprises derived in equation (1.1) and equation (1.2).

	total con	Low inc	High inc	Low edu	High edu	unem	full-time	30-49	50-64
					More informed				
p-values:					Im-Pesaran-Shin unit root test				
eq.(1.1) whole sample	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
eq.(1.1) pre-Crisis	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
eq.(1.1) post-Crisis	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
p-values:					Wooldridge test with null of no serial correlation				
eq.(1.1) whole sample	0.504	0.569	0.563	0.572	0.587	0.586	0.574	0.582	0.566
eq.(1.1) pre-Crisis	0.492	0.560	0.549	0.550	0.581	0.577	0.557	0.570	0.543
eq.(1.1) post-Crisis	0.802	0.801	0.881	0.764	0.998	0.559	0.865	0.935	0.753
p-values:					test for equality of Variances				
eq.(1.1) pre vs post	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
					Less informed				
p-values:					Im-Pesaran-Shin unit root test				
eq.(1.2) whole sample	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
eq.(1.2) pre-Crisis	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
eq.(1.2) post-Crisis	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
p-values:					Wooldridge test with null of no serial correlation				
eq.(1.2) whole sample	0.517	0.504	0.498	0.505	0.502	0.501	0.496	0.501	0.502
eq.(1.2) pre-Crisis	0.520	0.506	0.497	0.510	0.503	0.505	0.497	0.503	0.504
eq.(1.2) post-Crisis	0.789	0.733	0.839	0.730	0.871	0.193	0.872	0.944	0.675
					test for equality of Variances				
eq.(1.2) pre versus post	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: Reported are unit root and serial correlation test p-values along with tests for the equality of variances of monetary policy surprises before versus after the arrival of the Crisis.

optimally chosen lag lengths[26] for the different consumer types and periods we consider, as reported in Table 1.1. Hence, there is no linear temporal dependence in the residuals of the first stage dynamic panel models.

1.4 The impact of monetary surprises on inflation expectations

1.4.1 The Estimation Model

What happens to inflation expectations after an unanticipated change in monetary policy? Our goal will be to answer this question in relation to different types of consumers and different time periods using a panel data model. To this effect, we examine the impact on consumers' inflation expectations of the two kinds of monetary policy surprises described in the previous section. As the formation of inflation expectations should depend on the ability of individuals to obtain and interpret information, their economic situation, and personal experiences that might differ over the life cycle (Curtin (2009)), we will consider consumers grouped based on their income, occupation and age. We thus distinguish between low and

[26]The optimal number of lags chosen for equation (1.1) is 2 lags for all sample periods we consider, while for equation (1.2) this is 1 for the whole sample and the pre-Crisis period and 2 for the post-Crisis period.

high-income consumers,low and high-educated, unemployed and full-time workers, and consumers of ages 30 to 49 and ages 50 to 64.

Well-informed agents

Expectations' formation depends on the information set consumers have. Here, we consider the case where consumers have an information set resembling that of the Central Bank. In this setting, inflation expectations are explained by lagged values of inflation expectations, current and lagged values of actual inflation and by lagged values of monetary policy surprises obtained from equation (1.1), in separate panel regressions (across 15 European economies over time) for each consumer type as follows:

$$\begin{aligned}\pi^{e}_{k,t,i} = &\sum_{j=1}^{\mathbf{n}^{pre}_{\pi^{\mathrm{e}}}} b_{1\mathrm{k,j}}\pi^{e\ pre}_{k,t-j,i} + b_{2\mathrm{k}}\pi^{pre}_{t,i} + \sum_{j=1}^{\mathbf{n}^{pre}_{\pi}} b_{3\mathrm{k,j}}\pi^{pre}_{t-j,i} + \sum_{j=1}^{\mathbf{n}^{pre}_{u}} b_{4\mathrm{k,j}}\hat{u}^{pre}_{k,t-j,i} + \\ &\sum_{j=1}^{\mathbf{n}^{post}_{\pi^{\mathrm{e}}}} b_{5\mathrm{k,j}}\pi^{e\ post}_{k,t-j,i} + b_{6\mathrm{k}}\pi^{post}_{t,i} + \sum_{j=1}^{\mathbf{n}^{post}_{\pi}} b_{7\mathrm{k,j}}\pi^{post}_{t-j,i} + \sum_{j=1}^{\mathbf{n}^{post}_{u}} b_{8\mathrm{k,j}}\hat{u}^{post}_{k,t-j,i} + \\ &b_{9k}dpost + b_i + b_t + \epsilon_{k,t,i}\end{aligned} \tag{1.3}$$

where $\pi^{e}_{k,t,i}$ captures inflation expectations for type k at time t in country i, π_t is the actual inflation rate at time t, j is the lag length, $\mathbf{n}_{\pi^{\mathrm{e}}}$,$\mathbf{n}_{\pi}$, and $\mathbf{n}_u$ are vectors with the number of consumer type-specific lags corresponding to variables π^e, π and u, $\hat{u}_{\mathrm{k}}{}^{\mathrm{pre}}$ and $\hat{u}_{\mathrm{k}}{}^{\mathrm{post}}$ are the monetary surprises for the period before and since the Crisis respectively obtained in the previous section using equation (1.1), b_{i} and b_{t} are country and period dummies respectively and ϵ_t is the error term. Moreover, *dpre* is a dummy variable for the period before the Crisis, and *dpost* is a dummy variable for the period since the Crisis.[27] Superscripts *pre* and *post* indicate that the variables included in the estimation are multiplied with dummies *dpre* and *dpost* respectively. Given the endogenous break analysis, we construct the corresponding dummy variables that define the two regimes, where *dpre* takes value 1 from 1985:1 until 2008:6 and zero otherwise, while *dpost* takes value 1 from 2008:10 until 2015:3 and zero otherwise. We are particularly interested in evaluating how the estimated model in (1.3) differs with the recent Crisis arrival and to achieve this we consider interactions of each explanatory variable with the pre and post dummies. This will help us assess the role played by the recent Crisis in how inflation expectations are being formed or react to monetary policy changes. We also estimate a version of this relation which imposes that the estimated coefficients remain the same for the complete period under study rather than allowing them to change before and since the Crisis. In this case, we utilize the monetary policy surprise

[27]Time and Crisis dummies and interactions of the latter with other explanatory variables in regression equation (2.1) and the other regression equations, capture the changing economic environment since the Crisis which involved higher uncertainty for economic agents and the use of novel or unconventional monetary and other policies.

$\hat{u_{\mathrm{k}}}^{\mathrm{whole}}$ which was estimated using the whole period time sample for equation (1.1) in the first stage.

The optimal lag length for each demographic subgroup is optimally chosen in the context of a panel model following the sequential GS approach. The latter implies that only one lag of actual inflation should be included in equation (1.3) for all demographic subgroups. This indicates that current inflation expectations of all types of consumers are affected only by contemporaneous inflation and the inflation value they observed in the previous month.[28] We do not get this clear result for other variables that we use in equation (1.3). The optimal lag length for monetary surprises or inflation expectations differs across sub-periods and demographic subgroups as we report in the tables of results that follow.

Less-informed consumers

In our second specification, we explain inflation expectations of different types of consumers with lagged values of inflation expectations, contemporaneous and lagged values of actual inflation, and with lagged values of a monetary policy surprise obtained by estimating equation (1.2) which allows for the possibility that consumers might have specific macroeconomic beliefs based on a smaller information set as compared to the policymaker. Thus, we consider a panel model to explain type-specific inflation expectations for each consumer type k separately as follows:

$$\begin{aligned}\pi^{e}_{k,t,i} = &\sum_{j=1}^{\mathbf{n}_{\pi}^{pre}} b_{1\mathrm{k,j}}\pi^{e\ pre}_{k,t-j,i} + b_{2\mathrm{k}}\pi^{pre}_{t,i} + \sum_{j=1}^{\mathbf{n}_{\pi}^{pre}} b_{3\mathrm{k,j}}\pi^{pre}_{t-j,i} + \sum_{j=1}^{\mathbf{n}_{u}^{pre}} b_{4\mathrm{k,j}}\hat{u}^{pre}_{k,t-j,i} + \\ &\sum_{j=1}^{\mathbf{n}_{\pi}^{post}} b_{5\mathrm{k,j}}\pi^{e\ post}_{k,t-j,i} + b_{6\mathrm{k}}\pi^{post}_{t,i} + \sum_{j=1}^{\mathbf{n}_{\pi}^{post}} b_{7\mathrm{k,j}}\pi^{post}_{t-j,i} + \sum_{j=1}^{\mathbf{n}_{u}^{post}} b_{8\mathrm{k,j}}\hat{u}^{post}_{k,t-j,i} + \\ &b_{9k}dpost + b_i + b_t + \epsilon_{k,t,i}\end{aligned} \tag{1.4}$$

where $\pi^{e}_{k,t,i}$ are inflation expectations for type k at time t for country i, and $\hat{u}^{pre}_{k}$ and $\hat{u}^{post}_{k}$ are type-specific monetary surprises for the period before and since the Crisis respectively, obtained using equation (1.2). Again, we also estimate a version of the above relation which imposes unchanged coefficients for the period under study rather than allowing these to be different before and since the Crisis. In this case, we utilize the type-specific monetary surprise $\hat{u}^{whole}_{k}$ which was estimated using the whole sample period for equation (1.2) in the first stage.

[28] The contemporaneous actual inflation rate is meant to capture the household's own information about inflation that comes from observing prices directly in its daily transactions, while the lagged actual inflation rate captures the inflation rate announced by statistical agencies in the month before the household is surveyed. This is consistent with Curtin (2009).

1.4.2 Estimation Results

In this section, we discuss the empirical results of the models in equations (1.3) and (1.4). In the first subsection, we discuss results based on the monetary surprise obtained under the assumption that individuals are as informed as the policymaker, and in the second subsection we discuss results based on a monetary surprise obtained by allowing for individuals to be potentially less-informed. In all cases, we consider panel regressions with time and country effects as described in equations (1.3) and (1.4). Given that the panel models described in section 1.4.1 involve monetary policy surprises which are generated as regressors from a first step regression model, we report Murphy and Topel (1985) corrected standard errors. Finally, in all cases we report standardized coefficients[29] that enable comparability of the estimates in Tables 1.2 to 1.9.

Estimates for well-informed agents

In Table 1.3, we show estimation results based on equation (1.3) where we allow the impact of the variables to differ over the two periods. That is, we explain inflation expectations of total consumers and consumer subcategories with lagged values of inflation expectations, current and lagged values of actual inflation and lagged values of the monetary surprise that was constructed in the first stage assuming that individuals are informed about a set of basic variables that describe the macroeconomy. We also estimate an equation that includes the same variables but imposes that the estimated coefficients are unchanged over the period under study. Results for the latter estimation are shown in Table 1.2.

As shown in Table 1.2, an unanticipated change in the interest rate has a negative impact on inflation expectations which is statistically significant at the five percent level for low-income consumers, and significant at the ten percent level for low-educated consumers and those with ages 30-49. That is, inflation expectations for these consumers decline after an unanticipated increase in interest rates in line with "textbook"or neo-Keynesian channels. We also note that the current actual inflation rate has a positive impact on inflation expectations of all types of consumers indicating that the latter obtain information about current inflationary trends from sources other than the official announcements pertaining to previous periods' realizations of the inflation series, as in Curtin (2009).

[29] We standardize variables by subtracting the mean and dividing with the standard deviation.

Table 1.2: Explaining inflation expectations with the variables in equation (1.3) without regime change.

	total con	Low inc	High inc	Low edu	High edu	unem	full-time	30-49	50-64
VARIABLES	π_t^e	π_t^e	π_t^e	π_t^e	π_t^e	π_t^e	π_t^e	π_t^e	π_t^e
m surp lags (2)	-0.003	-0.021**	-0.013	-0.014*	-0.006	-0.015	-0.009	-0.012*	-0.009
	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.010)	(0.007)	(0.007)	(0.008)
π^e lags (6)	0.900***	0.870***	0.880***	0.889***	0.893***	0.825***	0.897***	0.897***	0.889***
	(0.009)	(0.011)	(0.011)	(0.010)	(0.009)	(0.015)	(0.009)	(0.009)	(0.010)
π_t	0.032***	0.030***	0.032***	0.035***	0.030***	0.038***	0.033***	0.033***	0.033***
	(0.006)	(0.008)	(0.009)	(0.007)	(0.006)	(0.010)	(0.006)	(0.006)	(0.007)
lagged π (1)	0.008	0.022***	0.012	0.015**	0.014**	0.017	0.014**	0.011*	0.015**
	(0.006)	(0.008)	(0.008)	(0.007)	(0.006)	(0.010)	(0.006)	(0.006)	(0.007)
Observations	3,524	3,385	3,393	3,543	3,543	3,124	3,468	3,468	3,468
$adj.\ R^2$	0.910	0.846	0.859	0.874	0.884	0.737	0.891	0.896	0.883

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income, low and high educated, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of the monetary surprise (constructed under the assumption that individuals are well informed), on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The number of lags included for each variable are shown in brackets for case of total consumers. The optimal lag length for inflation expectations varies across consumer types. For full-time working consumers, ages 30-49 and 50-64 we use 3 lags, for low and high income/educated consumers we use 4 lags, and for unemployed we use 5 lags.

Estimation results of equation (1.3) in Table 1.3 take into account possible changes in the estimated relationships before and since the Crisis for surprises estimated from equation (1.1) obtained under the assumption that individuals are informed about a variety of variables describing macroeconomic conditions. For the period before the Crisis, the monetary surprise is negatively significant at the 10% significance level only for the inflation expectations of low-income consumers. For the period since the Crisis, the impact of the monetary surprise is negative and statistically significant at the five percent significance level for high-income consumers, full-time working consumers and for ages 30-49. While, for high-educated consumers it is negative and statistically significant at the ten percent significance level. These results are in line with individuals with different costs and benefits of obtaining information and updating inflation expectations or with different ability to use information, reacting differently to monetary policy surprises. Consumer types we would a priori expect to have higher ability to extract signals from a given realization such us high-income or full-time working consumers as compared respectively to low-income and unemployed consumers, appear to be reacting more to a given monetary policy surprise since the Crisis, a period during which signal extraction is presumably more difficult and the incentive to extract signals is greater. For high-income and full- time working consumers we get respective statistically

significant estimates of -.040 and -.034 as compared to statistically indistinguishable from zero estimates of -.019 and 0 for the low-income and unemployed consumers respectively. Moreover, individuals with a longer horizon (ages 30-49) react more to a given monetary policy surprise as compared to individuals with a shorter horizon (ages 50-64). For the period since the Crisis, we get a statistically significant estimate of -.033 for ages 30-49 as compared to a statistically indistinguishable from zero -.014 for ages 50-64. We also note that those consumer types we would a priori expect to have higher ability to extract signals from a given realization (high-income, high-educated and full-time working) or with a longer horizon (ages 30-49), respond more to monetary surprises since the Crisis as compared to before.[30] Finally, we note that looking at the average effect on total consumers does not allow us to capture this impact which appears to exhibit meaningful heterogeneity across different types of consumers since the Crisis.

The current actual inflation rate is positively related with inflation expectations before and since the Crisis. We note, however, that its impact is statistically significant for more (all) consumer subgroups and with higher coefficient estimates for the period since as compared to before the Crisis. This indicates that individuals rely more on their own information about inflation from their daily transactions since the Crisis as compared to before. We also note that the current actual inflation rate has a significant positive impact on inflation expectations that is higher than that for the lagged inflation rate. The inflation realization of the previous month typically has no statistically significant impact on inflation expectations, implying that consumers do not rely on official announcements about inflation. Given the above results regarding the effect of current and lagged inflation on inflation expectations, we infer that consumers obtain information about current inflationary trends from sources other than the official announcements that pertain to previous periods' realized values of this series. Consumers appear to rely more on their own contemporaneous information about inflation based on their daily transactions rather than on official announcements and publicly available information from previous periods regarding, e.g., past values of inflation.

[30] Performing a Wald test for the equality of coefficients of monetary policy surprises pre-Crisis versus post Crisis for each consumer type separately, we see that in the case of well-informed agents we reject the hypothesis that the impact of monetary surprises is equal between the pre-Crisis versus post-Crisis period only for full-time working consumers, while for high-income consumers and ages 30-49 this test is marginally insignificant with p-values around 0.16. Detailed results are shown in Appendix A Table A22.

Table 1.3: Estimation results of equation (1.3) with the monetary policy surprise obtained from equation (1.1).

VARIABLES	total con π_t^e	Low inc π_t^e	High inc π_t^e	Low edu π_t^e	High edu π_t^e	unem π_t^e	full-time π_t^e	30-49 π_t^e	50-64 π_t^e
m surp lags pre-Cr (2)	0.004	-0.017*	-0.011	-0.011	-0.002	-0.013	-0.006	-0.009	-0.007
	(0.010)	(0.010)	(0.011)	(0.010)	(0.011)	(0.013)	(0.008)	(0.009)	(0.010)
m surp lag after (1)	-0.012	-0.019	-0.040**	-0.014	-0.026*	0.000	-0.034**	-0.033**	-0.014
	(0.016)	(0.016)	(0.019)	(0.017)	(0.014)	(0.023)	(0.014)	(0.014)	(0.015)
π^e lags pre-Cr (2)	0.846***	0.846***	0.783***	0.839***	0.831***	0.796***	0.834***	0.825***	0.825***
	(0.009)	(0.012)	(0.010)	(0.010)	(0.010)	(0.016)	(0.010)	(0.009)	(0.010)
π^e lags after (6)	0.945***	0.865***	0.947***	0.884***	0.938***	0.858***	0.948***	0.952***	0.950***
	(0.014)	(0.018)	(0.022)	(0.018)	(0.015)	(0.029)	(0.016)	(0.016)	(0.018)
π_t pre-Cr	0.019***	0.023**	0.017**	0.023***	0.012	0.021**	0.018***	0.021***	0.017**
	(0.006)	(0.010)	(0.007)	(0.008)	(0.007)	(0.011)	(0.007)	(0.007)	(0.007)
π_t after	0.041***	0.030**	0.034	0.037***	0.037***	0.046**	0.037***	0.033***	0.045***
	(0.011)	(0.013)	(0.021)	(0.013)	(0.011)	(0.021)	(0.012)	(0.013)	(0.014)
lagged π pre-Cr (1)	0.002	0.012	0.009	0.003	0.008	0.007	0.008	0.006	0.004
	(0.007)	(0.010)	(0.008)	(0.008)	(0.007)	(0.011)	(0.007)	(0.007)	(0.008)
lagged π after (1)	0.006	0.020	-0.001	0.018	-0.001	0.020	0.002	0.003	0.013
	(0.011)	(0.014)	(0.019)	(0.014)	(0.011)	(0.021)	(0.012)	(0.012)	(0.013)
after dummy	-0.414***	-0.412***	-0.450***	-0.490***	-0.429***	-0.367***	-0.430***	-0.420***	-0.435***
	(0.051)	(0.066)	(0.075)	(0.065)	(0.055)	(0.082)	(0.051)	(0.056)	(0.057)
Observations	3,370	3,259	3,267	3,317	3,356	2,952	3,356	3,356	3,317
$adj.\ R^2$	0.912	0.849	0.862	0.874	0.885	0.735	0.895	0.899	0.886

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income, low and high educated, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of the monetary surprise (constructed under the assumption that individuals are well informed), on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies.The number of lags included for each variable are shown in brackets for case of total consumers. The optimal lag length for inflation expectations varies across consumer types. In pre-Crisis period, we use 2 lags for high income and low educated consumers, we use 3 lags for low income, high educated, full-time working consumers, ages 30-49 and ages 50-64, and for unemployed we use 6 lags. In post-Crisis, we use 3 lags for high educated, full-time working consumers and ages 30-49, 4 lags for low income, high income, low educated, and ages 50-64, and 5 lags for unemployed.

Estimates for less-informed consumers

Here, we present results from the second stage regression using the monetary surprise that was estimated in the first stage allowing for consumers to be less-informed than the policymaker. In Tables 1.4 and 1.5, we show estimation results based on equation (1.4). We find that inflation expectations rise in response to unanticipated increases in the interest rate when the latter are obtained by allowing the consumers' information set to be rejected in their beliefs about the economy that are potentially different than those of the policymaker. More specifically, in Table 1.4 the estimation results for the whole period without the regime break show that the impact of these monetary surprises is significantly positive for total consumers at the one percent level, for high educated and ages 50 to 64 at the five percent level, and for

low-income and low-educated consumers at the ten percent level. A one standard deviation unanticipated increase in the interest rate leads to a .022 standard deviation increase in the inflation expectations of total consumers.

Table 1.4: Explaining inflation expectations with the variables in equation (1.4) without regime change.

	total con	Low inc	High inc	Low edu	High edu	unem	full-time	30-49	50-64
VARIABLES	π_t^e	π_t^e	π_t^e	π_t^e	π_t^e	π_t^e	π_t^e	π_t^e	π_t^e
m surp lag (1)	0.022***	0.028*	0.013	0.022*	0.029**	-0.006	0.017	0.012	0.025**
	(0.007)	(0.017)	(0.010)	(0.012)	(0.014)	(0.010)	(0.011)	(0.008)	(0.012)
π^e lags (6)	0.908***	0.879***	0.888***	0.909***	0.899***	0.863***	0.905***	0.910***	0.903***
	(0.008)	(0.012)	(0.011)	(0.009)	(0.009)	(0.013)	(0.009)	(0.009)	(0.009)
π_t	0.034***	0.030***	0.031***	0.033***	0.030***	0.033***	0.031***	0.030***	0.033***
	(0.005)	(0.007)	(0.008)	(0.006)	(0.006)	(0.009)	(0.006)	(0.006)	(0.006)
lagged π (1)	0.010*	0.022***	0.012	0.014**	0.015**	0.021**	0.013**	0.011*	0.013**
	(0.005)	(0.007)	(0.008)	(0.007)	(0.006)	(0.010)	(0.006)	(0.006)	(0.006)
Observations	4,090	3,791	3,808	3,892	3,870	3,455	3,934	3,924	3,939
$adj.\ R^2$	0.911	0.856	0.864	0.884	0.880	0.761	0.889	0.900	0.891

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income, low and high educated, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of the type specific monetary surprise (constructed based on consumers beliefs), on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The number of lags included for each variable are shown in brackets for case of total consumers. The optimal lag length for inflation expectations varies across consumer types. For full-time working consumers, ages 30-49 and ages 50-64 we use 3 lags, for low and high income/educated we use 4 lags, and for unemployed we use 6 lags.

Allowing for the impact of the surprise to be different before as compared to since the Crisis as in regression equation (1.4), we can see in Table 1.5 that the impact of these type-specific surprises is again estimated to be positive before the arrival of the Crisis. This positive impact of the monetary surprises before the Crisis, is significant for most consumer types, except for ages 30-49 and the unemployed. For total consumers this impact is significant at the one percent level, for low-income, high-educated consumers at the five percent level, and for high-income, low-educated, full-time working consumers and ages 50 to 64, at the ten percent level. Here, a one standard deviation unanticipated increase in the interest rate leads to a .026 standard deviation increase in the inflation expectations of total consumers.

Table 1.5: Estimation results of equation (1.4) with the monetary policy surprise obtained from equation (1.2).

VARIABLES	total con π_t^e	Low inc π_t^e	High inc π_t^e	Low edu π_t^e	High edu π_t^e	unem π_t^e	full-time π_t^e	30-49 π_t^e	50-64 π_t^e
m surp lag pre-Cr (1)	0.026***	0.033**	0.019*	0.027*	0.033**	-0.009	0.021*	0.016	0.035*
	(0.009)	(0.016)	(0.011)	(0.014)	(0.016)	(0.011)	(0.011)	(0.011)	(0.018)
m surp lag after (1)	-0.020	-0.027	-0.061**	-0.024	-0.040**	0.014	-0.038*	-0.035*	-0.030
	(0.022)	(0.022)	(0.025)	(0.023)	(0.019)	(0.032)	(0.020)	(0.019)	(0.020)
π^e lags pre-Cr (3)	0.854***	0.875***	0.824***	0.896***	0.850***	0.856***	0.863***	0.865***	0.867***
	(0.008)	(0.016)	(0.012)	(0.011)	(0.010)	(0.013)	(0.010)	(0.009)	(0.010)
π^e lags after (6)	0.960***	0.836***	0.942***	0.851***	0.941***	0.835***	0.931***	0.934***	0.928***
	(0.014)	(0.017)	(0.021)	(0.016)	(0.015)	(0.028)	(0.015)	(0.015)	(0.016)
π_t pre-Cr	0.023***	0.026***	0.017**	0.024***	0.015**	0.017*	0.019***	0.019***	0.023***
	(0.006)	(0.009)	(0.007)	(0.007)	(0.007)	(0.009)	(0.007)	(0.006)	(0.007)
π_t after	0.042***	0.030**	0.035*	0.037***	0.037***	0.045**	0.036***	0.034***	0.044***
	(0.011)	(0.012)	(0.021)	(0.012)	(0.011)	(0.020)	(0.012)	(0.012)	(0.013)
lagged π pre-Cr (1)	0.006	0.014	0.010	0.004	0.010	0.013	0.007	0.007	0.005
	(0.006)	(0.009)	(0.007)	(0.007)	(0.007)	(0.010)	(0.007)	(0.006)	(0.007)
lagged π after (1)	0.004	0.018	-0.006	0.016	-0.001	0.018	0.002	0.002	0.009
	(0.011)	(0.014)	(0.019)	(0.014)	(0.012)	(0.021)	(0.012)	(0.012)	(0.013)
after dummy	-0.475***	-0.394***	-0.465***	-0.511***	-0.464***	-0.397***	-0.443***	-0.436***	-0.430***
	(0.052)	(0.064)	(0.075)	(0.063)	(0.055)	(0.080)	(0.050)	(0.055)	(0.056)
Observations	3,950	3,678	3,696	3,780	3,758	3,325	3,836	3,826	3,782
adj. R^2	0.914	0.860	0.868	0.888	0.883	0.764	0.893	0.904	0.894

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income, low and high educated, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of type specific monetary surprise (constructed based on consumers beliefs), on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The number of lags included for each variable are shown in brackets for case of total consumers. The optimal lag length for inflation expectations varies across consumer types. In pre-Crisis period, we use 3 lags for low income, full-time working consumers, ages 30-49 and 50-64, for high income, low and high educated we use 4 lags, and for unemployed we use 6 lags. In post-Crisis period, we use 3 lags for full-time working consumers and ages 30-49, we use 4 lags for low income/educated, high income/educated and ages 50-64, and for unemployed we use 5 lags.

By contrast, since the Crisis, this estimated impact is no longer positive, turning negative and statistically significant for high-income and high-educated consumers at the five percent level, and for full-time working consumers and those with ages 30-49 at the ten percent significance level. This impact is distinctly different before and after the arrival of the Crisis for all consumer types except the unemployed which appear unresponsive to monetary surprises after the Crisis as they were before it.[31] For instance, for high-income consumers, a one standard deviation unanticipated increase in the interest rate leads to a .061 standard deviation fall in inflation expectations. We note again that consumer types we would a priory

[31] Performing a Wald test for the equality of coefficients of monetary policy surprises pre-Crisis versus post Crisis for each consumer type separately, we reject the hypothesis that this impact is equal in all cases except for the unemployed as shown in Appendix A Table A22.

expect to have higher ability to extract signals from a given realization such us high-income and full-time working consumers or have a longer horizon (ages 30-49), react more to a given monetary policy surprise as compared to low-income, unemployed, and older consumers (ages 50-64) since the Crisis, a period during which signal extraction is presumably more difficult and the incentive to extract signals is greater. Notably, for high-income, high-educated and full-time working consumers we get statistically significant estimates of -.061, -.040 and -.038 as compared to statistically indistinguishable from zero estimates of -.027, -.024 and .014 for low-income, low-educated and unemployed consumers.

Robustness Analysis

Panel VAR

We now evaluate the robustness of the above results, beginning with the re-estimation of surprises using recursive panel Vector Autoregressive (PVAR) models. We estimate a panel VAR model for each period and consumer type separately using the generalized method of moments. Our PVAR models employ the same variables as in equations (1.1) or (1.2). The optimal lag length for each variable and model is chosen using the sequential GS approach as in the baseline specification. Individual country effects are removed by the forward orthogonal deviation. Finally, as we are limited by the number of observations, especially so in the post Crisis sub-sample, we impose assumptions that restrict the number of estimated parameters.[32] The estimated surprises from the first-state PVAR models are used as generated regressors to re-estimate panel regression equations (1.3) and (1.4) choosing optimal lag lengths as before. Tables 1.6 and 1.7 report our estimates along with Murphy and Topel (1985) corrected standard errors for the model with regimes. While, the estimates of the equation (1.3) and equation (1.4) for the model without regimes are reported in Appendix A, Table A17 and Table A18.

[32]Our assumption on homogeneity across countries restricts coefficient matrices to be invariant across economies.We also assume no static interdependencies between the variables in any two countries, and no dynamic interdependencies so that lagged foreign variables do not impact domestic ones.

Table 1.6: Estimation results of equation (1.3) with panel VAR-implied surprise.

VARIABLES	total con π_t^e	Low inc π_t^e	High inc π_t^e	Low edu π_t^e	High edu π_t^e	unem π_t^e	full-time π_t^e	30-49 π_t^e	50-64 π_t^e
m surp lags pre-Cr (2)	-0.001	-0.023**	-0.013***	-0.013	-0.008	-0.014	-0.008	-0.014	-0.010
	(0.012)	(0.011)	(0.012)	(0.011)	(0.012)	(0.013)	(0.008)	(0.009)	(0.011)
m surp lag after (1)	-0.026*	0.030*	-0.064***	-0.029*	-0.039***	-0.024	-0.047***	-0.049***	-0.033**
	(0.015)	(0.018)	(0.018)	(0.017)	(0.014)	(0.023)	(0.014)	(0.014)	(0.015)
π^e lags pre-Cr (2)	0.844***	0.843***	0.781***	0.838***	0.830***	0.795***	0.832***	0.824***	0.825***
	(0.009)	(0.012)	(0.010)	(0.010)	(0.010)	(0.016)	(0.010)	(0.009)	(0.010)
π^e lags after (6)	0.943***	0.859***	0.944***	0.884***	0.943***	0.859***	0.946***	0.948***	0.943***
	(0.014)	(0.018)	(0.021)	(0.018)	(0.016)	(0.029)	(0.016)	(0.016)	(0.017)
π_t pre-Cr	0.018***	0.023**	0.017**	0.023***	0.012	0.021**	0.018***	0.020***	0.018**
	(0.006)	(0.010)	(0.007)	(0.008)	(0.007)	(0.011)	(0.007)	(0.007)	(0.007)
π_t after	0.040***	0.032**	0.032	0.036***	0.037***	0.044**	0.035***	0.032**	0.042***
	(0.011)	(0.013)	(0.021)	(0.013)	(0.011)	(0.021)	(0.012)	(0.013)	(0.013)
lagged π pre-Cr (1)	0.002	0.012	0.009	0.002	0.007	0.007	0.007	0.005	0.004
	(0.007)	(0.010)	(0.008)	(0.008)	(0.007)	(0.011)	(0.007)	(0.007)	(0.008)
lagged π after (1)	0.005	0.025*	-0.003	0.017	0.001	0.017	0.001	0.002	0.011
	(0.011)	(0.014)	(0.018)	(0.014)	(0.012)	(0.022)	(0.012)	(0.012)	(0.013)
after dummy	-0.410***	-0.421***	-0.433***	-0.481***	-0.420***	-0.356***	-0.424***	-0.413***	-0.425***
	(0.051)	(0.065)	(0.076)	(0.066)	(0.054)	(0.083)	(0.051)	(0.055)	(0.057)
Observations	3,370	3,260	3,267	3,317	3,317	2,952	3,356	3,356	3,356
adj. R^2	0.913	0.850	0.863	0.874	0.883	0.736	0.895	0.899	0.888

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income, low and high educated, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of the monetary shock (constructed under the assumption that individuals are well informed), on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The number of lags included for each variable are shown in brackets for case of total consumers. The optimal lag length for inflation expectations varies across consumer types. In pre-Crisis period, we use 2 lags for high income and low educated consumers, we use 3 lags for low income, high edcated, full-time working consumers, ages 30-49 and ages 50-64, and for unemployed we use 6 lags. In post-Crisis period, we use 3 lags for full-time working consumers, ages 30-49 and ages 50-64, we use 4 lags for low and high income/educated consumers, and for unemployed we use 5 lags.

The panel model (1.3) with PVAR estimated surprises yields a negative significant impact on inflation expectations of low-income consumers pre-Crisis in Table 1.6 as in Table 1.3. Since the Crisis, we see in Table 1.6 a significant negative impact for high-income, high-educated, full-time working consumers and consumers of ages 30 to 49 at the one percent, and at the five percent level for ages 50-64. In addition, as we show in Table 1.6, a significant negative impact is now present for total consumers, low-income and low-educated consumers at the ten percent level. We note again that since the Crisis, a period during which signal extraction is presumably more difficult and the incentive to extract signals greater, the impact of the monetary policy surprise is greater for high-income, high-educated, full-time working consumers, and those with ages 30-49, as compared respectively to low-income,low-educated, the unemployed, and those of ages 50-64. For high-income, high-educated, and full-time

Table 1.7: Estimation results of equation (1.4) with panel VAR-implied surprise based on consumers' stated beliefs.

VARIABLES	total con π_t^e	Low inc π_t^e	High inc π_t^e	Low edu π_t^e	High edu π_t^e	unem π_t^e	full-time π_t^e	30-49 π_t^e	50-64 π_t^e
m surp lag pre-Cr (1)	0.023***	0.036**	0.019	0.030**	0.035**	-0.006	0.020	0.020*	0.032**
	(0.008)	(0.017)	(0.012)	(0.015)	(0.017)	(0.011)	(0.013)	(0.012)	(0.015)
m surp lag after (1)	-0.019	-0.025	-0.072***	-0.028	-0.042**	0.022	-0.041**	-0.047**	-0.025
	(0.022)	(0.022)	(0.025)	(0.023)	(0.019)	(0.033)	(0.020)	(0.020)	(0.020)
π^e lags pre-Cr (3)	0.853***	0.875***	0.823***	0.895***	0.849***	0.856***	0.862***	0.861***	0.868***
	(0.008)	(0.014)	(0.012)	(0.010)	(0.010)	(0.013)	(0.010)	(0.010)	(0.010)
π^e lags after (6)	0.962***	0.838***	0.945***	0.854***	0.942***	0.834***	0.932***	0.937***	0.931***
	(0.014)	(0.017)	(0.021)	(0.017)	(0.015)	(0.028)	(0.015)	(0.015)	(0.016)
π_t pre-Cr	0.024***	0.026***	0.018**	0.024***	0.016**	0.016*	0.019***	0.020***	0.023***
	(0.006)	(0.009)	(0.007)	(0.007)	(0.007)	(0.009)	(0.007)	(0.007)	(0.007)
π_t after	0.042***	0.030**	0.036*	0.036***	0.038***	0.045**	0.036***	0.033***	0.044***
	(0.011)	(0.012)	(0.021)	(0.012)	(0.011)	(0.020)	(0.012)	(0.012)	(0.013)
lagged π pre-Cr (1)	0.007	0.016*	0.011	0.005	0.011	0.013	0.007	0.008	0.007
	(0.006)	(0.009)	(0.007)	(0.007)	(0.007)	(0.010)	(0.007)	(0.006)	(0.007)
lagged π after (1)	0.003	0.016	-0.010	0.014	-0.003	0.020	0.000	-0.001	0.008
	(0.011)	(0.014)	(0.019)	(0.014)	(0.012)	(0.021)	(0.012)	(0.012)	(0.013)
after dummy	-0.481***	-0.396***	-0.465***	-0.515***	-0.470***	-0.397***	-0.449***	-0.441***	-0.435***
	(0.053)	(0.064)	(0.075)	(0.063)	(0.055)	(0.080)	(0.051)	(0.055)	(0.056)
Observations	3,950	3,678	3,696	3,780	3,758	3,325	3,836	3,768	3,782
$adj.\ R^2$	0.914	0.860	0.868	0.888	0.883	0.764	0.893	0.903	0.894

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and the following subgroups of consumers: low- and high-income, low- and high-educated, full-time workers, the unemployed and ages between 30 - 49 and 50 - 64. These are explained by lagged values of the beliefs-based monetary surprise, lagged values of inflation expectations and contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The lag length is optimally chosen in the context of a panel model following the sequential GS approach. The number of lags included for each variable are shown in brackets for the case of total consumers. The optimal lag length for inflation expectations varies across consumer types. In the pre-Crisis period, we use 3 lags for low-income, full-time working consumers, ages 30-49 and ages 50-64, 4 lags for high-income, low and high educated consumers, and 6 lags for the unemployed. Post-Crisis, we use 3 lags for full-time working consumers, 4 lags for low-and high-income,low-and high-educated, ages 30-49 and ages 50-64, and 5 lags for the unemployed.

working consumers in particular, we get strongly significant estimates of -.064, -.039 and .047 as compared to .030 and -.029 for low-income and low-educated consumers (significant at the ten percent level) and an insignificant -.024 for the unemployed. Again, we find that consumer types we would a priori expect to have higher ability to extract signals from a given realization (high-income and full-time working) or with longer horizon (ages 30-49), respond more to monetary surprises since the Crisis as compared to before.[33]

The estimation results of the panel model (1.4) with the surprises from the PVAR first-stage model are shown in Table 1.7. The derived monetary policy surprises yield again a positive significant impact for most groups of consumers in the pre-Crisis period. Namely, for total consumers at the one percent level of statistical significance, for low-income, low-educated, high-educated and consumers with ages 50-64 at the five percent level, and for those with ages 30-49 at the ten percent level. For the period since the Crisis, the panel VAR-implied monetary surprise has a negative impact for high-income consumers at the one percent signif-

[33]The p-values for the Wald test statistic in Appendix A Table A22 imply that the impact is different after as compared to before the arrival of the Crisis for full-time working, high-income, high-educated, and low income consumers.

icance level, and for high-educated, full-time working consumers and those with ages 30-49 at the five percent significance level.[34] Once again, we find that consumer types with potentially higher ability to extract signals or with longer horizon, appear to be reacting more to a given monetary policy surprise than lower ability or shorter horizon consumer types since the Crisis.

Monetary surprises cleansed from inflation expectations lags in the first stage

The second robustness check is to consider monetary surprises that have been cleansed from the effect of inflation expectations in the first stage. That is, we augment the information set of the single equation model in (1.1) and (1.2) to add inflation expectations lags, and then consider the impact of the resulting monetary surprises in the second stage regression equations (1.3) or (1.4). Since monetary policy plausibly takes into account inflation expectations when setting interest rates, we find it useful to consider this variable in the policy reaction function. As in our baseline results, the optimal lag length is chosen based on the sequential GS approach. The estimates of the augmented equations (1.1) and (1.2) are reported in the Appendix A, for the whole sample period, pre-Crisis and post-Crisis period in Table A11 - Table A16. We find that adding inflation expectations lags in the first stage panel models to obtain monetary policy surprises, our second-stage results regarding the impact of these surprises on inflation expectations are robust as shown in Table 1.8 pertaining to well-informed individuals and Table 1.9 pertaining to less-informed ones, for the model with regimes. The corresponding estimates for the model without regimes are reported in Table A19 and Table A20 in the Appendix A.

Pre-Crisis, we still get a negative significant impact for low-income consumers in Table 1.8 as in Table 1.3. Since the Crisis, in Table 1.8 as in Table 1.3, we get negative significant impact for high-income, high-educated, full-time working consumers and those with ages 30-49 and greater than the respective impact for the low-income, low-educated, unemployed, and older consumers. Notably, once again, we obtain statistically significant estimates equal to -.041 and -.034 for high-income and full-time working consumers as compared to statistically indistinguishable from zero estimates of -.019 and -.001 for low-income and unemployed consumers respectively.

In Table 1.9, pertaining to less-informed consumers, the impact of monetary surprises is once again estimated to be positive before the arrival of the Crisis except for the unemployed and ages 30-49. This impact is statistically significant at the one percent level for total consumers, at the five percent level for low-income, high-educated and consumers with ages 50 to 64, and at the ten percent level for high-income, low-educated and full-time working consumers. These estimates are similar to those in Table 1.5. Since the Crisis, the estimated impact of monetary surprises on inflation expectations shown in Table 1.9 turns negative and statistically significant at the five percent for high-income and high-educated consumers and

[34]The Wald test for the equality of coefficients of monetary policy surprises pre-Crisis versus post Crisis (reported in Appendix A Table A22) rejects the hypothesis that this impact is equal in all cases except for the unemployed.

Table 1.8: Estimation results of equation (1.3) with surprise based on augmented form of equation (1.1).

VARIABLES	total con π_t^e	Low inc π_t^e	High inc π_t^e	Low edu π_t^e	High edu π_t^e	unem π_t^e	full-time π_t^e	30-49 π_t^e	50-64 π_t^e
m surp lags pre-Cr (2)	0.003	-0.018*	-0.011	-0.012	-0.003	-0.013	-0.006	-0.010	-0.007
	(0.010)	(0.010)	(0.011)	(0.010)	(0.011)	(0.013)	(0.008)	(0.008)	(0.010)
m surp lag after (1)	-0.012	-0.019	-0.041**	-0.014	-0.027*	-0.001	-0.034**	-0.033**	-0.014
	(0.015)	(0.016)	(0.019)	(0.017)	(0.014)	(0.023)	(0.014)	(0.014)	(0.015)
π^e lags pre-Cr (2)	0.846***	0.846***	0.783***	0.839***	0.831***	0.796***	0.834***	0.825***	0.825***
	(0.009)	(0.012)	(0.010)	(0.010)	(0.010)	(0.016)	(0.010)	(0.009)	(0.010)
π^e lags after (6)	0.945***	0.865***	0.946***	0.884***	0.944***	0.858***	0.949***	0.952***	0.950***
	(0.014)	(0.018)	(0.022)	(0.018)	(0.016)	(0.029)	(0.016)	(0.016)	(0.017)
π_t pre-Cr	0.019***	0.023**	0.017**	0.023***	0.012	0.021**	0.018***	0.021***	0.017**
	(0.006)	(0.010)	(0.007)	(0.008)	(0.007)	(0.011)	(0.007)	(0.007)	(0.007)
π_t after	0.041***	0.030**	0.034	0.037***	0.038***	0.046**	0.037***	0.033***	0.045***
	(0.011)	(0.013)	(0.021)	(0.013)	(0.011)	(0.021)	(0.012)	(0.013)	(0.014)
lagged π pre-Cr (1)	0.002	0.012	0.009	0.003	0.008	0.007	0.008	0.006	0.004
	(0.007)	(0.010)	(0.008)	(0.008)	(0.007)	(0.011)	(0.007)	(0.007)	(0.008)
lagged π after (1)	0.006	0.020	-0.001	0.018	0.002	0.020	0.002	0.003	0.012
	(0.011)	(0.014)	(0.019)	(0.014)	(0.012)	(0.021)	(0.012)	(0.012)	(0.013)
after dummy	-0.414***	-0.412***	-0.450***	-0.490***	-0.424***	-0.367***	-0.430***	-0.420***	-0.434***
	(0.051)	(0.065)	(0.076)	(0.065)	(0.054)	(0.082)	(0.051)	(0.056)	(0.057)
Observations	3,370	3,259	3,267	3,317	3,317	2,952	3,356	3,356	3,317
$adj.\ R^2$	0.912	0.849	0.862	0.874	0.883	0.735	0.895	0.899	0.886

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income,low and high educated, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of the monetary shock (constructed under the assumption that individuals are well informed), on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The number of lags included for each variable are shown in brackets for case of total consumers. The optimal lag length for inflation expectations varies across consumer types. In pre-Crisis period, we use 2 lags for high income, low educated, we use 3 lags for low income, high educated, full-time working consumers, ages 30-49 and ages 50-64, and for unemployed we use 6 lags. In post-Crisis, we use 3 lags for full-time working consumers and ages 30-49, we use 4 lags for low income, high income, low educated, high educated and ages 50-64, and for unemployed we use 5 lags.

at the ten percent level for full-time working consumers and for ages 30-49. These results exactly resemble those in Table 1.5. Once again, the significant impact of -.063 for high-income consumers is notably greater in absolute terms than the statistically indistinguishable from zero impact of -.026 for low-income ones. The impact for full-time working consumers and ages 30-49 is also respectively greater than for the unemployed and consumers of ages 50-64 as in the previous tables.

One finding that typically holds for the less-informed case we consider in Table 1.9 and elsewhere, is that the impact of monetary surprises is different after as compared to before the arrival of the Crisis. In Table A22 in the Appendix A, we report all p-values for the Wald test for the equality of coefficients pre-Crisis versus post Crisis. For monetary policy surprises pertaining to less-informed agents, this test rejects the hypothesis that the impact on inflation expectations is equal before and after the arrival of the Crisis for all consumer types except the unemployed, as shown in Tables 1.5, 1.7 and 1.9. For our strawman model of well-informed agents in Tables 1.3 and 1.8 this is not the case except for full-time working consumers for which we reject the null at the ten percent level, and for full-time working,

Table 1.9: Estimation results of equation (1.4) with surprise based on augmented form of equation (1.2).

VARIABLES	total con π_t^e	Low inc π_t^e	High inc π_t^e	Low edu π_t^e	High edu π_t^e	unem π_t^e	full-time π_t^e	30-49 π_t^e	50-64 π_t^e
m surp lag pre-Cr (1)	0.025***	0.033**	0.019*	0.027*	0.033**	-0.008	0.021*	0.016	0.028**
	(0.009)	(0.016)	(0.011)	(0.014)	(0.016)	(0.011)	(0.011)	(0.011)	(0.014)
m surp lag after (1)	-0.020	-0.026	-0.063**	-0.025	-0.040**	0.012	-0.038*	-0.036*	-0.022
	(0.022)	(0.022)	(0.025)	(0.022)	(0.019)	(0.032)	(0.020)	(0.019)	(0.020)
π^e lags pre-Cr (3)	0.855***	0.877***	0.825***	0.897***	0.852***	0.856***	0.864***	0.866***	0.871***
	(0.008)	(0.016)	(0.012)	(0.010)	(0.010)	(0.013)	(0.010)	(0.009)	(0.010)
π^e lags after (6)	0.961***	0.837***	0.942***	0.851***	0.942***	0.835***	0.932***	0.935***	0.927***
	(0.014)	(0.017)	(0.021)	(0.017)	(0.015)	(0.028)	(0.015)	(0.015)	(0.016)
π_t pre-Cr	0.023***	0.025***	0.017**	0.024***	0.015**	0.017*	0.018***	0.019***	0.021***
	(0.006)	(0.010)	(0.007)	(0.007)	(0.007)	(0.009)	(0.007)	(0.006)	(0.007)
π_t after	0.042***	0.030**	0.035*	0.037***	0.038***	0.045**	0.037***	0.034***	0.042***
	(0.011)	(0.012)	(0.021)	(0.012)	(0.011)	(0.020)	(0.012)	(0.012)	(0.013)
lagged π pre-Cr (1)	0.006	0.014	0.010	0.004	0.010	0.013	0.007	0.007	0.004
	(0.006)	(0.009)	(0.007)	(0.007)	(0.007)	(0.010)	(0.007)	(0.006)	(0.007)
lagged π after (1)	0.004	0.018	-0.006	0.016	-0.002	0.018	0.002	0.002	0.012
	(0.011)	(0.014)	(0.018)	(0.014)	(0.012)	(0.021)	(0.012)	(0.012)	(0.013)
after dummy	-0.475***	-0.395***	-0.465***	-0.511***	-0.464***	-0.396***	-0.443***	-0.436***	-0.428***
	(0.053)	(0.064)	(0.075)	(0.063)	(0.055)	(0.080)	(0.050)	(0.055)	(0.056)
Observations	3,950	3,678	3,696	3,780	3,758	3,325	3,836	3,826	3,841
$adj.\ R^2$	0.914	0.860	0.868	0.888	0.883	0.764	0.893	0.904	0.895

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income,low and high educated, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of the beliefs-based monetary shock, on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The number of lags included for each variable are shown in brackets for case of total consumers. The optimal lag length for inflation expectations varies across consumer types. In pre-Crisis period, we use 3 lags for low income, full-time working consumers, ages 30-49 and ages 50-64, for high income, low and high educated we use 4 lags, and for unemployed we use 6 lags. In post-Crisis, we use 3 lags for full-time working consumers, ages 30-49 and ages50-64, we use 4 lags for low income/educated and high income/educated, and for unemployed we use 5 lags.

high, and low-income consumers in the case of the PVAR generated surprises in Table 1.6 where we reject the null with respective p-values of .03, .06 and .01.

Other Robustness Checks

We consider two further changes to our baseline setup and briefly describe results in this section with detailed tables available in the appendix. First, we consider country-specific short-term interest rates that are available for our sample of EU countries even after the euro came into effect. Second, we estimate the policy reaction function using real-time data as in Giannone et al. (2012) and Orphanides (2001).

More specifically, we use interest rates that monetary financial institutions resident in the euro area apply to overnight euro-denominated deposits of households and non-financial corporations. These series start on January 2003 for most countries.[35] In the Appendix A, we present estimation results from our second stage model based on surprises obtained in the first stage model using these country-specific interest rates instead of short term interest rates

[35]Except for Estonia when the series for interest rates starts on January 2005, for Slovenia for which it starts on May 2005, and for Slovakia for which this starts in January of 2008.

used in our baseline which become common across countries since joining the Eurozone. The estimates of equation (1.3) and (1.4) for the model without and with regimes are shown in Appendix A, Table A37 - Table A40. Table A38 in the Appendix A, shows that for well-informed consumers, the impact of monetary policy on inflation expectations in the post-Crisis period is negative and statistically significant at the five percent level for high income consumers, and at the ten percent for high educated consumers. Table A40 in the Appendix A, shows that for the less-informed, we get negative impact for most consumer types after the arrival of the Crisis, which is consistent with our baseline model results for the less-informed. The impact of monetary surprises is negative and statistically significant at the one percent level for high income consumers, at the five percent level for total consumers, high educated consumers and ages 50-64, and at the ten percent level for full-time working consumers and those with ages 30-49. For the pre-Crisis period, the impact is typically insignificant which might be explained by the fact that given data availability, we start our sample in 2003 instead of 1985 thus lose a lot of information.

Finally, we use real-time data or data vintages for our macroeconomic variables published in real-time reflecting the economic situation at the given point in time that our models (presented in the previous sections) were estimated with revised data. For the unemployment rate and industrial production we use real-time data available on the month when the consumer survey is conducted, which refer to the previous two months (e.g. we use the real-time data in May 2015 released on July 2015), while for the inflation rate and commodity prices we use real-time data released on the month when the survey took place which refer to the previous month.[36] We re-estimate equations (1.1) and (1.3) for the well-informed, and equations (1.2) and (1.4) for the less-informed and report results in Appendix A. In general, estimates reported there using real-time data are very close to those obtained in Tables 1.2 - 1.5 using historical time series.

1.5 Conclusion

The question of how monetary policy affects inflation expectations addressed in this chapter is an important one from a policy and theory perspective alike. On the policy side, the Euro-

[36]Fieldwork for the monthly surveys used in our paper is performed in the first two to three weeks of each month. We take this into account along with the release dates in each country for each macroeconomic variable used in our models, available from Eurostat at http://ec.europa.eu/eurostat/web/links/nationalstatisticaloffices and at http://ec.europa.eu/eurostat/news/release-calendar. Comparing release dates across countries we find these have the same timing for our main variables. The unemployment rate is available during the first week of the second month following the reference month, and Industrial Production indices are released in the second to third week of the second month following the reference month. This means that the publication lag for the unemployment rate and industrial production is two lags. Consumer price indices are released within the third week of the month following the reference month, and the same happens with prices of commodities (the publication lag is one). Vintages for unemployment rate, industrial production, and inflation are from OECD real time database http://stats.oecd.org/mei/default.asp?rev=1, while vintages for Brent crude oil and Price of food are available on ECB Statistical Data Warehouse http://sdw.ecb.europa.eu/browseSelection.do?node=qview&SERIESKEY=194.RTD.M.S0.N.POILBR.E

pean Central Bank has repeatedly stated publicly over the past few years that their policies were intended to raise inflation expectations in line with their inflation objective, so as to boost current consumption and avoid a deflationary spiral.[37] The importance of the question regarding how monetary policy affects inflation expectations from the theory perspective is reflected in the attention it has received in a number of recent papers that suggest different theory-implied impact of monetary policy on inflation expectations. Our results here provide support for one class of theoretical models, emphasizing imperfect information as in Campbell et al. (2012), Del Negro, Giannoni, and Patterson (2012), Garcia-Schmidt (2015) and Melosi (2016).

A novel feature of our approach is the estimation of monetary policy surprises based on changes in monetary policy that were unanticipated by consumers as per their stated beliefs about the economy. We have shown that such monetary policy surprises can have different impact on inflation expectations as compared to those obtained under the assumption that consumers are well informed about a set of macroeconomic variables that describe the state of the economy. More specifically, relaxing the assumption of well-informed consumers and focusing on their stated beliefs about the economy so that they may be surprised by a broader set of monetary policy changes, we showed that consumers often lower their inflation expectations in response to lower interest rates before the Crisis. This is consistent with imperfect information theoretical settings where consumers learn from unanticipated interest rate cuts that the policymaker, based on her superior information set, is expecting a fall in inflation so that lowering the policy rate ends up lowering their inflation expectations. Instead, considering monetary policy surprises under the assumption that individuals have information about the macroeconomy comparable to that of the policymaker, the impact of unanticipated changes in short-term interest rates on inflation expectations is often negative. This reflects textbook macroeconomic channels where a cut in short-term interest rates boosts economic activity so that inflation and inflation expectations increase.

Interestingly, the impact of monetary policy surprises based on the economic beliefs of each consumer type changes sign from positive to negative in the period since the recent Crisis. Such monetary policy surprises usually affect inflation expectations negatively since the Crisis, consistent with the incentive to pay attention to the macroeconomy being greater since the Crisis inducing individuals to become rationally attentive so that their response to policy surprises becomes consistent with them observing the full set of macroeconomic variables' histories. Consumer types that we would a priori expect to have higher ability to extract signals from a given realization (such us high-income or high educated) or with a longer horizon (ages 30-49), typically react more to monetary policy surprises than those with potentially lower ability to extract signals (low-income/low-educated) or with a shorter horizon (ages 50-64) in the period since the Crisis, a period during which signal extraction is presumably

[37] In fact, the ECB has repeatedly stated its goal of achieving a two percent inflation rate in line with its mandate. To the extent that inflation expectations have not been revised upwards in line with the ECB's stated goal and interest rate policies, this would then reflect lack of credibility and absence of anchoring of inflation expectations.

more difficult and the incentive to extract information greater. This, again, contrasts to what we observe for these Eurozone consumers before the Crisis when their behavior is more in line with imperfect information.

A couple of caveats pertain to our current analysis, paving a promising path to future extensions of our work. First, while we have focused on monetary policy surprises to allow consideration of consumers that might be subject to surprise by a broader set of events than well-informed agents, recent monetary policy has shifted towards forward guidance and other instruments which relate to anticipated rather than unanticipated monetary policy changes. In our future study we take into account the unconventional monetary policy adopted since the recent financial crisis. Moreover, in our third chapter we extend our analysis using monthly quantitative data for consumers' inflation expectations in the United States, and see how the results change as compared to those found in the Eurozone countries.

Chapter 2

Firms' Expectations and Monetary Policy Shocks in the Eurozone

2.1 Introduction

Monetary policymakers' objective is to maintain price and production stability, both of which depend on firm-level decisions. Since current production and price choices made by firms depend directly upon their expectations of future economic developments, for monetary policymakers to achieve their policy goals it is crucial to understand how firms form their expectations.[1] Beyond its policy importance, the question of how policy decisions affect economic agents' expectations is one of the most fundamental and highly debated questions in macroeconomics. On the one hand, tightening monetary policy has the effect of reducing inflation and economic activity, as implied by standard macroeconomic models. On the other hand, an unexpected increase in policy rate might also cause higher inflation if this action signals to unaware agents that an inflationary shock is about to hit the economy. According to Melosi (2016), the policy rate signals information to firms and thus directly affects their beliefs about macroeconomic developments. Particularly, according to the signaling channel of monetary transmission, price setters interpret monetary policy changes in two different ways. First, a contractionary monetary policy might be interpreted that the Central Bank responds to an exogenous deviation from its policy rule. Thus, firms decrease their selling price expectations after an unanticipated increase in interest rates, as predicted by standard macroeconomic channels or Neo-Keynesian approach of Garcia-Schmidt (2015). Second, a contractionary monetary policy may also be interpreted as the response of the central bank

[1] As Bernanke et al. (2007) put it: "on which measure or combination of measures should central bankers focus to assess inflation developments? ... Information on the price expectations of businesses who are, after all, the price setters ... is particularly scarce".

to a positive demand shock or an adverse aggregate technology shock. In this case, an unanticipated increase in interest rate induces firms to expect higher inflation, and thus selling price expectations rise. The second case is consistent with imperfect information theoretical settings mentioned in Campbell et al. (2012), Del Negro, Giannoni, and Patterson (2012) or in neo-Fisherian approach of Cochrane (2016b). Moreover, there are rational inattention models supporting that agents rationally chose to not pay an attention to the information provided, and update their information at optimally chosen dates.[2] While, in the standard classical model agents are aware of all the information and are constantly using it to compute their optimal actions, there is a huge amount of information and most of it comes with a cost, in money or time. For example, Reis (2006) use the inattentiveness model of limited information to study the behavior of producers and shows that firms rationally choose to be inattentive to news, and only sporadically update their information due to costs associated with acquiring and processing information. The Lucas Jr (1972) islands model showed that if price-setters have imperfect information, they will adjust incompletely to news, which generates nominal rigidities and real effects of monetary policy. Surveys of consumers, firms, and professional forecasters have been used to study the impact of macroeconomic developments on expectation formation (see, for example, Carvalho and Nechio (2014), Coibion and Gorodnichenko (2015a), Coibion, Gorodnichenko, and Kumar (2015), Geiger and Scharler (2016) and Eminidou et al.(forthcoming). However, there is still a lot of uncertainty around the effects of monetary policy and the way that each type of agent interprets monetary policy changes.

As firms play a key role in setting prices in the economy, we find it useful to focus on firms' expectations and analyze how monetary policy affects them. Moreover, given that industry characteristics affect the frequency of planning and the formation of selling price and production expectations, in our analysis we examine the two main sub sectors of the total manufacturing sector. Particularly, we examine if firms' producing durable goods respond in a similar way to monetary policy shocks as compared to those producing non-durable consumer goods. We use monthly survey data on firms' expectations for the period 1999:1 - 2018:6, and focus on ten euro-area economies which are: Austria, Belgium, Germany, Greece, Spain, Finland, France, Italy, Netherlands, and Portugal. We investigate the impact of exogenous monetary policy shocks on firms' selling price and production expectations, using the methodology developed by Stock and Watson (2012) and Mertens and Ravn (2013) and applying it in the context of estimating a panel VAR model.

We find that a contractionary monetary policy shock increases firms' selling price or production expectations, but this impact becomes negative about a year after the shock occurred. The impulse responses indicate that first firms start to revise their production expectations, and then selling price expectations adjust accordingly. Moreover, distinguishing between firms producing durable versus non-durable consumer goods, we find that an overshooting

[2] According to Reis (2006), agents update their plans at certain dates regardless of the state of the economy at these dates.

pattern exists in both cases irrespective of the type of good the firm produces. However, firms producing durable goods are more sensitive to monetary policy shocks as compared to those producing non-durable goods.

Previous related work includes Andrade and Le Bihan (2013), who use a survey of professional forecasters to examine expectations at the micro-level and find results supportive to rational inattention. Similarly, Coibion and Gorodnichenko (2015a) studying inflation expectations from US Survey data, find that professional forecasters form their expectations in a way inconsistent with fully informed rational expectations. Coibion, Gorodnichenko, and Kumar (2015) use quantitative survey data of firms in New Zealand and find that firms' expectations formation is consistent with rational inattention and that their inattentiveness is systematically related to firms' incentives to process and collect such information. Overall, these empirical studies support models of the expectation formation process that allow for the existence of information rigidities.[3]

In general, when forming their expectations, firms face a trade-off between the cost of information acquisition and the expected benefit. If firms are aware that the collection of information is costly for them then they rationally take a decision not to pay attention to this (see, for example, Reis (2006)).[4] Furthermore, according to Melosi (2016), monetary policy actions provide new information to price setters by signaling the view of the central bank regarding macroeconomic developments, and they revise their expectations accordingly. Economic agents may in fact interpret monetary policy changes in two different ways. First, if they are aware that the Central Bank has more information than they have, they may interpret an unanticipated decrease in the interest rate as a signal that the policymaker is worried about deflation, and decrease their production and price expectations. Second, they may increase their production or price expectations after an expansionary monetary policy shock along the lines of the typical textbook channels.

This chapter empirically assesses the different theoretical channels by examining how firms' selling price and production expectations respond to monetary policy changes. Our findings are in line with the study of Reis (2006), who argues that a producer faces costs of collecting and processing information so that firms rationally choose to be inattentive to news and only sporadically update their information set. This is exactly what we find in our study. For the first eight or twelve months, depending on whether we consider production or selling price expectations, firms behave in a manner consistent with imperfect information theoretical settings. Then, as time passes, firms acquire more information about the monetary shock and come to expect that an expansionary monetary policy will increase economic activity and inflation. My study is closely related to recent empirical work on the expectations formation

[3]Such models include the sticky information model (e.g., Mankiw and Reis (2002), where agents do not update their information set due to costs associated with collecting and processing information, and the noisy information model (e.g., Sims (2003), and Mackowiak and Wiederholt (2009)), where agents continuously update the information set but never fully observe the true macroeconomic state.

[4]According to Reis (2006), even if some information can be obtained for free by producers, they still face time costs of collecting and processing the available information, and costs of hiring advisors to interpret it.

process and information rigidities. Studying firms' expectations in the euro-area countries, we draw similar conclusions in that firms are found to revise their expectations in response to monetary policy changes, in a manner consistent with rational inattention. But, given that formation of inaccurate expectations is costly to a producer or a price-setter, over time, firms appear to update their information set and revise their expectations along the lines of textbook or new-Keynesian channels.

Building on the existing literature and methodologies used so far, we deliver new insights both on the identification of monetary policy shocks and on the econometric framework that we use. In identifying monetary policy shocks, we do not make direct assumptions on structural parameters as is sometimes done in the literature, but we instead impose covariance restrictions from instruments that we construct for the Euro Area. Following the new promising approach of Stock and Watson (2012) and Mertens and Ravn (2013), we proxy the monetary policy innovations with external instruments that include additional information regarding monetary policy beyond the information contained in the estimation of the panel VAR model. Thus, following the narrative based approach of C. D. Romer and D. H. Romer (2004) and the high frequency identification approach from Gurkaynak, Sack, and Swanson (2004) and Gertler and Karadi (2015), we construct external instruments for the euro area based on ECB announcement dates. In particular, following the C. D. Romer and D. H. Romer (2004) methodology we construct a narrative monetary policy measure for the euro area as a deviation from the policy rule, given the information set of the central bank as reported by internal forecasts. We also construct high frequency identified factors for the euro area, using changes in Euribors with different maturities around ECB announcement dates as in Gurkaynak, Sack, and Swanson (2004).

I utilize the thus constructed external instruments as proxies in our panel SVAR analysis along the lines of Stock and Watson (2012) and Mertens and Ravn (2013), in order to obtain monetary policy shocks. In our analysis, these monetary policy innovations derive from estimating a panel SVAR model, allowing for cross-country heterogeneity that may exist across these euro area economies. Thus, beyond the construction of instruments for the euro area and the identification of exogenous monetary policy shocks which are free of endogenous and anticipated movements, we estimate a panel "proxy SVAR" model rather than limiting our analysis to individual country proxy SVARs.

The rest of this chapter is organized as follows. Section 2.2 describes the data and provides some preliminary data analysis. The following section describes how we construct the narrative and high frequency external instruments used to identify monetary policy shocks and how we estimate their impact on firms' expectation for euro area countries using a panel proxy SVAR model. Section 2.4 illustrates the estimated impulse response functions including a set of robustness checks, and the last section briefly concludes.

2.2 Data and preliminary analysis

2.2.1 Description of the data

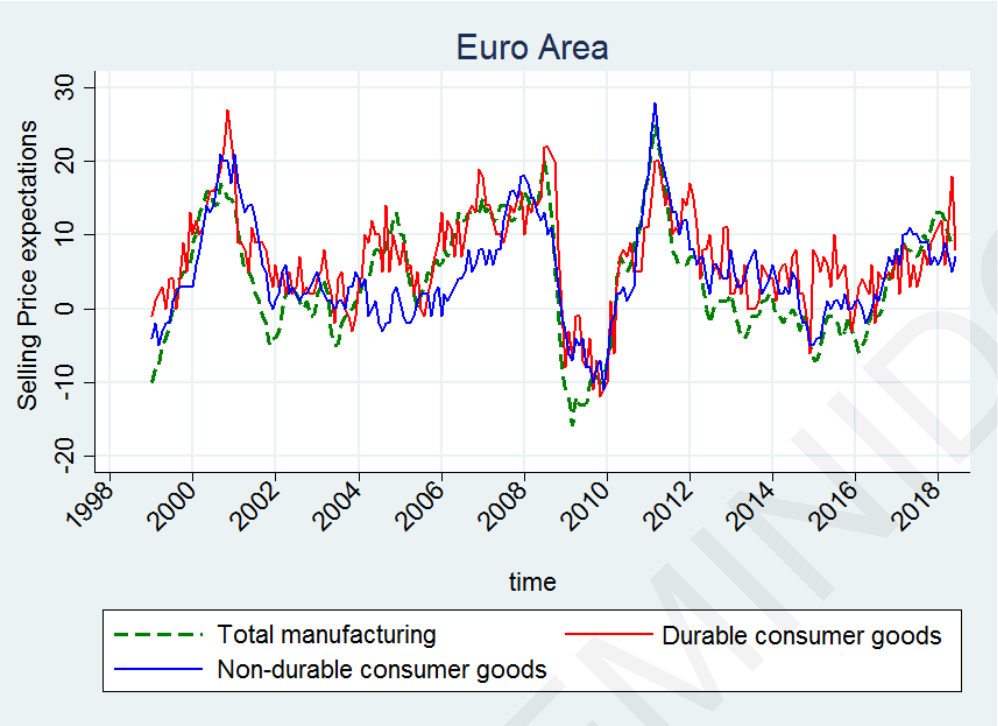
Firms' expectations

Data for firms' expectations are from the Joint Harmonised EU Programme of Business and Consumer Surveys database, which is published monthly by the European Commission. In my study, I mainly focus on the total manufacturing sector and two of its main subsectors comprising of firms that produce durable and non-durable consumer goods. We choose these two main subsectors as they are economically meaningful in that the formation of expectations and the attention to macroeconomic developments might differ across firms producing durable versus non-durable consumer goods since the expected duration until subsequent price or production decisions is different (see, for example, Coibion, Gorodnichenko, and Kumar (2015)).

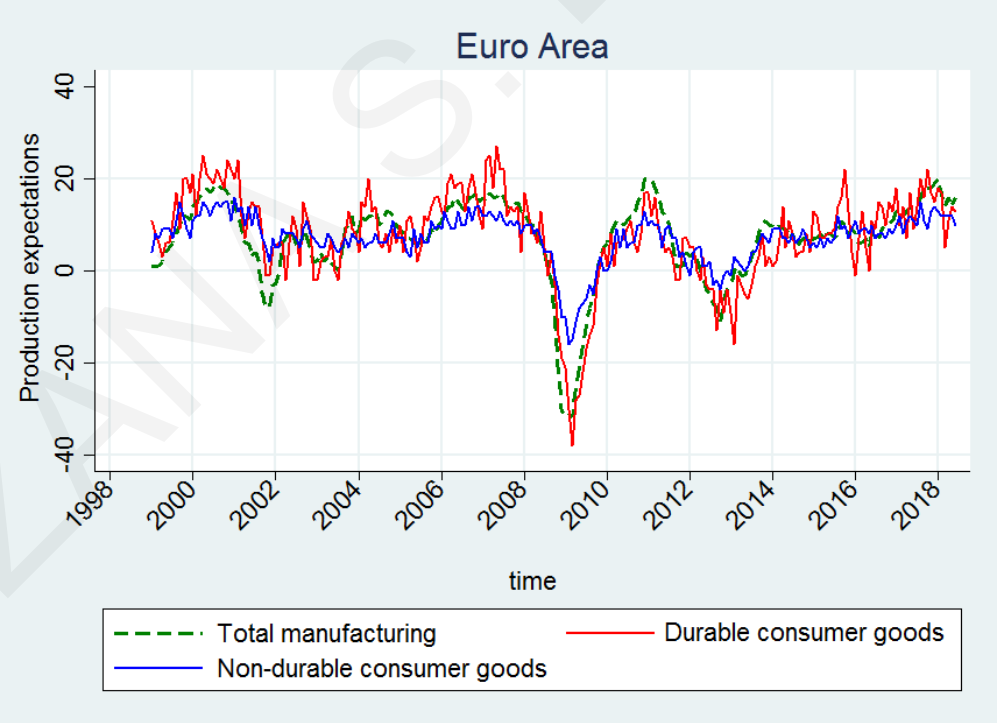
The sample size for each survey varies across countries according to their respective population size. The nominal sample of the industry survey includes more than 38000 firms that are surveyed every month, and the data that we use is qualitative and covers the period 1999:1 - 2018:6. The main questions in this survey refer to the assessment of recent trends in production, of the current levels of order books and stocks, along with expectations about production, selling prices and employment. We focus on the following two questions: Q5, "How do you expect your production to develop over the next 3 months? It will..." increase, remain unchanged, decrease; and Q6, "How do you expect your selling prices to change over the next 3 months? They will..." increase, remain unchanged, decrease. Since, the monthly data obtained from the Business and Consumer Surveys is qualitative, they are quantified using the simple balance statistic, given as the difference in the percentages of respondents giving positive and negative replies. Thus, balance values range from -100, when all respondents choose the negative option to +100, when all respondents choose the positive option. The Commission calculates those aggregates on the basis of the national results and seasonally adjusts the balance series that we use in our study.

Figure 2.1a and Figure 2.1b plot the time series balances of firm selling price and production expectations for the next 3 months in the euro area as a whole over the period 1999:1 - 2018:6. Time series balances of firms selling price and production expectations for each area country that we examine are reported in Figure B1, Figure B2 and Figure B3 for total manufacturing sector, and its two main subsectors in the Appendix B. As we can see in Figure 2.1a, selling price expectations declined sharply from + 20 on July 2008 to - 16 on March 2009. Comparing selling price expectations balances between firms producing durable consumer goods versus those producing non-durable goods, we see that price expectations for firms producing durable consumer goods were often slightly higher than those

Figure 2.1:
(a) Selling price expectations balances.



(b) Production expectations balances



producing non-durable goods during the period under study. Moreover, as we can see in Figure 2.1b, the number of firms expecting their production to fall increased dramatically after the Lehman Brothers Collapse. We also note that firms in the total manufacturing sector and firms producing durable goods, observed a higher decline in their production expectations during the Crisis period as compared to firms producing non-durable goods.

Macroeconomic data

In general, the macroeconomic variables we use in our analysis are similar to those used in Eminidou et al.(forthcoming) and they are extensively described there. These are as follows: inflation rate, industrial production, unemployment rate, short term interest rates, and price of crude oil. As in Eminidou et al.(

forthcoming

), inflation rates were obtained from OECD Stat. The harmonized unemployment rate for all persons, and industrial production are both seasonally adjusted and are from the OECD's Short-Term Economic Indicators. Data for the Europe Brent Spot Price fob (Dollars per Barrel) is from the Thomson Reuters database. Data for short term interest rates is taken from the OECD's Monthly Monetary and Financial Statistics.

For all Euro Area countries, the 3-month "European Interbank Offered Rate" is used as of the date the country joined the euro. Thus, from January 1999 short term interest rates are identical for 9 countries (i.e., excluding Greece) and become identical for all 10 euro area countries that we examine as of January 2001. By April 2015, short term interest rates are exactly equal to zero, and they take negative values since that date. Taking into account that since the recent Crisis, the traditional instrument of monetary policy is close to the zero lower bound, we study an alternative monetary policy indicator that relates to surprise changes in the quantity of money. Data for the monetary aggregate M1, is from the Statistical Data Warehouse of the European Central Bank. These time series are working day and seasonally adjusted. Also, in the robustness section we use two alternative measures of monetary policy which are Divisia M1 and Divisia M2 along with the corresponding user cost of money. Divisia monetary aggregates and the user cost of money for the euro area are constructed by Zsolt Darvas and are extensively described in his paper Darvas (2015).[5] Moreover, due to the fact that after the crisis period, the policy rate came close to its effective lower bound, the volatility of the short term interest rate declined significantly and the central bank started to employ unconventional methods such as Forward Guidance and Large-scale asset purchases to influence the longer term yield curve. In my future work, instead of short term EURIBOR rate, I will use longer term interest rates (like a 2-year or 5-year OIS rates) or Eonia rate, in order to check the robustness of the main results. The advantage of using a rate longer than the short term interest rate is that it incorporates the impact of forward guidance and therefore remains a valid measure of monetary policy stance also during the zero lower bound period. In our current analysis, the comparison of the effects of monetary policy shocks before and after the crisis was not possible since the short term interest rates do not fully reflect the policy shocks. The use of alternative measures give us the opportunity to compare the effects of monetary policy shocks before and after the crisis, especially if we consider the longer - term interest rates (see, for example, Gertler and Karadi (2015)).

Finally, our analysis takes into account financial market risk aversion measured by the im-

[5] http://bruegel.org/publications/datasets/divisia-monetary-aggregates-for-the-euro-area/

plied volatility index for the major stock market index.[6] Given the pattern that firms' expectations follow in Figure 2.1a and Figure 2.1b, we see that the global financial crisis influenced firms' expectations and thus find it useful to include a variable that relates to economic risk and uncertainty (see, for example, Gambacorta, Hofmann, and Peersman (2014)).

2.2.2 Preliminary Analysis

In what follows, we assess the statistical properties of the variables that we use in our analysis. We first implemented the Im-Pesaran-Shin panel unit root test (Im, Pesaran, and Shin (2003)) for the variables involved in the panel VAR model. As industrial production and the unemployment rate contain unit roots we use first differences of their log levels. As the price of crude oil is also found to contain a unit root, we smooth the log of commodity price by removing the trend using a Hodrick-Prescott time series filter and then take the smoothed change of the price of crude oil which is used as an exogenous variable in the panel VAR analysis. For the short term interest rate we reject the unit root null in favor of trend stationarity. In the case of inflation and firms' selling price and production expectations, we strongly reject the null hypothesis of a unit root, irrespective of the industry being considered. Finally, for M1 we cannot reject the null hypothesis of a unit root, thus in our estimations we use the growth rate of M1.

2.3 Estimation of the panel proxy structural VAR model

In this section we describe how we estimate a panel structural VAR (SVAR) model and the assumptions we make to derive monetary policy shocks.

2.3.1 Mean-group estimator of the panel VAR model

We first estimate a balanced panel VAR model built on the same logic as standard VARs commonly used in the existing policy literature to deal with dynamic systems of equations (see, e.g., Bernanke, Gertler, et al. (1997), Christiano, Eichenbaum, and Evans (1999), and Sims and Zha (2006a)). The use of a panel VAR allows us to obtain more efficient estimates relative to individual country estimations by also exploiting the cross-sectional dimension. In its unrestricted form, the estimation of a panel VAR for country i at time t with i = 1, ... , N and t = 1,..., T is described by

$$A_{0,\mathrm{i}} y_{\mathrm{i,t}} = A_{1,\mathrm{i}} Y_{\mathrm{i,t\text{-}1}} + A_{2,\mathrm{i}} Y_{\mathrm{i,t\text{-}2}} + ... + A_{\rho,\mathrm{i}} Y_{\mathrm{i,t\text{-}}\rho} + C_{\mathrm{i}} X_{\mathrm{t}} + e_{\mathrm{i,t}} \tag{2.1}$$

[6] CBOE Volatility Index Futures (VIX) are a popular measure of the national stock market's expectation of volatility. The VIX, is an indicator for financial market risk aversion capturing uncertainty shocks that have likely been important during the crisis (see, for example, Bloom (2009),Gambacorta, Hofmann, and Peersman (2014), and others)

where $y_{i,t}$ is a $(1xn)$ vector of endogenous variables for country i at time t, $Y_t = (y'_{1,t}, y'_{2,t}, \ldots, y'_{N,t})'$ is a vector of n variables for each country i, X_t is a (1xm) vector of exogenous variables (common to all units i), and $e_{i,t}$ is $(1 \times n)$ vector of structural white noise shocks. Finally, ρ is the number of lags used in the estimation of the panel VAR model. $A_{0,i}$ is an invertible, square matrix and $E[e_{i,t}e_{i,t}'] = \Sigma_{e,i}$, where $\Sigma_{e,i}$ is a positive definite matrix.[7] The matrices $A_{1,i}, A_{2,i}, \ldots, A_{\rho,i}$ [8] with dimensions $(n \times N * n)$ and the matrix C_i with dimension $(1 \times N * n)$ are parameters to be estimated. If we have N equations like (2.1) for each country i, we would then have to estimate $n * (N * n * p + m)$ coefficients for each country and as a result, $N * n * (N * n * p + m)$ coefficients for the panel VAR.

While estimating an unrestricted panel VAR model would be ideal, this is infeasible given the large number of parameters to estimate.[9] In our analysis, we deal with the dimensionality problem by estimating a panel VAR model using the mean-group estimator described in Pesaran and Smith (1995).[10] In contrast to the standard fixed effects panel estimator, the mean group estimator allows for cross-country heterogeneity and does not require that the euro area countries have the same economic structures and dynamics (see, e.g. Gambacorta, Hofmann, and Peersman (2014)). Restricting the heterogeneous coefficients to be the same across groups induces correlation between regressors and the error term as well as serial correlation in the residuals. Thus, with the estimation of mean group panel estimator, separate regressions for each cross-sectional unit is estimated and panel estimates are obtained by means of taking cross-sectional averages of the estimation results. Thus, in our analysis we avoid making the strong assumption of identical economic structure and dynamics for these euro area economies.[11]

Mean group estimator

In what follows, we describe in detail how we derive the reduced form residuals for each country i, estimating a panel VAR model in the Pesaran and Smith (1995) framework. Then, we explain how we identify the exogenous monetary policy shocks, which could be in the form of unanticipated interest rate hike innovations or monetary base (M1) expan-

[7] This corresponds to the assumption that the economic shocks are recoverable from finite list of current and past $Y_{i,t}$'s. In our analysis, we only need that a subset of the $e_{i,t}$'s be recoverable from current and past $Y_{i,t}$'s

[8] For each lag length p, the matrix A_i includes $(N*n)^2$ autoregressive coefficients and there are $N*n*(N*n+1)/2$ parameters in the error covariance matrix.

[9] The unrestricted panel VAR model is a tool which takes into account dynamic and static interdependencies among countries as well as cross-section heterogeneities. In particular, it allows lagged variables of foreign countries to have an impact on domestic variables. By static interdependencies between two variables of two countries it allows the covariance between the two to be unequal to zero. Finally, this model would allow the coefficient matrices to vary across economies.

[10] The existing literature suggests different ways to deal with the dimensionality problem. From a Bayesian perspective, the most commonly used way is to make the assumption of homogeneity, no dynamic and no static interdependencies (see, e.g., Abrigo and Love (2015) and Canova and Ciccarelli (2013)). Moreover, Canova and Ciccarelli (2009) allowing for static and dynamic interdependencies propose the cross sectional shrinkage approach. George et al. (2008), Korobilis (2016), Koop and Korobilis (2016) use the hierarchical prior identification approach.

[11] Given that we are restricted with a relatively small sample period and have ten different countries, we are not able to allow for cross- country spillover effects. However, we take into account cross-country heterogeneity.

sions. These monetary shocks are unanticipated in the sense that they cannot be predicted by market participants given the information contained in the panel VAR model and, based on the particular identification approach that we follow, given current and expected changes in interest rate contracts. Moreover, this shock is also unanticipated by the central bank in the sense that it cannot predict it given the information contained in its internal forecasts.

The general structural form of the panel VAR for each country i is given by equation (2.1). Multiplying each side of the equation by A_0^{-1} we get the reduced form representation

$$y_{\mathrm{i,t}} = B_{1,\mathrm{i}} Y_{\mathrm{i,t\text{-}1}} + B_{2,\mathrm{i}} Y_{\mathrm{i,t\text{-}2}} + ... + B_{\rho,\mathrm{i}} Y_{\mathrm{i,t\text{-}}\rho} + D_{\mathrm{i}} X_{\mathrm{t}} + u_{\mathrm{i,t}} \tag{2.2}$$

where $B_{j,i} = A_{0,i}^{-1} A_{j,i}$ and $u_{\mathrm{i,t}}$ denote the reduced form residuals which are related to the structural shocks by: $u_{\mathrm{i,t}} = A_{0,i}^{-1} e_{i,t}$. Imposing the restriction that the structural shocks are uncorrelated (e.g. $\Sigma_{e,i}$ assumed to be a diagonal matrix), then we can set $\Sigma_{e,i} = I$, and the variance-covariance matrix of the reduced form model is then equal to $\Sigma_i = E[u_{\mathrm{i,t}} u_{\mathrm{i,t}}{}'] = A_0{}^{-1} A_0{}^{-1\prime}$. In order to compute the impulse response functions, we need to know the matrix $\mathrm{A_{0,i}}$. While the $\mathrm{B_{j,i}}$'s and $u_{\mathrm{i,t}}$'s can be estimated by ordinary least square regressions, getting the matrix $\mathrm{A_0}$ is not possible without imposing some additional restrictions. The only information about the matrix $\mathrm{A_0}$ is contained in the relationship, $\Sigma_i = E[u_{\mathrm{i,t}} u_{\mathrm{i,t}}{}']$. To deal with the identification problem that arise estimating any model of simultaneous equations we impose a set of linear restrictions on the elements of $\mathrm{A_0}$ and a requirement that the diagonal elements of $\mathrm{A_0}$ be positive. But, before we proceed with the identification of specific structural monetary policy shock, we describe how we derive the reduced form residuals estimating a panel VAR model.

Following the Pesaran and Smith (1995) framework, we assume that the N countries of the model are characterized by heterogeneous VAR coefficients, but these coefficients are random processes sharing a common mean. Similarly, we assume that the residual variance-covariance matrix, is heterogeneous across countries but is characterized by a common mean. Making the assumptions above, we can estimate a single and homogeneous VAR model for the countries where the parameters of interest are the average effects of the countries. In particular, given the assumptions above, we obtain:

$$\begin{bmatrix} y_{1,\mathrm{t}} \\ y_{2,\mathrm{t}} \\ . \\ . \\ . \\ y_{\mathrm{N,t}} \end{bmatrix} = \begin{bmatrix} B_1{}^1 & 0 & 0 & 0 \\ 0 & B_2{}^1 & 0 & 0 \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ 0 & 0 & 0 & B_{\mathrm{N}}{}^1 \end{bmatrix} \begin{bmatrix} y_{1,\mathrm{t\text{-}1}} \\ y_{2,\mathrm{t\text{-}1}} \\ . \\ . \\ . \\ y_{\mathrm{N,t\text{-}1}} \end{bmatrix} + ... + \begin{bmatrix} B_1{}^{\mathrm{p}} & 0 & 0 & 0 \\ 0 & B_2{}^{\mathrm{p}} & 0 & 0 \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ 0 & 0 & 0 & B_{\mathrm{N}}{}^{\mathrm{p}} \end{bmatrix} \begin{bmatrix} y_{1,\mathrm{t\text{-}p}} \\ y_{2,\mathrm{t\text{-}p}} \\ . \\ . \\ . \\ y_{\mathrm{N,t\text{-}p}} \end{bmatrix} + \begin{bmatrix} D_{1,\mathrm{t}} \\ D_{2,\mathrm{t}} \\ . \\ . \\ . \\ D_{\mathrm{N,t}} \end{bmatrix} X_{\mathrm{t}} + \begin{bmatrix} u_{1,\mathrm{t}} \\ u_{2,\mathrm{t}} \\ . \\ . \\ . \\ u_{\mathrm{N,t}} \end{bmatrix} \tag{2.3}$$

and

$$\Sigma_i = \begin{bmatrix} \Sigma_1 & 0 & 0 & 0 \\ 0 & \Sigma_2 & 0 & 0 \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ 0 & 0 & 0 & \Sigma_{\mathrm{N}} \end{bmatrix} \tag{2.4}$$

From the equation (2.3) we obtain the following for each country i

$$y_{\mathrm{i,t}} = B_{1,\mathrm{i}} y_{\mathrm{i,t\text{-}1}} + B_{2,\mathrm{i}} y_{\mathrm{i,t\text{-}2}} + ... + B_{\rho,\mathrm{i}} y_{\mathrm{i,t\text{-}}\rho} + D_{\mathrm{i}} X_{\mathrm{t}} + u_{\mathrm{i,t}} \tag{2.5}$$

where

$$u_{i,t} \sim N(0, \Sigma_i) \tag{2.6}$$

Stacking over T periods for each country i we get the standard OLS model

$$\mathbf{y}_i = \mathbf{X}_i \beta_i + \mathbf{u}_i \tag{2.7}$$

where:

$$\mathbf{y}_{\mathrm{i}} = \begin{bmatrix} y'_{\mathrm{i,1}} \\ y'_{\mathrm{i,2}} \\ . \\ . \\ . \\ y'_{\mathrm{i,T}} \end{bmatrix}_{T\times n} \quad \mathbf{X}_{\mathrm{i}} = \begin{bmatrix} y'_{\mathrm{i,0}} & \cdots & y'_{\mathrm{i,1\text{-}p}} & x'_1 \\ y'_{\mathrm{i,1}} & \cdots & y'_{\mathrm{i,2\text{-}p}} & x'_2 \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ y'_{\mathrm{i,T\text{-}1}} & \cdots & y'_{\mathrm{i,T\text{-}p}} & x'_{\mathrm{T}} \end{bmatrix}_{T\times(np+m)} \quad \beta_{\mathrm{i}} = \begin{bmatrix} (B^1{}_{\mathrm{i}})' \\ . \\ . \\ . \\ (B^{\mathrm{p}}{}_{\mathrm{i}})' \\ (D_{\mathrm{i}})' \end{bmatrix}_{(np+m)\times n} \quad \mathbf{u}_{\mathrm{i}} = \begin{bmatrix} u'_{\mathrm{i,1}} \\ u'_{\mathrm{i,2}} \\ . \\ . \\ . \\ u'_{\mathrm{i,T}} \end{bmatrix}_{T\times n} \tag{2.8}$$

and for each country i, $\beta_i = b + b_i$ with b a $(n * p + m) \times 1$ vector of parameters and $b_{\mathrm{i}} \sim N(0, \Sigma_{\mathrm{b}})$. This implies that the coefficients of the VAR in different countries differ but have similar means and variances. Once the estimator $\hat{\beta}_{\mathrm{i}}$ is obtained for all countries, the mean-group estimator for b is given by $\hat{b} = 1/N \sum_{i=1}^{N} \hat{\beta}_i$, while the standard error for the mean-group estimator is given by:

$$\hat{\Sigma}_b = 1/N(N-1) \sum_{i=1}^{N} (\hat{\beta}_i - \hat{b})(\hat{\beta}_i - \hat{b})' \tag{2.9}$$

An estimate of the residual variance-covariance matrix Σ for each country i equals $\hat{\Sigma}_i = (1/T - k - 1) u_i' u_i$ and the variance-covariance matrix of the mean-group estimator can then be obtained as $\hat{\Sigma} = 1/N \sum_{i=1}^{N} \hat{\Sigma}_i$.

2.3.2 Construction of Instruments for the Euro Area

In this section, we describe how building on the work of C. D. Romer and D. H. Romer (2004), Gurkaynak, Sack, and Swanson (2004), Gertler and Karadi (2015) and others, we construct the external instruments we will use in our panel SVAR analysis. More specifically, we describe how we construct a narrative monetary measure for the Euro Area following the Romer and Romer (2004) methodology, and how, following the High Frequency Identification (HFI) approach along with principal components analysis, we construct two factors using changes in Euribors with different maturities around ECB announcement dates as in Gurkaynak, Sack, and Swanson (2004).

The Narrative approach

Following C. D. Romer and D. H. Romer (2004), we derive a monetary measure for the Euro Area which is relatively free of endogenous and anticipated movements. Since ECB's internal forecasts contain reliable information about future economic developments, we regress intended changes of the ECB's key interest rate on ECB's internal forecasts around ECB announcement days. Doing so, we isolate shifts of monetary policy that are not due to systematic responses to current and future economic conditions.

The Governing Council of the ECB announces on its website[12] its policy decisions for the level of three official interest rates: the main refinancing operations (MRO), the rate on the deposit facility, and the rate on the marginal lending facility. Table B1 in the appendix, shows the three official interest rates of the ECB along with their intended changes around ECB announcement dates. To construct the narrative measure of monetary policy, we first derive a series of initial and intended changes of the MRO rate, which is one of the ECB's key indicators. Second, to isolate exogenous shifts in the MRO rate not due to current or forecasted economic conditions, we use the ECB's internal forecasts of the harmonized consumer price index and of real GDP.[13] Third, we regress the intended changes of the MRO around ECB announcement dates on these internal forecasts.[14] Due to the fact that the macroeconomic projections of the ECB is published only four times in a year, while Governing Council Meetings are observed each month or even twice in a month, we do not have new staff forecasts for each meeting day in the case of the ECB. So, for each meeting I assign the last and more recent macroeconomic projection that was published. For example, if the meeting is on July, for that meeting I use the projection published in June. Being aware that the Central Bank may use some proxies for that macroeconomic variables instead of relying on the forecast that was done in the previous quarter, in my future work I will include the harmonised consumer price indices and industrial production realizations of the previous month

[12] https://www.ecb.europa.eu/press/govcdec/mopo/1999/html/index.en.html

[13] Twice a year, both ECB staff (March and September) and Eurosystem staff (June and December) publish macroeconomic projections for the euro area, available at https://www.ecb.europa.eu/mopo/strategy/ecana/html/table.en.html

[14] Our estimation is based on daily changes around the ECB's announcements days instead of intraday data that Gurkaynak, Sack, and Swanson (2004) use which focus on changes in the futures rate in narrow windows around the FOMC announcements.

Table 2.1: Estimation results of equation (2.10)

VARIABLES	Δ MRO$_m$
MRO	0.018**
	(0.009)
$\sum_{t=-1}^{2} \gamma_t$GDP$_t$	0.011**
	(0.004)
$\sum_{t=-1}^{2} \delta_t \Delta$ GDP$_t$	0.012***
	(0.004)
$\sum_{t=-1}^{2} \phi_t$HICP$_t$	-0.040*
	(0.023)
$\sum_{t=-1}^{2} \zeta_t \Delta$ dHICP$_t$	-0.028*
	(0.015)
Constant	0.016
	(0.025)
Observations	209
R-squared adjusted	0.154

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

in estimating the equation (2.10). The residuals from this regression show changes in the official interest rate that are not in response to information about current and future economic developments.

In line with C. D. Romer and D. H. Romer (2004), the equation we estimate to derive the narrative monetary measure that we later use as one of the instruments in our proxy SVAR in order to identify our monetary shock, is as follows:

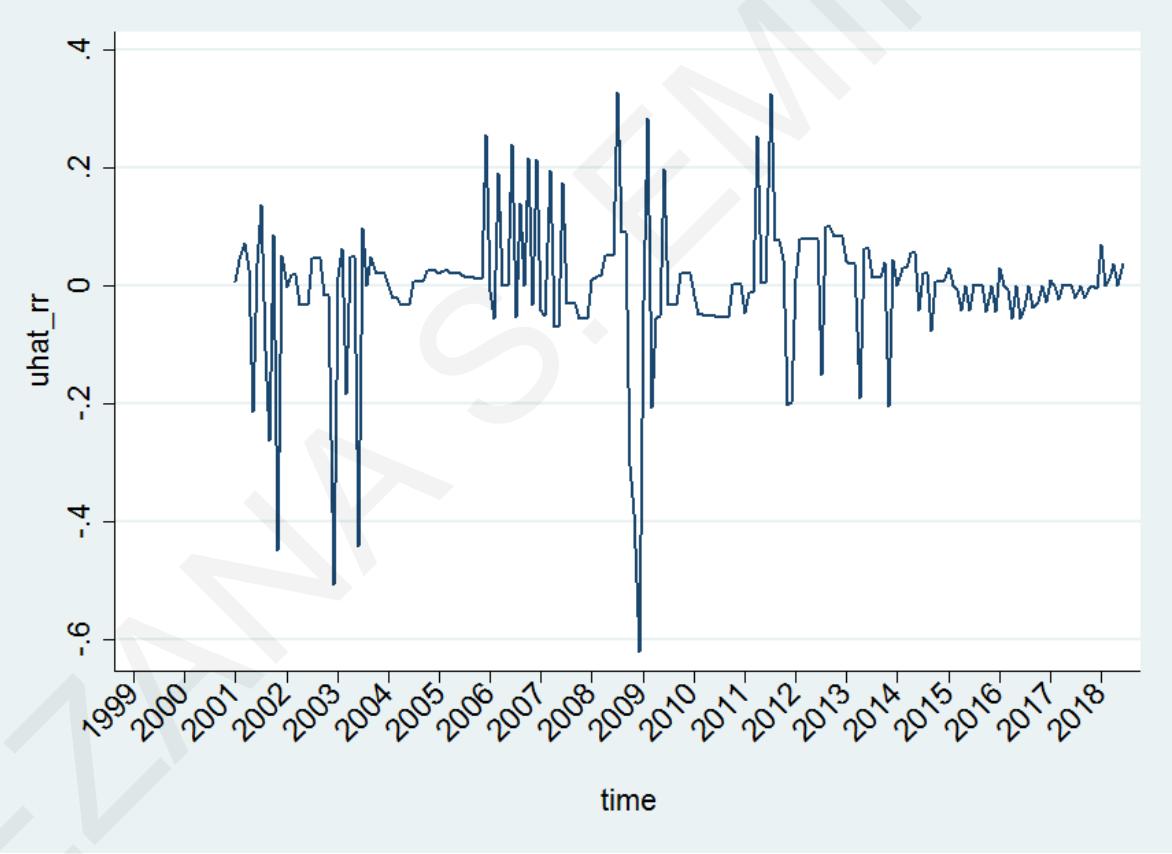
$$\Delta MRO_m = a + bMRO_m + \sum_{t=-1}^{2} \gamma_t GDP^f_{mt} + \sum_{t=-1}^{2} \delta_t (GDP^f_{mt} - GDP^f_{m-1,t}) + \sum_{t=-1}^{2} \phi_t HICP^f_{mt} + \sum_{t=-1}^{2} \zeta_t (HICP^f_{mt} - HICP^f_{m-1,t}) + u^{RR}_m \tag{2.10}$$

where ΔMRO_{m} is the change in the MRO around Governing Council meetings, m, MRO$_{\text{m}}$ is the level of the MRO before any changes associated with meeting m, GDP^{f} and $HICP^{\text{f}}$ are the respective forecasts of real activity (GDP) and of the harmonized consumer price index, and subscript t indicates the horizon of the forecast (-1 is the previous quarter, 0 is the current quarter and so on). We include forecasts up to two quarters ahead. We do not include the unemployment forecast in our analysis because these are available only as of 2014. The estimation results of the equation above are given in Table 2.1.

Both the MRO series we derive and the ECB forecast data correspond to Governing Council meetings. For the sample period that we examine, the number of scheduled ECB Governing

Council meetings is equal to 253. But, given that the macroeconomic projections for the euro area is available to us only since 2001, the number of observations in equation (2.10)is equal to 209. The residuals derived from equation (2.10) correspond to ECB meetings and were regarded by Romer and Romer (2004) as a measure of monetary shocks. Here, we go a step further and use this series as an external instrument in our panel SVAR analysis as in Mertens and Ravn (2013). For further analysis, we convert the residuals $\hat{u}_{\mathrm{m}}{}^{\mathrm{RR}}$ to a monthly series by assigning each shock to the month in which the corresponding meeting occurred. As in Romer and Romer (2004), if there is more than one meeting in a given month, we sum the residuals, while if there is no meeting in a given month we record a value of zero for that month. Figure 2.2 plots the new monetary measure constructed using the narrative identification approach of Romer and Romer (2004).

Figure 2.2: The constructed instrument for the Euro Area based on a narrative measure of monetary policy.



High Frequency Identification of monetary policy surprises

We now construct the two main factors describing the effects of monetary policy actions as in Gurkaynak, Sack, and Swanson (2004), to be used as external instruments in our proxy SVAR in order to identify monetary policy shocks. The reason for examining two-dimensional measures of monetary policy actions instead of focusing on one particular interest rate with a certain maturity date (see, for example, Kuttner (2001)) is that beyond the change in the current interest rate, we also want to capture the effect of monetary policy announcements through the expected interest rate path. The two-factor approach developed

by Gurkaynak, Sack, and Swanson (2004) distinguishes the effect of monetary policy to the "target" and "path" factors. In their study, "target" factor corresponds to the surprise changes in the current interest rate target, while the "path" factor corresponds to changes associated with central bank announcements and forward guidance. We thus construct the corresponding two factors for the Euro Area.

For each monetary policy announcement, we measure the surprise component of the change in the Euribor with one week, one month, two months, three months, six months, nine months and 12 months of maturity. In particular, we construct a (T x n) matrix G with rows corresponding to monetary policy announcements and columns corresponding to the change in the Euribor. We decompose matrix G into its principal components after normalizing each column to have mean zero and unit variance.

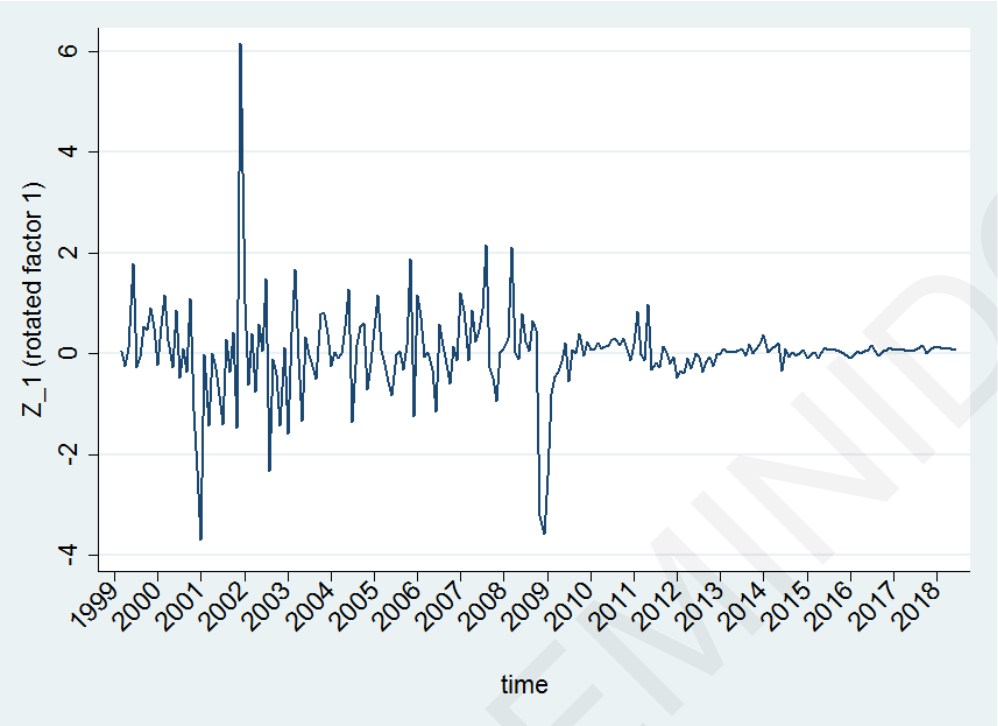
Supposing that matrix G can be represented as $G = F\Lambda + \eta$, where F is a $T \times m$ matrix of unobserved factors, Λ is a matrix of factor loadings, and η is a $T \times n$ matrix of white noise disturbances, we estimate the first two unobserved factors by principal components. This procedure decomposes the matrix G into a set of orthogonal vectors F_i, i = 1,...,n, where F_1 is the vector that has maximum explanatory power for G, and F_2 is the vector that has maximum explanatory power for the residuals of G after projecting it on each column of F_1. We focus only on the first two factors (F_1 and F_2) since they together explain about 93.4 percent of the variation in G. As these two unobserved factors do not have any structural interpretation, we follow Gurkaynak, Sack, and Swanson (2004) and rotate these factors into two new factors Z_1 and Z_2 that correspond respectively to surprise changes in the current interest rate and to movements in interest rate expectations that are not driven by changes in the current interest rate.

Figure 2.3 plots the two factors constructed using daily changes in Euribors with different maturities around ECB announcement dates. As we can see, the two factors move differently across time. For example, in 2002 the instrument Z_1 increases, while the second factor, Z_2, decreases.

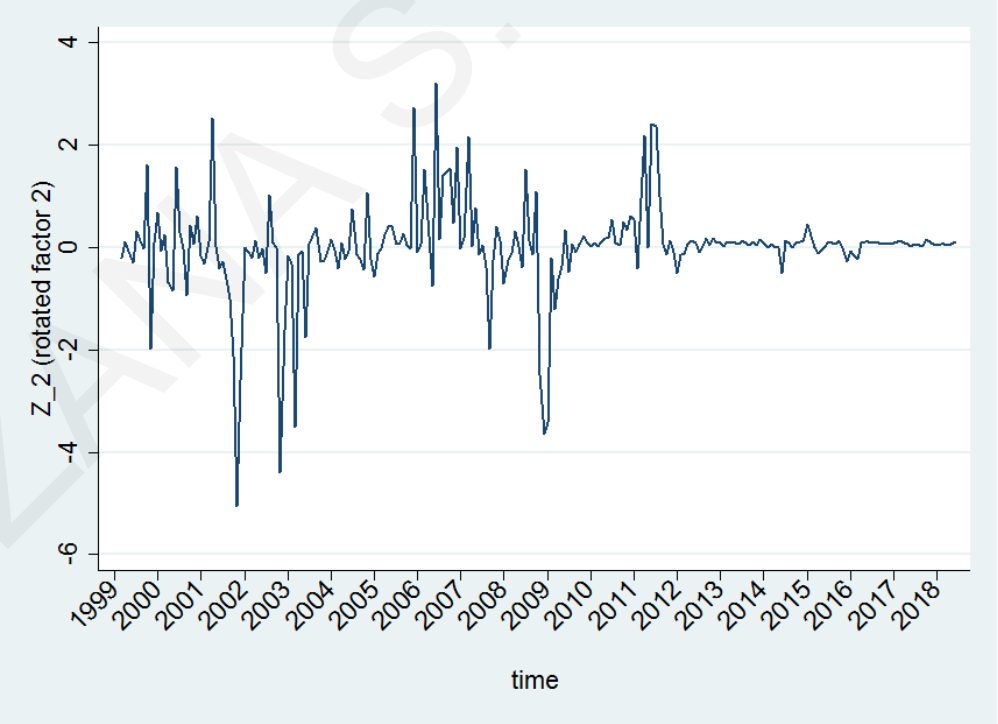
In this section, we have constructed an instrument based on a narrative measure of monetary policy, $\hat{u}_m^{RR}$, and two additional instruments, Z_1 and Z_2, based on high frequency Euribor changes. These instruments will be used to proxy the panel VAR residuals. The advantage of the use of external instruments in our identification method is that they capture information outside the panel VAR model. In our study, monetary policy shocks are exogenous in the sense that they are not anticipated by market participants nor by the central bank.

Figure 2.3

(a) The first factor constructed using daily changes in Euribors with different maturities around ECB announcement dates.



(b) The second factor constructed using daily changes in Euribors with different maturities around ECB announcement dates.



2.3.3 Identification of monetary policy shocks

Beside the dimensionality problem described earlier in this section, we have to deal with the identification problem which arises when estimating any VAR model of simultaneous equa-

tions. Since the innovations $e_{i,t}$ are contemporaneously correlated and are mutually dependent across the endogenous variables, we cannot identify the specific monetary policy structural shock which derives from a monetary policy indicator without further assumptions.[15] We follow the promising new approach of Mertens and Ravn (2013) with the introduction of external series for the identification of exogenous shocks. More precisely, we proxy the reduced form monetary policy residuals that derive from the estimation of the mean-group estimator of Pesaran and Smith (1995), with the instruments that we constructed in the previous subsection based on narrative and high frequency monetary policy series.

Studying how monetary policy affects firms' expectations and therefore economic activity, we take into account that monetary policy not only affects, but also responds to the state of the economy. In monetary policy transmission mechanism analysis, the endogeneity issue has been addressed in alternative ways. On the one hand, vector autoregressions (VARs) with common identification methods such as timing and sign restrictions have been used (see, e.g., Sims and Zha (2006a), Christiano, Eichenbaum, and Evans (1999), Geiger and Scharler (2016)). On the other hand, C. D. Romer and D. H. Romer (2004) use the narrative approach to identify a new measure of monetary policy shocks. Moreover, the high frequency identified approach (see, for example, Kuttner (2001), Gurkaynak, Sack, and Swanson (2004), and others), utilizes unexpected changes in the federal funds rate and Eurodollar futures to measure policy surprises around Federal Open Market Committee (FOMC) meetings.[16]

The new "proxy SVAR" approach developed by Stock and Watson (2012) and Mertens and Ravn (2013) we follow here, combines the strength of both SVARs and the narrative approach. This method is a promising new approach which incorporates external series for identification, such as series based on narrative evidence or high frequency information. This method was first applied to identify monetary shocks by Gertler and Karadi (2015) who combined traditional VAR analysis with high frequency identified shocks in a proxy SVAR.

The important parameters for identifying the effects of structural monetary policy shocks are the covariance matrix of the VAR innovations and the covariance matrix of the VAR innovations with the proxy variables. The main idea of the identification procedure we follow is to avoid imposing any direct timing assumptions on the contemporaneous impact of matrix A_0 shown in equation (2.1). The method we use exploits the advantage of information contained in narrative accounts of policy changes (see, e.g., Mertens and Ravn (2013)) and information contained in daily changes of market-based interest rates around ECB's an-

[15] Common methods to identify monetary policy shocks include the Cholesky decomposition of the variance-covariance matrix of the residuals, e.g. in Sims (1980), the SVAR of Blanchard and Watson (1986) and Bernanke (1986), the narrative approach of C. D. Romer and D. H. Romer (2004), the high frequency identification approach (see, for example, Kuttner (2001), Gurkaynak, Sack, and Swanson (2004), Gertler and Karadi (2015)), and the proxy SVAR introduced by Stock and Watson (2008) and developed by Stock and Watson (2012) and Mertens and Ravn (2013). Moreover, Miranda-Agrippino and Ricco (2018) building on the intuition provided by models of asymmetric information, suggest a new method to identify the transmission of monetary policy shocks using Bayesian Local projection analysis.

[16] The use of futures data in measuring monetary policy shocks was introduced by Rudebusch (1998).

nouncement dates (see, for example, Gertler and Karadi (2015)). Thus, following Stock and Watson (2008) and Mertens and Ravn (2013), we proxy the monetary policy residuals that we derived previously from the estimation of a panel VAR, with the external instruments containing additional information beyond that already contained in the panel VAR.

In line with previous studies of the monetary policy transmission mechanism (see, for example, Sims and Zha (2006a), Christiano, Eichenbaum, and Evans (1999), Leeper and Roush (2003), and Belongia and Ireland (2015)), we assume that vector $\mathbf{y}_{i,t}$ in equation (2.7) includes the following variables with the following ordering: short term nominal interest rate, M1 growth rate, firm-specific selling price or production expectations, inflation rate, the differenced log of industrial production, the differenced unemployment rate, and the level of implied stock market volatility index VIX. The vector with exogenous variables includes a dummy for the post crisis period and the smoothed change in the log of the price of crude oil.

As we are interested in the identification of specific variables contained in vector $\mathbf{y}_{i,t}$ and not in the other shocks, we distinguish among the residuals contained in vector $\mathbf{u}_{\mathrm{i,t}}$. Also, due to the fact that our sample includes the period during which the traditional instrument of monetary policy is close to the zero lower bound, beyond the conventional policy shocks, we explore the impact of monetary policy through alternative measures (see, e.g., Curdia and Woodford (2011), Belongia and Ireland (2015), Darvas (2015) and Keating, Kelly, and Valcarcel (2014))[17]. Thus, depending on the policy indicator that we consider, the monetary policy shock relates to unexpected changes in the short term interest rate, or to unanticipated changes in M1, or to the Divisia M1 and the Divisia M2.

We examine the impact of unanticipated changes of two distinct policy indicators on firm's expectations in two different specifications. In the first specification, we study the impact of monetary policy shocks on selling price expectations for the total manufacturing sector and two of its main subsectors. In the second specification, we study firms' production expectations.

To identify structural monetary policy shocks we follow the following steps: First, we estimate a panel VAR model using the mean-group estimator methodology discussed in subsection 3.1. Thus, we obtain an estimate of β_{i} for each country i, $\hat{\beta}_{\mathrm{i,t}} = (X'_{i,t}X_{i,t})^{-1}X'_{i,t}y_{i,t}$, by standard OLS estimation. Then, we get the vector with reduced form residuals $\hat{\mathbf{u}}_{i,t}$ for each country i, $\hat{\mathbf{u}}_{i,t} = \mathbf{y}_{i,t} - \mathbf{X}_{i,t}\hat{\beta}_{\mathrm{i,t}}$. Letting ${y_{\mathrm{i,t}}}^{\mathrm{pi}}$ be the policy indicator contained in vector $\mathbf{y}_{i,t}$ and $\mathbf{y}_{i,t}^{others}$ the rest of the variables contained in vector $\mathbf{y}_{\mathrm{i,t}}$, we then partition the vector of reduced form residuals $\mathbf{u}_{i,t} = [u_{i,t}^{pi'}, \mathbf{u}_{i,t}^{others'}]'$, where $u_{i,t}^{pi}$ is the reduced form vector of residuals for the policy indicator and the $(n-1)\times 1$ vector ${\mathbf{u}_{\mathrm{i,t}}}^{\mathrm{others}}$ contains all other $n-1$ reduced

[17] Belongia and Ireland (2015) found that Divisia measures of money contain information and have significant explanatory power comparable to that found in interest rates and thus, including measures of money in the SVAR's information set helps reduce the so called "price puzzle". Keating et al.(2014) identify the effects of monetary policy shocks on macroeconomic variables in VARs using the Divisia measure of money instead of the Federal funds rate as the policy indicator variable. He showed that a SVAR model using Divisia-money worked well for the period before the crisis as well as in the period of zero lower bound.

form residuals. Similarly, $e_{i,t}^{pi}$ denotes the shocks of interest to us, and the $(n-1)\times 1$ vector $\mathbf{e}_{\mathrm{i,t}}{}^{\mathrm{others}}$ contains all other $n-1$ shocks.

To investigate the impact of monetary policy shocks on firms' expectations for each country i, we then estimate

$$y_{i,t} = \sum_{j=1}^{p} \beta_{i,j} y_{i,t-j} + \mathbf{s} e_{i,t}^{pi} \tag{2.11}$$

As in the Pesaran and Smith (1995) approach, the parameter of interest is the mean effect b, we take the average effects and derive the impulse responses by using the equation below:

$$y_{i,t} = \sum_{j=1}^{p} b_j y_{i,t-j} + \mathbf{s} e_t^{pi} \tag{2.12}$$

Using the mean-group estimator in the Pesaran and Smith (1995) methodology, the mean-group residuals for the policy indicator are given by $e_t = 1/N \sum_{i=1}^{N} e_{i,t}^{pi}$. As we are interested only on the impact of the monetary policy shock, e_t^{pi} and not all other shocks, we do not have to identify all the coefficients of A_0^{-1} but just the elements in column **s** denoting the column in matrix A_0^{-1} corresponding to the impact of the structural policy shock $e_{i,t}^{pi}$ on each element of the vector of reduced form residuals $\mathbf{u}_{i,t}$.

Following Stock and Watson (2008), Mertens and Ravn (2013) and Gertler and Karadi (2015), we let $\mathbf{Z}_{\mathrm{t}}$ be a vector with proxy variables that are correlated with the structural shock of interest but orthogonal to other shocks. Given that conditions $E[\mathbf{Z}_{\mathrm{t}} e_{\mathrm{i,t}}{}^{\mathrm{pi}\prime}] = \Phi$ and $E[\mathbf{Z}_{\mathrm{t}} e_{\mathrm{i,t}}{}^{\mathrm{others}\prime}] = 0$, where $\mathbf{Z}_{\mathrm{t}} = [\hat{u}_{i,t}^{RR}, Z_1, Z_2]$, are satisfied, we can obtain estimates of the elements of vector **s** from equation (2.11) for each country i by estimating two stage least squares (2SLS) regression of $\mathbf{u}_{i,t}^{others}$ on $u_{i,t}^{pi}$, using the instrument set $\mathbf{Z}_t$. In particular, in the first stage, we estimate the reduced form residuals of policy indicator $u_{i,t}^{pi}$ on $\mathbf{Z}_{\mathrm{t}}$ to form the fitted values $\hat{u}_{\mathrm{i,t}}{}^{\mathrm{pi}}$ for each country i. In the second stage, we regress the vector $\mathbf{u}_{\mathrm{i,t}}{}^{\mathrm{others}}$ on fitted values, $\hat{u}_{\mathrm{i,t}}{}^{\mathrm{pi}}$ and get the estimates for **s**. Finally, due to the fact that we are interested in identifying the effect of one specific structural shock (interest rate hike innovation or M1 expansion), the number of structural shock of interest is equal to one. Since the number of structural shock that we want to identify is less than the number of external instruments, we do not need any additional assumptions to derive the impulse response functions.

Given estimates of β_{ij} and **s** we can use equation (2.11) to compute impulse responses to monetary policy shocks for each country i. Finally, the impulse responses for the average effect $\mathrm{b_j}$ based on the mean-group estimator approach are estimated using equation (2.12).

2.4 Estimation Results

In this section, we present individual country impulse responses from the estimation of equation (2.11), and impulse responses for the average country from the estimation of equation

(2.12) using the mean-group estimator. In each case, the figures report the estimated impulse responses along with 90 percent confidence intervals[18], computed using bootstrap methods.[19] In all cases, the number of lags we use in our estimations is equal to four.[20] In line with Mertens and Ravn (2013) and Gertler and Karadi (2015), we produce confidence intervals for impulse response functions using a residual-based wild bootstrap. Even though this method has been viewed until recently as the most sophisticated and appropriate for inference with the proxy SVAR methodology, and has subsequently become popular in the proxy SVAR literature, Jentsch and Lunsford (2016) argue that a wild bootstrap is not valid and produces confidence intervals that are much too small. In particular, Jentsch and Lunsford (2016) argue that this distributional choice is especially problematic because the bootstrap multipliers effectively drop out of the bootstrap algorithm when computing the covariance matrix of the VAR innovations and the covariance between the VAR residuals and the proxy variables. In my future work, I will incorporate alternative bootstrap methodologies in deriving impulse response functions to overcome any problematic issues related to wild bootstrap methodology used so far. For example, Jentsch and Lunsford (2016) propose a residual-based moving block bootstrap to produce confidence intervals for impulse response functions from proxy SVARs. The use of residual-based moving block bootstrap methodology is robust against conditional heteroskedasticity and it will effectively account for uncertainty in identification (see, for example, Brüggemann, Jentsch, and Trenkler (2016) Jentsch and Lunsford (2016)). Also, an alternative measure of confidence intervals could be the one proposed by Olea, Stock, and Watson (2013).[21]

In Figure 2.4, we show the responses of selling price expectations to two distinct monetary policy shocks, namely an interest rate hike innovation and M1 expansion, for the total manufacturing sector and two of its main sub-categories. As we can see, unanticipated increases in the short term interest rate lead to an increase of selling price expectations and this positive impact remains significant eight months after the shock occurs. This result is consistent with imperfect information theory models where unanticipated increases in the interest rate are interpreted by previously unaware price-setters as revealing that the central bank is worried about inflation, which leads them to raise their selling price expectations. Consistent with this, expansionary monetary policy shocks lead to a decrease of selling price expectations, and this impact remains statistically significant about eight months after the shock occurs. These results are then consistent with the signaling effect mentioned in Melosi (2016) where

[18] A number of papers that utilize survey expectations data, e.g., D'Amico and King (2017) and Ueda (2010), use much narrower bands, e.g., 68 percent confidence intervals, recognizing the relatively high uncertainty characterizing survey expectations data and model parameters in this case.

[19] In line with Mertens and Ravn (2013) and Gertler and Karadi (2015), we avoid any potential "generated regressor problem" using wild bootstrap that generates valid confidence bands under heteroskedasticity and the use of instruments. The estimation errors related to the instrumental variable regression is taken into account when calculating the confidence bands, since both stages of the impulse response estimation are included in the bootstrapping procedure.

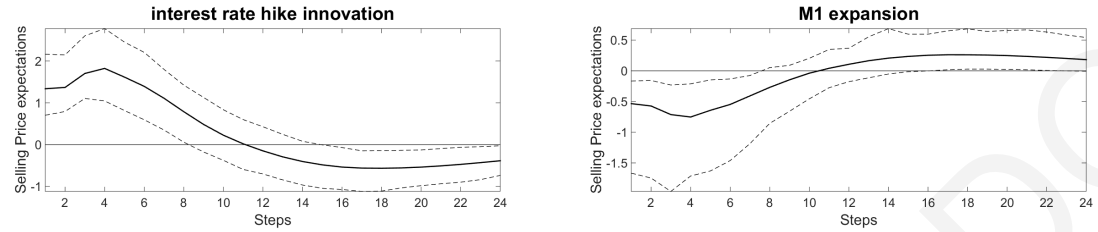
[20] We note, however, that our results are robust using 2 or 6 lags.

[21] The confidence intervals proposed by Olea, Stock, and Watson (2013) are restricted to the case where one proxy variable identifies one structural shock.

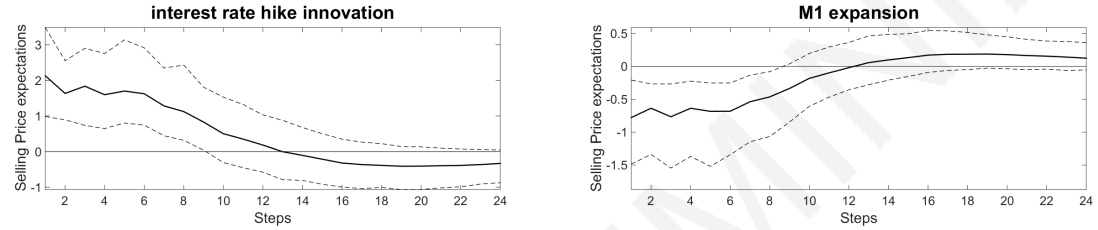
central bank actions signal to unaware price-setters their view about the economy thus influencing their expectations.

Figure 2.4: Selling price expectations' responses

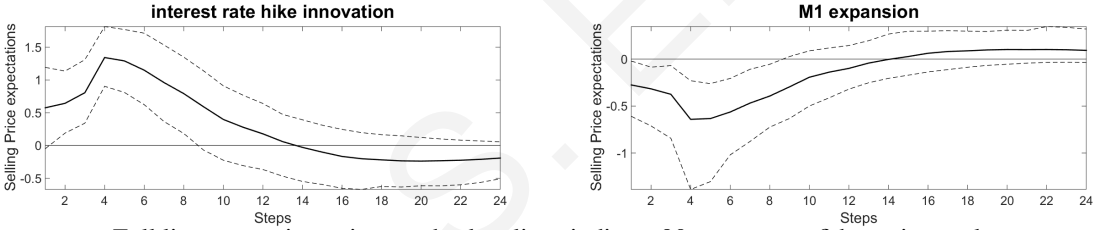
(a) Total manufacturing sector



(b) Firms producing durable consumer goods



(c) Firms producing non-durable consumer goods



Full lines are point estimates; broken lines indicate 90 percent confidence intervals.

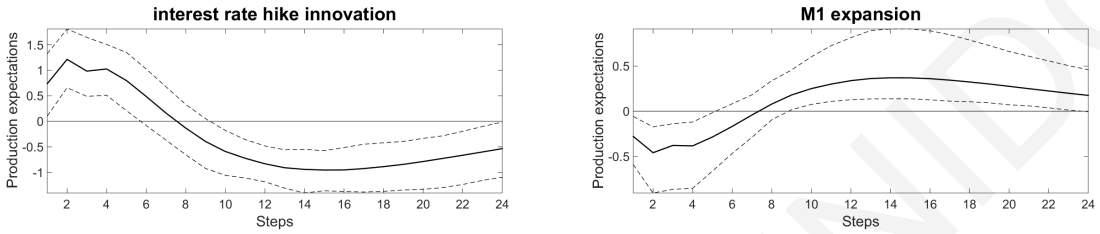
However, over time, firms appear to learn that contractionary (expansionary) monetary policy reduces (increases) inflation and thus start decreasing (increasing) their selling price expectations which become negative (positive) at about 14 months following the shock, as shown in the two panels of Figure 2.4(a) for an interest hike shock and M1 expansion shock respectively.

Comparing the responses between firms producing durable versus non-durable goods shown in Figure 2.4b and Figure 2.4c respectively, we see that the impact of monetary policy shocks is stronger on the expectations of firms producing durable consumer goods as compared to those producing-non durable goods. For example, a one standard deviation unanticipated increase in the interest rate induces firms selling price expectations to increase by 2.1 on impact and then gradually start to decrease and begin receiving negative values thirteen months after the shock occurred. In the case of firms producing non-durable goods, selling price expectations increase only by .6 on impact, peaking at 1.4 on the 4th month and then gradually decrease and take negative values beginning at fourteen months after the shock occurred. Because durable goods last for a long time they tend to be more expensive to both manufacture and purchase while non-durable goods have a shorter life span and usually cost less to produce and procure. Importantly, the pricing decision of the firm for durables involves the

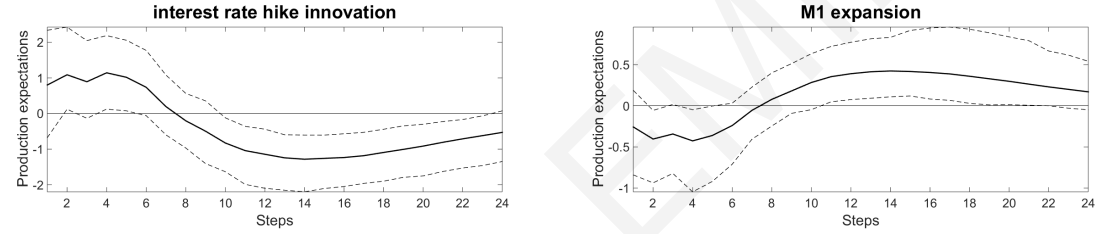
assessment of market conditions and uncertainty over a longer horizon as compared to non-durables. These differences in characteristics make a firm's pricing decision for durables distinct from the case of non-durables, with firms selling price expectations of the former appearing as a result to be more sensitive to monetary policy shocks than is the case for non-durables.[22]

Figure 2.5: Production expectations' responses

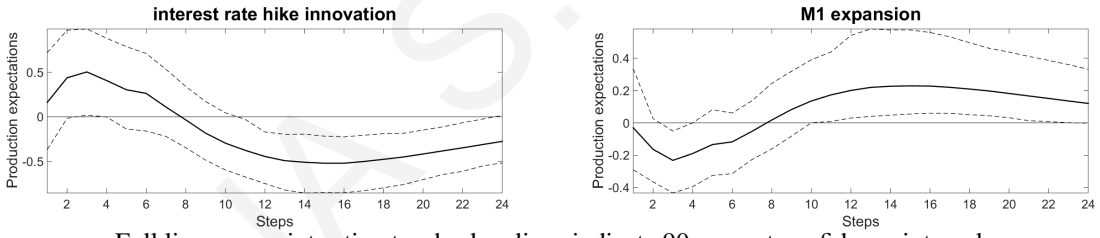
(a) Total manufacturing sector



(b) Firms producing durable consumer goods



(c) Firms producing non-durable consumer goods



Full lines are point estimates; broken lines indicate 90 percent confidence intervals.

Next, in Figure 2.5, we consider the responses of production expectations to monetary policy shocks. After an interest rate hike innovation, production expectations first increase significantly for the first six months, in line with imperfect information theoretical settings where firms find out after an interest rate hike shock that the Central Bank is worried about inflation thus raise their production expectations. Later, production expectations decline and become negative eight months after the shock occurred with the impact becoming statistically significant nine months after the shock and remaining so at two years out. Evidently, we have an overshooting pattern for production expectations in Figure 2.5, and this is now stronger than was the case for selling price expectations in Figure 2.4. This overshooting pattern suggests that, over time, firms come to expect that contractionary monetary policy decreases economic activity, thus start decreasing their production expectations.

[22]The distinct dynamic nature of the pricing decision of a firm for durables versus non-durable goods is supported by Ronald Coase's assertion that "a monopolist selling a durable good is in a harder position than a monopolist of non-durable goods because with durable goods, the monopolist is essentially competing with itself over time".

Comparing the impulse responses in Figure 2.5 versus Figure 2.4, we see that production expectations start to adjust a few months earlier before firms start revising their selling price expectations which become significantly negative only 14 months after the shock occurs as compared to 9 months out for production expectations. This suggests that first the economy moves, then firms observe this and thus learn about the impact of this contractionary interest rate hike on the economy, and finally start adjusting their selling prices in accordance with this learning experience over time. Given that forming inaccurate production expectations is costly to firms, they eventually start decreasing their production expectations after perceiving the impact of the interest rate hike shock on the economy. This is consistent with Reis (2006) who argues that producers facing costs of collecting and processing information rationally choose to be inattentive to news, but sporadically update their information. We note that our results regarding the response of firms' production expectations to an M1 expansion shock are entirely analogous with the results described above regarding the impact of an interest rate hike shock, with production expectations first falling significantly and then becoming significantly positive starting at nine months out.

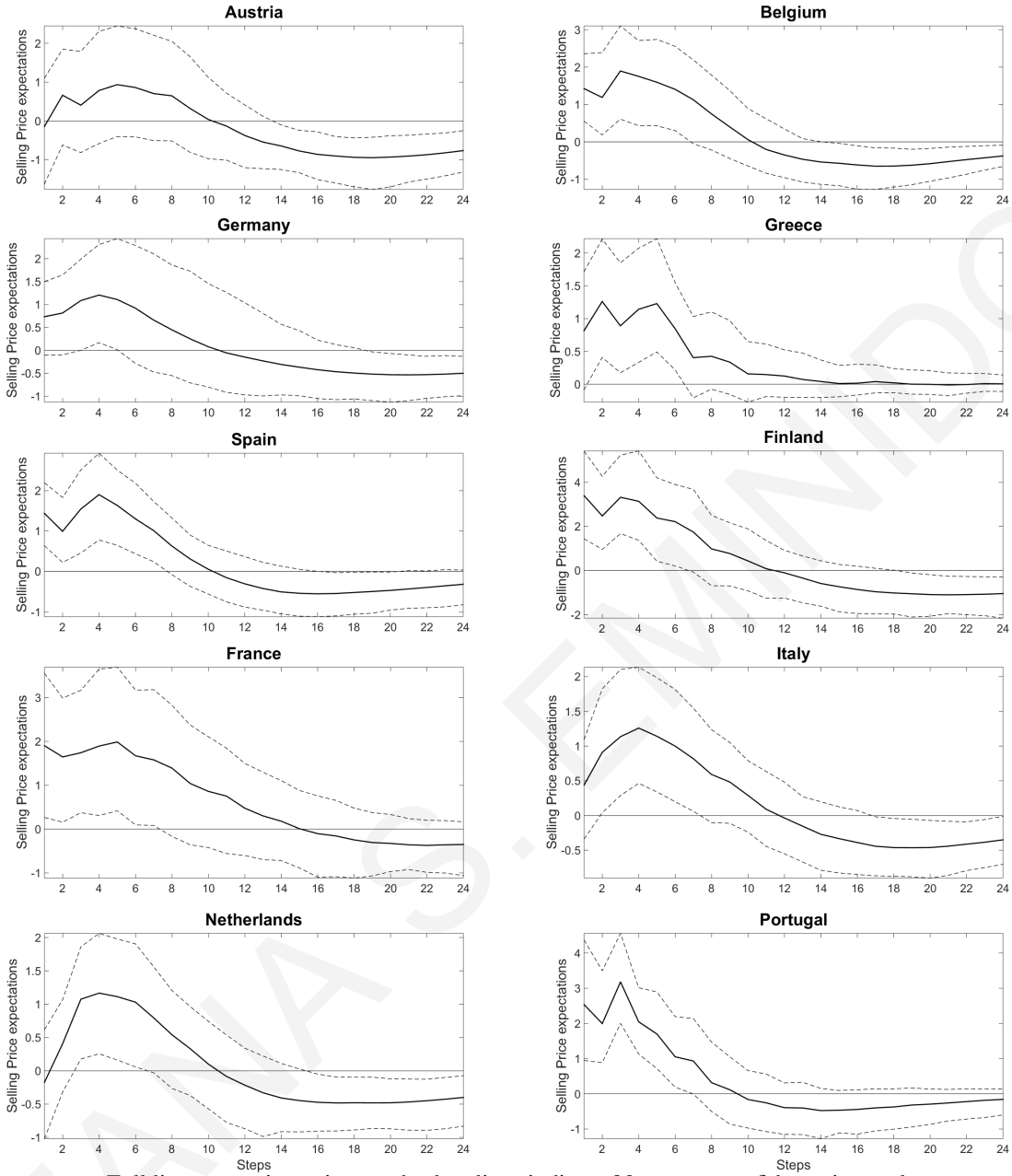
Our next finding arises comparing the impulse responses between firms producing durable versus non-durable goods as presented in Figure 2.5b and Figure 2.5c. A one standard deviation unanticipated increase in the interest rate leads production expectations of firms producing non-durable goods to increase by .2 on impact, while the increase in production expectations of durable goods is four times greater. Similarly, production expectations for firms producing durable goods are more sensitive to M1 expansion shocks than for firms producing non-durable goods. Overall, our results here, reinforce the argument that expectations of firms producing durable goods are more sensitive to monetary policy shocks as compared to firms producing non-durable goods.

Finally, looking at country specific impulse responses, we see that firms that belong to a common monetary policy union may behave differently after a monetary policy shock. Figures 2.6 and 2.7 present the responses of selling price expectations to an interest rate hike innovation and M1 expansion, respectively, while Figures 2.8 and 2.9 present the responses of production expectations to an interest rate hike innovation and M1 expansion, respectively. Each of these figures shows all the country-specific impulse responses to the monetary policy shocks. For the sake of brevity, we present only the responses of the total manufacturing sector's expectations.[23]

The impulse responses in Figure 2.6 indicate that firms' expectations in these euro area countries respond differently to monetary policy shocks. For example, in Austria the response of selling price expectations to an interest rate hike innovation becomes significant only thirteen months after the shock and this impact is negative, while in France an interest rate hike innovation leads to a 1.9 increase in selling price expectations on impact and becomes insignificantly different than zero starting at about seven months after the shock occurs. In

[23]The individual country impulse responses for firms producing durable and non-durable consumers goods are given in Figure B4 to Figure B11 in the Appendix B.

Figure 2.6: Selling price expectations' responses to interest rate hike innovation

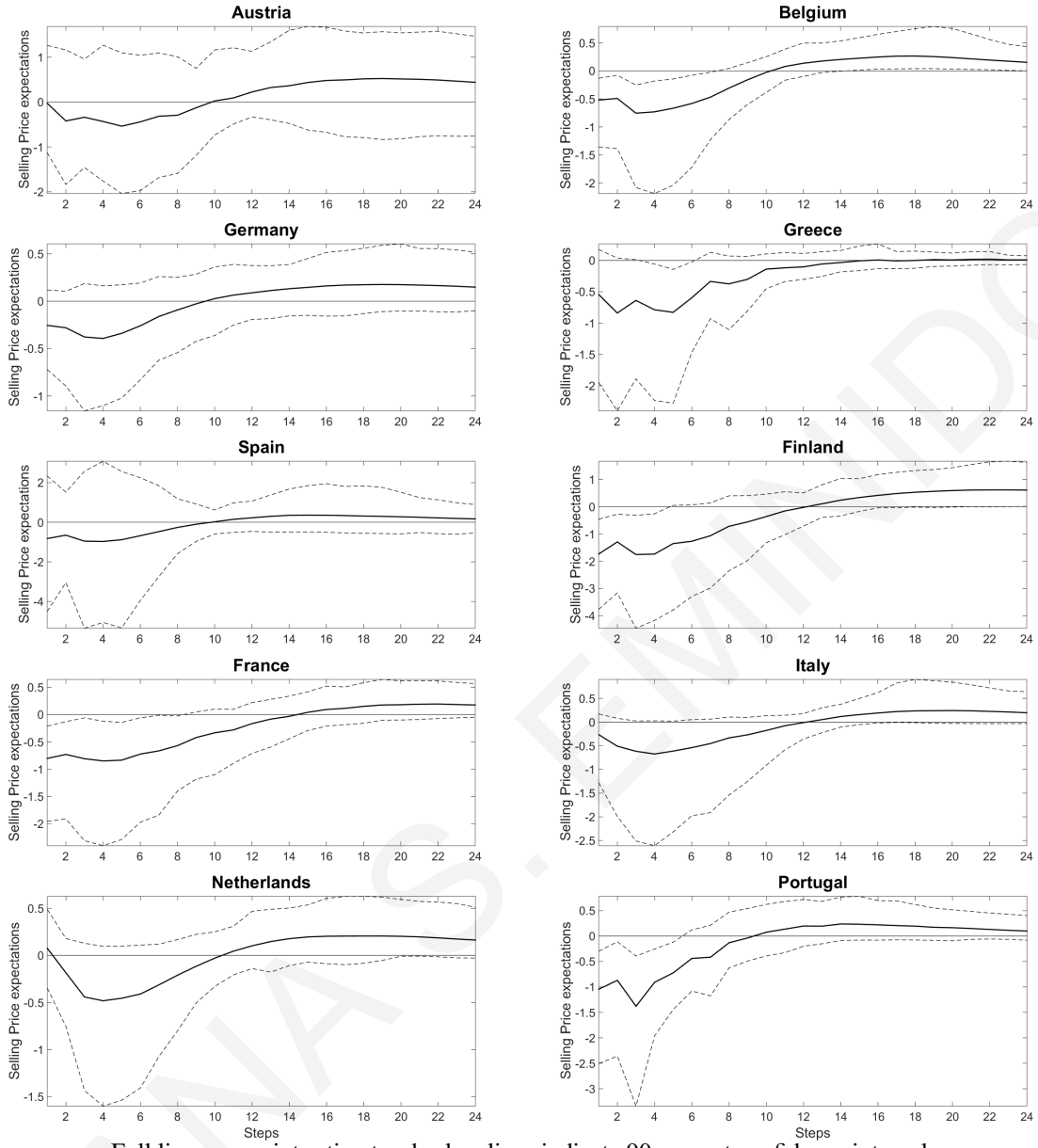


Full lines are point estimates; broken lines indicate 90 percent confidence intervals.

general, the results in Figure 2.6 indicate that an interest rate hike innovation signals to unaware price setters that the central bank is worried about inflation and thus they increase their selling price expectations initially. This positive impact typically remains significant for more than half a year after the shock.

Here, as in the case of the pooled impulse responses in Figure 2.4, following the initial surprise firms gradually come to expect an interest hike innovation to eventually decrease inflation, thus revise their expectations accordingly by decreasing their selling price expectations. For most countries, we end up having a statistically significant negative impact between 13 to 18 months after the shock occurred. However, in Greece, Portugal and France we do not get a significant overshooting pattern, with the negative impact that follows the initial positive impact never becoming statistically significant.

Figure 2.7: Selling price expectations' responses to M1 expansion

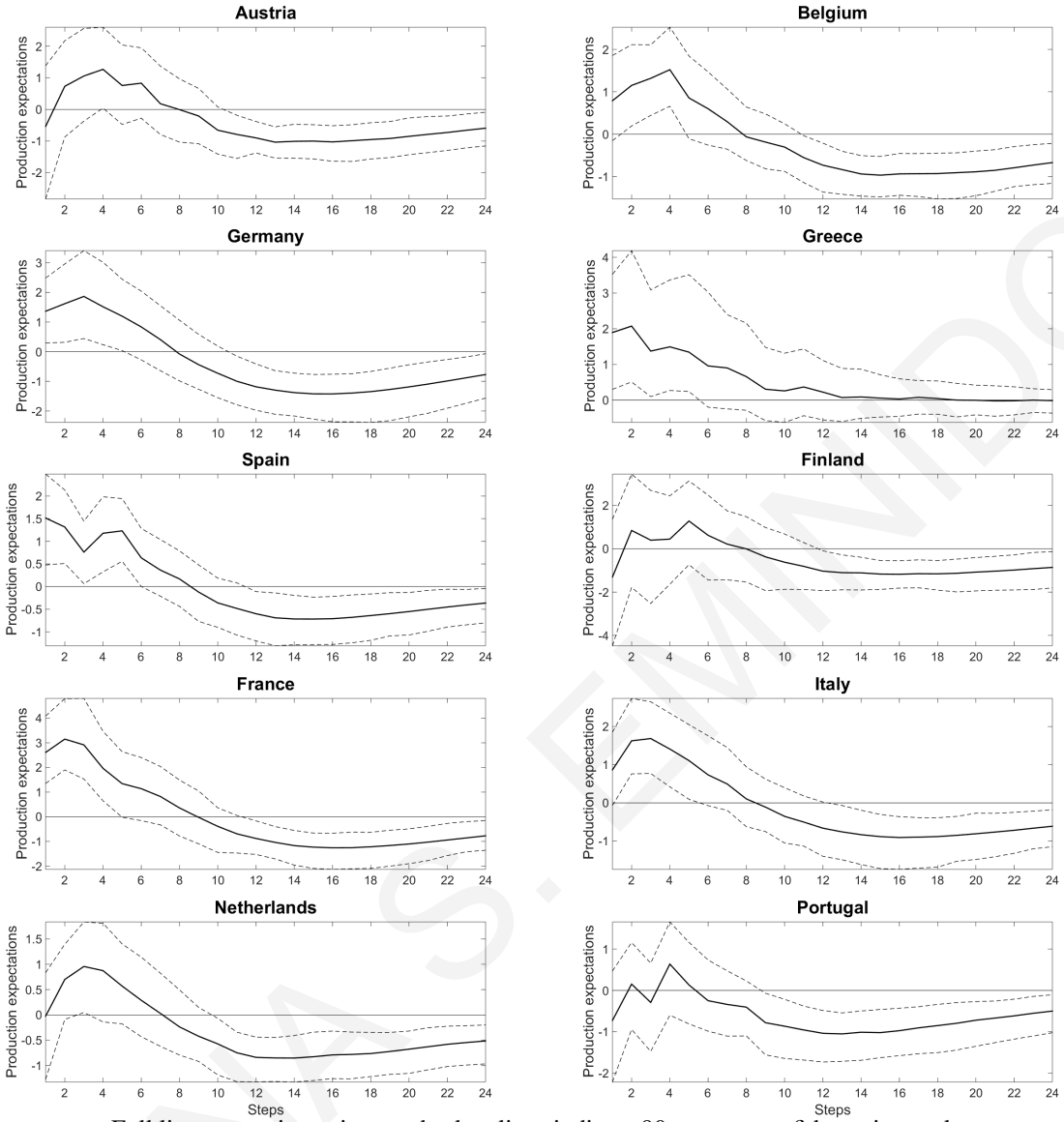


Full lines are point estimates; broken lines indicate 90 percent confidence intervals.

Moreover, the impulse responses of firms' selling expectations after an unanticipated M1 expansion in Figure 2.7 are consistent with our results shown in Figure 2.6. That is, an unanticipated M1 expansion appears to reduce selling price expectations and this impact is statistically significant in countries such as Belgium, Finland, France, and Portugal for up to six months. Once again, an expansionary monetary policy shock is interpreted by unaware and inattentive price setters as signalling that the central bank is worried about deflation, and thus they decrease their selling price expectations. But, over time, firms learn that expansionary monetary policy shocks eventually increase inflation, thus they start to increase their selling price expectations with the impact on these eventually turning positive between 13 to 20 months after the shock and significantly so in the likes of Belgium, Finland, Italy and the Netherlands.

Turning now to the country-specific responses of production expectations to a monetary pol-

Figure 2.8: Production expectations' responses to interest rate hike innovation

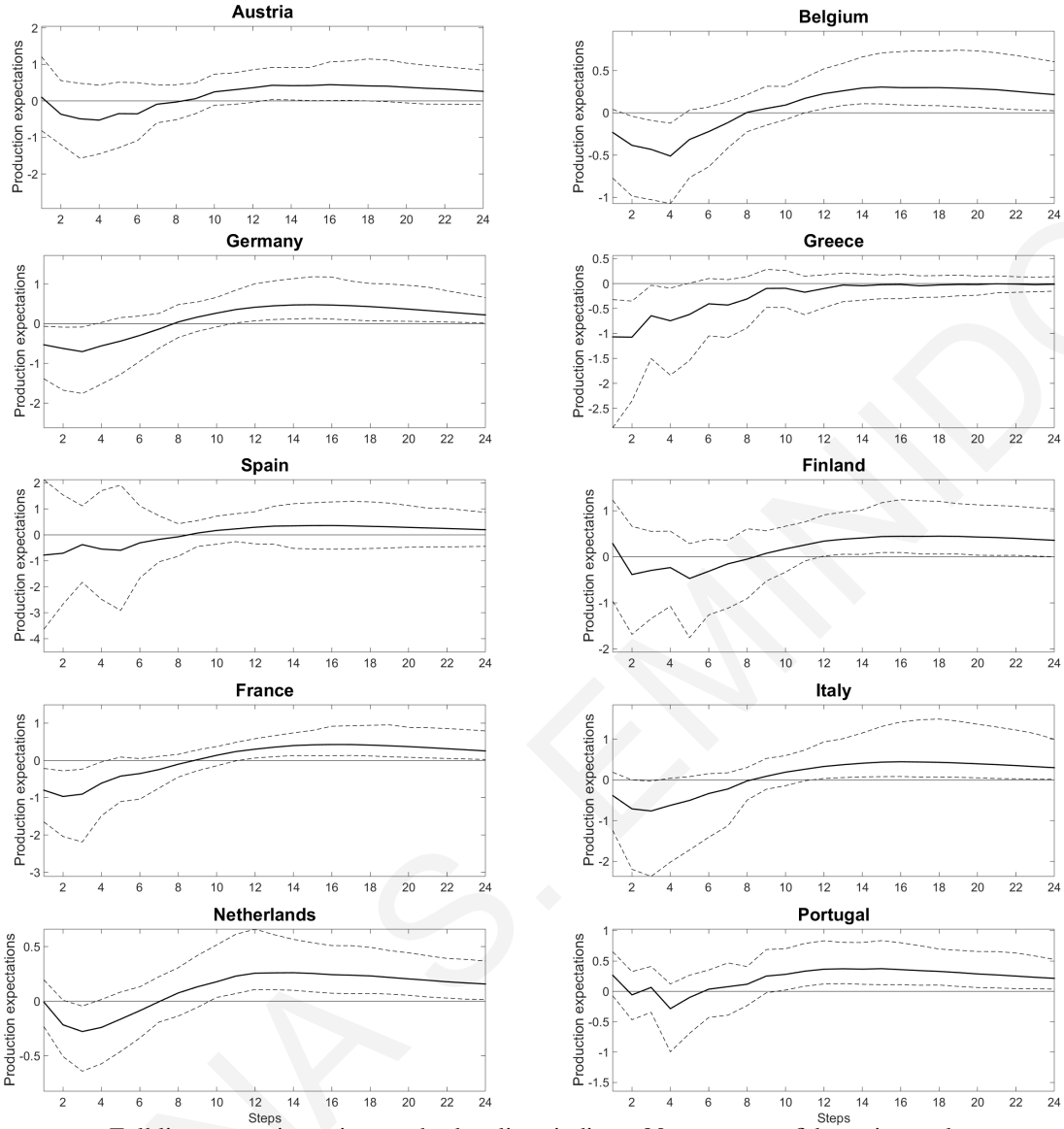


Full lines are point estimates; broken lines indicate 90 percent confidence intervals.

icy shock, we see in Figure 2.8 that the impact of an unanticipated interest rate shock on production expectations is positive and significantly so for about half a year in the likes of Belgium, Germany, Greece, Spain, France and Italy. Moreover, in all countries except Greece, firms are coming to understand over time that an interest rate hike will finally have a negative impact on economic activity and thus they start decreasing their production expectations a few months after the shock occurs with this impact eventually turning significantly negative ten months to a year after the shock occurred.

In Figure 2.9, we can see that an M1 expansion shock signals to unaware firms negative news about the state of the economy so that they decrease their production expectations on impact and significantly so for about 4 to 6 months in Belgium, Germany, Greece and France. Following this initial surprise, firms gradually come to expect this monetary expansion to eventually increase economic activity and significantly so after about one year in all countries except Greece and Spain. Thus, firms in the majority of countries revise their expectations

Figure 2.9: Production expectations' responses to M1 expansion



Full lines are point estimates; broken lines indicate 90 percent confidence intervals.

accordingly by increasing their production expectations. This overshooting pattern is not evident in Greece and Spain. In Greece, firms' production expectations decrease on impact after an expansionary monetary policy shock and this negative impact gradually dissipates less than half a year after the shock occurred, while in Spain the impact of an M1 expansion is never statistically significant at any horizon.

2.5 Robustness Analysis

Alternative monetary aggregates

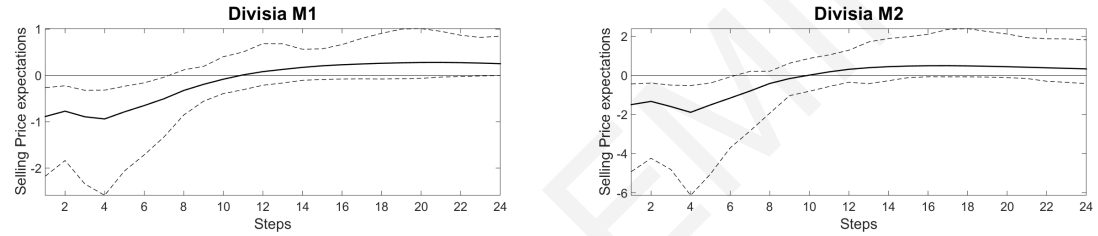
We now evaluate the robustness of the results by considering alternative measures of monetary policy. Leeper and Roush (2003), Keating, Kelly, and Valcarcel (2014), Belongia and Ireland (2015), and Darvas (2015) find that divisia indices of money have desirable proper-

ties as measures of money. Thus, in examining how sensitive our results are to using different monetary policy indicators other than the M1 growth rate, we consider the growth rates of the Divisia M1 or Divisia M2 as the policy indicator of the central bank.[24] The inclusion of Divisia monetary aggregates in our panel SVAR analysis, is accompanied with the inclusion of the corresponding user cost of money.

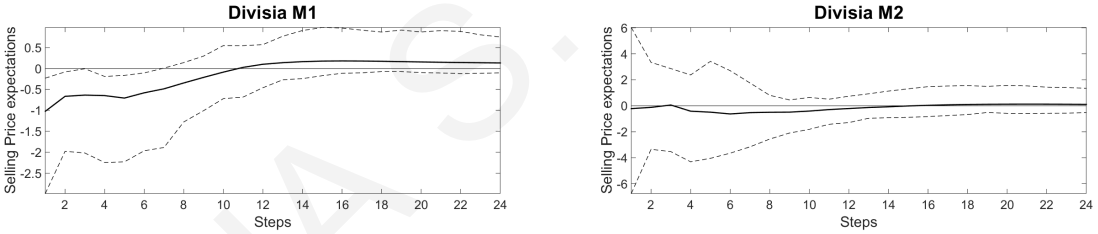
The impulse responses that we get re-estimating the proxy Panel VAR models with those two alternative measures are reported in Figures 2.10 and 2.11 for selling price and production expectations' responses respectively. Our results are mostly robust. However, in the case of the Divisia M2 growth rate the estimated impulse response functions are statistically insignificant for non-durable and durable consumer goods alike.

Figure 2.10: Selling price expectations' responses to Divisia monetary growth rates.

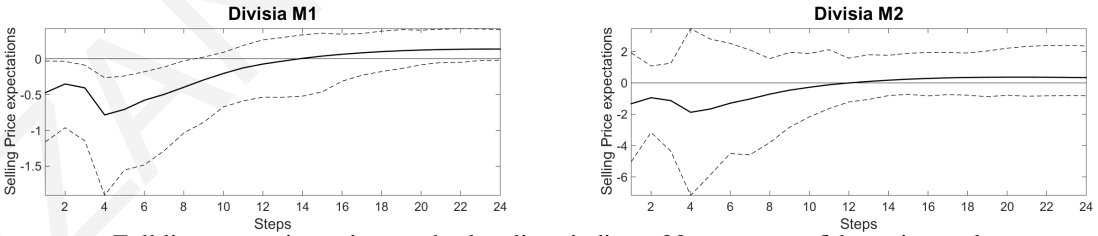
(a) Total manufacturing sector



(b) Firms producing durable consumer goods



(c) Firms producing non-durable consumer goods

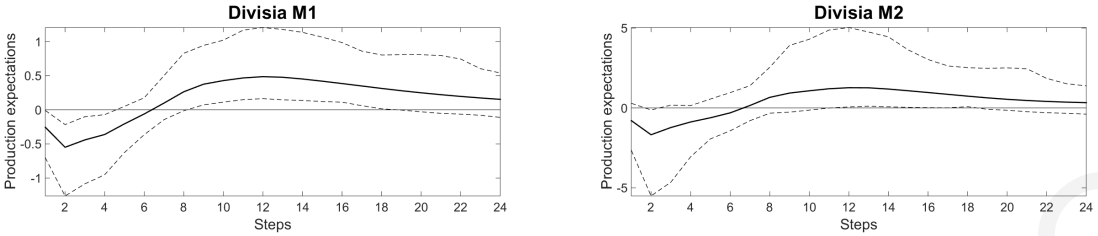


Full lines are point estimates; broken lines indicate 90 percent confidence intervals.

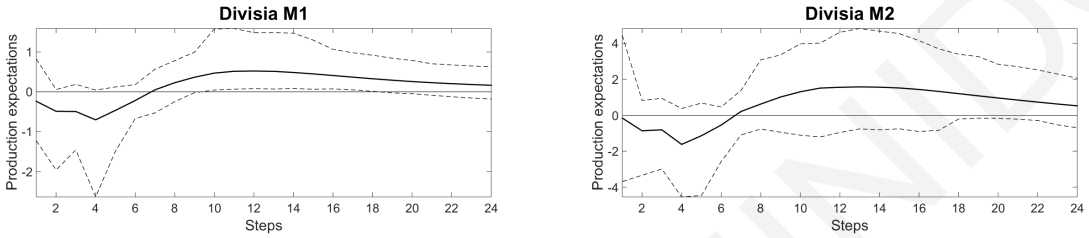
[24] Keating, Kelly, and Valcarcel (2014) use the divisia index of M4 as the monetary policy indicator and find that it works as well as the Federal funds rate in the pre-Crisis period but also in the post-Crisis period when the Federal funds rate reaches the zero lower bound. Moreover, Belongia, Ireland, et al. (2018) find that the Fed has been in fact targeting the growth rate of Divisia monetary aggregates since the arrival of the recent financial crisis.

Figure 2.11: Production expectations' responses to Divisia monetary growth rates

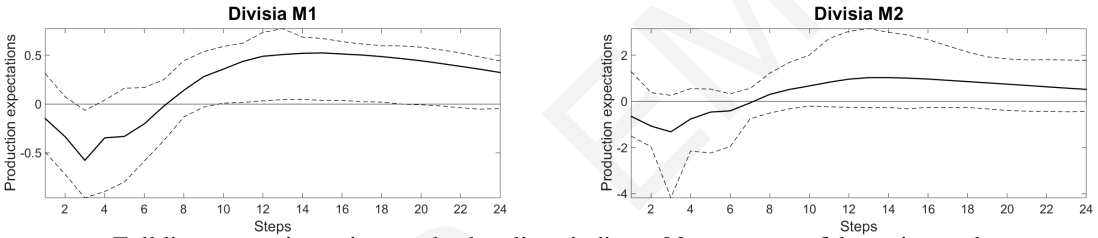
(a) Total manufacturing sector



(b) Firms producing durable consumer goods



(c) Firms producing non-durable consumer goods



Full lines are point estimates; broken lines indicate 90 percent confidence intervals.

Euribor rates as external instruments

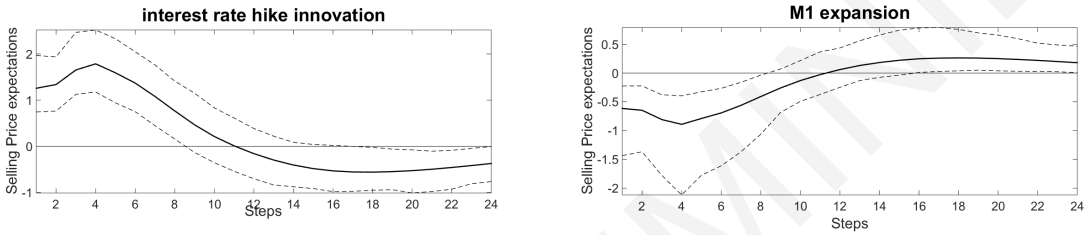
To evaluate the robustness of our results, we re-estimate the panel SVAR models and the corresponding impulse responses using as external instruments daily changes in the Euribor rates with one month or three months of maturity (see, for example, Gertler and Karadi (2015)) in place of the two factors that we have used in our benchmark estimations. The impulse responses for firms' selling price and production expectations using the unanticipated changes in the current Euribor rate as an external instrument, are presented in Figure 2.12 and in Figure 2.13, respectively. The impulse responses for firms' selling price and production expectations using the 3-months ahead Euribor rate changes as the external instrument, are presented in Figure 2.14 and in Figure 2.15, respectively.

Once again, we find that our results are robust to using the daily surprise changes in the current or three months ahead Euribor rate, as external instruments. For example, in the first column of Figure 2.12, and exactly resembling the findings in Figure 2.4, we see that an interest rate hike shock has a significantly positive impact on selling price expectations for the first eight months. In analogous fashion, in the second column of Figure 2.12 we see that an M1 expansion shock has a significantly negative impact on selling price expectations for the first eight months. This impact of an unanticipated interest rate hike (M1 expansion) is reversed turning significantly negative (positive) at about sixteen months out in the case of total manufacturing, which again resembles the significant overshooting pattern in Figure

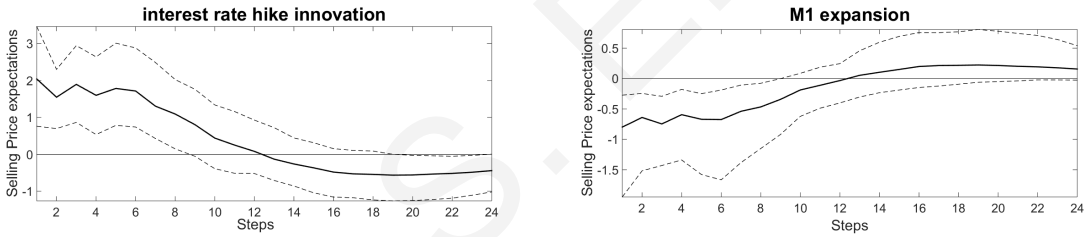
2.4. Moreover, our estimated impulse responses for production expectations in Figure 2.13 resemble those in our baseline estimation portrayed in Figure 2.5. The impact of an interest rate hike (M1 expansion) shock is significantly positive (negative) for the first six months for total manufacturing as before, and then becomes significantly negative (positive) at about nine months out as was the case in Figure 2.5 for our baseline. Finally, using the 3-months ahead Euribor changes as an external instrument in Figures 2.14 and 2.15 for firms' selling price and production expectations respectively, the results described above remain intact and not much changed relative to the baseline in Figures 2.4 and 2.5.

Figure 2.12: Selling price expectations' responses using current Euribor instrument.

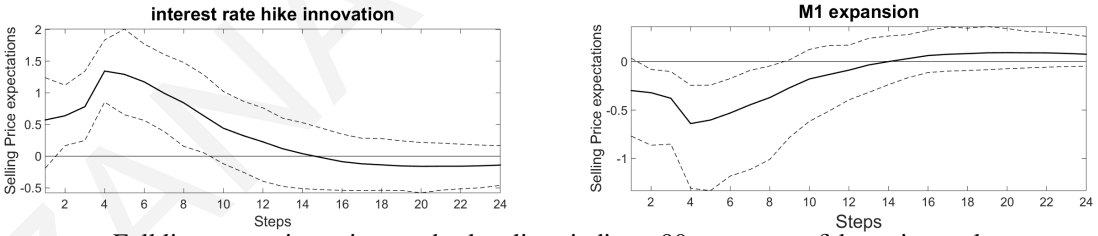
(a) Total manufacturing sector



(b) Firms producing durable consumer goods



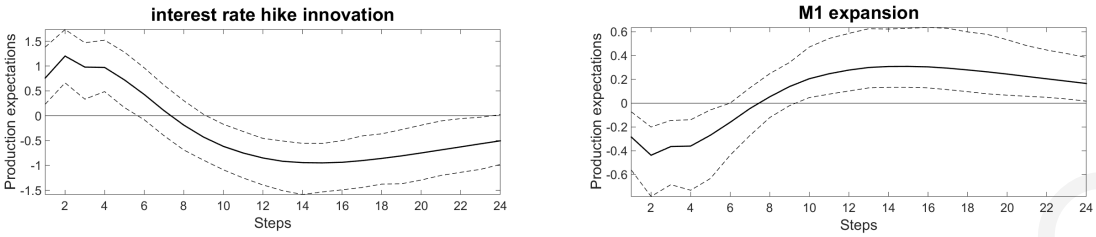
(c) Firms producing non-durable consumer goods



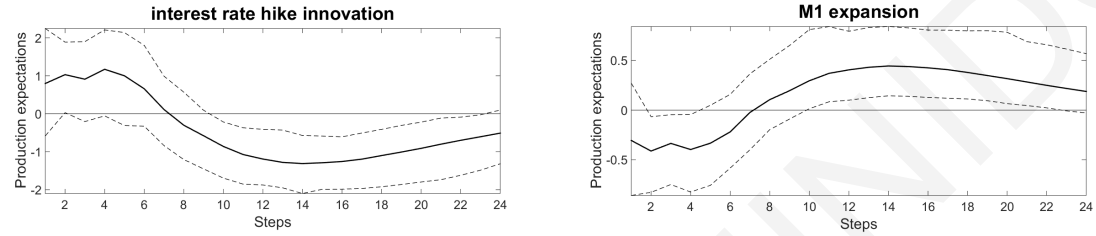
Full lines are point estimates; broken lines indicate 90 percent confidence intervals.

Figure 2.13: Production expectations' responses using current Euribor instrument.

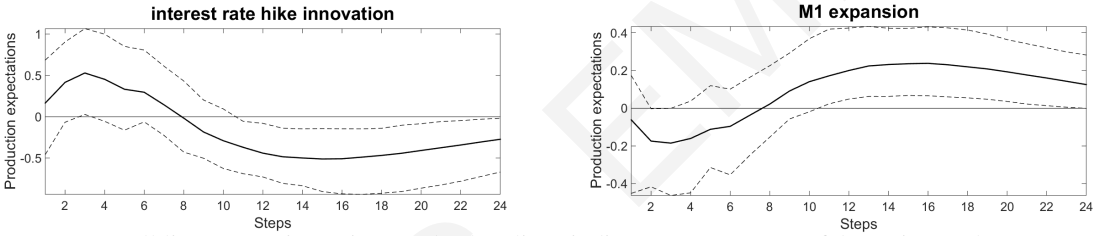
(a) Total manufacturing sector



(b) Firms producing durable consumer goods



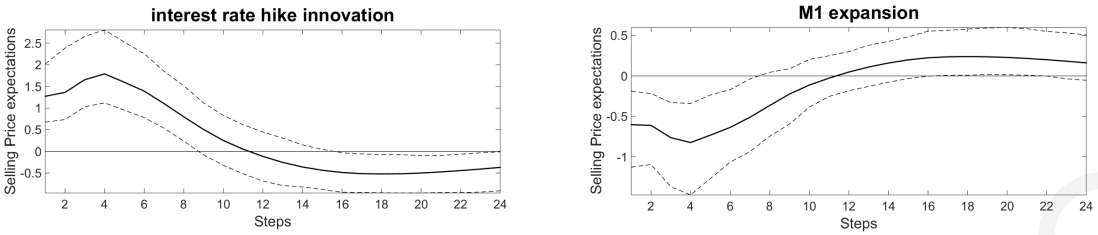
(c) Firms producing non-durable consumer goods



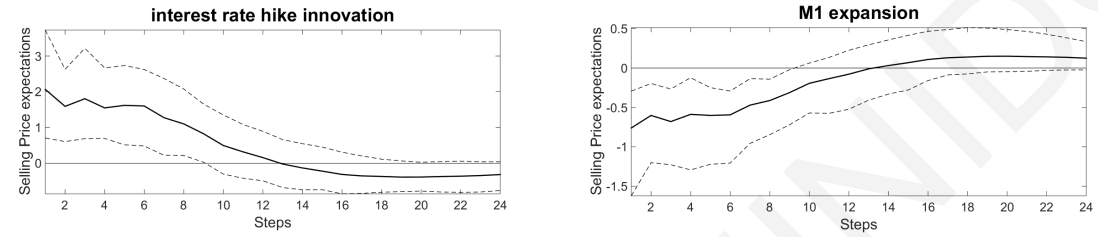
Full lines are point estimates; broken lines indicate 90 percent confidence intervals.

Figure 2.14: Selling price expectations' responses using 3-month Euribor instrument.

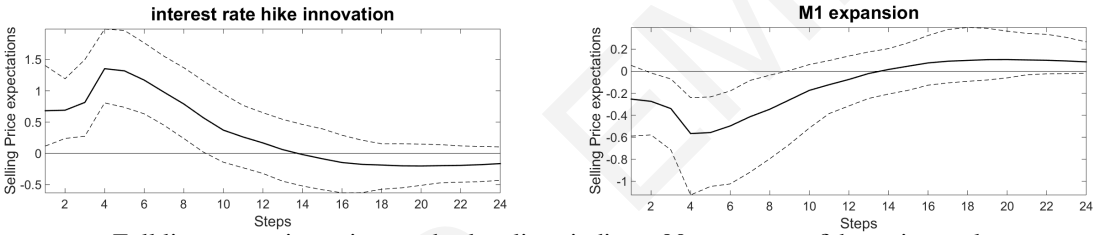
(a) Total manufacturing sector



(b) Firms producing durable consumer goods



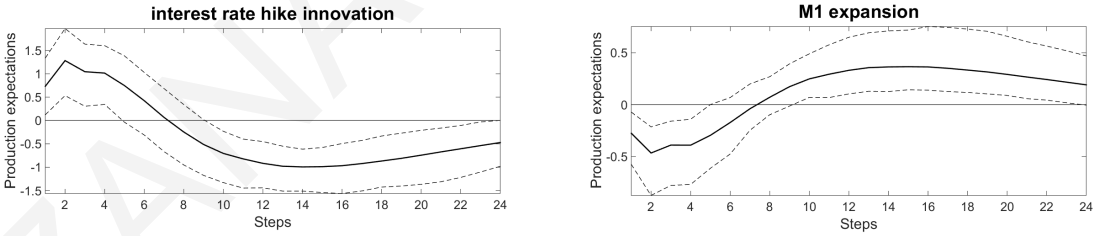
(c) Firms producing non-durable consumer goods



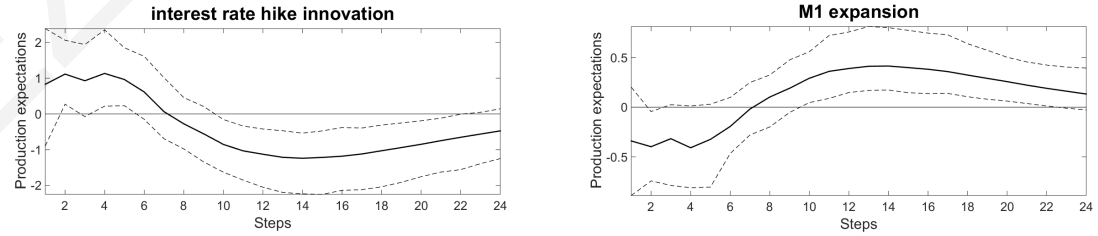
Full lines are point estimates; broken lines indicate 90 percent confidence intervals.

Figure 2.15: Production expectations' responses using 3 month Euribor instrument.

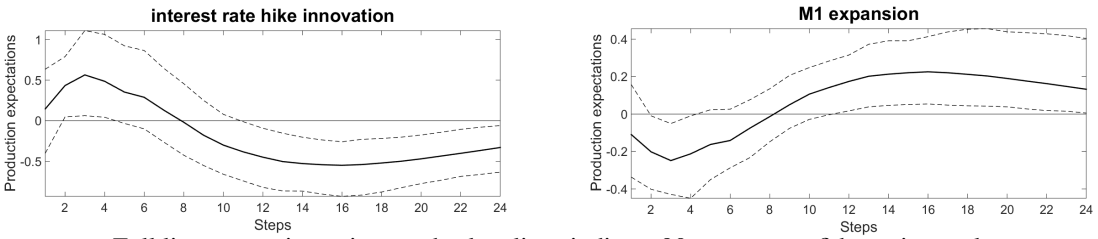
(a) Total manufacturing sector



(b) Firms producing durable consumer goods



(c) Firms producing non-durable consumer goods



Full lines are point estimates; broken lines indicate 90 percent confidence intervals.

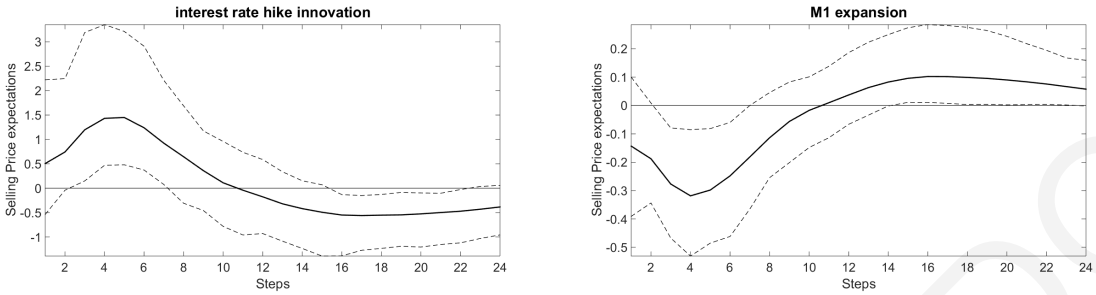
Finally, instead of using a daily interest rate changes as an external instrument in our proxy VAR, we use intraday surprise series constructed by Kerssenfischer (2019). The advantage of using these series is twofold. First, Kerssenfischer (2019) constructs intraday surprise changes in a narrow window instead of daily series that we use in our baseline model. Second, we take into account the possibility that the ECB's announcements may convey information not only about monetary policy, but also about economic fundamentals. Kerssenfischer (2019) uses the immediate change in 2-year German bond yields as a naive measure of policy surprises, and isolates non-monetary components from central bank announcements using sing restrictions. In particular, the immediate change in 2-year German bond yields and the Euro STOXX 50 index are measured 10 minutes prior to the ECB's press release with those 20 minutes after the end of the ensuing press conference. Then, using sign restrictions he decomposes announcements into two distinct components namely "pure policy shocks" and "information shocks". In my analysis, I use the series constructed by the Kerssenfischer (2019) as external instruments.

Figure 2.16 and Figure 2.17 show the impulse response functions for selling price expectations, using as external instrument the "Pure Policy" shock and "Information" shock, respectively. While, Figure 2.18 and Figure 2.19 reports the impulse responses for production expectations, using as external instruments the "Pure Policy" shock and "Information" shock, respectively.[25]

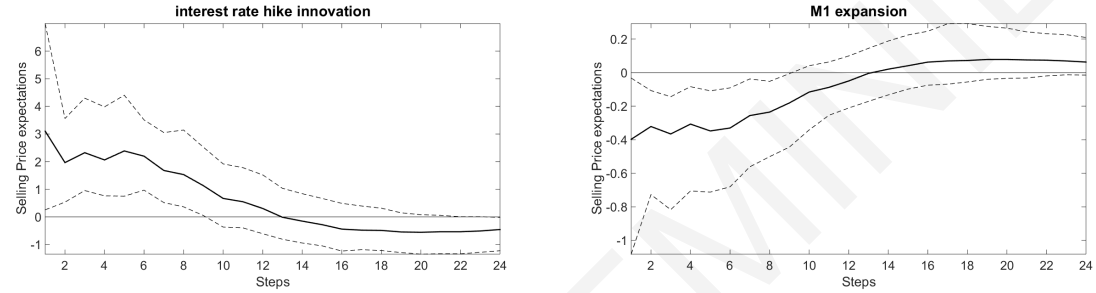
[25]Note that when we use changes in the 2-year German bond yield around ECB announcements as a naive proxy for policy news shocks, without discriminating between the pure monetary policy and information shocks, then we do not get any meaningful significant results.

Figure 2.16: Selling price expectations' responses using as external instrument the "Pure Policy" shock.

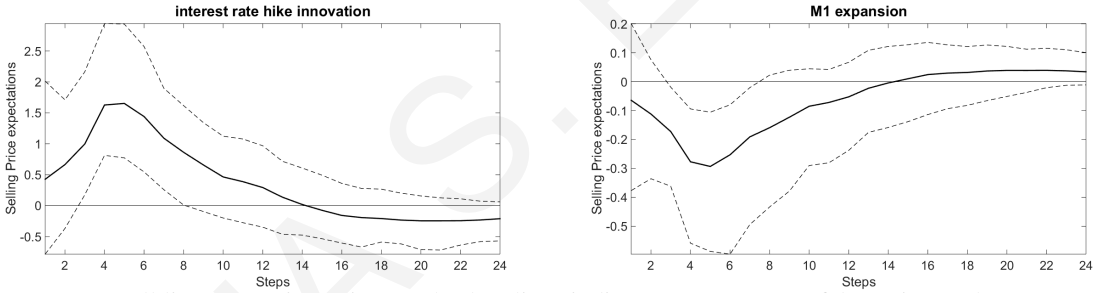
(a) Total manufacturing sector



(b) Firms producing durable consumer goods



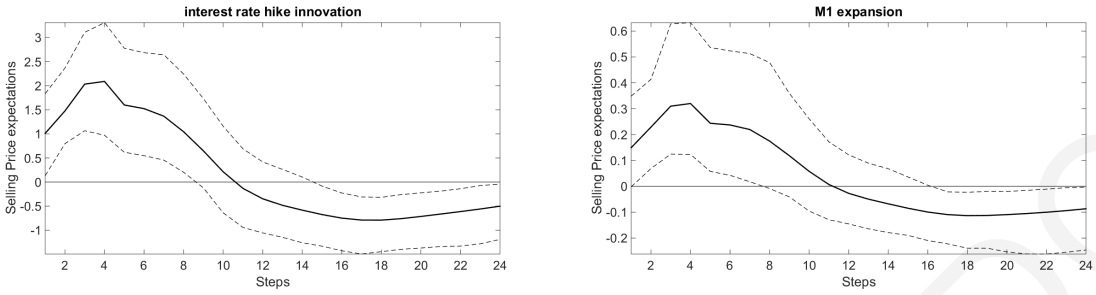
(c) Firms producing non-durable consumer goods



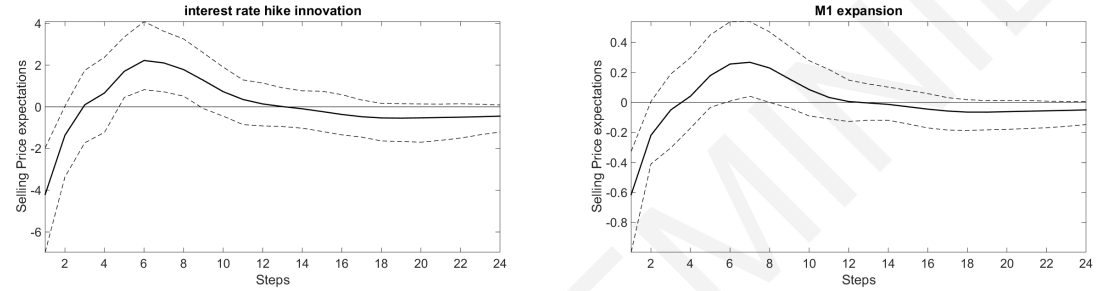
Full lines are point estimates; broken lines indicate 90 percent confidence intervals.

Figure 2.17: Selling price expectations' responses using as external instrument the "Information" shock.

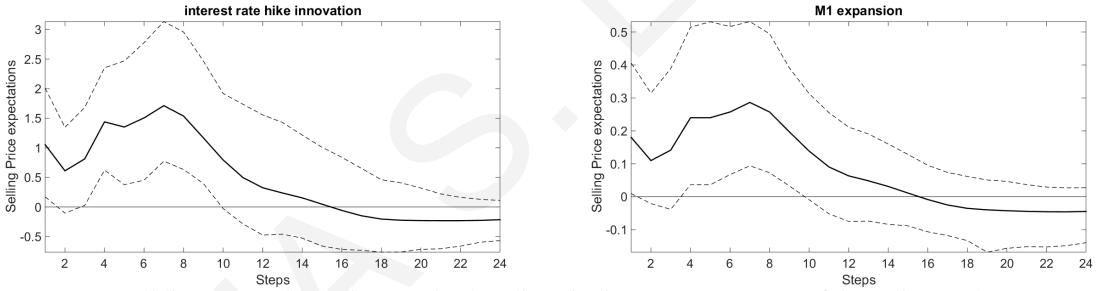
(a) Total manufacturing sector



(b) Firms producing durable consumer goods



(c) Firms producing non-durable consumer goods

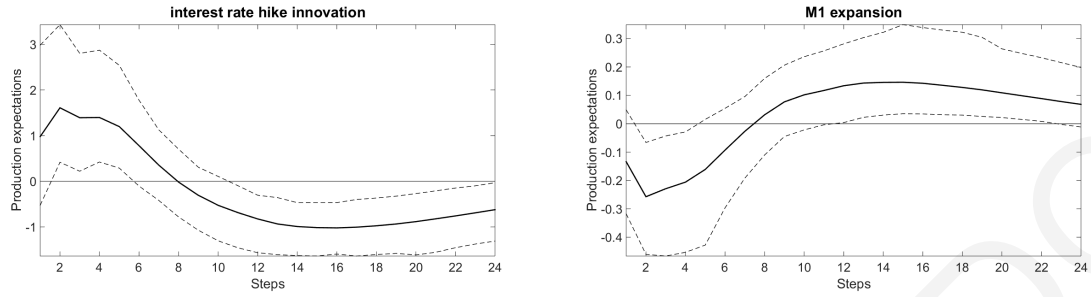


Full lines are point estimates; broken lines indicate 90 percent confidence intervals.

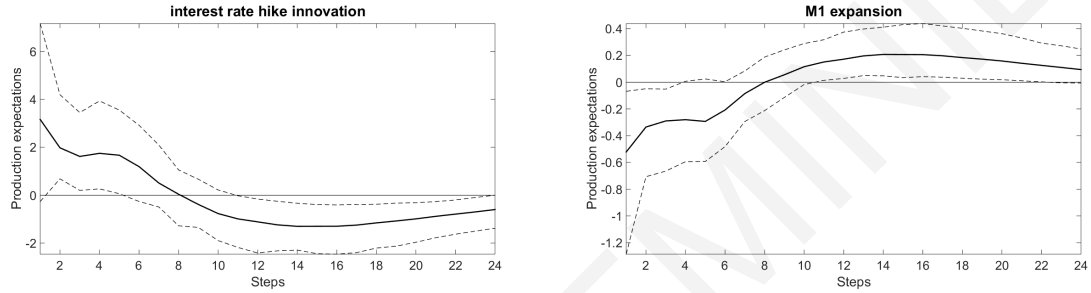
The responses of selling price expectations shown in Figure 2.16 and production expectations shown in Figure 2.18, to two distinct monetary policy shocks, are quite similar to what we had in our baseline model. We see that, firms increase their selling price and production expectations to an interest rate hike innovation. While, an expansion in M1 leads to a decrease of firms' selling price and production expectations. Once again, firms producing durable consumer goods respond more to monetary policy shock as compared to firms producing non-durable goods. However, if we compare the results shown in Figure 2.16 and 2.18 to those obtained using as an external instrument the "Information" shock shown in 2.17 and Figure 2.17, we see that expansion in M1 increases firms' selling price or production expectations, consistent to standard textbook channels. As we see, firms respond differently to M1 expansion, depending the external instrument that we use in order to proxy the latter. Our results here are consistent to Kerssenfischer (2019), who mentions that policy shock may have different effect on expectations as compared to policy shocks.

Figure 2.18: Production expectations' responses using as external instrument the "Pure Policy" shock.

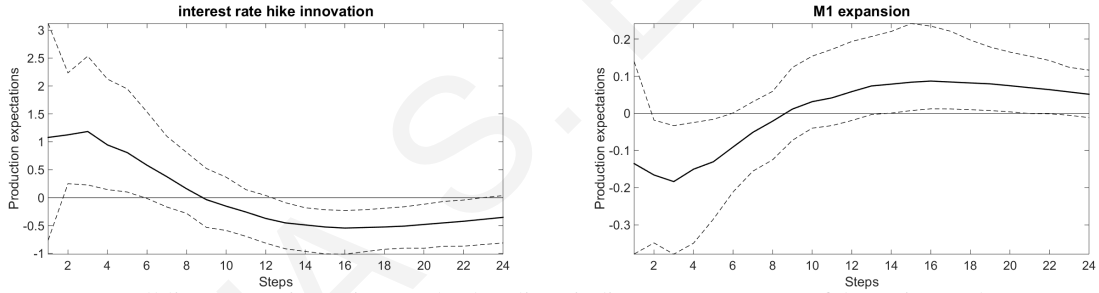
(a) Total manufacturing sector



(b) Firms producing durable consumer goods



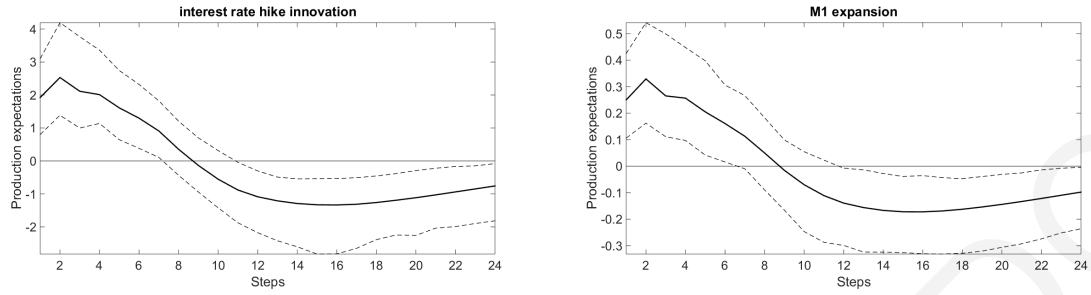
(c) Firms producing non-durable consumer goods



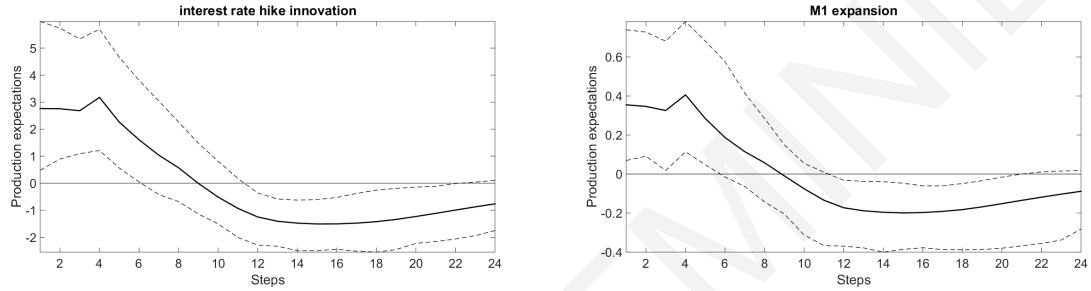
Full lines are point estimates; broken lines indicate 90 percent confidence intervals.

Figure 2.19: Production expectations' responses using as external instrument the "Information" shock.

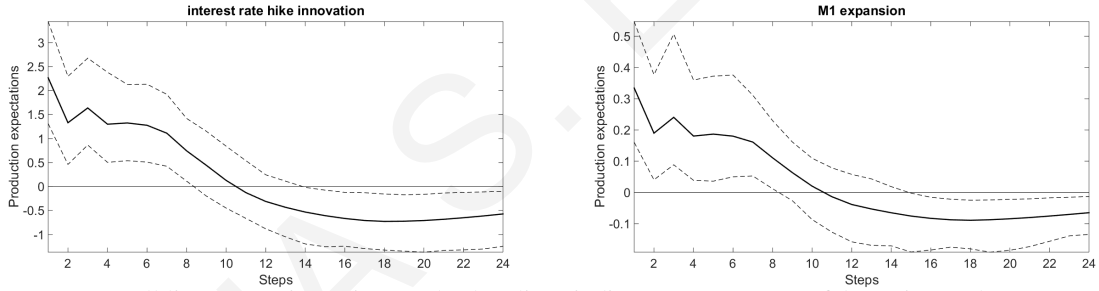
(a) Total manufacturing sector



(b) Firms producing durable consumer goods



(c) Firms producing non-durable consumer goods



Full lines are point estimates; broken lines indicate 90 percent confidence intervals.

2.6 Conclusion

There is a growing literature studying the impact of monetary policy on economic activity. Not just the magnitude but even the sign of the responses are controversial and depend on the identification strategy of the shocks and the econometric framework used. In this chapter, we identify monetary policy shocks and then investigate the impact of these on firms' expectations. As firms are after all the price-setters in the economy and current production depends upon firms' expectations of future economic developments, assessing the impact of monetary policy on firms' expectations is of paramount importance for understanding monetary policy transmission.

To identify monetary policy shocks we begin by applying the narrative approach of Romer and Romer (2004) and high frequency identified approach of Gurkaynak et al.(2004), to construct external instruments for the euro area based on ECB's announcement days. Then, building on the proxy SVAR methodology developed by Stock and Watson (2012) and

Mertens and Ravn (2013), I estimated a panel proxy SVAR, incorporating the above-described external series in order to identify monetary policy shocks.

Our study delivers a number of insights. We find that an interest rate hike innovation leads to a temporary rise in firms' selling price and production expectations. This is consistent with imperfect information theoretical settings where firms exhibit rational inattention (see, e.g., Reis (2006), and Coibion and Gorodnichenko (2015a)). That is, given that firms are aware that the policymaker has more information than they have, they interpret an unanticipated increase in the interest rate as positive news about the state of the economy and thus increase their production and selling price expectations. This impact later becomes negative for both selling price and production expectations. The positive impact becomes negative about three quarters after the shock occurred for production expectations and within five quarters for selling price expectations. The different timing of production and selling price expectations suggests that first the economy moves and then firms observe this and learn about the contractionary impact of the interest rate hike on the economy, which leads them to adjust their production and finally their selling price expectations in accordance with this learning experience over time.

Overall, the overshooting pattern we observe suggests that following the initial surprise that leads, what appear to be, imperfectly informed firms to raise (reduce) their production and selling expectations after an unanticipated interest rate hike (M1 expansion), firms gradually come to expect contractionary (expansionary) monetary policy shocks to eventually decrease (increase) production and then inflation, thus revise their expectations accordingly by decreasing (increasing) first their production expectations and then their selling price expectations.

Chapter 3

Inflation Expectations and Monetary Policy Shocks in the US

3.1 Introduction

Given the importance of expectations about the future for current economic decisions which shape macroeconomic developments, we find it useful to continue our analysis along the lines of the previous chapters. In our previous study of how monetary policy affects consumers' inflation expectations (Chapter 1), and firms' production and selling price expectations (Chapter 2) in the Eurozone countries, we found that the impact of monetary policy shocks varies across consumer types, their information set, and the period under study. In our current study we focus on consumers' inflation expectations in the United States using quantitative Survey data from the University of Michigan, instead of the qualitative data that is available for the Eurozone countries.

Economic agents' expectations matter.[1] At the onset of the financial crisis in the summer of 2007, the chairman of the Federal Reserve, Ben Bernanke, chose to devote his speech at the National Bureau of Economic Research to the topic of Inflation Expectations, arguing that "improving the public's understanding of the central bank's policy strategy reduces economic and financial uncertainty and helps households and firms make more informed decisions." Modern macroeconomic theory and recent empirical studies emphasize the importance of taking into account the inflation expectations of economic agents and interpreting how monetary policy affects them (see, for example, Garcia-Schmidt and Woodford (2019), Carvalho and Nechio (2014), and others). Inflation expectations are important for under-

[1] James Bullard, President and CEO Federal Reserve Bank of St. Louis, mentions that given that central banks are concerned with price stability, policymakers have to pay attention to inflation expectations in addition to actual inflation.

standing how households and firms make saving, spending, and investing decisions, and are a key input into negotiations for labor contracts and the pricing of financial instruments. The ability of monetary policymakers to achieve price stability depends on an accurate understanding of inflation expectations. Based on this, our main question of interest here will be how economic agents, in particular consumers[2], interpret monetary policy changes induced by the Fed in the US. Inflation expectations formation depends on the ability of individuals to gather and interpret information as well as on the economic situation and personal experiences that differ over the life cycle (see, e.g., Curtin 2010). Thus, in the current study, I compare the impact of monetary policy changes on consumers' expectations based on their age, income and education. In future work, it would be interesting to examine some additional demographic subgroups (e.g., gender, purchasing attitudes, personal current and expected financial situation).

After the volatility of the Great Inflation in the 1970s, the economy in the United States was characterized by a period of relative macroeconomic stability. From the mid-1980s to 2007, monetary policy was targeting the federal funds rate based on a Taylor rule, and the inflation was low and relatively stable (see, for example, Stock and Watson (2003), Bernanke, Issing, and Kohn (2004)). But, since the global financial crisis and the end of the Great Moderation period, policymakers in the US and elsewhere, were unable to boost economic activity via conventional monetary policy. The zero lower bound on interest rates led the Federal Reserve to adopt non-conventional policy tools such as Quantitative Easing or Forward Guidance regarding the future conduct of monetary policy. Moreover, given that agents' current economic decisions are affected by their expectations of future economic developments which in turn depend on expected monetary policy decisions, the FOMC started issuing a brief statement announcing decisions to change policy as of February 1994.[3] Since 2011, the Fed has introduced "calendar-based" communication via which it aims to shape agents' expectations regarding future monetary policy. Given the above, assessing the impact of monetary policy during the period under study will involve taking into account Fed announcements along with other variables that serve to capture monetary policy changes, beyond changes in federal funds rates.

We focus on inflation expectations of consumers using monthly survey data over the period 1979:10 - 2018:12. The sample period examined starts with the Volcker period where interest rates were at very high levels, and its latter part contains the recent global financial crisis, where the federal funds rate reached the zero lower bound. Thus, in our analysis we identify monetary policy shocks using both, the standard identification strategy imposing timing

[2]Coibion and Gorodnichenko (2015b) explain that since there is no quantitative measure of firm inflation expectations available in the United States, they use inflation expectations of households. They state that "given that many prices are set by small and medium-sized enterprises who do not have professional forecasters on staff, their inflation expectations are well-proxied by household forecasts", and argue that households are likely to be better than professional forecasters in proxying for firm forecasts.

[3]According to Eggertsson et al. (2003) the central bank can stimulate the economy by committing to maintain a high level of policy accommodation in the future. Moreover, Carvalho and Nechio (2014) explain how policymakers can improve policy effectiveness by communicating with the public.

restrictions[4] (see, for example, Christiano, Eichenbaum, and Evans (1999), Sims and Zha (2006b), and others), and a new methodology developed by Stock and Watson (2012) and Mertens and Ravn (2013), incorporating external instruments which are constructed using daily data around FOMC meeting days.

A growing literature proposes calculating monetary policy shocks using high frequency data from the federal funds future contracts. Kuttner (2001) calculate monetary policy shocks using daily data from the federal funds future contracts. Using federal futures he separates changes in the target funds rate into anticipated and unanticipated policy actions and finds that the unanticipated changes in the funds rate have significant impact on market rates. Gurkaynak, Sack, and Swanson (2004) use unexpected changes in federal funds rate and Eurodollar futures on Federal Open Market Committee (FOMC) dates to measure policy surprises. Moreover, monetary policy shocks are identified as a deviation from the policy rule, given the information set of the central bank as reported by internal forecasts (see, for example Romer and Romer (2004)). Finally, "proxy SVAR" model developed by Stock and Watson (2012) and Mertens and Ravn (2013) incorporates in the estimation of a VAR model a series of external instruments based on FOMC announcement days. For example, Gertler and Karadi (2015) combine traditional vector autoregression (VAR) analysis with high frequency identification of monetary policy shocks. In particular, they identify shocks using price adjustments in traded federal futures around FOMC announcement dates and use these as external instruments in a proxy SVAR model.

We investigate the impact of exogenous monetary policy shocks on consumers' inflation expectations estimating a structural VAR model for each consumer type separately. More precisely, we begin our analysis by estimating a structural VAR model with a standard Cholesky identification as in Christiano, Eichenbaum, and Evans (1999). Then, given that our sample includes the zero lower bound period and the extensive use of forward guidance by the Fed, we continue our analysis estimating a SVAR model with the use of external instruments. Overall, we find that a contractionary monetary policy shock increases consumers' inflation expectations, irrespective of the identification method and demographic subgroup that considered. In line with imperfect information theoretical settings, the impulse response functions indicate that consumers' inflation expectations increase after an unanticipated increase in interest rates.[5] These results are consistent with our previous findings in Chapter 2 related to firms' expectations in the Eurozone.

In general, the question of how economic agents interpret monetary policy changes is highly debated in the existing literature. The first strand of the literature is closely related to models of information frictions and rational inattention, such as Melosi (2016), Coibion and Gorodnichenko (2015a), Andrade and Le Bihan (2013) and others. Thus, if consumers are aware that the Fed has more information than they have, they may interpret an unanticipated de-

[4] Based on the ordering of variables in a VAR model, we assume that within a period the policy rate respond to all the other variables in the VAR but not vice versa.

[5] According to Coibion and Gorodnichenko (2015a) this could be associated with the decline of macroeconomic volatility during the Great Moderation period where economic agents tend to be more inattentive.

crease in the interest rate as a signal that the policymaker is worried about deflation, and decrease their inflation expectations. For example, Campbell et al. (2012) in their study find the opposite than standard textbook theory predicts, and consistent with Delphic forward guidance,where lower interest rates lead to lower expectations of inflation and output.

A second strand of the literature, however, finds that economic agents interpret monetary policy in line with standard theory. D'Amico and King (2017) use survey forecasts to capture the anticipated path of interest rates and estimate a structural VAR model using sign restrictions. In their study, they find that a monetary policy easing leads to an immediate and persistent increase in prices and in economic activity. Carvalho and Nechio (2014) use the Michigan Survey data to study whether households in the US form expectations in a way consistent with standard economic theory. Studying the pre-Great Recession period they find that individuals in the US are aware of the basic principles of a Taylor rule, however the results may vary across consumer types. Similarly, Ueda (2010) study the determinants of households' inflation expectations using survey data for Japan and the US. The impulse response functions of a VAR model with short term non-recursive restrictions indicate that inflation, and inflation expectations decrease after an interest rate hike innovation. Finally, Geiger and Scharler (2016) using survey data from the University of Michigan estimate VAR imposing zero and sign restrictions. They find that consumers tend to be relatively uncertain about how to process monetary policy shocks.

In this current chapter, we empirically assess the different theoretical channels by focusing on consumers' inflation expectations in the US. According to models with information rigidities, a decline in macroeconomic volatility during the Great Moderation should increase the degree of inattention (see, for example, Coibion and Gorodnichenko (2015a)). Moreover, given that there is a cost in collecting and processing information, individuals sometimes choose to hold less accurate expectations. Our results, are in line with the imperfect information theoretical settings, where consumers choose to not pay attention to macroeconomic developments. Moreover, due to the fact that the cost of collecting and processing information may vary across demographic subgroups (Curtin (2010)) we compare how different demographic subgroups of consumers respond to monetary policy shocks.

Impulse response functions indicate that the impact of monetary policy shocks is stronger and more persistent in the case of low income and low educated consumers, and for those with ages more than 54. Thus, consumer types that we would priory expect to have lower ability (e.g. low income or low educated) or shorter horizon (ages more than 54) react more to monetary policy shocks as compared to those who have greater ability or incentives to collect and process information. Our results reinforce those in Coibion and Gorodnichenko (2015a), who find that information rigidities are present not just for professional forecasters but also for firms and consumers. Overall, our results indicate that indeed consumers behave in a way which is inconsistent with standard economy theory.

Our study is organized as follows. Section 2 describes the data and provides some preliminary data analysis. Section 3 describes how we estimate structural monetary policy shocks

and investigate their impact on inflation expectations of consumers. The last section briefly concludes.

3.2 Data and preliminary analysis

Consumers' expectations

Data for consumers' expectations are from the Surveys of consumers which are conducted by the Survey Research Center, under the direction of Richard T. Curtin, at the University of Michigan.[6] In contrast to our previous study in Chapter 1, data for inflation expectations in the US is quantitative.[7] The database categorizes inflation expectations data according to respondents income, education, age, region and gender. In our study we will be considering two subcategories for the categories based on their income, education and age. We will thus be using monthly data for the period starting from 1979:10-2018:12. In our baseline estimations the sample period start with the beginning of Paul Volcker period.[8] But, in the robustness section we show that our main results do not change if the starting point begins with the end of "Great inflation" period. As we already mentioned in the Chapter 1, the formation of inflation expectations might depend on the ability of the respondents to gather and interpret information, as well as on the economic situation and particular point in their life cycle. Thus, the consumer subgroups (abbreviations to be used in the tables) we focus on are: low income consumers (Low inc), high income consumers (High inc), low educated consumers (Low edu), high educated consumers (High edu), consumers with ages between 35 and 54 (35-54), and consumers with ages more than 54 (>54). Moreover, we examine the inflation expectations of total consumers (total con). The latter category includes some other subcategories that we do not examine in detail (e.g. the 2nd quartile of income, ages between 18 - 34, secondary education, etc.).

For the US inflation expectations, we use the median as provided by the Survey Research Center of the University of Michigan,[9] which derives from the responses to the following question: "During the next 12 months, do you think that prices in general will go up, or go down, or stay where they are now?" and "By what percent do you expect prices to go up/down, on the average, during the next 12 months?".[10]

[6]Each month, a minimum of 500 interviews are conducted by telephone from the Ann Arbor facility. The samples for the Surveys of Consumers are statistically designed to be representative of all American households, excluding those in Alaska and Hawaii.

[7]A memo is provided in order to describe the procedures used to impute missing data, adjust for extreme values, and adjust for changes in questionnaire wording so as to provide a consistent time-series of measurements.

[8]We do not use the pre-Volcker data based on evidence of differences in monetary policy regime pre versus post Volcker era (see, for example, Clarida, Gali, and Gertler (2000), Gertler and Karadi (2015), and others).

[9]According to the studies by the University of Michigan, a review of the estimates of inflation expectations indicated that for comparisons over time, the median, was a more reliable indicator of month-to-month changes in price expectations.

[10]In some cases, only partial information was obtained where the respondents indicated the direction they expected prices to change but didn't know how much prices would increase or how much prices would decline.

Our beliefs set $\mathbf{B}_{k,i,t}$ for the US contains responses to the following questions. Q1: "Would you say that at the present time business conditions are better or worse than they were a year ago? They are ... better, same, worse, don't know." Q3: "Now turning to business conditions in the country as a whole - do you think that during the next 12 months we'll have good times financially, or bad times, or what? ... good times, uncertain, bad times, don't know." Q5: "And how about a year from now, do you expect that in the country as a whole business conditions will be better, or worse than they are at present, or just about the same? ... better, same, etc." The three questions above relate to the general economic situation. The next two questions relate to the household's financial situation. Q2: "Would you say that you (and your family living there) are better or worse off financially than you were a year ago?... better, same, etc." Q6: "Do you think that a year from now you (and your family living there) will be better off financially, worse off, or just about the same as now? ... better, same, etc." As in the Chapter 1, there is one question about unemployment. Q4: "How about people out of work during the coming 12 months? Do you think that there will be more unemployment than now, about the same, or less? ... less, same, more, don't know." Finally, an additional question now exists relating directly to interest rates. Q7: "No one can say for sure, but what do you think will happen to interest rates for borrowing money during the next 12 months "will they go up, stay the same, or go down?" For these variables, we use the simple balance statistic calculated as the difference between "better" and "worse" responses to the survey questions[11], excluding "same" and "don't know" responses. Values range from -100, when all respondents choose the "worse" option to +100, when all respondents choose the "better" option.

Figure 3.1 presents the median of month-to month changes in price expectations for total consumers in the US. As we can see from the Figure 3.1, the "Great inflation" period which was characterized by high inflation and high inflation expectations continued until the end of 1982.

Macroeconomic data

The macroeconomic data obtained from the Federal Reserve Economic Data (FRED) database[12] are the growth rate of seasonally adjusted monthly consumer price index for all items[13], the seasonally adjusted civilian unemployment rate[14] and St. Louis adjusted monetary base in

When respondents do not denote by how much they expect prices to change, the following adjustments are made: Will go down - assign the median decrease calculated among the complete data cases (where respondent answers by what percent they expect prices to decline). Will go up - assign the median increase calculated among the complete data cases (where respondent answers by what percent they expect prices to increase). The partial information codes "prices will go down" or "prices will go up" are not eliminated but instead the median increase or decrease is imputed from the complete data cases by distributing incomplete answers (go up or go down, without indicating by how much) across all response codes in the same proportions as cases with complete information.

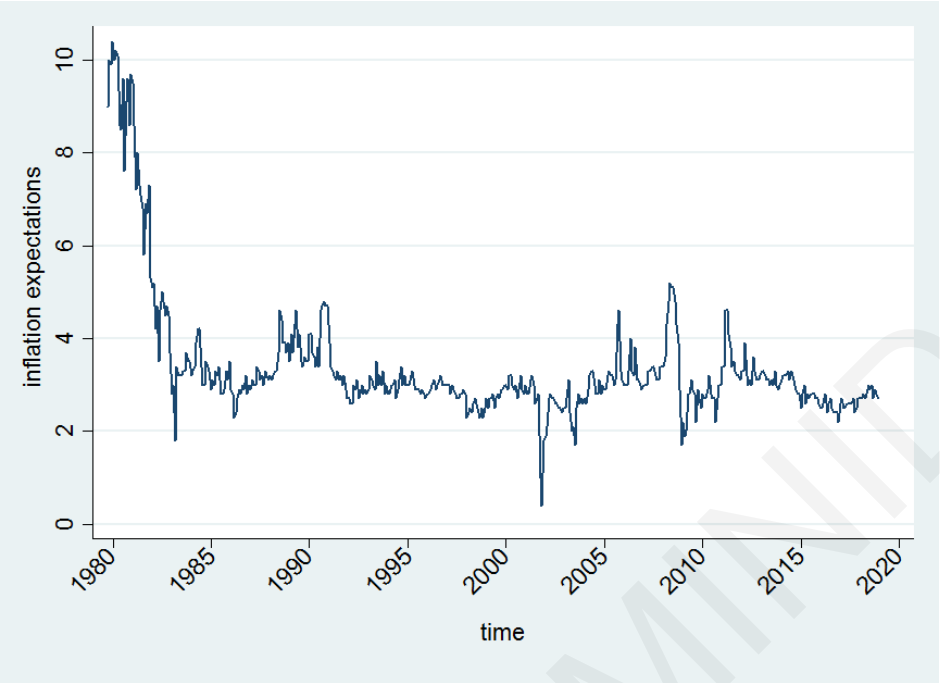
[11] The questions Q1 to Q7 are numbered in a sequence that they are included in vector **B**.

[12] https://fred.stlouisfed.org/

[13] https://fred.stlouisfed.org/series/CPALTT01USM661S

[14] https://fred.stlouisfed.org/series/UNRATE

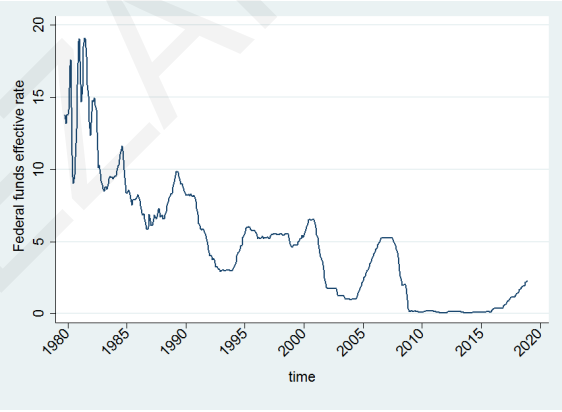
Figure 3.1: Expected change in prices during the next year for total consumers.

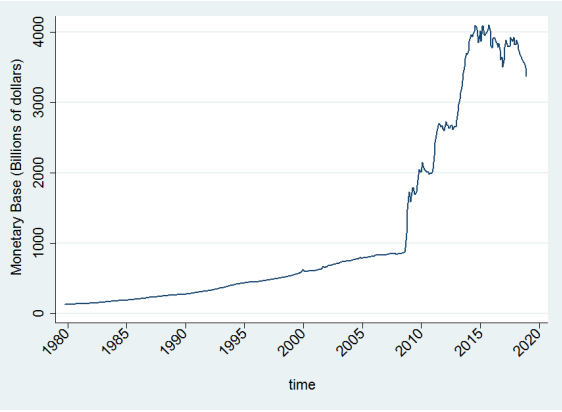


billions of dollars.[15] Data for federal funds effective rate[16] and industrial production[17] are from the Federal Reserve database. Finally, monthly indices in nominal US dollars for food and energy are from World Bank Commodity Price Data (The Pink Sheet).[18] The monetary policy indicators that we use in our analysis are illustrated in Figure 25. The period of high inflation led the Fed Chairman Paul Volcker to increase the federal funds which became 19 percent in June 1981. Figure 3.2a shows how federal funds move across time and how the US economy with high inflation and fed funds rate in early 1980 reached the zero lower bound period since the recent Crisis arrival.

Figure 3.2

(a) Federal funds effective rate. (b) St. Louis Adjusted Monetary Base.





While in Figure 3.2b, we see that the monetary base is growing relatively smoothly for the

[15] https://fred.stlouisfed.org/series/AMBSL
[16] https://www.federalreserve.gov/releases/h15/
[17] https://www.federalreserve.gov/datadownload/Build.aspx?rel=g17
[18] http://www.worldbank.org/en/research/commodity-markets

first part of our sample. But, the financial crisis of 2008 lead to an expansion of the monetary base which increase dramatically since then. In our robustness section, instead of federal funds rate, we use as an alternative monetary policy indicator the one year government bond yield from the Global Financial Data[19].

In constructing and updating Romer and Romer (2004) monetary policy measure, we use data regarding to changes in the intended federal funds rate decided upon around FOMC meetings from the FOMC statements which are provided in the Federal Reserve database.[20] Internal forecasts for macroeconomic variables are also given in FOMC meeting records in projection materials.[21] To derive high-frequency monetary policy instrument as in Gertler and Karadi (2015), we use the 30-day federal fund future contracts from the Macrotrends LLC database.[22]

Before we proceed with the estimations, we analyze the statistical properties of main variables we use in our estimations. To correctly specify our regression models, we evaluated the unit root test for the variables included in our models. Performing the augmented Dickey-Fuller test that a variable follows a unit-root process, we find that industrial production, the unemployment rate, and commodity prices contain unit roots. Thus, we take first difference of the log of industrial production and the first difference of unemployment rate. Regarding the price of food and price of energy, following the previous related research (e.g. Christiano et al.(1999)), Eminidou et al. (forthcoming)) we smooth the log of commodity prices by removing the trend using a Hodrick-Prescott time-series filter and take the first difference of these new created variables. Finally, we take first difference of the log of monetary base in our estimations.

3.3 Estimation of monetary policy shocks

The identification of monetary policy shocks and its subsequent interpretation depends on the strategy that we use and the assumptions that we make in order to derive them.[23] In our current study, we consider two different identification schemes. In the first case, we estimate a structural VAR model (SVAR) and apply a traditional identification approach using the Cholesky decomposition. In the second case, we identify the structural shock by proxying

[19] https://www.globalfinancialdata.com/gfdplatform/

[20] Statements for intended federal funds from 1997 until 2012 is given https://www.federalreserve.gov/monetarypolicy/fomchistorical1997.htm up to https://www.federalreserve.gov/monetarypolicy/fomchistorical2013.htm. Since 2014 intended federal funds are given in https://www.federalreserve.gov/monetarypolicy/fomccalendars.htm

[21] From 1997 up to 2010 we find the macroeconomic projections from Greenbook (Part I) https://www.federalreserve.gov/monetarypolicy/fomccalendars.htm. Since June 2010 internal forecasts are reported in Beige book, Tealbook A

[22] https://www.macrotrends.net/futures/30-day-fed-funds

[23] Christiano, Eichenbaum, and Evans (1999) mention in their paper that there are different strategies in analyzing monetary policy shocks. The primary focus of their analysis is related with the identification assumptions which are essential in order to estimate the Fed's feedback rule.

the monetary policy indicator with external instruments, as we did in our previous study in Chapter 2.

In particular, the first part of our analysis is closely related to the strategy discussed in Christiano et al.(1999), where we derive monetary policy shocks by estimating a SVAR model and impose recursive identifying assumptions. While, in the second part of our analysis, we follow the new methodology developed by Stock and Watson (2008) and Mertens and Ravn (2013) estimating a proxy SVAR model. In the next two subsections, we describe in detail how we estimate a SVAR model and the identification assumptions that we impose in deriving a structural monetary policy shocks.

3.3.1 Structural VAR model

In this subsection, we review a structural VAR model and investigate the impact of monetary policy shocks on consumers' inflation expectations in the United States. We start by defining the structural VAR model and discuss the identification problem involved in measuring the dynamic response of inflation expectations to a monetary policy shock. As was mentioned in our previous chapter, the structural VAR model is given by the equation below

$$A_0 y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + X_t + e_t \tag{3.1}$$

Premultiplying (3.1) by invertible square matrix, A_0, the equation (3.1) can be written as

$$y_t = A_0^{-1} A_1 y_{t-1} + ... + A_0^{-1} A_p y_{p-1} + X_t + A_0^{-1} e_t \tag{3.2}$$

defining

$$B_i = A_0^{-1} A_i, \quad where \quad i = 1, ..., p \tag{3.3}$$

we obtain the reduced form of a VAR model

$$y_t = B_1 y_{t-1} + ... + B_p y_{t-p} + X_t + u_t \tag{3.4}$$

where y_t is a q-dimensional vector of variables, p is a nonnegative integer indicating the number of lags that we use in our estimations, and u_t is the VAR disturbance term [24] which is uncorrelated with all variables dated $t-1$ and earlier. By running ordinary least squares equation by equation on (3.4) we obtain consistent estimates of the B_i's and then estimate $V = E[u_t u_t']$ from the fitted residuals. Here, we make similar assumption to what we made

[24]The error terms in u_t are the surprise movements in the variables after taking past values into account and they are correlated with each other if the variables in vector y are correlated.

in Chapter 2 [25] and estimate $A_0^{-1}A_i$, $A_0^{-1}e_t$, and $A_0^{-1}D(A_0^{-1})'$ given the structural form in equation(3.2). But, we can not identify the impact of structural[26] monetary policy shock on consumers' inflation expectations without imposing any additional identifying assumptions.[27] To compute the impulse response functions we should know the matrix A_0. Given that all of the information about A_0 is in the relationship, $V= A_0^{-1}D(A_0^{-1})'$, we impose the restriction that the fundamental economic shocks are uncorrelated, meaning that D is a diagonal matrix (D=I) and $V= A_0^{-1}(A_0^{-1})'$ (see, for example, Christiano, Eichenbaum, and Evans (1999)). But, as long as q¿1, there will in general be many solutions to this set of equations which implies that we have an identification problem.[28] Thus, we derive the structural monetary policy shock by imposing zero restrictions through the Cholesky factorization.[29]

Impact of monetary policy shocks on inflation expectations

The assumption that we make regarding the information set of consumers' is the same with what we assumed in our previous study in Chapter 1. First, we include in vector y_t a set of macroeconomic variables assuming that individuals are well informed.[30] Thus, the vector y_t contains the following variables in that particular order:[31] the smoothed change in the log of the price of energy (P_{e_t}), the smoothed change in the log of the price of food (P_{f_t}), inflation rate for all items (π_t), the differenced log of industrial production (IP_t), the differenced unemployment rate ($Unem_t$), differenced log of monetary base ($Dlnmb_t$), federal funds effective rate (ff_t), and inflation expectations of consumer type k at time t ($\pi^e_{k,t}$). Thus, the dimension of vector y_t is equal to eight ($q = 8$) with the first six variables describing the monetary authority's information set at time t which may coincide with that of the individual's. The vector with exogenous variables, X_t, includes dummies for the great inflation period starting from 1979:10-1982:12, and for the great recession period 2007:8-2009:6. Since, costs of updating inflation expectations might differ across economic agents, our analysis allows us to examine this possibility. We will thus consider inflation expectations of consumers grouped based on their income, education and age. Here, k stands for consumer type k=[total consumers, Low income, High income, Low educed, High educated, 35-54, >54].

[25] In identifying structural monetary policy shocks we assume that the relationship of the VAR disturbances, u_t, and the structural economic shocks, e_t, is given by $u_t= A_0^{-1}e_t$, and $E[e_te_t']$=D, where D is a positive definite matrix. This means that $V=A_0^{-1}D(A_0^{-1})'$

[26] In econometrics, structural means that they are mean zero and are uncorrelated with each other at time t, meaning that the covariance between two structural shocks $e_{q,t}$ and $e_{s,t}$ in e_t should be equal to zero.

[27] Since each element of u_t reflects the effects of all the fundamental economic shocks we can not assume that any element of u_t corresponds to a particular economic shock, in our case to monetary policy shock. In general, any element $y_{n,t}$ in y_t will be correlated with the structural shock $e_{s,t}$, meaning that we get pervasive simultaneity bias and the assumptions for OLS to be consistent are violated.

[28] Without imposing any restrictions on A_0 there will be many solutions to these simultaneous equations. In general, there are two types of restrictions: a set of linear restrictions on the elements of A_0 and a requirement that the diagonal elements of A_0 are positive.

[29] The Cholesky factor of a positive definite, symmetric matrix, V, is a lower triangular matrix, C, which has positive elements along the diagonal, and it satisfies the property, $CC' = V$.

[30] Given that we are restricted with the sample size and the degrees of freedom, we chose to not include the belief based variables in the information set of well informed agents to avoid the overparametrized estimation of a VAR model which will give us poor estimates

[31] Here, we order the variables in the decreasing order of exogeneity.

The recursiveness assumption places zero restrictions on matrix A_0[32] : as shown in equation (3.5). Based on the ordering of variables in vector y_t, we assume that policymaker can observe the current values of industrial production, the unemployment rate, the inflation rate and commodity prices.[33] Based on our previous study of inflation expectations in Chapter 1, contemporaneous actual inflation is included in equation of inflation expectations because here it is meant to capture the household's own information about inflation that comes from observing prices directly in its daily transactions. While the lagged actual inflation rate captures the inflation rate announced by statistical agencies in the month before the household is surveyed. The number of lags used in the estimation of a VAR model is based on Hannan-Quinn information criterion and it is equal to two for all consumer types that we consider.

We derive the structural monetary policy shock for well-informed consumers, e_t^{ff},given the equation $u_t=A_0^{-1} e_t$ which, in matrix form is given by

$$\begin{bmatrix} u_{Pe\,t} \\ u_{Pf\,t} \\ u_{\pi\,t} \\ u_{IP\,t} \\ u_{Unem\,t} \\ u_{Dlnmb\,t} \\ u_{ff\,t} \\ u_{\pi_k^e\,t} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{0,21} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{0,31} & a_{0,32} & 1 & 0 & 0 & 0 & 0 & 0 \\ a_{0,41} & a_{0,42} & a_{0,43} & 1 & 0 & 0 & 0 & 0 \\ a_{0,51} & a_{0,52} & a_{0,53} & a_{0,54} & 1 & 0 & 0 & 0 \\ a_{0,61} & a_{0,62} & a_{0,63} & a_{0,64} & a_{0,65} & 1 & 0 & 0 \\ a_{0,71} & a_{0,72} & a_{0,73} & a_{0,74} & a_{0,75} & a_{0,76} & 1 & 0 \\ a_{0,81} & a_{0,82} & a_{0,83} & a_{0,84} & a_{0,85} & a_{0,86} & a_{0,87} & 1 \end{bmatrix}^{-1} \times \begin{bmatrix} e_{Pe\,t} \\ e_{Pf\,t} \\ e_{\pi\,t} \\ e_{IP\,t} \\ e_{Unem\,t} \\ e_{Dlnmb\,t} \\ e_{ff\,t} \\ e_{\pi_k^e\,t} \end{bmatrix} \tag{3.5}$$

Second, given that consumers are more likely than other economic agents to face some cost in obtaining information, we relax the assumption that they observe the macroeconomic variables, by focusing on their type specific beliefs about the economy.[34] As in Chapter 1, the monetary policy surprise identified in this case will be relevant for potentially less-informed consumers surprised by a wider set of monetary events as compared to agents that are well-informed about macroeconomic fundamentals.

Thus, in our second specification, the vector $y_{k,t}$ contains balances based on the responses to the questions Q1-Q7 described in section 3.2, for each consumer type k. Moreover, the inflation for all items is included in our both specifications since irrespective if we consider that consumers are more or less informed, they are observing the current inflation rate by their daily transactions (see, for example, Richard Curtin, 2010). As in case of more informed individuals, the ordering of variables in $y_{k,t}$ is in the decreasing order of exogeneity.

[32] In general, the number of restrictions needed is n(n-1)/2, in order the model to be identified.

[33] This assumption is consistent, with Christiano, Eichenbaum, and Evans (1999) and **mihov1995measuring** but comes in contrast with the specification of Sims and Zha (1995) where only lagged values of these variables are included.

[34] In other words, we allow for the fact that individuals may have a smaller information set than that of the policymaker due to costs associated with collecting and identifying information.

The dimension of the vector $y_{k,t}$ is ten[35] and the identification of the structural monetary shock,$e^{ff}_{t,k}$, is given from the relation below

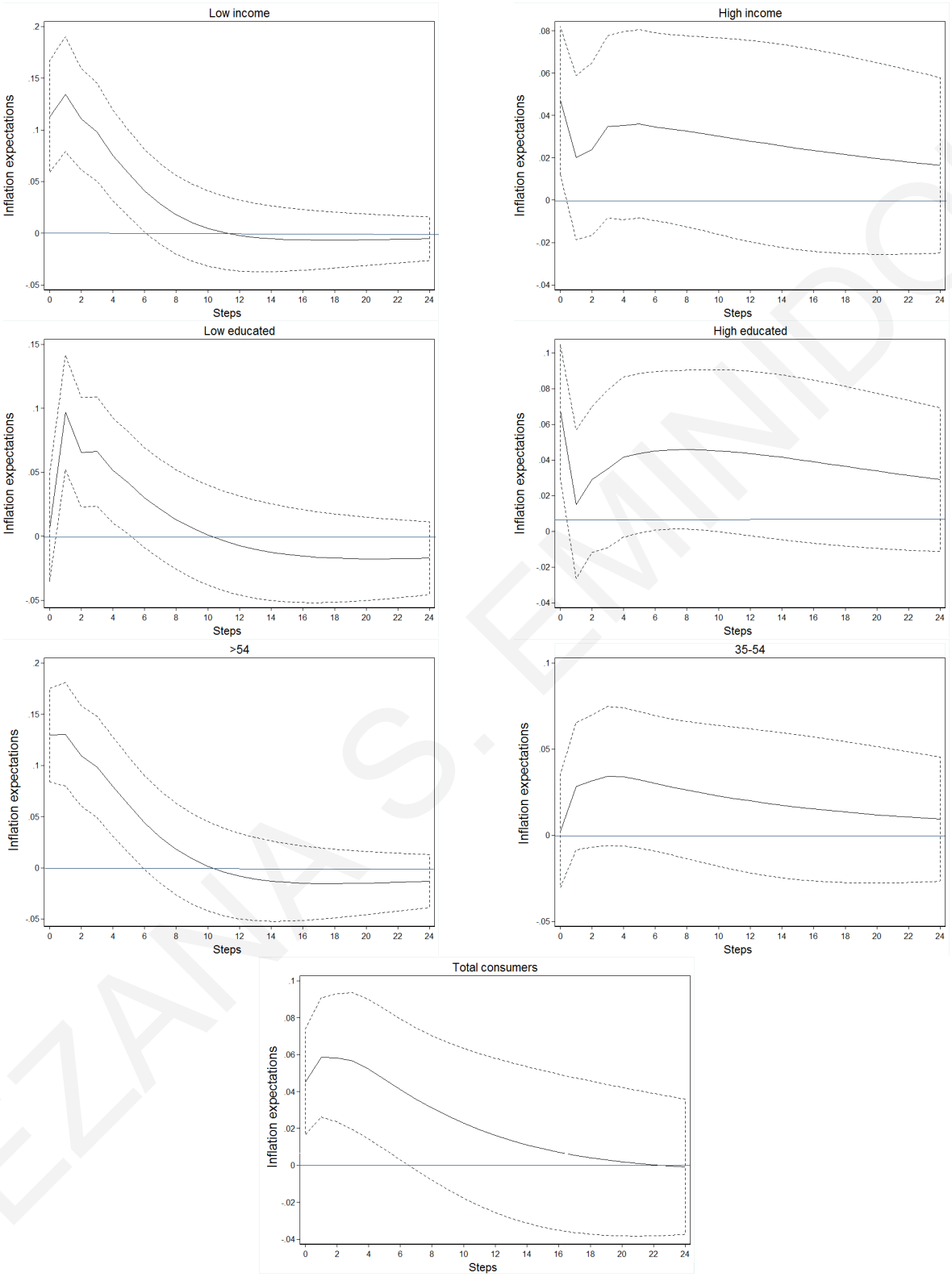
$$\begin{bmatrix} u_{Q_1,k,t} \\ u_{Q_2,k,t} \\ u_{Q_3,k,t} \\ u_{Q_4,k,t} \\ u_{Q_5,k,t} \\ u_{Q_6,k,t} \\ u_{Q_7,k,t} \\ u_{\pi,t} \\ u_{ff,t} \\ u_{\pi^e_k t} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{0,21,k} & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{0,31,k} & a_{0,32,k} & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{0,41,k} & a_{0,42,k} & a_{0,43,k} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{0,51,k} & a_{0,52,k} & a_{0,53,k} & a_{0,54,k} & 1 & 0 & 0 & 0 & 0 & 0 \\ a_{0,61,k} & a_{0,62,k} & a_{0,63,k} & a_{0,64,k} & a_{0,65,k} & 1 & 0 & 0 & 0 & 0 \\ a_{0,71,k} & a_{0,72,k} & a_{0,73,k} & a_{0,74,k} & a_{0,75,k} & a_{0,76,k} & 1 & 0 & 0 & 0 \\ a_{0,81,k} & a_{0,82,k} & a_{0,83,k} & a_{0,84,k} & a_{0,85,k} & a_{0,86,k} & a_{0,87,k} & 1 & 0 & 0 \\ a_{0,91,k} & a_{0,92,k} & a_{0,93,k} & a_{0,94,k} & a_{0,95,k} & a_{0,96,k} & a_{0,97,k} & a_{0,98,k} & 1 & 0 \\ a_{0,101,k} & a_{0,102,k} & a_{0,103,k} & a_{0,104,k} & a_{0,105,k} & a_{0,106,k} & a_{0,107,k} & a_{0,108,k} & a_{0,109,k} & 1 \end{bmatrix}^{-1} \times \begin{bmatrix} e_{Q_1,k,t} \\ e_{Q_2,k,t} \\ e_{Q_3,k,t} \\ e_{Q_4,k,t} \\ e_{Q_5,k,t} \\ e_{Q_6,k,t} \\ e_{Q_7,k,t} \\ e_{\pi,t} \\ e_{ff,t} \\ e_{\pi^e_k t} \end{bmatrix} \tag{3.6}$$

Impulse Responses from the structural VAR

Figure 3.3 and Figure 3.4 illustrate the impulse response functions of the two kinds of monetary policy shocks, for well-informed consumers and potentially less-informed consumers, on inflation expectations. These figures indicate that irrespective of the assumption that we make regarding the consumers' information set and their ability to collect and update this, consumers' inflation expectations rise after an unanticipated increase in the federal funds rate. In particular, Figure 3.3 indicates that an unanticipated increase in the federal funds rate increases inflation expectations of low income and low educated consumers, those with ages more than 54, as well as for the average consumer in our data. For example, a one percentage point increase in the federal funds rate leads the inflation expectations of low income consumers to rise on impact by 0.12, and this impact remains significant for six months. By contrast, for high income consumers the impact of the monetary policy shock is never significant. Similar results are reported in Figure 3.4, where inflation expectations rise in response to an unanticipated increase in the federal funds rate when this monetary surprise is obtained by allowing the consumers' information set to be reflected only by their stated beliefs about the economy instead of including the full set of macroeconomic variables' histories. Once again, we see that the impact of the monetary surprise is positive and statistically significant for low-income and low-educated consumers, for consumers with ages more than 54, and for the average consumer in our data. Moreover, in this case high-educated consumers also appear to increase their inflation expectations.

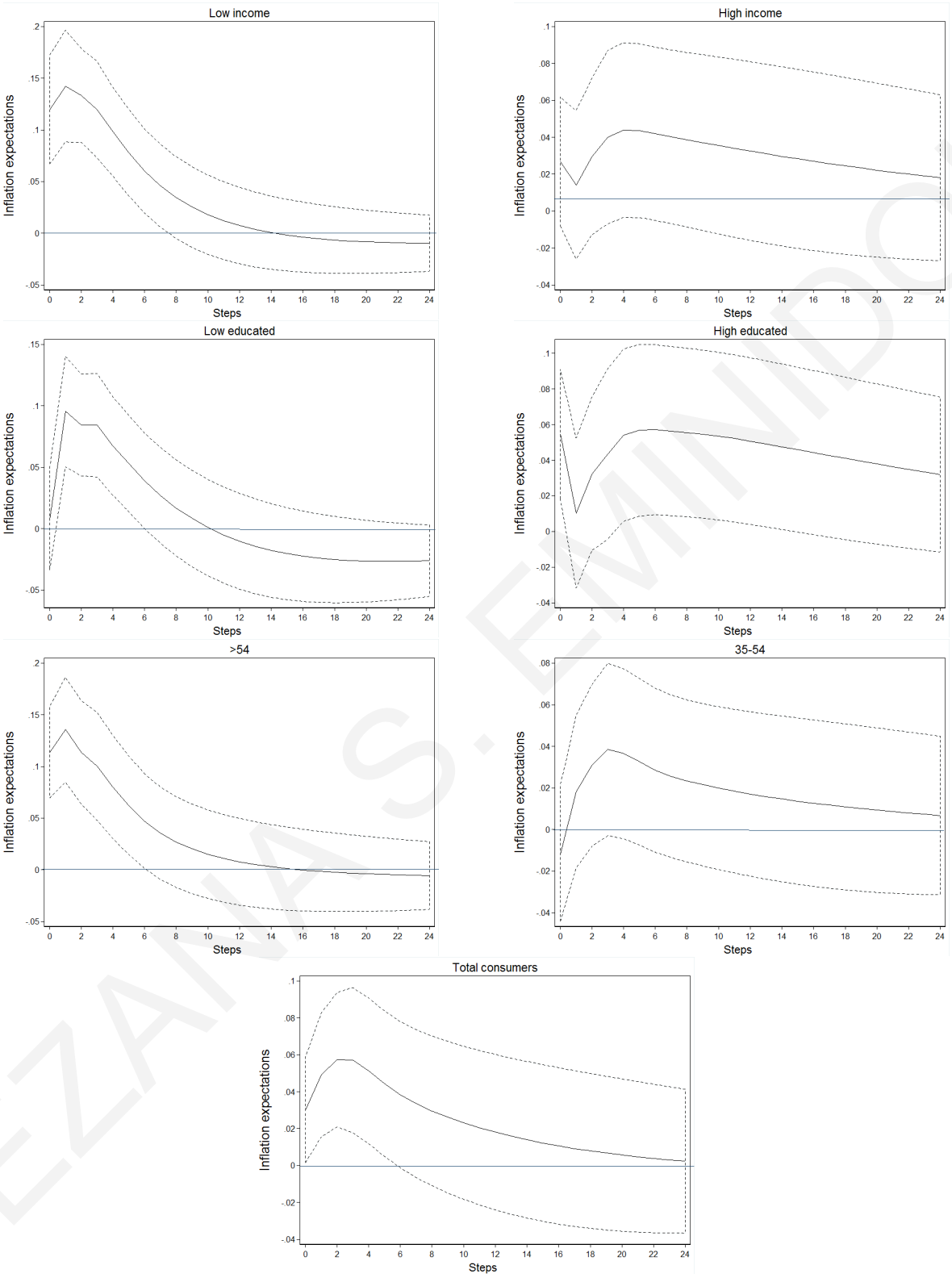
[35]Because we have 10 endogenous variables, we impose 10(10-1)/2 = 45 zero restrictions.

Figure 3.3: Impulse response functions based on macro variables.



Notes: Figure shows the response to a one percentage point increase in the federal funds rate. Full lines are point estimates, while the broken lines indicate 95 percent confidence intervals for orthogonalized impulse response functions.

Figure 3.4: Impulse response functions based on consumers' type-specific beliefs.



Notes: Figure shows the response to a one percentage point increase in the federal funds rate. Full lines are point estimates, while the broken lines indicate 95 percent confidence intervals for orthogonalized impulse response functions.

3.3.2 Proxy SVAR model

In this subsection, following the promising approach of Stock and Watson (2012) and Mertens and Ravn (2013), we identify a structural monetary policy shock by proxying the monetary policy innovations with external instruments that include additional information regarding monetary policy beyond the information contained in the estimation of the structural VAR model. Thus, following the narrative based approach of Romer and Romer (2004) and the high frequency identification approach of Gertler and Karadi (2015), we construct external instruments for the US around FOMC announcement dates. In particular, following the Romer and Romer (2004) methodology, we extend the Romer and Romer (2004) monetary policy series, as a deviation from the policy rule given the information set of the central bank as reported by internal forecasts. We also construct a high frequency identified measure, using changes in current federal funds future rates, as in Gertler and Karadi (2015). Then, we investigate the impact of monetary policy shocks on inflation expectations of different demographic consumer subgroups. The monetary policy shock is initially derived assuming that consumers are well informed about the state of the economy, but we then relax this strong assumption by focusing instead on consumers' actual stated beliefs.

Construction of external instruments

In Chapter 2, we constructed the external instruments for the euro area based on ECB's announcement days. In the same way, we construct a series with external instruments that we use to proxy for monetary policy changes in the US. The reason for doing so is to overcome the issue of any implausible timing assumptions imposed in our previous identification method. The identification method developed in the next section is based on the two leading external instruments that have been proposed in the literature by Romer and Romer (2004) using the narrative approach, and by Gertler and Karadi (2015) using the high-frequency identification approach. Particularly, Romer and Romer (2004) derive a new monetary shock measure and estimate its effects on the economy. In our analysis, we go a step further. First, we update the series of Romer and Romer (2004) until the end of our sample. Second, we use this measure as a proxy of monetary policy in the estimation of the proxy SVAR model in line with Mertens and Ravn (2013). In doing so, we derive a series of intended changes in the federal funds rate around FOMC meetings.

More precisely, we collect new data from the Federal Reserve Board press releases regarding the federal funds rate target based on FOMC statements. For each FOMC meeting we collect a series of the federal funds rate, and then get a series with the changes of the federal funds rate around FOMC announcement days.[36] Then, to control for Federal Reserve forecasts, we collect the internal FOMC forecasts[37] for inflation, real economic activity and the unemployment rate. Once again, for each announcement day, we collect the new data regarding

[36]Table C1 in the Appendix C, shows the changes in the federal funds rate around FOMC meetings and the level of the federal funds rate before any changes made in meeting m.

[37]Internal forecasts or Greenbook forecasts, are prepared by the Federal Reserve staff before the FOMC meeting

Federal reserve forecasts from the Greenbook until April 2010, and from Beigebook since then. Finally, we derive the new measure of monetary policy by estimating the equation below

$$\Delta ff_{\mathrm{m}} = \alpha + \beta ff_{b,m} + \sum_{j=-1}^{2} \gamma_{\mathrm{i}} gdp_{\mathrm{mi}} + \sum_{j=-1}^{2} \delta_{\mathrm{i}} (gdp_{\mathrm{mi}} - gdp_{\mathrm{m\text{-}1,i}}) + \sum_{j=-1}^{2} \phi_{\mathrm{i}} \pi_{\mathrm{mi}} + \sum_{j=-1}^{2} \theta_{\mathrm{i}} (\pi_{\mathrm{mi}} - \pi_{\mathrm{m\text{-}1,i}}) + \rho un_{\mathrm{m0}} + u_m^{RR} \tag{3.7}$$

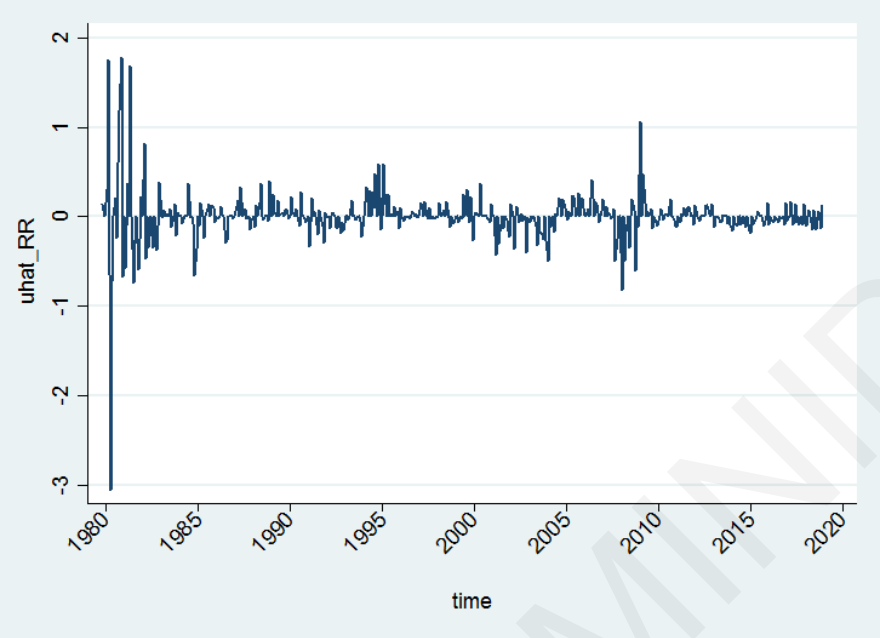
where Δff_m is the change in the federal funds rate around FOMC meeting m, ff_b is the level of the federal funds rate before any changes made in meeting m, gdp, π, and un are the forecasts of inflation, real output and unemployment rate. Subscript i is the horizon of the forecast and refers to previous quarter, current quarter, and one and two quarters ahead as in Romer and Romer (2004). Since a huge amount of resources is used by the Federal Reserve in order to forecast the macroeconomic variables which describe the state of the economy, we assume that any deviations in target interest rates are based on information about future economic developments. Thus, the residuals from this regression show changes in the federal funds rate not taken in response to information about future economic developments (see, for example, Romer and Romer (2004), Mertens and Ravn (2013)). Both, the changes in the federal funds rate target and the internal forecasts correspond to FOMC meetings. Therefore, in the estimation of equation (3.7), the number of observations correspond to FOMC meetings days, which means that the residuals from equation (3.7) also correspond to FOMC meetings days. To convert daily series of residuals, $\hat{u}_m^{RR}$, into monthly we assign each $\hat{u}_m^{RR}$ to the month in which the corresponding FOMC meeting occurred. If there are two meetings in a month, we sum the $\hat{u}_m^{RR}$ and if there is not any meeting in a month, we suppose that the $\hat{u}_m^{RR}$ is zero on that month. Figure 3.5a shows the $\hat{u}_m^{RR}$ series derived by estimating equation (3.7).

Next, we construct a surprise change of the current federal funds futures rate in line with Gertler and Karadi (2015). Given that our sample includes the zero lower bound period, and the increasing use of forward guidance by the Federal Reserve, we take into consideration market participants beliefs about the expected path of the federal funds rate. In particular, we derive the surprise changes in the 30-day federal funds future rate around FOMC meeting dates. The new measure we derive as a proxy for monetary policy changes, is given by the surprise in the federal funds futures rate on FOMC dates. Thus, the series that we derive is based on particular days and its size equals the number of FOMC meetings. To proceed with our analysis, we convert the daily series into monthly, as we did in the case of the Romer and Romer (2004) monetary policy measure. Figure 3.5b shows the surprise in the current federal funds futures rate. As we can see, this instrument is available from 1988:10 onwards.[38]

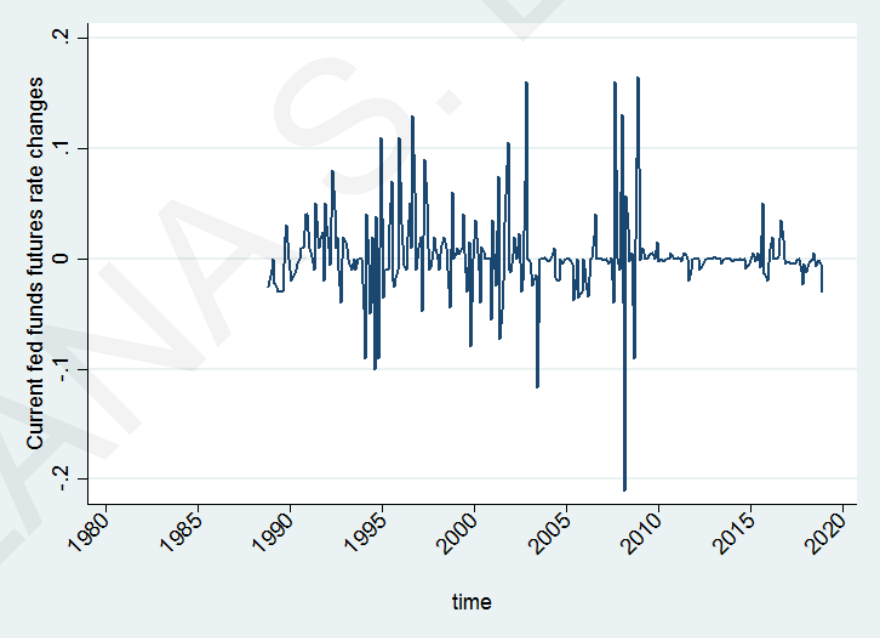
[38]Thus, while in estimating the reduced form residuals we use the full sample period, in identifying the contemporaneous impact of the monetary policy shock by proxying the monetary policy innovation with the external instruments we use the corresponding period starting from 1988:10.

Figure 3.5: Measures of monetary policy surprises

(a) A new measure of monetary policy surprises based on Romer and Romer (2004).



(b) Surprise in the current federal funds futures rate.



The structural form of the VAR we consider is the same used in section 3.3.1 and is given by equation (3.1). Once again, the vector y_t includes a set of macroeconomic variables along with commodity prices, the policy indicator, and inflation expectations of consumer type k at time t, $(\pi^e_{k,t})$. Since $E[u_t u_t'] = (A_0^{-1})(A_0^{-1})'$, an estimate of the covariance matrix of u_t provides q(q+1)/2 identifying restrictions. However, the identification of at least one of the columns of (A_0^{-1}) requires more identifying restrictions. In the previous section, we used the recursive identification method where the ordering of variables in the vector y_t matters. Here, we identify the structural monetary policy shock imposing covariance restrictions from

external instruments that we constructed earlier in this section.

Following the methodology of Stock and Watson (2012) and Mertens and Ravn (2013), let Z_t be a vector with external instruments $\hat{u}_t^{RR}$ and *Dff1*$_t$ constructed using the narrative approach of Romer and Romer (2004) and high frequency identification (Gertler and Karadi (2015)), respectively. Let $\mathbf{e_t^q}$ be a vector with structural shocks other than the policy shock, e_t^{ff}. To be valid instruments for the policy shock, $\hat{u}_t^{RR}$ and *Dff1*$_t$ must be correlated with e_t^{ff} but orthogonal to $\mathbf{e_t^q}$.[39]

Table 3.1: Estimates of external instruments on structural monetary policy shocks derived under the assumption that consumers are well informed.

VARIABLES	Total cons.	Low inc.	High inc.	Low educ.	High educ.	35-54	>54
uhat_rr	0.394***	0.396***	0.398***	0.400***	0.398***	0.390***	0.397***
	(0.066)	(0.065)	(0.066)	(0.066)	(0.067)	(0.068)	(0.066)
dff1	-0.526*	-0.519*	-0.517*	-0.509*	-0.475	-0.411	-0.511*
	(0.306)	(0.302)	(0.306)	(0.303)	(0.309)	(0.314)	(0.303)
Constant	-0.008	-0.006	-0.008	-0.007	-0.006	-0.009	-0.008
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Observations	362	362	362	362	362	362	362
F-test	22.34	23.12	22.65	23.28	21.89	19.82	22.92
R-squared adj.	0.106	0.109	0.107	0.110	0.104	0.0944	0.108

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

[39] As mentioned in Chapter 2, the essential conditions in estimating a SVAR model with exogenous instruments are given by $E[Z_t e_t^{ff'}] = \phi$ and $E[Z_t \mathbf{e_t^{q'}}] = \mathbf{0}$

Table 3.2: Estimates of external instruments on structural monetary policy shocks derived under the assumption that consumers are less informed.

VARIABLES	total cons.	Low inc.	High inc.	Low educ.	High educ.	35-54	>54
uhat_rr	0.286***	0.249***	0.311***	0.226***	0.408***	0.260***	0.213***
	(0.065)	(0.065)	(0.063)	(0.065)	(0.063)	(0.068)	(0.068)
dff1	-0.017	-0.632**	0.019	-0.071	-0.122	-0.092	-0.040
	(0.299)	(0.298)	(0.289)	(0.302)	(0.290)	(0.313)	(0.312)
Constant	-0.014	-0.015	-0.014	-0.012	-0.012	-0.014	-0.011
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Observations	362	362	362	362	362	362	362
F-test	10.26	11.93	12.87	6.475	22.84	8.039	5.295
R-squared adj.	0.049	0.057	0.062	0.029	0.108	0.038	0.023

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Before we proceed with the estimation of impulse response functions of a proxy SVAR model, we test for the relevance of the instruments estimating the two kinds of monetary policy innovations on our constructed instruments. In particular, in Table 3.1 we use monetary policy innovations derived given the assumption that consumers are well informed about the state of the economy, and thus the vector y_t in the equation (3.1) includes a full set of macroeconomic variables. In Table 3.2 we use monetary policy innovations derived by estimating the equation (3.1) under the assumption that consumers are less informed and the vector $y_{k,t}$ includes consumers' type-specific beliefs. Stock, Wright, and Yogo (2002) recommend the first stage F statistic to detect weak instruments. In our study, following Stock, Wright, and Yogo (2002) we overcome the concern of a weak instrument problem using the threshold value of ten for the F-statistic from the first stage regression.[40] In Table 3.1, we see that the F statistic is greater than ten for all consumer types. In Table 3.2, the F statistic is higher than 10 for high educated consumers (22.84), high income consumers (12.87), low income consumers (11.93), and total consumers (10.26), indicating that the external instruments are more relevant for these groups.

Then, we compute the impulse responses to a monetary shock estimating the equation below

$$y_{\mathrm{t}} = \sum_{j=1}^{p} A_0{}^{-1} A_{\mathrm{j}} y_{\mathrm{t-j}} + \mathbf{a}_0 e_t{}^{\mathrm{ff}} \tag{3.8}$$

Given the assumption that the structural shocks are uncorrelated (D = I), the variance covariance matrix of the reduced form model is $V = A_0{}^{-1}(A_0{}^{-1})'$. Let $\mathbf{a}_0$ denote the column in matrix

[40] As a rule of thumb, the F-statistic of a joint test whether all excluded instruments are significantly different from zero should be bigger than 10 in case of a single endogenous regressor. In case of a single instrument and a single endogenous regressor, this implies that the t-value for the instrument should be bigger than square root of 10 (around 3.2) or the corresponding p-value below 0.0016.

A_0^{-1} corresponding to impact of the structural policy shock e_t^{ff} on each element of the vector of reduced form residuals $\mathbf{u}_t$. Thus, we estimate the reduced form VAR model by the ordinary least squares, and obtain estimates of the coefficients in each matrix A_0^{-1} A_j. Then, we use the external instruments as an identification strategy to obtain estimates of the column $\mathbf{a}_0$ in matrix A_0^{-1}. More precisely, we obtain estimates of the elements in the vector $\mathbf{a}_0$ with the following steps. First, we obtain estimates of the vector of reduced form residuals, $\mathbf{u_t}$ from the ordinary least squares regression of the reduced form VAR. Then, partitioning the vector $\mathbf{u}_t$ to u_t^{ff} with the reduced form residual from the equation for the policy indicator and $\mathbf{u_t^q}$ with the reduced form residuals from the equation for variables q other than policy indicator. Finally, we obtain estimate for the vector $\mathbf{a}_0$ from the two stage least squares regression of $\mathbf{u_t^q}$ on u_t^{ff}, using the instrument set Z_t.

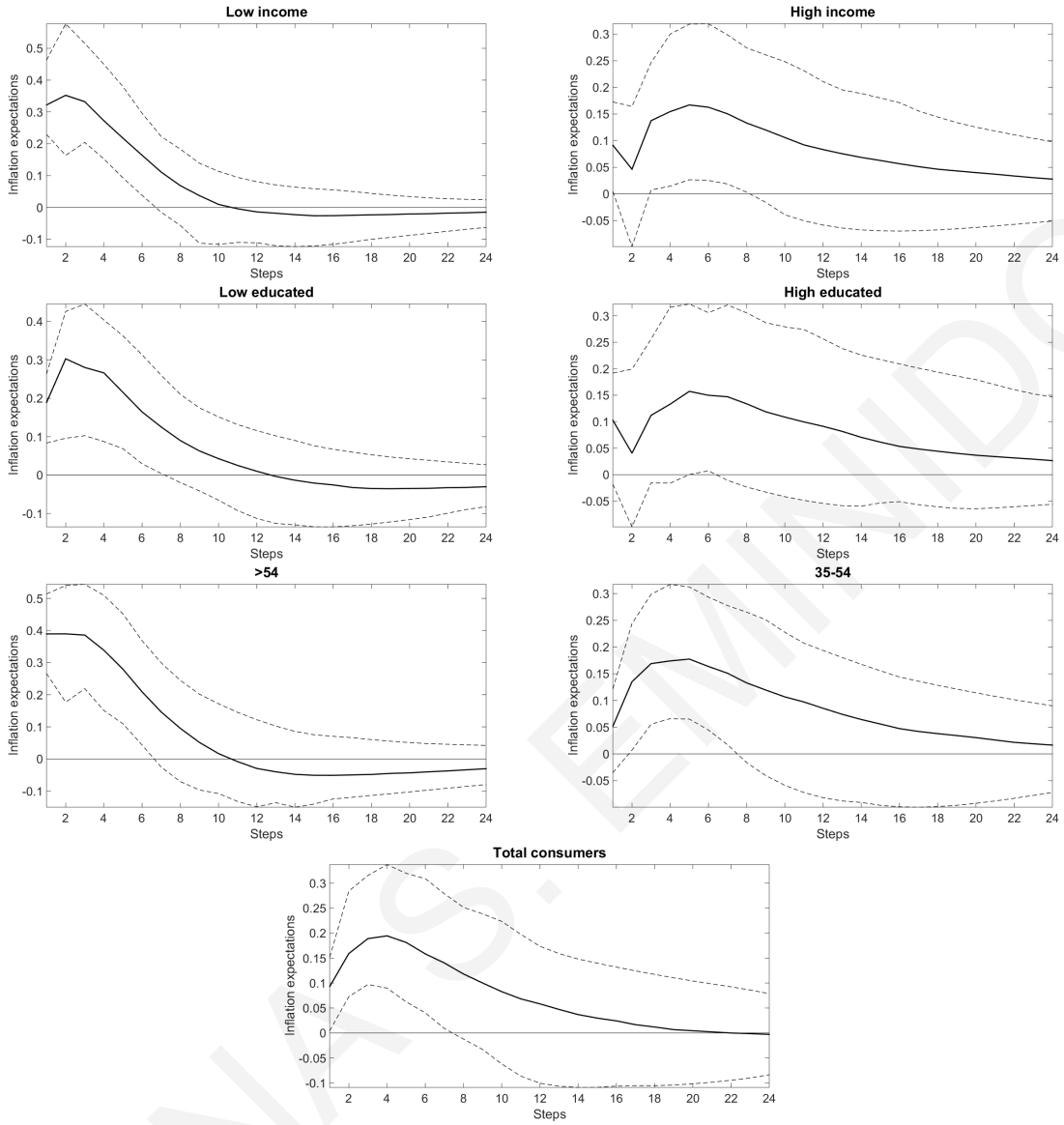
Impulse responses from proxy SVAR model estimation

Figures 3.6 and 3.7 show the impulse responses from estimating a proxy SVAR model. In particular, Figure 3.6 shows the response of inflation expectations of different consumer types to a monetary policy shock identified imposing the assumption that consumers are well informed about the state of the economy. Figure 3.7 shows the impulse responses from our second specification where we assume that consumers are potentially less informed. In both specifications, the number of lags that we use are determined using the Hannan-Quinn information criterion (HQC) and are equal to two.

As we see in Figure 3.6, a one percentage point unanticipated increase in the federal funds rate increases inflation expectations of total consumers by 10 basis points and the positive impact remains statistically significant for eight months. Comparing the results across consumer demographic subgroups we see the impact of monetary policy is greater for low income, low educated, and for ages more than 54 as compared to those with high income, high educated, and ages between 35-54. For example, inflation expectations of low income consumers rise by 32 basis points on impact after a federal funds hike innovation, while high income consumers increase their inflation expectations only by 9 basis points, and the impact of the federal funds hike innovation is significant only after 3 months. Similarly, low educated consumers increase their inflation expectations by 20 basis points on impact and this positive impact remains significant for eight months, as compared to high educated consumers where we do not get any significant impact of a federal funds hike innovation.

Figure 3.7 shows the impulse responses of a monetary policy shock derived by including consumer type-specific beliefs in a proxy SVAR model instead of macroeconomic variables used in our first specification. Once again, we see that the impact of the federal funds rate hike innovation on inflation expectations of consumers in the US is positive and statistically significant for total consumers, low-income and low-educated consumers. Moreover, comparing the impulse response functions between consumers with ages between 35-54 versus to those more than 54, we see that the latter increase their inflation expectations by 40 basis points on impact and the positive impact remains statistically significant for six months after the shock occurred, while those with ages 35-54 increase their inflation expectations by

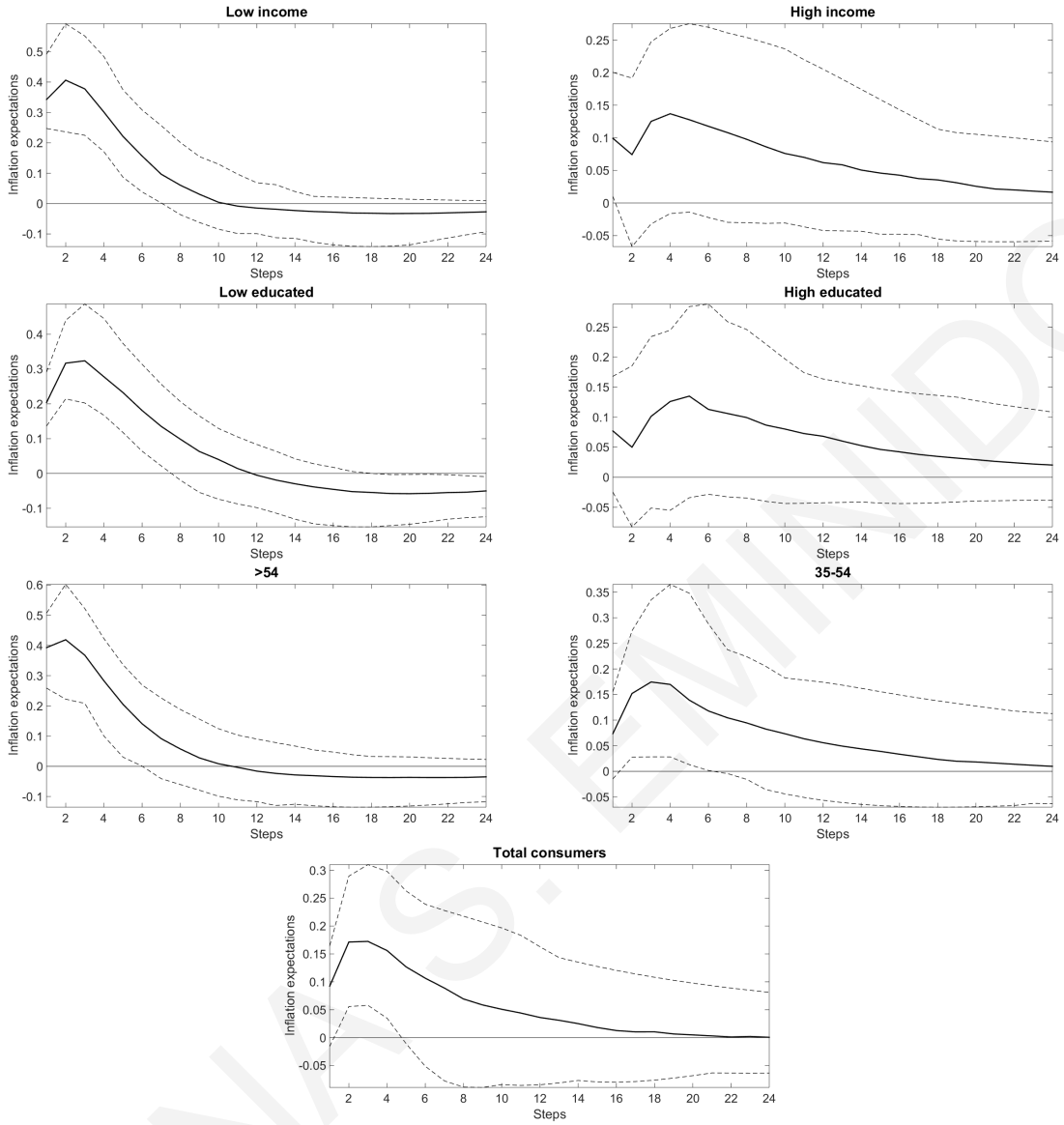
Figure 3.6: Impulse response functions based on macro variables.



Notes: Figure shows the response to a one percentage point increase in the federal funds rate. Full lines are point estimates, while the broken lines indicate 95 percent confidence intervals.

only 7 basis point on impact and become insignificant five months afte the shock occurred. Overall, we see that inflation expectations of consumers rise in response to a contractionary monetary policy shock. Interestingly, in the case of the United States, types of individuals that are likely to be less-informed such as low-income (or low educated) or with a shorter horizon (those over 54 years of age), respond to an unanticipated increase in the interest rate in a manner consistent with an imperfect information setting. This occurs irrespective of the assumptions made regarding the consumers information set as compared to the results in the euro area countries, where only those assumed to be less informed behave in a way which is consistent with imperfect information theoretical settings. Our results emphasize imperfect information theoretical settings (see, for example, Campbell et al. (2012), Del Negro, Giannoni, and Patterson (2012),Garcia-Schmidt (2015) and Melosi (2016)) where consumers learn from an unanticipated interest rate cuts that the Fed, based on its superior informa-

Figure 3.7: Impulse response functions based on type specific beliefs.



Notes: Figure shows the response to a one percentage point increase in the federal funds rate. Full lines are point estimates, while the broken lines indicate 95 percent confidence intervals.

tion set, is expecting a fall in inflation so it starts lowering the federal funds rate. However, our results come in contrast to the findings of Jarocinski and Karadi (2018). Jarocinski and Karadi (2018) assess the impact of high-frequency monetary policy surprises on inflation expectations using the Consensus survey of professional forecasters. In their analysis, they separate monetary policy shocks from central bank information shocks in a structural VAR model[41] and find that expectations decline after a monetary policy shock in the US. In my future research, I will examine what explains this difference. Are the expectations of professionals forecasters so different from those of the households? Or are there differences between using intraday versus daily surprises? Since, Federal Reserve's announcements convey information not only about monetary policy, but also about economic fundamentals,

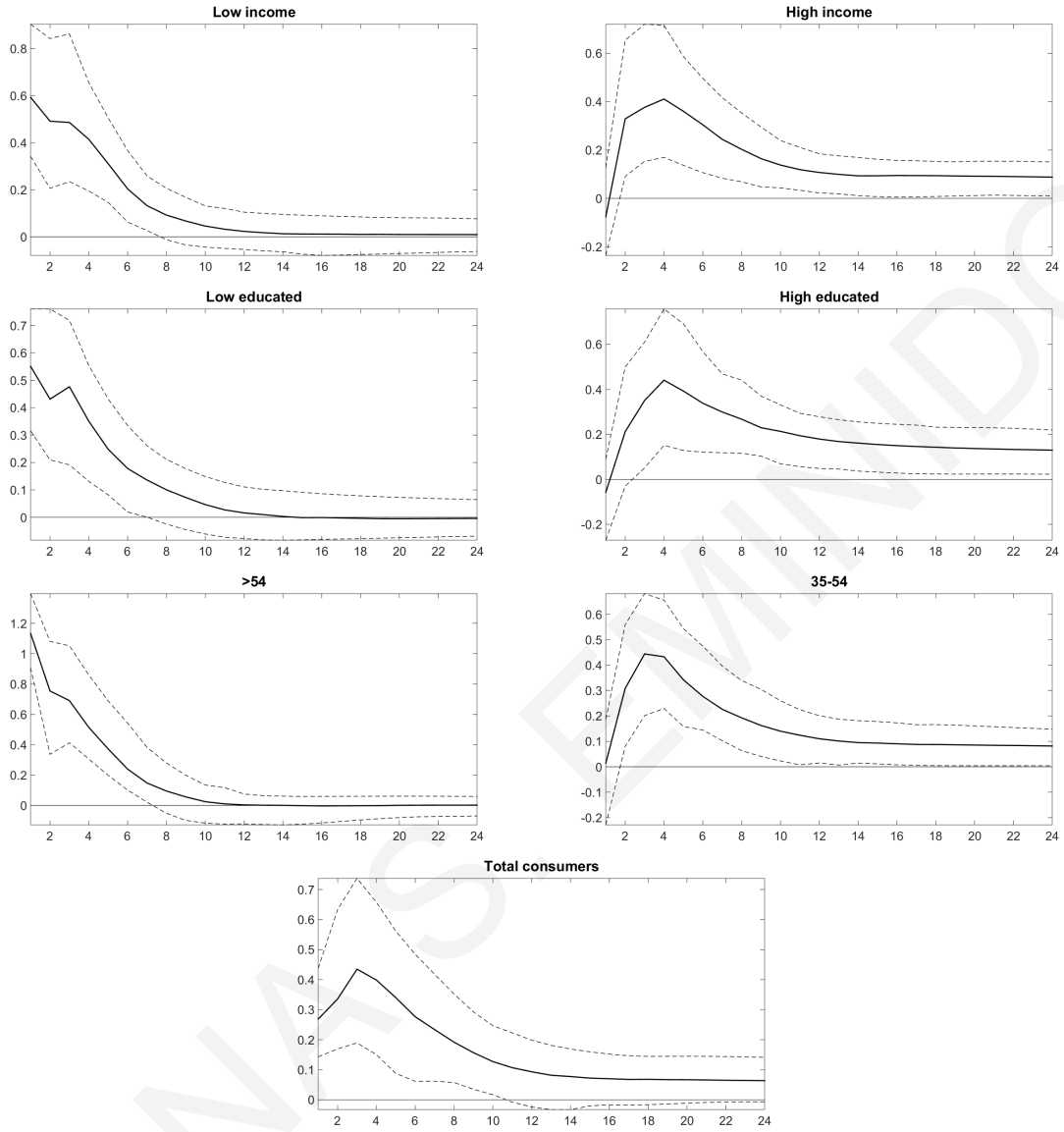
[41] Jarocinski and Karadi (2018) found that the presence of information shocks can bias the results of the standard high-frequency monetary policy identification, and thus estimate the response of macroeconomic variables on two different types of shocks.

I will separate the "information shocks" from "pure policy shocks" via sign restrictions using intraday data around FOMC meetings (see, for example, Jarocinski and Karadi (2018), Kerssenfischer (2019)) and examine if the separation of these two types of shocks affects our main results.

Robustness

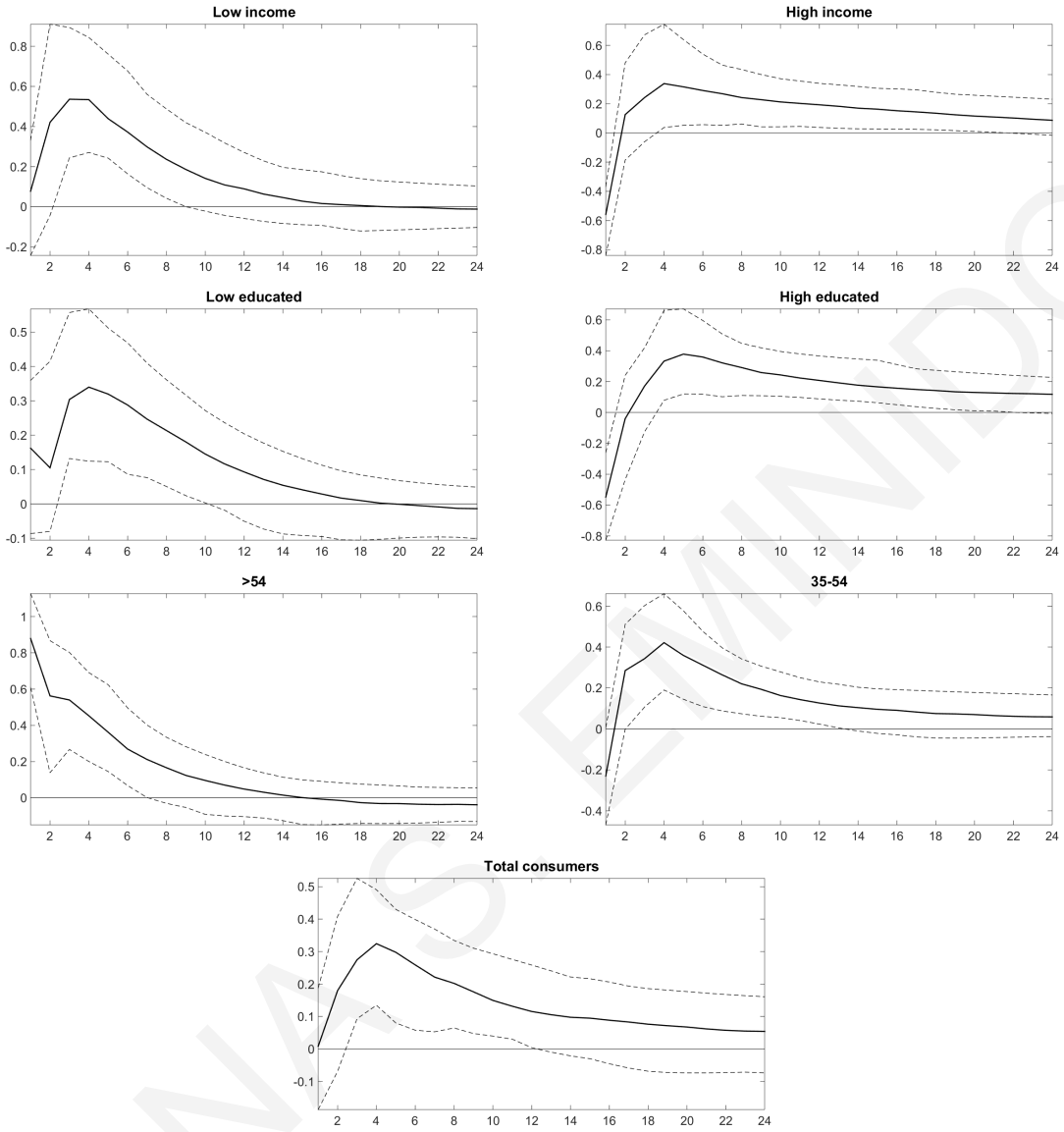
We evaluate the robustness of the above results taking into account the structural change in monetary policy regimes during the sample period under study. First, we exclude from our sample the Great Inflation period where the federal funds rate was at very high levels as the Federal Reserve attempted to decrease the high inflation. The impulse response functions from the estimation of a proxy SVAR model for the sample period 1983:1 - 2018:12 for well informed and less informed consumers are reported respectively in Figures 3.8 and 3.9. As we can see, the impact of a federal funds hike innovation on consumers' inflation expectations is once again positive. The impact of the monetary policy shock is greater on impact for low income and low educated consumers as compared to high income and high educated consumers. The positive impact becomes significant two months after the shock occurred in the case of well informed consumers (Figure 3.8), and after four months in the case of less informed consumers (Figure 3.9).

Figure 3.8: Impulse response functions based on macro variables for the sample 1983:1-2018:12.



Notes: Figure shows the response to a one percentage point increase in the federal funds rate. Full lines are point estimates, while the broken lines indicate 95 percent confidence intervals.

Figure 3.9: Impulse response functions based on type specific beliefs for the sample 1983:1-2018:12.



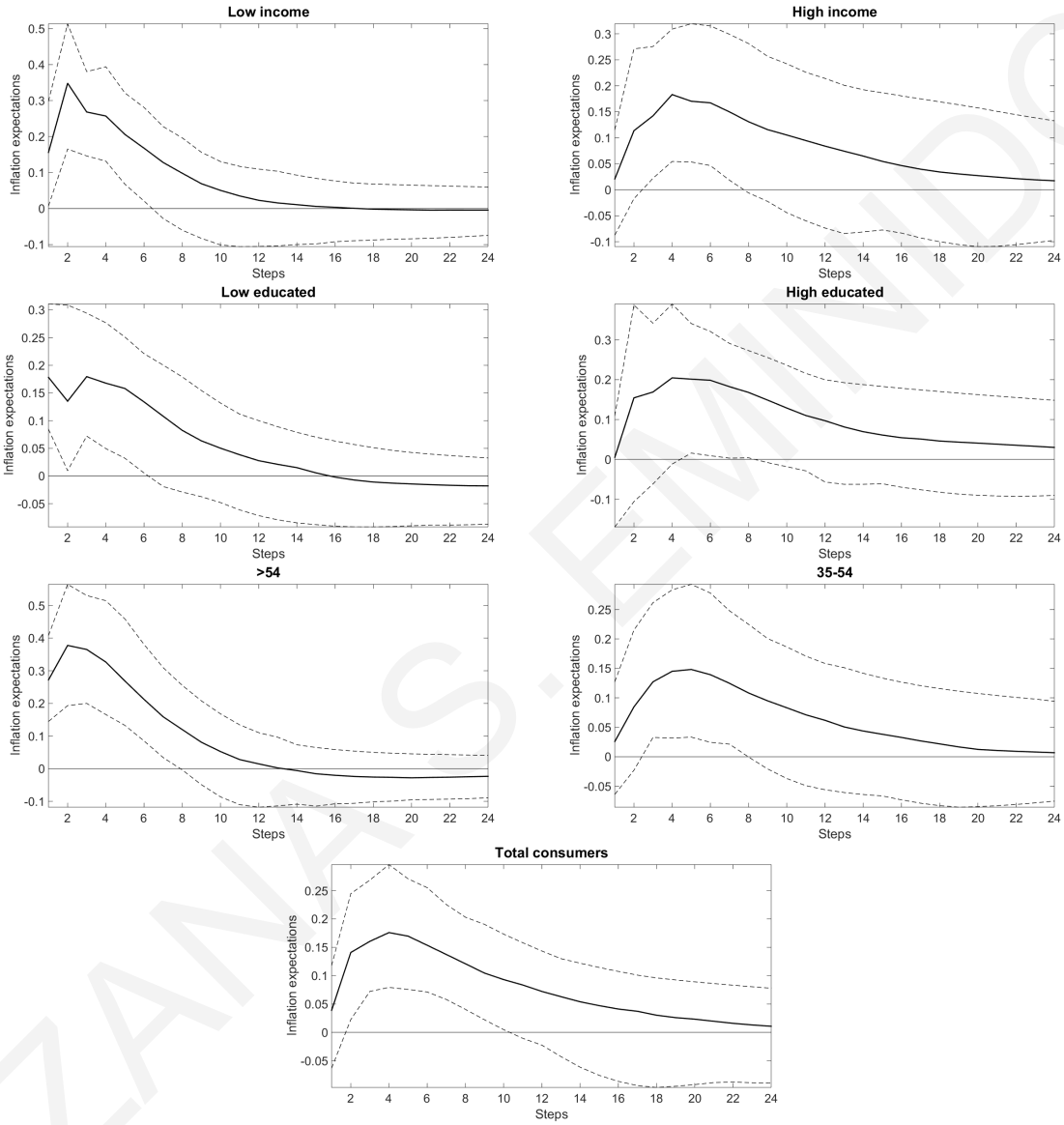
Notes: Figure shows the response to a one percentage point increase in the federal funds rate. Full lines are point estimates, while the broken lines indicate 95 percent confidence intervals.

Second, since unconventional policies have been used by the Fed since late 2008 when the federal funds reached the zero lower bound, we find it useful to examine alternative measures of monetary policy shocks. We thus consider here the one-year government bond rate instead of the federal funds rate as a monetary policy indicator.[42] According to Gertler and Karadi (2015), government bond rates take into account the expected path of the federal funds rate (see also, Gurkaynak, Sack, and Swanson (2004)) rather than just its current changes. As we want to include shocks to forward guidance in our measure of monetary policy innovation, we re-estimate a proxy SVAR model using the one-year government bond rate as the policy

[42]While the federal funds rate had been the key policy indicator and therefore unanticipated changes in federal funds could be interpreted as policy shocks (see, for example, Bernanke and Mihov (1998)), this has not been the case over the past decade or so.

indicator instead of the federal funds rate.[43] The results are shown in Figures 3.10 and 3.11 for our first and second specifications, respectively. As we can see, results are similar with those reported in Figures 3.6 and 3.7.

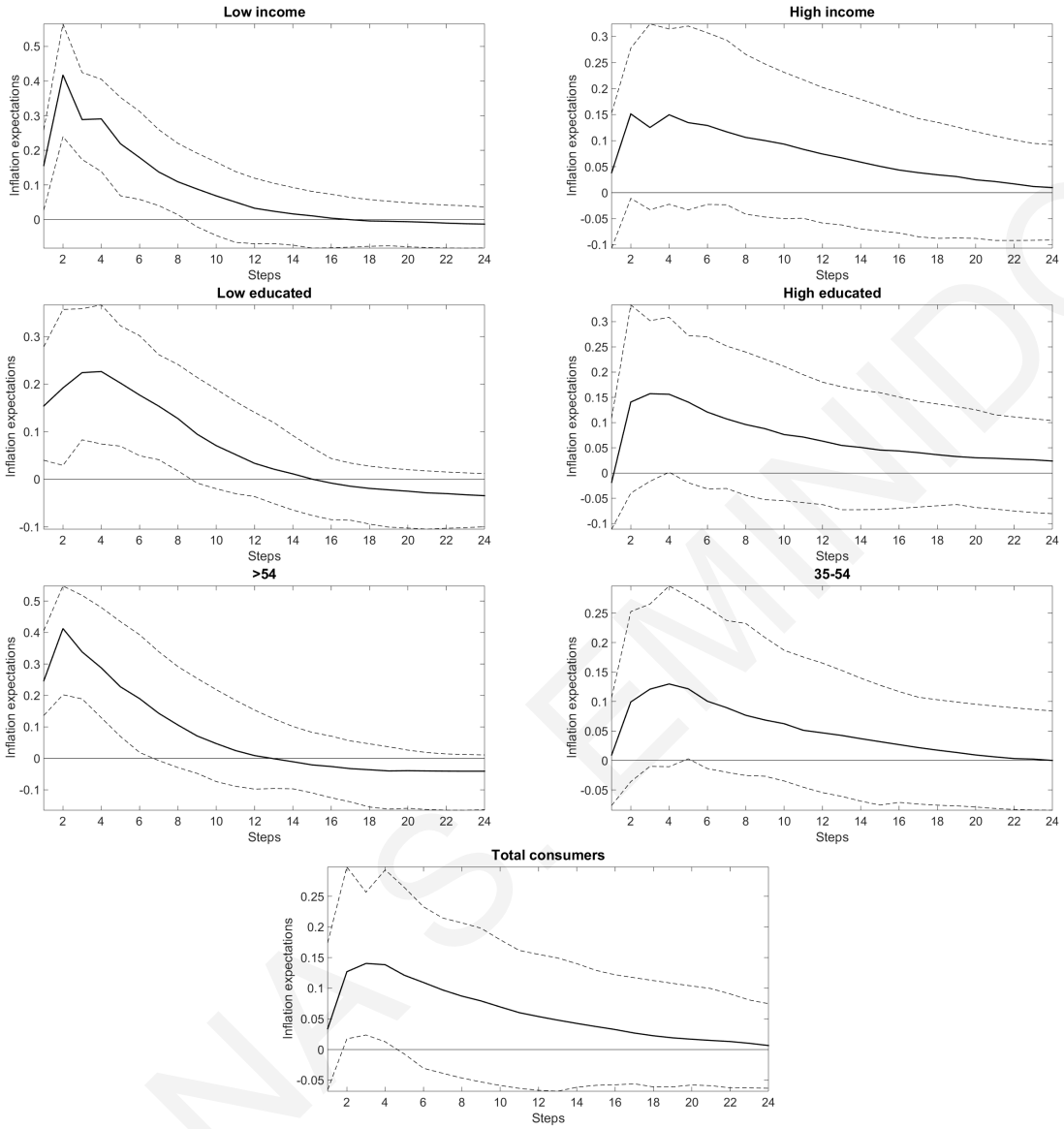
Figure 3.10: Impulse response functions based on macro variables using the one year government bond rate as monetary policy indicator.



Notes: Figure shows the response to a one percentage point increase in the one year government bond yield. Full lines are point estimates, while the broken lines indicate 95 percent confidence intervals.

[43] Gertler and Karadi (2015) mention that using the government bond rate as a policy indicator we incorporate not only the effects of surprises in the current funds rate but also shifts in expectations about the future path of the funds rate.

Figure 3.11: Impulse response functions based on type specific beliefs using the one year government bond rate as monetary policy indicator.



Notes: Figure shows the response to a one percentage point increase in the one year government bond yield. Full lines are point estimates, while the broken lines indicate 95 percent confidence intervals.

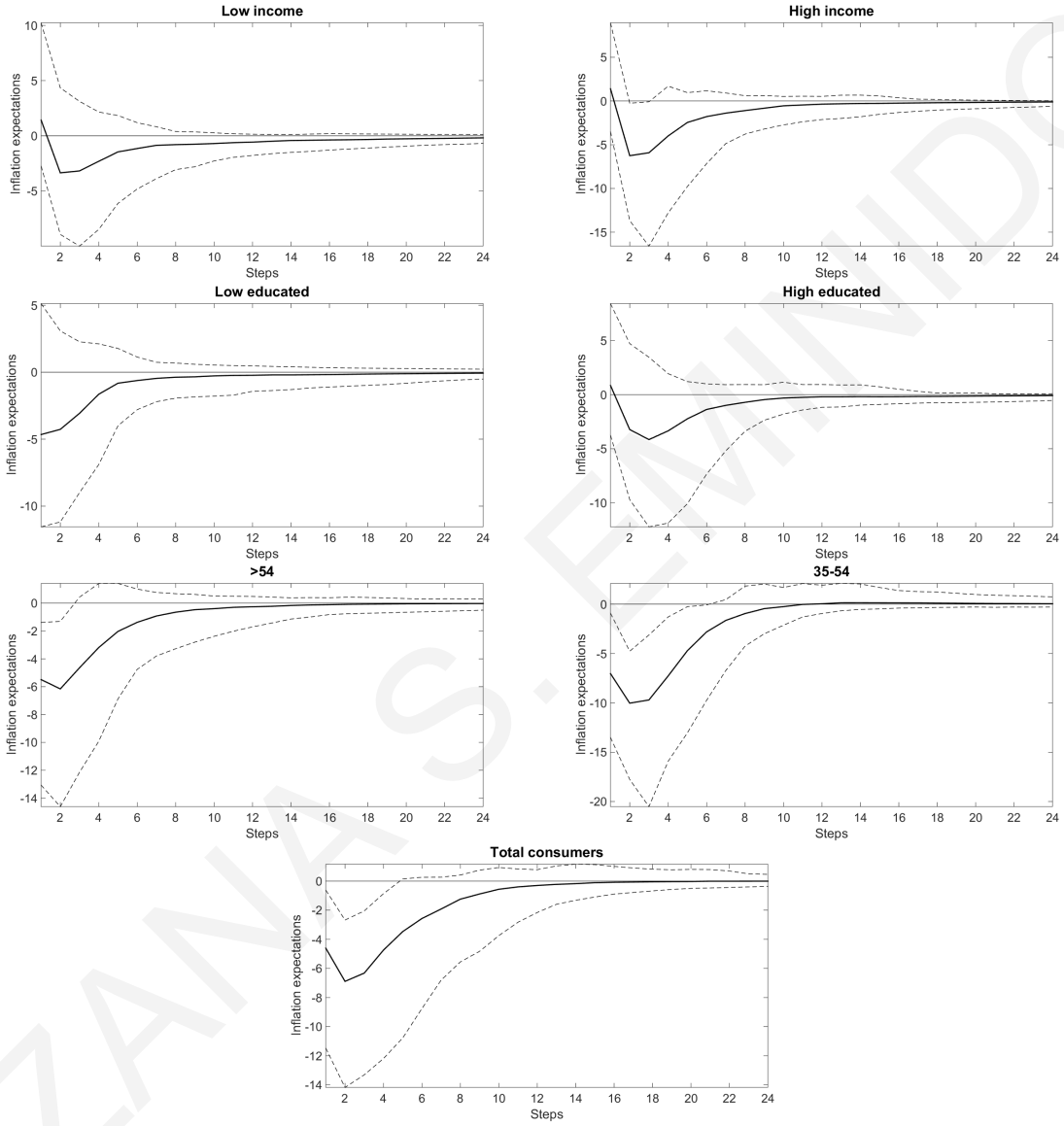
Finally, following a number of papers which emphasize the importance of the monetary base in measuring the reaction function of the Federal Reserve (see, for example, Karras (2013), Belongia and Ireland (2015), and Barnett et al. (2013)) especially since the recent global financial crisis, we use the monetary base instead of the federal funds rate as an alternative measure for monetary policy.[44] The results of expansionary monetary policy shocks are reported in Figure 3.12, for the period beginning with with the Great Recession.[45] The results reported in Figure 3.12 indicate that consumers' tend to decrease their inflation expectations

[44]Given that unconventional monetary policy was adopted since the Great Recession, we derive the monetary policy shock using as monetary policy indicator the monetary base for 2007:8 until 2018:12.

[45]The impulse response functions for the whole sample period do not give significant results, given that there was not much variation before the late part of our sample when the expansion in the monetary base commenced.

after an expansion in the monetary base. Once again, we see that consumers behave in a way which is inconsistent with standard textbook theory where somebody would expect the opposite, e.g. an increase in inflation expectations after an expansionary monetary policy shock.

Figure 3.12: Impulse response functions to Monetary Base expansion (2007:8-2018:12).



Notes: Figure shows the response to a one percentage point increase in the Monetary Base. Full lines are point estimates, while the broken lines indicate 95 percent confidence intervals.

3.4 Conclusion

Our main finding in this chapter is that irrespective of the model that we use to identify monetary policy shocks (standard Cholesky identification approach or proxy SVAR model), and irrespective of the assumption that we make regarding the consumers' information set and their ability to collect and update their information set, consumers' types that are likely to be less informed such as low income (or low educated) or with shorter horizon (those over 54

years of age), respond more to an unanticipated increase in the interest rate, and in a manner consistent with imperfect information settings. Consumers appear to learn from unanticipated federal fund rate cuts that the policymaker is worried about deflation, so that lowering the federal funds rate ends up lowering inflation expectations for consumers. This finding is consistent with what we had found in Chapter 1 regarding consumers' inflation expectations in the Eurozone economies.[46] My main finding here is that monetary policy shocks affect consumers' types that are more likely to be subject to misinformation and behave in a way consistent with imperfect information theoretical settings. Expansionary monetary policy is interpreted by unaware consumers as implying that central bank is worried about deflation and thus they decrease their inflation expectations. My main results are consistent with the signaling effect mentioned in Melosi (2016), or Delphic Forward guidance mentioned in Campbell et al. (2012). Moreover, the heterogeneity that exist across consumers' types and the way that they interpret monetary policy changes can lead to distributional effects (see, for example, Coibion and Gorodnichenko (2012), Doepke and Schneider (2006), Erosa and Ventura (2002)). Particularly, Coibion and Gorodnichenko (2012) find that monetary policy shocks have statistically significant effects on inequality, and a contractionary monetary policy shock raise the observed inequality across households in income, labor earnings, expenditures and consumption. Thus, policy makers should seriously take into account how monetary policy changes are interpreted by economic agents and how individuals depending on their financial and economic situation, education and age respond to monetary policy shocks. In future work I would like to explore further the impact of monetary policy and/or fiscal policy changes on economic agents' expectations using a detailed household-level or firm-level data, in order to verify my results based on individual level data.

[46] One of our findings in Chapter 1 was that, given the assumption that consumers are less informed about the state of the economy and focusing on their stated beliefs, consumers raise inflation expectations after an interest rate hike.

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Appendices

.1 Appendix A

Table A1: Estimation results for equation (1.1) whole sample.

	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
Indl Production	1.037***	1.170***	1.164***	1.096***	1.137***	1.132***	1.047***	1.085***	1.091***
	(0.379)	(0.322)	(0.318)	(0.315)	(0.332)	(0.343)	(0.315)	(0.323)	(0.317)
Unem. rate	0.073	0.078*	0.078*	0.084*	0.083*	0.087*	0.083*	0.076*	0.083*
	(0.053)	(0.045)	(0.046)	(0.043)	(0.044)	(0.046)	(0.044)	(0.044)	(0.043)
inflation	0.003	0.010	0.010	0.009	0.009	0.009	0.007	0.010	0.009
	(0.019)	(0.021)	(0.023)	(0.019)	(0.021)	(0.023)	(0.022)	(0.021)	(0.020)
Price of crude oil	0.204*	0.211***	0.180**	0.195***	0.188**	0.199**	0.181**	0.197***	0.191**
	(0.107)	(0.076)	(0.075)	(0.075)	(0.073)	(0.083)	(0.074)	(0.073)	(0.076)
Price of food	-0.245	-0.364*	-0.478*	-0.270	-0.284	-0.293	-0.322	-0.304	-0.299
	(0.241)	(0.218)	(0.263)	(0.223)	(0.233)	(0.247)	(0.234)	(0.228)	(0.230)
$Q5$	-0.008	-0.003	-0.000	-0.004	-0.002	-0.002	-0.000	-0.004	-0.003
	(0.006)	(0.004)	(0.001)	(0.004)	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)
$Q3$	-0.005	-0.003	-0.001	-0.003	-0.002	-0.002	0.002	-0.001	-0.002
	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
$Q1$	-0.010**	-0.001	-0.000	-0.005**	-0.001	-0.000	-0.010**	-0.010**	-0.003
	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.005)	(0.005)	(0.003)
$Q2$	0.001	-0.001	0.001	-0.000	-0.001	-0.001	0.003	-0.000	0.001
	(0.005)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.004)	(0.003)	(0.003)
$Q4$	0.003	0.004**	0.003**	0.003	0.002	0.002	-0.000	0.003	0.002
	(0.003)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$Q7$	-0.002	-0.001	0.000	-0.002	0.000	-0.000	-0.001	-0.000	-0.001
	(0.003)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
interest rate lags (2)	0.902***	0.901***	0.904***	0.900***	0.901***	0.900***	0.902***	0.901***	0.901***
	(0.033)	(0.034)	(0.033)	(0.033)	(0.033)	(0.034)	(0.033)	(0.033)	(0.033)
Indl production lags (2)	2.011*	2.319**	2.289**	2.194**	2.263**	2.323*	2.150**	2.270**	2.209**
	(1.187)	(1.161)	(1.112)	(1.078)	(1.133)	(1.264)	(1.089)	(1.142)	(1.122)
Unem. rate lags (2)	-0.008	0.021	0.038	0.040	0.063	0.036	0.050	0.043	0.052
	(0.074)	(0.072)	(0.069)	(0.068)	(0.071)	(0.075)	(0.062)	(0.068)	(0.064)
inflation lags (2)	0.023	0.042	0.044	0.041	0.046	0.044	0.039	0.044	0.044
	(0.027)	(0.031)	(0.032)	(0.029)	(0.032)	(0.036)	(0.033)	(0.031)	(0.029)
Price of crude oil lags (2)	0.809***	0.696***	0.626***	0.721***	0.686***	0.739***	0.663***	0.701***	0.695***
	(0.200)	(0.183)	(0.154)	(0.181)	(0.164)	(0.185)	(0.156)	(0.171)	(0.173)
Price of food lags (2)	0.372	0.497	0.530	0.508	0.583	0.580	0.488	0.579	0.536
	(0.426)	(0.359)	(0.352)	(0.380)	(0.373)	(0.406)	(0.386)	(0.364)	(0.388)
$Q5$ lags (2)	0.009	0.005	0.001	0.006	0.003	0.003	0.002	0.006*	0.005
	(0.006)	(0.004)	(0.001)	(0.004)	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)
$Q3$ lags (2)	0.004	0.001	0.001	0.002	0.001	0.001	-0.003	-0.000	0.000
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.002)
$Q1$ lags (2)	0.012***	0.005**	0.001	0.005**	0.001	0.000	0.010**	0.010**	0.003
	(0.004)	(0.002)	(0.003)	(0.002)	(0.003)	(0.001)	(0.004)	(0.004)	(0.004)
$Q2$ lags (2)	-0.006	-0.002	-0.004**	-0.002	0.000	0.001	-0.003	-0.001	-0.001
	(0.006)	(0.003)	(0.002)	(0.003)	(0.003)	(0.001)	(0.004)	(0.004)	(0.004)
$Q4$ lags (2)	0.002	0.001	0.001	0.001	0.002	-0.000	0.004	0.001	0.002
	(0.003)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
$Q7$ lags (2)	0.002	0.001	-0.000	0.002	-0.000	-0.000	0.001	-0.000	0.001
	(0.003)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)
Constant	0.123	0.171**	0.108*	0.127	0.125	0.139**	0.133*	0.123	0.134
	(0.091)	(0.071)	(0.064)	(0.090)	(0.078)	(0.064)	(0.075)	(0.076)	(0.092)
Observations	3,660	3,536	3,539	3,584	3,584	3,293	3,584	3,584	3,584
adjusted R squared	0.966	0.966	0.966	0.968	0.968	0.967	0.968	0.968	0.968

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 1985:1-2015:3. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). We are estimating equation (1.1), regressing short term interest rates on macroeconomic variables and on individual type specific beliefs that contains balances based on the responses to the questions Q1 to Q7 which are described in Tables A4 - A6.

Table A2: Estimation results for equation (1.1) before the Crisis.

	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
Indl Production	1.203**	1.523***	1.459***	1.307***	1.441***	1.432***	1.364***	1.292**	1.368***
	(0.612)	(0.499)	(0.491)	(0.494)	(0.504)	(0.539)	(0.495)	(0.515)	(0.495)
Unem. rate	0.138	0.139*	0.145**	0.166**	0.176**	0.165**	0.165**	0.155**	0.163**
	(0.086)	(0.074)	(0.073)	(0.071)	(0.071)	(0.076)	(0.071)	(0.072)	(0.071)
inflation	0.003	0.020	0.021	0.014	0.018	0.016	0.017	0.015	0.018
	(0.029)	(0.031)	(0.031)	(0.028)	(0.031)	(0.035)	(0.030)	(0.031)	(0.028)
Price of crude oil	0.167	0.168	0.145	0.164	0.145	0.168	0.134	0.162	0.147
	(0.156)	(0.112)	(0.119)	(0.117)	(0.115)	(0.137)	(0.120)	(0.113)	(0.121)
Price of food	0.038	-0.307	-0.313	-0.099	-0.092	-0.086	-0.228	-0.123	-0.134
	(0.460)	(0.467)	(0.515)	(0.456)	(0.496)	(0.516)	(0.534)	(0.471)	(0.480)
$Q5$	-0.012	-0.004	-0.002	-0.006	-0.003	-0.003	0.000	-0.006	-0.006
	(0.011)	(0.006)	(0.003)	(0.008)	(0.004)	(0.004)	(0.003)	(0.006)	(0.008)
$Q3$	-0.010	-0.007	-0.003	-0.007	-0.003	-0.003	0.003	-0.003	-0.004
	(0.007)	(0.005)	(0.004)	(0.007)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
$Q1$	-0.013**	0.000	0.000	-0.005	-0.000	-0.001	-0.014*	-0.015*	-0.004
	(0.007)	(0.003)	(0.003)	(0.004)	(0.003)	(0.002)	(0.008)	(0.008)	(0.004)
$Q2$	0.004	-0.001	0.004	-0.000	0.000	-0.001	0.007	0.002	0.004
	(0.010)	(0.004)	(0.004)	(0.005)	(0.004)	(0.003)	(0.006)	(0.007)	(0.006)
$Q4$	0.005	0.006**	0.004*	0.007	0.003	0.003	-0.002	0.005	0.003
	(0.005)	(0.003)	(0.002)	(0.005)	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)
$Q7$	-0.002	-0.001	0.001	-0.001	0.001	0.000	-0.001	0.001	-0.001
	(0.004)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)
interest rate lags (2)	0.891***	0.889***	0.895***	0.886***	0.890***	0.889***	0.889***	0.888***	0.887***
	(0.039)	(0.044)	(0.041)	(0.040)	(0.040)	(0.042)	(0.040)	(0.041)	(0.040)
Indl production lags (2)	2.424	3.234*	3.204*	2.936*	3.052	3.030	2.880	3.004	2.936
	(1.946)	(1.876)	(1.940)	(1.778)	(1.902)	(2.097)	(1.840)	(1.872)	(1.898)
Unem. rate lags (2)	-0.028	0.016	0.053	0.071	0.097	0.050	0.095	0.078	0.074
	(0.115)	(0.100)	(0.099)	(0.098)	(0.112)	(0.116)	(0.093)	(0.104)	(0.097)
inflation lags (2)	0.014	0.043	0.044	0.040	0.048	0.039	0.039	0.045	0.044
	(0.036)	(0.042)	(0.044)	(0.037)	(0.044)	(0.050)	(0.043)	(0.042)	(0.037)
Price of crude oil lags (2)	0.516**	0.304	0.226	0.377*	0.275*	0.411*	0.284*	0.339*	0.328*
	(0.209)	(0.185)	(0.154)	(0.194)	(0.153)	(0.210)	(0.161)	(0.182)	(0.170)
Price of food lags (2)	-0.376	-0.421	-0.314	-0.237	-0.194	-0.072	-0.190	-0.142	-0.241
	(0.852)	(0.710)	(0.680)	(0.787)	(0.753)	(0.754)	(0.746)	(0.770)	(0.809)
$Q5$ lags (2)	0.015	0.009	0.004	0.010	0.005	0.006*	0.003	0.009*	0.009
	(0.010)	(0.006)	(0.003)	(0.007)	(0.004)	(0.003)	(0.003)	(0.005)	(0.007)
$Q3$ lags (2)	0.012**	0.003	0.003	0.006	0.002	0.004	-0.003	0.003	0.003
	(0.005)	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)	(0.005)	(0.004)	(0.003)
$Q1$ lags (2)	0.012*	0.005	-0.002	0.005	-0.000	-0.001	0.010	0.011	0.002
	(0.007)	(0.003)	(0.007)	(0.004)	(-0.000)	(0.002)	(0.007)	(0.008)	(0.006)
$Q2$ lags (2)	-0.007	-0.001	-0.005	-0.001	0.003	0.002	-0.001	0.002	-0.001
	(0.009)	(0.006)	(0.004)	(0.005)	(0.005)	(0.002)	(0.007)	(0.007)	(0.006)
$Q4$ lags (2)	0.001	0.001	-0.000	0.001	0.002	-0.001	0.006	-0.001	0.002
	(0.005)	(0.004)	(0.002)	(0.003)	(0.003)	(0.002)	(0.004))	(0.004)	(0.004)
$Q7$ lags (2)	0.004	0.002	0.000	0.003	-0.001	0.000	0.002	-0.000	0.002
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Constant	0.520**	0.584**	0.523**	0.506**	0.566**	0.427	0.575**	0.548**	0.538**
	(0.232)	(0.278)	(0.215)	(0.246)	(0.232)	(0.267)	(0.231)	(0.241)	(0.255)
Observations	2,457	2,336	2,336	2,381	2,381	2,171	2,381	2,381	2,381
adjusted R squared	0.947	0.947	0.947	0.950	0.950	0.948	0.950	0.950	0.950

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 1985:1-2008:6. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). We are estimating equation (1.1), regressing short term interest rates on macroeconomic variables and on individual type specific beliefs that contains balances based on the responses to the questions Q1 to Q7 which are described in Tables A4 - A6.

Table A3: Estimation results for equation (1.1) since the Crisis.

	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
Indl Production	-0.155	-0.166	-0.161	-0.131	-0.178	-0.162	-0.183	-0.165	-0.137
	(0.140)	(0.141)	(0.152)	(0.142)	(0.145)	(0.151)	(0.146)	(0.144)	(0.139)
Unem. rate	0.021	0.021	0.016	0.020	0.018	0.016	0.019	0.020	0.022
	(0.025)	(0.025)	(0.025)	(0.026)	(0.025)	(0.025)	(0.024)	(0.025)	(0.025)
inflation	0.013***	0.012**	0.012**	0.013***	0.013***	0.011**	0.013***	0.012**	0.014***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Price of crude oil	0.141***	0.121***	0.142***	0.146***	0.135***	0.141***	0.135***	0.147***	0.139***
	(0.039)	(0.037)	(0.039)	(0.039)	(0.038)	(0.040)	(0.039)	(0.039)	(0.038)
Price of food	-0.942***	-0.939***	-0.917***	-0.932***	-0.940***	-0.928***	-0.929***	-0.956***	-0.943***
	(0.176)	(0.180)	(0.175)	(0.181)	(0.177)	(0.189)	(0.174)	(0.176)	(0.175)
$Q5$	-0.000	0.000	0.000	-0.000	-0.000	0.000	0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q3$	0.002**	0.002**	0.001	0.002**	0.000	0.001***	0.001	0.002***	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q1$	0.001	0.001	-0.000	-0.001	0.001	0.001*	0.001	0.000	0.000
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q2$	-0.002	-0.001	0.000	0.000	-0.003***	-0.000	-0.003***	-0.002	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q4$	-0.002**	-0.001	-0.001	-0.002***	-0.001	-0.001**	-0.001	-0.002**	-0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q7$	-0.001*	-0.001*	-0.000	-0.001**	-0.002**	-0.000	-0.001*	-0.001*	-0.002***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
interest rate lags (2)	0.948***	0.946***	0.951***	0.948***	0.947***	0.951***	0.949***	0.948***	0.947***
	(0.016)	(0.016)	(0.017)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Indl production lags (2)	0.015	0.021	0.031	0.001	0.031	0.024	0.023	0.003	0.006
	(0.133)	(0.132)	(0.141)	(0.133)	(0.136)	(0.141)	(0.136)	(0.135)	(0.134)
Unem. rate lags (2)	-0.018	-0.018	-0.017	-0.020	-0.016	-0.016	-0.016	-0.017	-0.019
	(0.024)	(0.024)	(0.025)	(0.025)	(0.024)	(0.025)	(0.024)	(0.024)	(0.025)
inflation lags (2)	0.017**	0.016**	0.019**	0.020**	0.018**	0.019**	0.019**	0.018**	0.020***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)	(0.008)
Price of crude oil lags (2)	0.126	0.138	0.120	0.140	0.095	0.163	0.115	0.139	0.106
	(0.108)	(0.103)	(0.111)	(0.103)	(0.108)	(0.109)	(0.107)	(0.107)	(0.106)
Price of food lags (2)	0.514***	0.588***	0.509***	0.546***	0.506***	0.544***	0.510***	0.553***	0.530***
	(0.114)	(0.118)	(0.114)	(0.118)	(0.113)	(0.123)	(0.112)	(0.116)	(0.114)
$Q5$ lags (2)	0.001	0.001	-0.000	0.000	0.000	0.000	0.000	0.001	0.001
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q3$ lags (2)	-0.002**	-0.002**	-0.001	-0.002**	-0.001	-0.001**	-0.001	-0.002***	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q1$ lags (2)	0.004*	0.002**	0.001	0.003**	0.002	0.001	0.003**	0.003**	0.003*
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
$Q2$ lags (2)	-0.001	-0.000	-0.001	-0.001	0.001	0.000	-0.000	-0.000	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q4$ lags (2)	0.002*	0.001	0.001	0.002**	0.001	0.001	0.001	0.002*	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q7$ lags (2)	0.001	0.001	0.000	0.001	0.001*	0.000	0.001	0.001	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Constant	0.661	0.736*	0.637	0.648	0.662	0.719	0.726	0.750*	0.616
	(0.423)	(0.421)	(0.427)	(0.421)	(0.421)	(0.440)	(0.444)	(0.439)	(0.416)
Observations	1,161	1,158	1,161	1,161	1,161	1,083	1,161	1,161	1,161
adjusted R squared	0.991	0.991	0.990	0.990	0.991	0.990	0.991	0.991	0.991

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 2008:10-2015:3. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). We are estimating equation (1.1), regressing short term interest rates on macroeconomic variables and on individual type specific beliefs that contains balances based on the responses to the questions Q1 to Q7 which are described in Tables A4 - A6.

Table A4: Estimation results for equation (1.2) whole sample.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
$Q5$	-0.006	-0.006	-0.002	-0.006	-0.003	-0.001	-0.003	-0.005	-0.003
	(0.006)	(0.004)	(0.002)	(0.005)	(0.003)	(0.002)	(0.003)	(0.004)	(0.005)
$Q3$	-0.011**	-0.008**	-0.005**	-0.006**	-0.006*	-0.001	-0.007	-0.004	-0.008*
	(0.005)	(0.004)	(0.002)	(0.003)	(0.004)	(0.002)	(0.005)	(0.003)	(0.004)
$Q1$	-0.000	0.002	0.003	-0.003	0.001	-0.004	-0.001	-0.008*	0.003
	(0.008)	(0.003)	(0.003)	(0.005)	(0.004)	(0.003)	(0.005)	(0.005)	(0.007)
$Q2$	0.004	-0.001	0.007*	0.004	0.005	-0.001	0.008*	0.006	0.005
	(0.005)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.005)	(0.004)	(0.004)
$Q4$	0.009**	0.012***	0.004	0.007**	0.005	0.004	0.006**	0.005**	0.005*
	(0.004)	(0.004)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)
$Q7$	0.002	0.000	0.003	-0.001	0.005*	-0.001	0.002	0.002	0.001
	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
inflation	0.071*	0.073*	0.076*	0.070*	0.072*	0.073*	0.075*	0.076*	0.073*
	(0.039)	(0.040)	(0.041)	(0.039)	(0.039)	(0.042)	(0.041)	(0.041)	(0.040)
interest rate lag	0.845***	0.837***	0.841***	0.836***	0.839***	0.832***	0.839***	0.840***	0.838***
	(0.062)	(0.066)	(0.066)	(0.065)	(0.065)	(0.066)	(0.065)	(0.065)	(0.065)
$Q5$ lag	0.011*	0.010**	0.005**	0.010**	0.006*	0.004**	0.006**	0.008*	0.007
	(0.006)	(0.004)	(0.002)	(0.005)	(0.003)	(0.002)	(0.003)	(0.004)	(0.005)
$Q3$ lag	0.010**	0.003	0.002	0.004	0.005	0.002	0.004	0.003	0.006
	(0.005)	(0.003)	(0.002)	(0.003)	(0.004)	(0.002)	(0.004)	(0.002)	(0.004)
$Q1$ lag	-0.001	0.002	-0.003	0.003	-0.004	-0.001	-0.001	0.003	-0.006
	(0.008)	(0.003)	(0.004)	(0.003)	(0.005)	(0.002)	(0.004)	(0.004)	(0.006)
$Q2$ lag	-0.002	0.003	-0.007**	0.001	0.000	0.007*	-0.000	0.002	0.003
	(0.005)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)
$Q4$ lag	0.000	-0.003	0.003*	0.000	-0.000	-0.001	-0.000	-0.000	-0.001
	(0.003)	(0.004)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
$Q7$ lag	0.001	-0.000	-0.002	0.001	-0.004	0.002	-0.001	-0.001	-0.000
	(0.003)	(0.002)	(0.003)	(0.002)	(0.004)	(0.002)	(0.002)	(0.003)	(0.003)
inflation lag	0.129***	0.130**	0.131***	0.130***	0.132***	0.136**	0.134***	0.134***	0.133***
	(0.049)	(0.050)	(0.049)	(0.050)	(0.049)	(0.053)	(0.050)	(0.050)	(0.049)
Constant	0.187*	0.302***	0.170	0.236*	0.191*	0.109	0.203*	0.169*	0.241**
	(0.096)	(0.107)	(0.116)	(0.126)	(0.113)	(0.075)	(0.104)	(0.092)	(0.108)
Observations	4,260	3,973	3,984	4,056	4,044	3,718	4,061	4,074	4,088
adjusted R squared	0.939	0.931	0.931	0.936	0.936	0.932	0.935	0.936	0.936

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 1985:1-2015:3. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). Here, we identify the type specific monetary policy surprise based on individual beliefs regarding the economy based on the information set of consumer type k, at time t in country i. We are estimating equation (1.2), regressing short term interest rates on individual type specific beliefs that contains balances based on the responses to the following questions: Q1 How has the financial situation of your household changed over the last 12 months? Q2 How do you expect the financial position of your household to change over the next 12 months? Q3 How do you think the general economic situation in the country has changed over the past 12months? Q4 How do you expect the general economic situation in this country to develop over the next 12 months? Q5 How do you think that consumer prices have developed over the past 12 months? and Q7 How do you expect the number of people unemployed in this country to change over the next 12 months?

Table A5: Estimation results for equation (1.2) before the Crisis.

	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
$Q5$	-0.011	-0.008	-0.005	-0.011	-0.004	-0.004	-0.004	-0.007	-0.005
	(0.011)	(0.006)	(0.004)	(0.008)	(0.004)	(0.004)	(0.004)	(0.006)	(0.008)
$Q3$	-0.017*	-0.011**	-0.008**	-0.010*	-0.007	-0.001	-0.008	-0.004	-0.010*
	(0.009)	(0.006)	(0.004)	(0.005)	(0.004)	(0.003)	(0.006)	(0.004)	(0.006)
$Q1$	-0.000	0.001	0.006	-0.005	-0.000	-0.010*	-0.002	-0.013*	0.003
	(0.013)	(0.005)	(0.005)	(0.009)	(0.004)	(0.005)	(0.006)	(0.008)	(0.010)
$Q2$	0.011	-0.001	0.017**	0.007	0.007	-0.002	0.012*	0.014**	0.010
	(0.009)	(0.006)	(0.008)	(0.006)	(0.004)	(0.006)	(0.007)	(0.007)	(0.006)
$Q4$	0.009	0.016**	0.004	0.009*	0.005	0.006	0.006*	0.004	0.005
	(0.006)	(0.007)	(0.004)	(0.005)	(0.005)	(0.005)	(0.003)	(0.004)	(0.005)
$Q7$	0.004	0.002	0.005	0.001	0.008**	-0.001	0.004	0.004	0.003
	(0.004)	(0.002)	(0.003)	(0.003)	(0.004)	(0.004)	(0.002)	(0.003)	(0.003)
inflation	0.080	0.090	0.092	0.085	0.085	0.089	0.089	0.088	0.086
	(0.056)	(0.060)	(0.059)	(0.059)	(0.059)	(0.063)	(0.060)	(0.060)	(0.058)
interest rate lag (1)	0.821***	0.816***	0.820***	0.814***	0.818***	0.807***	0.817***	0.815***	0.815***
	(0.067)	(0.071)	(0.070)	(0.070)	(0.070)	(0.071)	(0.070)	(0.070)	(0.070)
$Q5$ lag (1)	0.019*	0.013**	0.009**	0.017**	0.008**	0.008**	0.010***	0.012*	0.011
	(0.010)	(0.006)	(0.004)	(0.008)	(0.004)	(0.004)	(0.004)	(0.006)	(0.008)
$Q3$ lag (1)	0.020**	0.006	0.005	0.007	0.007	0.005	0.006	0.006	0.010*
	(0.009)	(0.005)	(0.004)	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)
$Q1$ lag (1)	-0.013	-0.001	-0.010	-0.002	-0.009	-0.004	-0.005	-0.002	-0.013
	(0.015)	(0.005)	(0.008)	(0.004)	(0.008)	(0.003)	(0.005)	(0.008)	(0.009)
$Q2$ lag (1)	0.004	0.005	-0.012**	0.003	0.002	0.012*	0.002	0.007	0.008
	(0.009)	(0.007)	(0.005)	(0.005)	(0.004)	(0.006)	(0.005)	(0.008)	(0.007)
$Q4$ lag (1)	-0.003	-0.005	0.003	-0.000	-0.001	-0.003	0.000	-0.004	-0.003
	(0.006)	(0.006)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)
$Q7$ lag (1)	0.000	-0.001	-0.004	0.001	-0.007	0.003	-0.002	-0.003	-0.001
	(0.004)	(0.003)	(0.004)	(0.003)	(0.005)	(0.003)	(0.003)	(0.004)	(0.004)
inflation lag (1)	0.164**	0.169**	0.175**	0.173**	0.167**	0.185**	0.173**	0.173**	0.171**
	(0.073)	(0.078)	(0.075)	(0.078)	(0.071)	(0.088)	(0.076)	(0.075)	(0.075)
Constant	0.741***	0.956***	0.905**	0.908***	0.876**	0.585**	0.932***	0.867**	0.912***
	(0.272)	(0.332)	(0.413)	(0.319)	(0.435)	(0.276)	(0.351)	(0.361)	(0.319)
Observations	3,056	2,771	2,780	2,852	2,840	2,595	2,857	2,870	2,884
adjusted R squared	0.914	0.902	0.902	0.909	0.909	0.904	0.907	0.909	0.909

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 1985:1-2008:6. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). Here, we identify the type specific monetary policy surprise based on individual beliefs regarding the economy based on the information set of consumer type k, at time t in country i. We are estimating equation (1.2), regressing short term interest rates on individual type specific beliefs that contains balances based on the responses to the following questions: Q1 How has the financial situation of your household changed over the last 12 months? Q2 How do you expect the financial position of your household to change over the next 12 months? Q3 How do you think the general economic situation in the country has changed over the past 12months? Q4 How do you expect the general economic situation in this country to develop over the next 12 months? Q5 How do you think that consumer prices have developed over the past 12 months? and Q7 How do you expect the number of people unemployed in this country to change over the next 12 months?

Table A6: Estimation results for equation (1.2) since the Crisis.

	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
$Q5$	0.000	0.000	0.000	0.000	-0.000	0.000	0.001	-0.000	-0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q3$	0.001	0.001*	0.001	0.001**	0.000	0.001**	0.000	0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q1$	0.000	0.001	0.000	-0.002	0.001	0.000	0.001	-0.000	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q2$	-0.003**	-0.001	-0.000	0.000	-0.003***	-0.000	-0.004***	-0.002**	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q4$	-0.002*	-0.000	-0.001	-0.002**	-0.001	-0.001**	-0.001	-0.002**	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q7$	-0.002**	-0.001**	-0.001	-0.001***	-0.002***	-0.000	-0.002**	-0.002**	-0.002***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
inflation	0.019***	0.020***	0.020***	0.022***	0.020***	0.021***	0.020***	0.020***	0.021***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
interest rate lags (2)	0.950***	0.950***	0.953***	0.949***	0.950***	0.951***	0.951***	0.950***	0.950***
	(0.018)	(0.018)	(0.019)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
$Q5$ lags (2)	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.001	-0.000	0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q3$ lags (2)	-0.002**	-0.001*	-0.001	-0.002**	-0.000	-0.001	-0.001	-0.001*	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Q1$ lags (2)	0.002	0.001	0.001	0.003**	0.001	0.000	0.003*	0.002*	0.003*
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
$Q2$ lags (2)	0.000	-0.000	-0.001	-0.001	0.001	0.000	0.000	0.001	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q4$ lags (2)	0.002	0.001	0.001**	0.002*	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Q7$ lags (2)	0.002	0.002*	0.001	0.001*	0.002*	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
inflation lags (2)	0.019**	0.020***	0.022***	0.023***	0.020***	0.023***	0.020***	0.021***	0.021***
	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)
Constant	0.001	0.023	-0.004	-0.008	-0.011	0.011	-0.011	-0.009	0.005
	(0.016)	(0.029)	(0.013)	(0.022)	(0.013)	(0.025)	(0.013)	(0.013)	(0.018)
Observations	1,161	1,158	1,161	1,161	1,161	1,083	1,161	1,161	1,161
adjusted R squared	0.990	0.990	0.990	0.990	0.990	0.989	0.990	0.990	0.990

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 2008:10-2015:3. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). Here, we identify the monetary policy surprise based on individual beliefs regarding the economy based on the information set of consumer type k, at time t in country i. We are estimating equation (1.2), regressing short term interest rates on individual type specific beliefs that contains balances based on the responses to the following questions: Q1 How has the financial situation of your household changed over the last 12 months? Q2 How do you expect the financial position of your household to change over the next 12 months? Q3 How do you think the general economic situation in the country has changed over the past 12months? Q4 How do you expect the general economic situation in this country to develop over the next 12 months? Q5 How do you think that consumer prices have developed over the past 12 months? and Q7 How do you expect the number of people unemployed in this country to change over the next 12 months?

Table A7: The relation of forward and backward-looking Beliefs variables with macroeconomic variables leads and lags.

	Pre-Crisis					
	$Q1_t$	$Q2_t$	$Q3_t$	$Q4_t$	$Q5_t$	$Q7_t$
Indl prod.	0.045	0.272***	0.282***	0.408***	-0.123**	-0.046
	(0.074)	(0.066)	(0.071)	(0.073)	(0.054)	(0.071)
Unem.	-0.453***	-0.393***	-0.660***	-0.495***	0.101***	0.509***
	(0.026)	(0.027)	(0.024)	(0.029)	(0.021)	(0.027)
inflation	-0.130***	0.153***	-0.073**	0.054	0.843***	-0.177***
	(0.045)	(0.048)	(0.037)	(0.045)	(0.034)	(0.042)
Observations	2,972	3,045	2,970	3,045	2,883	3,045
adj. R^2	0.583	0.610	0.586	0.473	0.694	0.561
	Post-Crisis					
	$Q1_t$	$Q2_t$	$Q3_t$	$Q4_t$	$Q5_t$	$Q7_t$
Indl prod.	0.155***	0.057***	0.231***	0.134***	-0.068**	-0.106***
	(0.014)	(0.021)	(0.031)	(0.040)	(0.030)	(0.039)
Unem.	-0.342***	-0.396***	-0.134***	-0.208***	-0.535***	0.329***
	(0.029)	(0.049)	(0.046))	(0.065)	(0.045)	(0.067)
inflation	-0.226***	0.128*	-0.230***	0.197**	0.702***	-0.122
	(0.036)	(0.070)	(0.072)	(0.087)	(0.064)	(0.078)
Observations	1,080	990	1,073	990	1,073	990
adj. R^2	0.951	0.901	0.775	0.720	0.828	0.725

Notes: We consider six monthly leads or lags depending on whether the beliefs variable to be explained is forward or backward looking. The beliefs variables Q1 to Q7 are as described in section 1.2.1.

Table A8: t test for equality of means for pre-Crisis versus post-Crisis period inflation expectations.

	total con	Low inc	High inc	Low edu	High edu	unem	full-time	30-49	50-64
p-values:									
Austria	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Belgium	0.001	0.010	0.001	0.000	0.032	0.021	0.032	0.143	0.263
Germany	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Estonia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Greece	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Spain	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Finland	0.001	0.000	0.894	0.000	0.475	0.000	0.022	0.075	0.349
France	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000
Ireland	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Italy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Luxembourg	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.002
Netherlands	0.006	0.371	0.000	0.378	0.000	-	0.000	0.000	0.039
Portugal	0.471	0.247	0.117	0.054	0.268	0.024	0.186	0.506	0.103
Slovenia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Slovakia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: Reported are two sample t test p-values on the equality of means allowing for differences in variances.

Table A9: Test on the equality of variances for pre-Crisis versus post-Crisis period inflation expectations.

	total con	Low inc	High inc	Low edu	High edu	unem	full-time	30-49	50-64
p-values:									
Austria	0.004	0.001	0.003	0.011	0.001	0.003	0.029	0.015	0.002
Belgium	0.002	0.021	0.002	0.009	0.006	0.001	0.009	0.046	0.087
Germany	0.818	0.545	0.856	0.280	0.357	0.613	0.746	0.816	0.977
Estonia	0.000	0.004	0.007	0.000	0.000	0.000	0.000	0.000	0.000
Greece	0.001	0.005	0.006	0.001	0.011	0.001	0.003	0.002	0.001
Spain	0.000	0.000	0.001	0.000	0.006	0.000	0.000	0.000	0.000
Finland	0.244	0.926	0.002	0.254	0.032	0.216	0.128	0.092	0.012
France	0.024	0.001	0.041	0.006	0.535	0.000	0.027	0.059	0.032
Ireland	0.000	0.000	0.517	0.000	0.074	0.014	0.653	0.611	0.869
Italy	0.000	0.006	0.504	0.000	0.000	0.000	0.000	0.000	0.000
Luxembourg	0.000	0.002	0.000	0.005	0.000	0.000	0.000	0.000	0.000
Netherlands	0.500	0.191	0.601	0.070	0.812	-	0.706	0.496	0.737
Portugal	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Slovenia	0.001	0.003	0.002	0.002	0.001	0.000	0.005	0.004	0.007
Slovakia	0.082	0.260	0.009	0.288	0.010	0.073	0.070	0.081	0.118

Notes: Reported are variance comparison test p-values on the equality of variances.

Table A10: Kolmogorov-Smirnov test for equality of distribution functions of pre-Crisis period versus post-Crisis period inflation expectations.

	total con	Low inc	High inc	Low edu	High edu	unem	full-time	30-49	50-64
p-values:									
Austria	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
Belgium	0.013	0.012	0.015	0.001	0.091	0.010	0.154	0.194	0.196
Germany	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000
Estonia	- 0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Greece	- 0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Spain	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Finland	0.000	0.000	0.338	0.000	0.155	0.000	0.002	0.008	0.160
France	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ireland	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Italy	- 0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Luxembourg	0.002	0.012	0.004	0.001	0.001	0.000	0.001	0.001	0.007
Netherlands	0.000	0.196	0.000	0.070	0.000	-	0.000	0.000	0.003
Portugal	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000
Slovenia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Slovakia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: Reported are the KS test p-values.

Table A11: Estimation results for augmented form of equation (1.1) whole sample.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
Indl Production	0.954***	1.092***	1.066***	0.985***	1.017***	1.022***	0.942***	0.993***	0.968***
	(0.368)	(0.329)	(0.319)	(0.310)	(0.332)	(0.349)	(0.311)	(0.326)	(0.311)
Unem. rate	0.069	0.071	0.070	0.079*	0.080*	0.075	0.079*	0.071	0.079*
	(0.055)	(0.048)	(0.048)	(0.046)	(0.047)	(0.049)	(0.047)	(0.047)	(0.046)
inflation	0.007	0.017	0.013	0.015	0.013	0.015	0.011	0.014	0.012
	(0.019)	(0.021)	(0.023)	(0.019)	(0.021)	(0.023)	(0.022)	(0.021)	(0.020)
Price of crude oil	0.079	0.077	0.074	0.065	0.078	0.077	0.067	0.067	0.067
	(0.104)	(0.074)	(0.074)	(0.074)	(0.072)	(0.082)	(0.073)	(0.073)	(0.075)
Price of food	-0.564**	-0.723***	-0.799***	-0.619**	-0.621**	-0.658**	-0.672**	-0.637**	-0.639**
	(0.265)	(0.249)	(0.286)	(0.254)	(0.258)	(0.279)	(0.263)	(0.255)	(0.259)
$Q5$	-0.005	-0.002	0.001	-0.002	-0.000	-0.001	0.002	-0.002	-0.001
	(0.006)	(0.004)	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)
$Q3$	-0.005	-0.003	-0.001	-0.003	-0.002	-0.002	0.002	-0.001	-0.002
	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
$Q1$	-0.009**	-0.002	-0.000	-0.005***	-0.001	-0.001	-0.009*	-0.009**	-0.003
	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.005)	(0.005)	(0.003)
$Q2$	-0.001	-0.001	0.001	0.000	-0.002	-0.001	0.001	-0.002	0.000
	(0.006)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.004)	(0.004)	(0.003)
$Q4$	0.002	0.003	0.002	0.002	0.001	0.001	-0.001	0.002	0.001
	(0.003)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$Q7$	-0.002	-0.002	-0.000	-0.002	-0.000	-0.001	-0.002	-0.001	-0.002
	(0.003)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
interest rate lags (2)	0.917***	0.917***	0.920***	0.915***	0.917***	0.916***	0.918***	0.917***	0.916***
	(0.028)	(0.028)	(0.028)	(0.028)	(0.027)	(0.028)	(0.027)	(0.027)	(0.028)
Indl production lags (2)	2.041*	2.426**	2.266**	2.233**	2.225*	2.362*	2.140*	2.274*	2.145*
	(1.214)	(1.228)	(1.143)	(1.130)	(1.177)	(1.352)	(1.129)	(1.188)	(1.146)
Unem. rate lags (2)	-0.026	-0.016	0.006	0.015	0.037	-0.005	0.021	0.013	0.028
	(0.076)	(0.075)	(0.071)	(0.069)	(0.074)	(0.081)	(0.065)	(0.071)	(0.065)
inflation lags (2)	0.024	0.048	0.045	0.045	0.047	0.051	0.038	0.044	0.043
	(0.027)	(0.030)	(0.033)	(0.028)	(0.031)	(0.034)	(0.032)	(0.031)	(0.029)
Price of crude oil lags (2)	0.691***	0.547***	0.510***	0.566***	0.560***	0.597***	0.531***	0.578***	0.556***
	(0.198)	(0.170)	(0.142)	(0.168)	(0.156)	(0.165)	(0.151)	(0.171)	(0.166)
Price of food lags (2)	0.344	0.483	0.521	0.518	0.574	0.570	0.460	0.578	0.530
	(0.432)	(0.364)	(0.357)	(0.385)	(0.381)	(0.407)	(0.396)	(0.371)	(0.401)
$Q6$ lags (2)	0.002**	0.002***	0.002***	0.003***	0.002***	0.002***	0.002***	0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Q5$ lags (2)	0.006	0.003	0.000	0.003	0.002	0.002	0.000	0.003	0.003
	(0.005)	(0.003)	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)
$Q3$ lags (2)	0.003	0.001	0.000	0.002	0.000	0.001	-0.004	-0.001	-0.000
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.002)
$Q1$ lags (2)	0.009**	0.003	0.000	0.003	0.001	-0.000	0.009**	0.008**	0.002
	(0.005)	(0.002)	(0.003)	(0.003)	(0.003)	(0.001)	(0.004)	(0.004)	(0.004)
$Q2$ lags (2)	-0.002	-0.001	-0.003	0.001	0.001	0.001	-0.001	0.001	0.000
	(0.007)	(0.003)	(0.002)	(0.004)	(0.003)	(0.001)	(0.004)	(0.004)	(0.005)
$Q4$ lags (2)	0.002	0.001	0.001	0.001	0.002	-0.000	0.004*	0.002	0.002
	(0.003)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
$Q7$ lags (2)	0.001	-0.001	-0.001	0.000	-0.002	-0.002	-0.000	-0.001	-0.000
	(0.003)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)
Constant	0.013	0.004	-0.005	-0.025	0.020	-0.010	0.006	-0.004	0.003
	(0.094)	(0.084)	(0.074)	(0.098)	(0.078)	(0.083)	(0.078)	(0.086)	(0.095)
Observations	3,660	3,536	3,539	3,584	3,584	3,293	3,584	3,584	3,584
adjusted R squared	0.965	0.966	0.966	0.967	0.967	0.966	0.967	0.967	0.967

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 1985:1-2015:3. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). We are estimating equation (1.1), regressing short term interest rates on macroeconomic variables and on individual type specific beliefs that contains balances based on the responses to the questions Q1 to Q7 which are described in Tables A4 - A6.

Table A12: Estimation results for augmented equation (1.1) before the Crisis.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
Indl Production	1.171*	1.505***	1.436***	1.263***	1.404***	1.439***	1.334***	1.238**	1.335***
	(0.608)	(0.496)	(0.488)	(0.484)	(0.496)	(0.540)	(0.489)	(0.508)	(0.491)
Unem. rate	0.139	0.140*	0.145**	0.167**	0.176**	0.165**	0.163**	0.153**	0.166**
	(0.086)	(0.073)	(0.074)	(0.070)	(0.071)	(0.075)	(0.070)	(0.071)	(0.072)
inflation	0.003	0.019	0.020	0.013	0.017	0.015	0.017	0.016	0.017
	(0.029)	(0.031)	(0.031)	(0.028)	(0.031)	(0.035)	(0.030)	(0.031)	(0.028)
Price of crude oil	0.156	0.164	0.148	0.161	0.153	0.169	0.137	0.142	0.153
	(0.161)	(0.113)	(0.120)	(0.119)	(0.116)	(0.139)	(0.123)	(0.120)	(0.122)
Price of food	0.069	-0.285	-0.310	-0.053	-0.084	-0.074	-0.221	-0.101	-0.112
	(0.452)	(0.462)	(0.515)	(0.446)	(0.493)	(0.516)	(0.534)	(0.463)	(0.478)
$Q5$	-0.012	-0.005	-0.002	-0.006	-0.003	-0.003	0.000	-0.006	-0.006
	(0.011)	(0.006)	(0.003)	(0.007)	(0.004)	(0.004)	(0.003)	(0.006)	(0.008)
$Q3$	-0.011	-0.007	-0.003	-0.007	-0.004	-0.003	0.002	-0.004	-0.004
	(0.007)	(0.005)	(0.004)	(0.007)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
$Q1$	-0.013**	-0.000	0.000	-0.006*	-0.001	-0.001	-0.014*	-0.015*	-0.004
	(0.007)	(0.003)	(0.003)	(0.004)	(0.003)	(0.002)	(0.008)	(0.008)	(0.004)
$Q2$	0.003	-0.001	0.004	-0.000	0.000	-0.001	0.008	0.002	0.004
	(0.010)	(0.004)	(0.004)	(0.006)	(0.004)	(0.003)	(0.006)	(0.007)	(0.006)
$Q4$	0.006	0.007**	0.005*	0.007	0.003	0.003	-0.002	0.005	0.003
	(0.005)	(0.003)	(0.002)	(0.005)	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)
$Q7$	-0.002	-0.000	0.001	-0.001	0.002	0.000	-0.001	0.001	-0.001
	(0.004)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)
interest rate lags (2)	0.889***	0.887***	0.893***	0.886***	0.888***	0.889***	0.887***	0.886***	0.885***
	(0.040)	(0.044)	(0.041)	(0.040)	(0.040)	(0.042)	(0.041)	(0.041)	(0.041)
Indl production lags (2)	2.373	3.195*	3.157	2.891	2.981	3.045	2.837	2.929	2.852
	(1.930)	(1.865)	(1.932)	(1.766)	(1.907)	(2.098)	(1.838)	(1.849)	(1.893)
Unem. rate lags (2)	-0.030	0.016	0.045	0.075	0.094	0.049	0.094	0.073	0.077
	(0.117)	(0.101)	(0.100)	(0.098)	(0.112)	(0.117)	(0.093)	(0.106)	(0.097)
inflation lags (2)	0.011	0.041	0.041	0.037	0.047	0.037	0.037	0.042	0.042
	(0.037)	(0.041)	(0.044)	(0.037)	(0.044)	(0.050)	(0.043)	(0.042)	(0.037)
Price of crude oil lags (2)	0.582**	0.337*	0.262*	0.411**	0.301*	0.425**	0.313*	0.407**	0.361**
	(0.235)	(0.196)	(0.156)	(0.203)	(0.157)	(0.213)	(0.166)	(0.207)	(0.175)
Price of food lags (2)	-0.341	-0.374	-0.273	-0.187	-0.153	-0.045	-0.156	-0.099	-0.191
	(0.856)	(0.708)	(0.680)	(0.783)	(0.759)	(0.763)	(0.751)	(0.772)	(0.810)
$Q6$ lags (2)	0.002*	0.003**	0.002**	0.002**	0.002	0.001	0.002**	0.003**	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Q5$ lags (2)	0.015	0.008	0.004	0.009	0.005	0.005	0.002	0.009*	0.009
	(0.010)	(0.006)	(0.003)	(0.006)	(0.004)	(0.003)	(0.003)	(0.005)	(0.006)
$Q3$ lags (2)	0.011**	0.003	0.003	0.005	0.002	0.004	-0.004	0.002	0.002
	(0.005)	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)	(0.005)	(0.004)	(0.003)
$Q1$ lags (2)	0.010	0.004	-0.003	0.003	-0.001	-0.001	0.009	0.009	0.001
	(0.007)	(0.003)	(0.007)	(0.004)	(0.004)	(0.002)	(0.006)	(0.008)	(0.006)
$Q2$ lags (2)	-0.003	0.000	-0.003	0.002	0.005	0.002	0.001	0.005	0.002
	(0.010)	(0.006)	(0.004)	(0.005)	(0.005)	(0.002)	(0.007)	(0.007)	(0.007)
$Q4$ lags (2)	0.001	0.002	0.001	0.001	0.003	-0.001	0.007*	0.000	0.003
	(0.005)	(0.004)	(0.002)	(0.003)	(0.003)	(0.002)	(0.004)	(0.004)	(0.004)
$Q7$ lags (2)	0.003	0.002	0.000	0.003	-0.001	0.000	0.002	-0.000	0.002
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Constant	0.439**	0.476*	0.463**	0.425*	0.510**	0.379	0.506**	0.454**	0.475*
	(0.214)	(0.260)	(0.208)	(0.243)	(0.212)	(0.252)	(0.214)	(0.223)	(0.244)
Observations	2,457	2,336	2,336	2,381	2,381	2,171	2,381	2,381	2,381
adjusted R squared	0.947	0.947	0.947	0.950	0.950	0.948	0.950	0.950	0.950

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 1985:1-2008:6. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). We are estimating equation (1.1), regressing short term interest rates on macroeconomic variables and on individual type specific beliefs that contains balances based on the responses to the questions Q1 to Q7 which are described in Tables A4 - A6.

Table A13: Estimation results for augmented equation (1.1) since the Crisis.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
Indl Production	-0.145	-0.167	-0.154	-0.125	-0.160	-0.161	-0.170	-0.152	-0.134
	(0.140)	(0.142)	(0.153)	(0.142)	(0.144)	(0.151)	(0.145)	(0.144)	(0.138)
Unem. rate	0.020	0.020	0.015	0.019	0.015	0.015	0.018	0.018	0.021
	(0.025)	(0.025)	(0.026)	(0.026)	(0.025)	(0.025)	(0.024)	(0.025)	(0.026)
inflation	0.013***	0.013***	0.012**	0.013***	0.013***	0.012**	0.013***	0.013***	0.014***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Price of crude oil	0.135***	0.118***	0.142***	0.145***	0.128***	0.139***	0.128***	0.142***	0.133***
	(0.039)	(0.036)	(0.039)	(0.039)	(0.038)	(0.039)	(0.039)	(0.038)	(0.038)
Price of food	-0.927***	-0.932***	-0.914***	-0.927***	-0.931***	-0.923***	-0.918***	-0.947***	-0.934***
	(0.174)	(0.180)	(0.173)	(0.181)	(0.175)	(0.189)	(0.173)	(0.174)	(0.174)
$Q5$	-0.000	0.000	0.000	-0.000	-0.000	0.000	0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q3$	0.002**	0.002***	0.001	0.002**	0.001	0.001***	0.001	0.002***	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q1$	0.001	0.001	-0.000	-0.001	0.001	0.001*	0.002	0.001	0.000
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q2$	-0.002*	-0.001	0.000	0.000	-0.003***	-0.000	-0.003***	-0.002	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q4$	-0.002**	-0.001	-0.001	-0.002***	-0.001	-0.001**	-0.001	-0.002***	-0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q7$	-0.001*	-0.001**	-0.000	-0.001**	-0.001**	-0.000	-0.001**	-0.001**	-0.002***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
interest rate lags (2)	0.948***	0.946***	0.951***	0.948***	0.946***	0.951***	0.949***	0.948***	0.947***
	(0.016)	(0.016)	(0.017)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Indl production lags (2)	-0.013	0.010	0.030	-0.007	-0.000	0.010	-0.005	-0.026	0.000
	(0.131)	(0.131)	(0.140)	(0.133)	(0.133)	(0.140)	(0.135)	(0.134)	(0.131)
Unem. rate lags (2)	-0.017	-0.018	-0.016	-0.019	-0.013	-0.016	-0.016	-0.016	-0.018
	(0.024)	(0.024)	(0.026)	(0.025)	(0.025)	(0.025)	(0.024)	(0.024)	(0.025)
inflation lags (2)	0.018**	0.017**	0.018**	0.020***	0.018**	0.020***	0.019***	0.019**	0.020***
	(0.007)	(0.007)	(0.008)	(0.007)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)
Price of crude oil lags (2)	0.130	0.137	0.122	0.144	0.103	0.158	0.120	0.140	0.115
	(0.110)	(0.104)	(0.112)	(0.103)	(0.110)	(0.109)	(0.108)	(0.108)	(0.108)
Price of food lags (2)	0.522***	0.591***	0.513***	0.548***	0.521***	0.549***	0.513***	0.556***	0.541***
	(0.116)	(0.119)	(0.114)	(0.119)	(0.115)	(0.124)	(0.112)	(0.117)	(0.116)
$Q6$ lags (2)	-0.001	-0.000	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q5$ lags (2)	0.001	0.001	-0.000	0.000	0.000	0.000	0.000	0.001	0.001
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q3$ lags (2)	-0.002***	-0.002**	-0.001	-0.002**	-0.001	-0.001**	-0.001*	-0.002***	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q1$ lags (2)	0.004*	0.002**	0.001	0.002**	0.002	0.001	0.003**	0.003**	0.003*
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
$Q2$ lags (2)	-0.001	-0.001	-0.001	-0.001	0.001	0.000	-0.000	-0.000	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q4$ lags (2)	0.002*	0.001	0.001	0.002**	0.001	0.001	0.001	0.002*	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q7$ lags (2)	0.001	0.001	0.000	0.001	0.001*	0.000	0.001	0.001	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Constant	0.762*	0.804*	0.603	0.656	0.734*	0.790*	0.814*	0.847*	0.634
	(0.445)	(0.446)	(0.433)	(0.426)	(0.438)	(0.454)	(0.460)	(0.456)	(0.429)
Observations	1,161	1,158	1,161	1,161	1,161	1,083	1,161	1,161	1,161
R-squared a	0.991	0.991	0.990	0.990	0.991	0.990	0.991	0.991	0.991

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 2008:10-2015:3. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). We are estimating equation (1.1), regressing short term interest rates on macroeconomic variables and on individual type specific beliefs that contains balances based on the responses to the questions Q1 to Q7 which are described in Tables A4 - A6.

Table A14: Estimation results for augmented form of equation (1.2) whole sample.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
$Q5$	-0.007	-0.006	-0.002	-0.007	-0.003	-0.001	-0.004	-0.006	-0.004
	(0.006)	(0.004)	(0.002)	(0.005)	(0.003)	(0.002)	(0.003)	(0.004)	(0.005)
$Q3$	-0.012**	-0.008**	-0.005**	-0.007**	-0.007*	-0.001	-0.007	-0.004	-0.008**
	(0.005)	(0.004)	(0.002)	(0.003)	(0.004)	(0.002)	(0.005)	(0.003)	(0.004)
$Q1$	-0.004	0.001	0.002	-0.005	-0.000	-0.005	-0.003	-0.010**	0.002
	(0.008)	(0.003)	(0.003)	(0.005)	(0.004)	(0.003)	(0.005)	(0.005)	(0.007)
$Q2$	0.006	-0.001	0.008*	0.006*	0.006	-0.001	0.010**	0.008*	0.006
	(0.005)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.005)	(0.005)	(0.004)
$Q4$	0.009**	0.012***	0.004*	0.006**	0.005	0.004	0.006**	0.005**	0.005*
	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)
$Q7$	0.002	0.000	0.003	-0.000	0.005*	-0.001	0.002	0.002	0.001
	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
inflation	0.068*	0.071*	0.072*	0.068*	0.070*	0.071*	0.072*	0.072*	0.068*
	(0.038)	(0.039)	(0.040)	(0.038)	(0.039)	(0.041)	(0.041)	(0.040)	(0.039)
interest rate lag	0.841***	0.835***	0.839***	0.834***	0.838***	0.831***	0.837***	0.837***	0.835***
	(0.062)	(0.066)	(0.066)	(0.065)	(0.065)	(0.067)	(0.065)	(0.065)	(0.066)
$Q6$ lag	0.005***	0.004***	0.004***	0.004***	0.004***	0.002	0.004***	0.004***	0.004***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Q5$ lag	0.010	0.009**	0.004*	0.009*	0.005*	0.004*	0.006**	0.008*	0.006
	(0.006)	(0.004)	(0.002)	(0.005)	(0.003)	(0.002)	(0.002)	(0.004)	(0.005)
$Q3$ lag	0.010**	0.003	0.002	0.003	0.005	0.002	0.004	0.003	0.006
	(0.005)	(0.003)	(0.002)	(0.003)	(0.004)	(0.002)	(0.004)	(0.002)	(0.004)
$Q1$ lag	-0.004	0.001	-0.004	0.001	-0.006	-0.001	-0.003	0.002	-0.007
	(0.008)	(0.003)	(0.004)	(0.002)	(0.005)	(0.002)	(0.004)	(0.005)	(0.006)
$Q2$ lag	0.002	0.004	-0.005*	0.003	0.002	0.007*	0.001	0.003	0.005
	(0.006)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)
$Q4$ lag	0.001	-0.002	0.004**	0.001	0.001	-0.001	0.001	0.000	-0.000
	(0.003)	(0.004)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
$Q7$ lag	0.000	-0.001	-0.003	0.000	-0.005	0.002	-0.001	-0.002	-0.001
	(0.003)	(0.002)	(0.003)	(0.002)	(0.004)	(0.002)	(0.002)	(0.003)	(0.003)
inflation lag	0.122**	0.125**	0.126***	0.126**	0.127***	0.134**	0.129***	0.129***	0.127***
	(0.048)	(0.050)	(0.048)	(0.049)	(0.048)	(0.054)	(0.049)	(0.049)	(0.048)
Constant	0.038	0.183**	0.102	0.125	0.106	0.059	0.109	0.062	0.126
	(0.064)	(0.085)	(0.114)	(0.108)	(0.107)	(0.075)	(0.093)	(0.080)	(0.090)
Observations	4,260	3,973	3,983	4,056	4,044	3,718	4,061	4,049	4,063
R-squared a	0.939	0.931	0.931	0.936	0.936	0.932	0.935	0.936	0.936

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 1985:1-2015:3. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). We are estimating equation (1.1), regressing short term interest rates on macroeconomic variables and on individual type specific beliefs that contains balances based on the responses to the questions Q1 to Q7 which are described in Tables A4 - A6.

Table A15: Estimation results for augmented equation (1.2) before the Crisis.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
$Q5$	-0.012	-0.008	-0.005	-0.012	-0.004	-0.004	-0.005	-0.008	-0.006
	(0.010)	(0.006)	(0.004)	(0.008)	(0.004)	(0.004)	(0.004)	(0.006)	(0.008)
$Q3$	-0.019**	-0.012**	-0.008**	-0.010*	-0.007*	-0.002	-0.009	-0.005	-0.011*
	(0.009)	(0.006)	(0.004)	(0.006)	(0.004)	(0.003)	(0.006)	(0.004)	(0.006)
$Q1$	-0.003	-0.000	0.005	-0.007	-0.002	-0.010*	-0.003	-0.016**	0.002
	(0.013)	(0.005)	(0.005)	(0.009)	(0.004)	(0.005)	(0.006)	(0.008)	(0.010)
$Q2$	0.014	-0.000	0.018**	0.009	0.009*	-0.002	0.015**	0.016**	0.010
	(0.009)	(0.006)	(0.008)	(0.006)	(0.005)	(0.006)	(0.007)	(0.007)	(0.006)
$Q4$	0.010	0.017**	0.005	0.009*	0.005	0.006	0.006*	0.004	0.005
	(0.006)	(0.007)	(0.004)	(0.005)	(0.005)	(0.005)	(0.003)	(0.004)	(0.005)
$Q7$	0.004	0.002	0.005	0.001	0.008**	-0.001	0.003	0.005	0.003
	(0.004)	(0.002)	(0.004)	(0.003)	(0.004)	(0.004)	(0.002)	(0.003)	(0.003)
inflation	0.081	0.091	0.091	0.085	0.086	0.089	0.089	0.086	0.083
	(0.056)	(0.060)	(0.059)	(0.059)	(0.059)	(0.063)	(0.060)	(0.059)	(0.057)
interest rate lag	0.816***	0.814***	0.817***	0.812***	0.816***	0.806***	0.814***	0.811***	0.811***
	(0.068)	(0.071)	(0.070)	(0.070)	(0.070)	(0.072)	(0.070)	(0.071)	(0.071)
$Q6$ lag	0.008***	0.005***	0.006***	0.005***	0.005***	0.002	0.006***	0.005***	0.005***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$Q5$ lag	0.017*	0.012**	0.008**	0.015*	0.007*	0.007**	0.008**	0.011*	0.010
	(0.010)	(0.006)	(0.004)	(0.008)	(0.004)	(0.003)	(0.003)	(0.006)	(0.008)
$Q3$ lag	0.018**	0.005	0.004	0.006	0.006	0.005	0.005	0.005	0.010*
	(0.009)	(0.005)	(0.004)	(0.004)	(0.006)	(0.003)	(0.006)	(0.004)	(0.006)
$Q1$ lag	-0.016	-0.002	-0.011	-0.003	-0.011	-0.004	-0.007	-0.004	-0.015
	(0.015)	(0.005)	(0.008)	(0.004)	(0.008)	(0.003)	(0.006)	(0.008)	(0.010)
$Q2$ lag	0.009	0.006	-0.010**	0.006	0.004	0.012*	0.003	0.009	0.010
	(0.010)	(0.007)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.008)	(0.007)
$Q4$ lag	-0.000	-0.003	0.005*	0.001	0.001	-0.003	0.002	-0.002	-0.002
	(0.006)	(0.007)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)
$Q7$ lag	-0.001	-0.001	-0.004	0.000	-0.007	0.003	-0.002	-0.004	-0.001
	(0.004)	(0.003)	(0.004)	(0.003)	(0.005)	(0.003)	(0.003)	(0.004)	(0.004)
inflation lag	0.161**	0.167**	0.172**	0.172**	0.165**	0.184**	0.171**	0.169**	0.167**
	(0.072)	(0.078)	(0.075)	(0.077)	(0.071)	(0.088)	(0.075)	(0.074)	(0.075)
Constant	0.516**	0.771***	0.763*	0.757***	0.741*	0.529**	0.779**	0.674**	0.770***
	(0.224)	(0.291)	(0.390)	(0.293)	(0.413)	(0.258)	(0.327)	(0.329)	(0.284)
Observations	3,056	2,771	2,779	2,852	2,840	2,595	2,857	2,845	2,859
R-squared a	0.914	0.902	0.902	0.909	0.909	0.904	0.907	0.909	0.909

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 1985:1-2008:6. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). Here, we identify the type specific monetary policy surprise based on individual beliefs regarding the economy based on the information set of consumer type k, at time t in country i. We are estimating equation (1.2), regressing short term interest rates on individual type specific beliefs that contains balances based on the responses to the following questions: Q1 How has the financial situation of your household changed over the last 12 months? Q2 How do you expect the financial position of your household to change over the next 12 months? Q3 How do you think the general economic situation in the country has changed over the past 12months? Q4 How do you expect the general economic situation in this country to develop over the next 12 months? Q5 How do you think that consumer prices have developed over the past 12 months? and Q7 How do you expect the number of people unemployed in this country to change over the next 12 months?

Table A16: Estimation results for augmented equation (1.2) since the Crisis.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
$Q5$	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	-0.000
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q3$	0.001	0.001*	0.001	0.002**	0.000	0.001**	0.001	0.001*	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q1$	0.001	0.001	-0.000	-0.002	0.001	0.001	0.001	-0.000	-0.000
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q2$	-0.003**	-0.001	-0.000	-0.000	-0.004***	-0.000	-0.004***	-0.002**	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q4$	-0.002*	-0.000	-0.001	-0.002**	-0.001	-0.001**	-0.001	-0.002**	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q7$	-0.002**	-0.001**	-0.000	-0.002***	-0.002***	-0.000	-0.002**	-0.002**	-0.002***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
inflation	0.020***	0.021***	0.020***	0.022***	0.020***	0.022***	0.020***	0.021***	0.021***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
interest rate lags(2)	0.950***	0.950***	0.952***	0.949***	0.950***	0.952***	0.951***	0.949***	0.950***
	(0.018)	(0.018)	(0.019)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
$Q6$ lags(2)	-0.001	-0.000	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q5$ lags(2)	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.001	-0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
$Q3$ lags(2)	-0.002**	-0.001*	-0.001	-0.002**	-0.001	-0.001**	-0.001	-0.002**	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Q1$ lags(2)	0.003	0.001	0.001	0.003**	0.001	0.000	0.002	0.002*	0.003
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
$Q2$ lags(2)	0.000	-0.000	-0.001	-0.001	0.001	-0.000	0.000	0.000	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q4$ lags(2)	0.002*	0.001	0.001**	0.002*	0.001	0.001	0.001	0.001	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Q7$ lags(2)	0.002	0.002*	0.000	0.001*	0.002*	0.000	0.001	0.001	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
inflation lags(2)	0.021***	0.021***	0.021***	0.024***	0.021***	0.026***	0.023***	0.023***	0.022***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)	(0.007)	(0.007)	(0.007)
Constant	0.014	0.035	-0.008	-0.005	-0.003	0.019	-0.001	0.003	0.009
	(0.020)	(0.031)	(0.016)	(0.020)	(0.019)	(0.024)	(0.017)	(0.017)	(0.021)
Observations	1,161	1,158	1,161	1,161	1,161	1,083	1,161	1,161	1,161
adjusted R squared	0.990	0.990	0.990	0.990	0.990	0.989	0.990	0.990	0.990

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 2008:10-2015:3. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). Here, we identify the monetary policy surprise based on individual beliefs regarding the economy based on the information set of consumer type k, at time t in country i. We are estimating equation (1.2), regressing short term interest rates on individual type specific beliefs that contains balances based on the responses to the following questions: Q1 How has the financial situation of your household changed over the last 12 months? Q2 How do you expect the financial position of your household to change over the next 12 months? Q3 How do you think the general economic situation in the country has changed over the past 12months? Q4 How do you expect the general economic situation in this country to develop over the next 12 months? Q5 How do you think that consumer prices have developed over the past 12 months? and Q7 How do you expect the number of people unemployed in this country to change over the next 12 months?

Table A17: Estimation results of equation (1.3) using PVAR-implied surprise based on equation (1.1) without regime change.

VARIABLES	total con π_t^e	Low inc π_t^e	High inc π_t^e	Low edu π_t^e	High edu π_t^e	unem π_t^e	full-time π_t^e	30-49 π_t^e	50-64 π_t^e
m surp lags (2)	-0.006	-0.022**	-0.015	-0.019**	-0.010	-0.022*	-0.012	-0.016**	-0.012
	(0.009)	(0.009)	(0.010)	(0.009)	(0.010)	(0.011)	(0.007)	(0.008)	(0.009)
π^e lags (6)	0.899***	0.867***	0.880***	0.889***	0.890***	0.825***	0.897***	0.897***	0.888***
	(0.009)	(0.011)	(0.011)	(0.010)	(0.009)	(0.015)	(0.009)	(0.009)	(0.010)
π_t	0.032***	0.030***	0.032***	0.034***	0.030***	0.038***	0.033***	0.033***	0.033***
	(0.006)	(0.008)	(0.009)	(0.007)	(0.006)	(0.010)	(0.006)	(0.006)	(0.007)
lagged π (1)	0.008	0.022***	0.012	0.015**	0.014**	0.016	0.014**	0.011*	0.015**
	(0.006)	(0.008)	(0.008)	(0.007)	(0.006)	(0.010)	(0.006)	(0.006)	(0.007)
Observations	3,524	3,412	3,393	3,443	3,468	3,124	3,468	3,468	3,468
$adj.\ R^2$	0.910	0.847	0.859	0.871	0.881	0.737	0.891	0.896	0.883

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income,low and high educated, low and high educated, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of the monetary surprise (constructed under the assumption that individuals are well informed), on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The number of lags included for each variable are shown in brackets for case of total consumers. The optimal lag length for inflation expectations varies across consumer types. For full-time working consumers, low income, high educated, ages 30-49 and 50-64 we use 3 lags, for high income and low educated consumers we use 4 lags, and for unemployed we use 5 lags.

Table A18: Estimation results of equation (1.4) using PVAR-implied surprise based on equation (1.2) without regime change.

VARIABLES	total con π_t^e	Low inc π_t^e	High inc π_t^e	Low edu π_t^e	High edu π_t^e	unem π_t^e	full-time π_t^e	30-49 π_t^e	50-64 π_t^e
m surp lag (1)	0.023**	0.033**	0.022*	0.034**	0.038**	-0.009	0.023*	0.019	0.032**
	(0.009)	(0.017)	(0.013)	(0.015)	(0.019)	(0.011)	(0.013)	(0.012)	(0.015)
π^e lags (3)	0.913***	0.876***	0.892***	0.913***	0.902***	0.879***	0.905***	0.915***	0.911***
	(0.009)	(0.016)	(0.013)	(0.012)	(0.011)	(0.015)	(0.011)	(0.011)	(0.011)
π_t	0.024***	0.024***	0.017**	0.024***	0.016**	0.015	0.018***	0.019***	0.021***
	(0.006)	(0.009)	(0.007)	(0.008)	(0.008)	(0.010)	(0.007)	(0.007)	(0.007)
lagged π (1)	0.005	0.011	0.009	0.003	0.010	0.011	0.006	0.006	0.003
	(0.006)	(0.009)	(0.008)	(0.007)	(0.007)	(0.010)	(0.007)	(0.007)	(0.007)
Observations	2,994	2,659	2,625	2,709	2,687	2,356	2,749	2,739	2,754
$adj.\ R^2$	0.911	0.862	0.867	0.890	0.868	0.780	0.882	0.899	0.895

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income,low and high educated, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of the type specific monetary surprise (constructed based on consumers beliefs), on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The number of lags included for each variable are shown in brackets for case of total consumers. The optimal lag length for inflation expectations varies across consumer types. For low income, full-time working consumers, ages 30-49 and ages 50-64 we use 3 lags, for high income, low and high educated we use 4 lags, and for unemployed we use 6 lags.

Table A19: Estimation results of equation (1.3) with surprise based on augmented equation (1.1) without regime change.

VARIABLES	total con π_t^e	Low inc π_t^e	High inc π_t^e	Low edu π_t^e	High edu π_t^e	unem π_t^e	full-time π_t^e	30-49 π_t^e	50-64 π_t^e
m surp lags (2)	-0.003	-0.020**	-0.013	-0.015*	-0.006	-0.015	-0.010	-0.013*	-0.009
	(0.008)	(0.008)	(0.009)	(0.008)	(0.009)	(0.010)	(0.007)	(0.007)	(0.008)
π^e lags (6)	0.899***	0.866***	0.880***	0.889***	0.890***	0.824***	0.897***	0.897***	0.888***
	(0.009)	(0.011)	(0.011)	(0.010)	(0.009)	(0.015)	(0.009)	(0.009)	(0.010)
π_t	0.032***	0.030***	0.032***	0.035***	0.030***	0.038***	0.033***	0.033***	0.033***
	(0.006)	(0.008)	(0.009)	(0.007)	(0.006)	(0.010)	(0.006)	(0.006)	(0.007)
lagged π (1)	0.008	0.022***	0.012	0.015**	0.014**	0.017	0.014**	0.011*	0.015**
	(0.006)	(0.008)	(0.008)	(0.007)	(0.006)	(0.010)	(0.006)	(0.006)	(0.007)
Observations	3,524	3,412	3,393	3,443	3,468	3,124	3,468	3,468	3,468
$adj.\ R^2$	0.910	0.847	0.859	0.871	0.881	0.737	0.891	0.896	0.883

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of the monetary surprise (constructed under the assumption that individuals are well informed), on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The number of lags included for each variable are shown in brackets for case of total consumers. The optimal lag length for inflation expectations varies across consumer types. For full-time working consumers, low income, high educated, ages 30-49 and 50-64 we use 3 lags, for high income and low educated consumers we use 4 lags, and for unemployed we use 5 lags.

Table A20: Estimation results of equation (1.4) with surprise based on augmented equation (1.2) without regime change.

VARIABLES	total con π_t^e	Low inc π_t^e	High inc π_t^e	Low edu π_t^e	High edu π_t^e	unem π_t^e	full-time π_t^e	30-49 π_t^e	50-64 π_t^e
m surp lag (1)	0.020***	0.027*	0.012	0.022*	0.028**	-0.006	0.016	0.011	0.024**
	(0.007)	(0.014)	(0.010)	(0.012)	(0.014)	(0.010)	(0.010)	(0.009)	(0.012)
π^e lags (6)	0.909***	0.880***	0.888***	0.910***	0.900***	0.863***	0.905***	0.911***	0.905***
	(0.008)	(0.007)	(0.011)	(0.009)	(0.009)	(0.013)	(0.009)	(0.009)	(0.009)
π_t	0.034***	0.030***	0.031***	0.033***	0.030***	0.033***	0.031***	0.030***	0.033***
	(0.005)	(0.006)	(0.008)	(0.007)	(0.006)	(0.009)	(0.006)	(0.006)	(0.006)
lagged π (1)	0.010*	0.022***	0.012	0.014**	0.015**	0.021**	0.013**	0.011*	0.013**
	(0.005)	(0.007)	(0.008)	(0.007)	(0.006)	(0.010)	(0.006)	(0.006)	(0.006)
Observations	4,090	3,791	3,808	3,892	3,870	3,455	3,934	3,924	3,939
$adj.\ R^2$	0.911	0.856	0.864	0.884	0.880	0.761	0.889	0.900	0.891

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income, low and high educated, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of the type specific monetary surprise (constructed based on consumers beliefs), on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The number of lags included for each variable are shown in brackets for case of total consumers. The optimal lag length for inflation expectations varies across consumer types. For full-time working consumers, ages 30-49 and ages 50-64 we use 3 lags, for low and high income, low and high educated we use 4 lags, and for unemployed we use 6 lags.

Table A21: Kolmogorov-Smirnov test for equality of distribution functions of pre-Crisis versus post-Crisis surprises.

	For well-informed agents								
	total con	Low inc	High inc	Low edu	High edu	unem	full-time	30-49	50-64
p-values:									
Austria	0.001	0.002	0.003	0.003	0.001	0.001	0.000	0.002	0.000
Belgium	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Germany	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Estonia	0.023	0.042	0.214	0.117	0.131	0.032	0.127	0.194	0.219
Greece	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Spain	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Finland	0.002	0.001	0.002	0.002	0.004	0.002	0.003	0.002	0.003
France	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000
Ireland	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Italy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Luxembourg	0.019	0.004	0.204	0.020	0.071	0.118	0.047	0.162	0.050
Netherlands	0.000	0.000	0.000	0.000	0.000	-	0.000	0.001	0.000
Portugal	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Slovenia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Slovakia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	For less-informed agents								
	total con	Low inc	High inc	Low edu	High edu	unem	full-time	30-49	50-64
Austria	0.000	0.000	0.000	0.002	0.004	0.000	0.000	0.001	0.000
Belgium	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Germany	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Estonia	0.000	0.041	0.007	0.045	0.025	0.016	0.069	0.028	0.267
Greece	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Spain	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Finland	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
France	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ireland	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Italy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Luxembourg	0.001	0.001	0.001	0.000	0.003	0.000	0.000	0.009	0.009
Netherlands	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000
Portugal	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Slovenia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Slovakia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: Reported are the KS test p-values.

Table A22: Results of a Wald test for equality of coefficients of monetary policy surprises pre-Crisis versus post-Crisis.

	total con	Low inc	High inc	Low edu	High edu	unem	full-time	30-49	50-64
p-values:	Surprises obtained from equation (1.1) for well-informed								
baseline model (Table 1.3)	0.389	0.911	0.162	0.874	0.178	0.619	0.081	0.156	0.701
with PVAR surprises (Table 1.6)	0.185	0.014	0.021	0.426	0.092	0.714	0.018	0.041	0.229
augmented with infl.exp lags (Table 1.8)	0.395	0.937	0.163	0.888	0.178	0.648	0.081	0.154	0.702
p-values:	Surprises obtained from equation (1.2) for less-informed								
baseline model (Table 1.5)	0.052	0.025	0.003	0.056	0.004	0.503	0.009	0.021	0.016
with PVAR surprises (Table 1.7)	0.075	0.027	0.001	0.032	0.003	0.423	0.010	0.004	0.020
augmented with infl.exp lags (Table 1.9)	0.051	0.025	0.003	0.051	0.004	0.541	0.009	0.019	0.040

Notes: Reported are the Wald test p-values.

Table A23: Kolmogorov-Smirnov test for equality of distribution functions of monetary policy surprises derived in baseline model versus panel VAR model.

	total con	Low inc	High inc	Low inc	High inc	unem	full-time	30-49	50-64
p-values:				Well-informed pre-Crisis					
Austria	-0.000	0.081	0.000	-0.000	-0.000	-0.000	0.000	-0.000	-0.000
Belgium	0.000	0.000	0.873	0.000	0.000	0.000	0.406	0.119	0.000
Germany	-0.000	0.568	0.004	-0.000	0.000	-0.000	0.000	-0.000	-0.000
Estonia	0.000	0.724	0.064	0.002	0.000	0.000	0.095	0.000	0.000
Greece	-0.000	0.001	0.000	-0.000	-0.000	0.000	-0.000	- 0.000	-0.000
Spain	0.000	0.558	0.005	0.000	0.000	-0.000	0.000	0.000	0.000
Finland	0.031	0.001	0.816	0.022	0.532	-0.000	0.000	0.894	0.000
France	-0.000	0.835	0.000	0.000	0.000	-0.000	0.000	0.000	0.000
Ireland	0.000	0.968	0.482	-0.000	0.000	-0.000	0.000	0.000	0.000
Italy	0.000	0.001	0.000	-0.000	0.000	-0.000	0.000	0.000	0.000
Luxembourg	0.028	0.006	0.069	0.000	0.000	0.000	0.152	0.003	0.000
Netherlands	0.001	0.017	0.012	-0.000	0.180	-	0.053	0.925	0.000
Portugal	-0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.000	0.000
Slovenia	0.000	0.028	0.152	0.000	0.000	0.000	0.000	0.000	0.000
Slovakia	0.000	0.410	0.183	0.000	0.513	0.000	0.097	0.006	0.000
p-values:				Well-informed post-Crisis					
Austria	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Belgium	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Germany	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Estonia	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Greece	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Spain	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Finland	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
France	-0.000	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Ireland	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Italy	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Luxembourg	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Netherlands	-0.000	-0.000	-0.000	-0.000	-0.000	-	-0.000	-0.000	-0.000
Portugal	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Slovenia	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Slovakia	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000

Notes: Reported are the KS test p-values.

Table A24: Kolmogorov-Smirnov test for equality of distribution functions of monetary policy surprises derived in baseline model versus panel VAR model.

	total con	Low inc	High inc	Low edu	High edu	unem	full-time	30-49	50-64
p-values:				Less informed pre-Crisis					
Austria	0.000	0.000	0.083	0.000	0.001	0.000	0.000	0.000	0.000
Belgium	0.000	0.000	0.000	0.000	0.000	0.000	-0.000	0.000	-0.000
Germany	0.004	-0.000	0.000	0.000	0.000	-0.000	0.008	0.025	-0.000
Estonia	0.000	0.000	0.000	0.000	0.044	0.000	0.000	0.000	0.000
Greece	0.000	0.000	0.000	0.028	0.000	0.001	0.000	0.000	0.000
Spain	0.000	-0.000	0.636	0.000	0.975	-0.000	0.202	0.116	-0.000
Finland	0.000	-0.000	0.295	0.142	0.016	-0.000	0.016	-0.000	0.142
France	0.012	0.000	0.001	0.002	0.084	-0.000	0.000	0.000	0.000
Ireland	0.000	-0.000	0.018	0.000	0.023	-0.000	0.008	0.078	-0.000
Italy	0.000	-0.000	0.065	-0.000	0.370	0.000	0.000	0.000	-0.000
Luxembourg	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Netherlands	0.056	-0.000	0.059	0.038	0.003	-	0.000	0.000	0.000
Portugal	0.423	-0.000	0.000	0.000	0.000	-0.000	0.158	0.002	-0.000
Slovenia	0.309	0.000	0.538	0.006	0.414	0.000	0.029	0.002	0.000
Slovakia	0.000	0.000	0.015	0.033	0.000	0.000	0.000	0.000	0.033
p-values:				Less informed post-Crisis					
Austria	0.075	0.000	0.316	0.004	0.230	0.000	0.075	0.000	0.019
Belgium	0.001	0.000	0.075	0.000	0.075	0.000	0.012	0.000	0.000
Germany	0.810	0.112	0.915	0.230	0.915	0.000	0.915	0.112	0.810
Estonia	0.680	0.546	0.075	0.680	0.012	0.000	0.162	0.680	0.422
Greece	0.230	0.000	0.162	0.422	0.422	0.000	0.546	0.031	0.112
Spain	0.007	0.000	0.031	0.000	0.162	-0.000	0.422	0.000	0.000
Finland	0.162	0.019	0.810	0.019	0.230	0.000	0.230	0.000	0.075
France	0.001	0.000	0.049	0.000	0.075	-0.000	0.112	0.000	0.012
Ireland	0.604	0.000	0.959	0.747	0.466	0.000	0.030	0.747	0.249
Italy	0.002	0.000	0.019	0.000	0.075	-0.000	0.031	0.000	0.000
Luxembourg	0.049	0.000	0.915	0.007	0.316	0.000	0.162	0.000	0.162
Netherlands	0.012	0.000	0.162	0.001	0.316	-	0.162	0.000	0.031
Portugal	0.316	0.000	0.112	0.075	0.680	0.000	0.810	0.001	0.546
Slovenia	0.004	0.000	0.007	0.004	0.316	-0.000	0.075	0.000	0.001
Slovakia	0.810	0.000	0.810	0.316	0.546	-0.000	0.810	0.075	0.680

Notes: Reported are the KS test p-values.

Table A25: Estimation results for equation (1.1) whole sample with country-specific interest rates on deposits.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
Indl Production	0.268***	0.270***	0.280***	0.274***	0.264***	0.281***	0.279***	0.270***	0.268***
	(0.068)	(0.069)	(0.068)	(0.069)	(0.068)	(0.072)	(0.068)	(0.068)	(0.068)
Unem. rate	0.008	0.007	0.007	0.006	0.008	0.006	0.008	0.008	0.009
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
inflation	0.003	0.003	0.003	0.003	0.003	0.002	0.003	0.003	0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Price of crude oil	0.023	0.026	0.026	0.025	0.024	0.032*	0.022	0.022	0.024
	(0.017)	(0.017)	(0.017)	(0.017)	(0.016)	(0.017)	(0.017)	(0.017)	(0.017)
Price of food	-0.045	-0.035	-0.038	-0.038	-0.051	-0.023	-0.044	-0.042	-0.041
	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)	(0.055)	(0.054)	(0.054)	(0.054)
$Q5$	0.001*	-0.000	0.000	0.000	0.000	-0.000*	0.001***	0.001*	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q3$	0.001	0.000	0.000	0.001**	0.000	-0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q1$	-0.001	-0.000	0.000	-0.001*	-0.001	-0.000	0.000	-0.000	-0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q2$	-0.000	-0.000	-0.001*	0.000	-0.000	-0.000	-0.001	-0.000	-0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
$Q4$	0.000	0.000	0.000	-0.000	0.000	0.000*	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q7$	-0.000	-0.000	-0.000	-0.000	-0.000*	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
interest rate lags (2)	0.970***	0.969***	0.971***	0.969***	0.971***	0.972***	0.971***	0.971***	0.970***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.009)	(0.009)	(0.009)
Indl production lags (2)	0.330***	0.334***	0.346***	0.345***	0.331***	0.342***	0.336***	0.328***	0.326***
	(0.063)	(0.064)	(0.063)	(0.064)	(0.063)	(0.065)	(0.063)	(0.063)	(0.063)
Unem. rate lags (2)	0.009	0.008	0.008	0.008	0.009	0.004	0.009	0.010	0.008
	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)
inflation lags (2)	0.001	0.002	0.001	0.002	0.001	0.001	0.001	0.002	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Price of crude oil lags (2)	0.070***	0.081***	0.076***	0.077***	0.072***	0.081***	0.069***	0.072***	0.069***
	(0.021)	(0.022)	(0.021)	(0.021)	(0.021)	(0.023)	(0.021)	(0.021)	(0.021)
Price of food lags (2)	0.094**	0.108**	0.083*	0.098**	0.090*	0.079*	0.091**	0.093**	0.097**
	(0.047)	(0.047)	(0.046)	(0.047)	(0.047)	(0.047)	(0.046)	(0.046)	(0.047)
$Q5$ lags (2)	-0.001**	0.000	-0.000*	-0.000*	-0.000	-0.000	-0.001***	-0.001**	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q3$ lags (2)	-0.001*	-0.000	-0.001**	-0.001**	-0.000	-0.000	-0.001	-0.001*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q1$ lags (2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)
$Q2$ lags (2)	0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000	-0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
$Q4$ lags (2)	0.000	0.000	0.001**	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q7$ lags (2)	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.023**	0.027**	0.023**	0.024**	0.023**	0.026**	0.026**	0.027**	0.024**
	(0.011)	(0.011)	(0.010)	(0.011)	(0.010)	(0.012)	(0.011)	(0.011)	(0.011)
Observations	2,065	2,063	2,065	2,065	2,065	1,913	2,065	2,065	2,065
adjusted R squared	0.991	0.991	0.991	0.991	0.991	0.990	0.991	0.991	0.991

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 1985:1-2015:3. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). We are estimating equation (1.1), regressing country-specific interest rates on macroeconomic variables and on individual type specific beliefs that contains balances based on the responses to the questions Q1 to Q7 which are described in Tables A4 - A6.

Table A26: Estimation results for equation (1.1) before the Crisis using country-specific interest rates on deposits.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
Indl Production	0.086	0.082	0.071	0.092	0.078	0.082	0.106	0.094	0.073
	(0.080)	(0.080)	(0.081)	(0.081)	(0.078)	(0.083)	(0.082)	(0.080)	(0.081)
Unem. rate	0.005	0.006	0.005	0.001	0.008	0.004	0.005	0.006	0.005
	(0.014)	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)	(0.014)	(0.014)	(0.014)
inflation	0.006	0.006	0.006*	0.005	0.006*	0.005	0.006*	0.006	0.005
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)
Price of crude oil	-0.024	-0.025	-0.016	-0.027	-0.025	-0.020	-0.029	-0.027	-0.024
	(0.021)	(0.022)	(0.022)	(0.022)	(0.021)	(0.023)	(0.021)	(0.021)	(0.022)
Price of food	0.053	0.061	0.065	0.049	0.060	0.047	0.047	0.052	0.048
	(0.082)	(0.080)	(0.082)	(0.079)	(0.082)	(0.085)	(0.081)	(0.081)	(0.081)
$Q5$	-0.000	-0.001*	-0.000	-0.000	-0.000	-0.000	0.001	0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
$Q3$	0.003***	0.001**	0.002***	0.002***	0.002***	0.000	0.002***	0.002***	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q1$	-0.003**	-0.000	-0.001	-0.002**	-0.001**	-0.000	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q2$	0.002	0.000	0.000	0.002*	0.000	0.000	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q4$	-0.001	-0.000	-0.001**	-0.001*	-0.001	0.000	-0.001*	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q7$	0.000	0.001*	0.001**	0.001*	0.000	0.000	0.001*	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
interest rate lag	0.956***	0.962***	0.954***	0.957***	0.956***	0.963***	0.956***	0.957***	0.957***
	(0.019)	(0.018)	(0.019)	(0.019)	(0.019)	(0.017)	(0.019)	(0.019)	(0.019)
Indl production lag	0.187**	0.187**	0.185**	0.210***	0.192**	0.189**	0.190**	0.176**	0.184**
	(0.080)	(0.080)	(0.083)	(0.079)	(0.078)	(0.084)	(0.079)	(0.079)	(0.079)
Unem. rate lag	0.002	-0.002	0.005	0.001	0.002	0.002	0.002	0.002	0.001
	(0.012)	(0.012)	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
inflation lag	-0.002	-0.002	-0.002	-0.003	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
Price of crude oil lag	-0.063***	-0.067***	-0.067***	-0.060***	-0.063***	-0.070***	-0.064***	-0.062***	-0.065***
	(0.022)	(0.022)	(0.022)	(0.021)	(0.022)	(0.023)	(0.022)	(0.022)	(0.022)
Price of food lag	-0.091	-0.083	-0.090	-0.087	-0.083	-0.106	-0.094	-0.088	-0.104
	(0.080)	(0.081)	(0.080)	(0.079)	(0.080)	(0.084)	(0.080)	(0.081)	(0.081)
$Q5$ lag	0.000	0.000	0.000	0.001	0.000	0.000	-0.001	-0.000	-0.000
	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
$Q3$ lag	-0.001	-0.001	-0.001*	-0.001*	-0.001	0.000	-0.001*	-0.001	-0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q1$ lag	0.001	-0.000	-0.001	0.001	0.000	0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q2$ lag	0.000	0.001	0.000	-0.000	0.000	0.000	0.000	-0.000	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q4$ lag	0.001	-0.000	0.001	0.001	0.000	0.000	0.001	0.001	0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
$Q7$ lag	0.000	-0.000	-0.000	-0.000	0.000	0.000**	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.028	0.032	0.046	0.031	0.035	0.037	0.032	0.038	0.027
	(0.031)	(0.031)	(0.028)	(0.033)	(0.028)	(0.033)	(0.030)	(0.030)	(0.034)
Observations	861	861	861	861	861	790	861	861	861
adjusted R squared	0.991	0.991	0.992	0.992	0.991	0.991	0.991	0.991	0.991

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 1985:1-2008:6. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). We are estimating equation (1.1), regressing country-specific interest rates on macroeconomic variables and on individual type specific beliefs that contains balances based on the responses to the questions Q1 to Q7 which are described in Tables A4 - A6.

Table A27: Estimation results for equation (1.1) since the Crisis using country-specific interest rates on deposits.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
Indl Production	0.137**	0.127*	0.147**	0.140**	0.131**	0.146**	0.149**	0.145**	0.140**
	(0.065)	(0.066)	(0.066)	(0.066)	(0.066)	(0.066)	(0.065)	(0.065)	(0.064)
Unem. rate	0.002	0.008	0.003	0.005	0.005	0.005	0.003	0.001	0.005
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
inflation	0.000	0.001	0.000	0.001	-0.000	-0.000	0.000	0.000	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Price of crude oil	-0.006	-0.006	0.000	-0.008	-0.001	-0.011	-0.005	-0.006	-0.005
	(0.016)	(0.015)	(0.015)	(0.015)	(0.015)	(0.014)	(0.015)	(0.015)	(0.015)
Price of food	-0.197***	-0.208***	-0.214***	-0.200***	-0.201***	-0.204***	-0.199***	-0.200***	-0.193***
	(0.064)	(0.065)	(0.064)	(0.064)	(0.064)	(0.064)	(0.064)	(0.063)	(0.064)
$Q5$	-0.000	-0.000*	-0.000	0.000	-0.000	-0.000***	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q3$	-0.000	-0.000	-0.000	-0.000	-0.000	0.000	-0.001	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q1$	-0.001	-0.001***	-0.000	-0.001*	-0.001**	-0.000**	-0.001	-0.001**	-0.001*
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q2$	-0.001	-0.000	-0.000	-0.000	-0.000	-0.000	-0.001	-0.001	-0.001
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q4$	0.000	-0.000	0.000	-0.000	0.000	0.000	0.001	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q7$	-0.000	-0.000**	-0.000	-0.000***	-0.000	-0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
interest rate lag	0.847***	0.845***	0.847***	0.842***	0.848***	0.840***	0.851***	0.849***	0.848***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.022)	(0.021)	(0.021)	(0.021)
Indl production lag	-0.032	-0.035	-0.042	-0.046	-0.025	-0.037	-0.038	-0.032	-0.033
	(0.066)	(0.067)	(0.065)	(0.066)	(0.067)	(0.068)	(0.065)	(0.066)	(0.065)
Unem. rate lag	-0.004	-0.008	-0.003	-0.005	-0.006	-0.004	-0.004	-0.003	-0.007
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
inflation lag	0.002	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Price of crude oil lag	0.071***	0.071***	0.075***	0.071***	0.076***	0.072***	0.073***	0.069***	0.070***
	(0.024)	(0.024)	(0.024)	(0.023)	(0.024)	(0.025)	(0.024)	(0.024)	(0.024)
Price of food lag	0.018	0.032	0.016	0.016	0.018	0.006	0.017	0.014	0.026
	(0.048)	(0.048)	(0.048)	(0.049)	(0.048)	(0.048)	(0.047)	(0.048)	(0.048)
$Q5$ lag	-0.000	-0.000	-0.000	-0.001***	-0.000	0.000	-0.000*	-0.000	-0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q3$ lag	0.000	0.000	-0.000	-0.000	0.000	-0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q1$ lag	-0.001	-0.000	-0.000	-0.001	-0.001	-0.000*	-0.001***	-0.001*	-0.001
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
$Q2$ lag	0.001	-0.000	-0.000	0.000	0.000	-0.000*	0.000	0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q4$ lag	-0.000	-0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q7$ lag	-0.001**	-0.001**	-0.000**	-0.001**	-0.000**	-0.000*	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.428***	-0.372***	-0.434***	-0.379***	-0.432***	-0.469***	-0.447***	-0.460***	-0.440***
	(0.140)	(0.143)	(0.146)	(0.147)	(0.140)	(0.150)	(0.142)	(0.143)	(0.142)
Observations	1,162	1,160	1,162	1,162	1,162	1,084	1,162	1,162	1,162
adjusted R squared	0.984	0.984	0.984	0.984	0.984	0.983	0.984	0.984	0.984

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 2008:10-2015:3. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). We are estimating equation (1.1), regressing country-specific interest rates on macroeconomic variables and on individual type specific beliefs that contains balances based on the responses to the questions Q1 to Q7 which are described in Tables A4 - A6.

Table A28: Estimation results for equation (1.2) whole sample with country-specific interest rates on deposits.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
$Q5$	0.001***	0.000	0.000**	0.000**	0.001**	-0.000	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q3$	0.001	0.000	0.000	0.001**	0.000	-0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q1$	-0.001	-0.000	0.000	-0.001**	-0.001	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)
$Q2$	-0.001	-0.000	-0.001**	0.000	-0.000	-0.000	-0.001	-0.000	-0.001
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
$Q4$	0.000	0.000	0.000	-0.000	0.000	0.000*	0.000	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q7$	-0.001***	-0.001***	-0.000***	-0.001***	-0.001***	-0.000***	-0.001***	-0.001***	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
inflation	0.007***	0.008***	0.007***	0.008***	0.007***	0.008***	0.007***	0.007***	0.007***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
interest rate lag (1)	0.967***	0.966***	0.969***	0.966***	0.969***	0.968***	0.968***	0.968***	0.967***
	(0.010)	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)	(0.009)	(0.009)
$Q5$ lag (1)	-0.001***	-0.000	-0.001***	-0.001***	-0.001***	-0.000	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q3$ lag (1)	-0.001*	-0.000	-0.001**	-0.001*	-0.000	-0.000	-0.000	-0.001*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q1$ lag (1)	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)
$Q2$ lag (1)	0.000	0.000	-0.000	0.000	0.000	-0.000	-0.000	-0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q4$ lag (1)	0.000	-0.000	0.001**	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q7$ lag (1)	0.000	-0.000	-0.000	-0.000	0.000	-0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
inflation lag (1)	0.005**	0.006**	0.005**	0.006**	0.005**	0.005**	0.005**	0.005**	0.005**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.014	0.015	0.012	0.007	0.016*	0.021*	0.016*	0.016*	0.017*
	(0.009)	(0.011)	(0.009)	(0.009)	(0.009)	(0.012)	(0.009)	(0.009)	(0.009)
Observations	2,065	2,063	2,065	2,065	2,065	1,913	2,065	2,065	2,065
adjusted R squared	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 1985:1-2015:3. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). We are estimating equation (1.1), regressing country-specific interest rates on macroeconomic variables and on individual type specific beliefs that contains balances based on the responses to the questions Q1 to Q7 which are described in Tables A4 - A6.

Table A29: Estimation results for equation (1.2) before the Crisis using country-specific interest rates on deposits.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
$Q5$	-0.000	-0.001*	-0.000	-0.001	-0.000	-0.000	0.000	0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
$Q3$	0.003***	0.001**	0.002***	0.002***	0.002***	0.000	0.002***	0.002***	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q1$	-0.003**	-0.000	-0.001	-0.002**	-0.001**	-0.000	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q2$	0.002	0.000	0.000	0.002*	0.000	0.000	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q4$	-0.001	0.000	-0.001*	-0.001	-0.001	0.000	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q7$	0.001	0.001*	0.001***	0.001**	0.000	0.000	0.001**	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
inflation	0.003	0.004	0.003	0.003	0.003	0.003	0.004	0.003	0.003
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
interest rate lag	0.956***	0.962***	0.953***	0.957***	0.957***	0.963***	0.956***	0.957***	0.956***
	(0.019)	(0.018)	(0.019)	(0.019)	(0.019)	(0.017)	(0.019)	(0.019)	(0.019)
$Q5$ lag	0.000	0.000	0.000	0.001	0.000	0.000	-0.000	-0.000	-0.000
	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
$Q3$ lag	-0.001	-0.001	-0.001	-0.001	-0.001	0.000	-0.001*	-0.001	-0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q1$ lag	0.001	-0.000	-0.001	0.001	0.000	0.001	-0.000	0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q2$ lag	0.000	0.001	0.001	-0.001	0.000	0.000	0.000	-0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q4$ lag	0.000	-0.000	0.000	0.001	0.000	-0.000	0.001	0.000	0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
$Q7$ lag	0.000	-0.000	-0.000	-0.000	0.000	0.000**	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
inflation lag	-0.003	-0.002	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.002
	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)
Constant	0.034	0.039	0.050*	0.038	0.040	0.046	0.039	0.044	0.033
	(0.031)	(0.030)	(0.028)	(0.033)	(0.028)	(0.033)	(0.030)	(0.030)	(0.034)
Observations	861	861	861	861	861	790	861	861	861
adjusted R squared	0.991	0.991	0.991	0.991	0.991	0.991	0.991	0.991	0.991

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 1985:1-2008:6. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). Here, we identify the type specific monetary policy surprise based on individual beliefs regarding the economy based on the information set of consumer type k, at time t in country i. We are estimating equation (1.2), regressing country-specific interest rates on individual type specific beliefs that contains balances based on the responses to the following questions: Q1 How has the financial situation of your household changed over the last 12 months? Q2 How do you expect the financial position of your household to change over the next 12 months? Q3 How do you think the general economic situation in the country has changed over the past 12months? Q4 How do you expect the general economic situation in this country to develop over the next 12 months? Q5 How do you think that consumer prices have developed over the past 12 months? and Q7 How do you expect the number of people unemployed in this country to change over the next 12 months?

Table A30: Estimation results for equation (1.2) since the Crisis using country-specific interest rates on deposits.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
$Q5$	0.000	-0.000	-0.000	0.000	-0.000	-0.000**	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q3$	-0.000	-0.000	-0.000	0.000	-0.000	0.000	-0.001*	-0.001*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q1$	-0.000	-0.001*	-0.000	-0.001	-0.001	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q2$	-0.001	-0.000	-0.001**	-0.000	-0.001	-0.000	-0.001**	-0.001**	-0.001
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q4$	0.001	-0.000	0.000	-0.000	0.000	0.000	0.001*	0.001*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q7$	-0.000	-0.001***	-0.000	-0.001***	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
inflation	0.002	0.003	0.003	0.003	0.003	0.002	0.003	0.003	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
interest rate lag	0.838***	0.836***	0.841***	0.833***	0.839***	0.834***	0.841***	0.839***	0.840***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.024)	(0.022)	(0.022)	(0.022)
$Q5$ lag	-0.001*	-0.000	-0.000	-0.001***	-0.000	0.000	-0.000*	-0.000*	-0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q3$ lag	0.000	0.000	-0.000	-0.000	0.000	-0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q1$ lag	-0.001	-0.000	0.000	-0.000	-0.000	-0.000	-0.001	-0.000	-0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q2$ lag	0.001	-0.000	-0.000	0.000	0.001	-0.000	0.000	0.001*	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q4$ lag	-0.001	-0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Q7$ lag	-0.001**	-0.001**	-0.000**	-0.000**	-0.001**	-0.000**	-0.001**	-0.001**	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
inflation lag	0.005**	0.005**	0.005**	0.005**	0.005**	0.004*	0.005**	0.005**	0.005**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.061***	0.065***	0.059***	0.064***	0.061***	0.052***	0.064***	0.064***	0.060***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)
Observations	1,162	1,160	1,162	1,162	1,162	1,084	1,162	1,162	1,162
R-squared a	0.983	0.983	0.983	0.983	0.983	0.982	0.983	0.983	0.983

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 2008:10-2015:3. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). Here, we identify the monetary policy surprise based on individual beliefs regarding the economy based on the information set of consumer type k, at time t in country i. We are estimating equation (1.2), regressing country-specific interest rates on individual type specific beliefs that contains balances based on the responses to the following questions: Q1 How has the financial situation of your household changed over the last 12 months? Q2 How do you expect the financial position of your household to change over the next 12 months? Q3 How do you think the general economic situation in the country has changed over the past 12months? Q4 How do you expect the general economic situation in this country to develop over the next 12 months? Q5 How do you think that consumer prices have developed over the past 12 months? and Q7 How do you expect the number of people unemployed in this country to change over the next 12 months?

Table A31: Estimation results for equation (1.1) whole sample using real-time data.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
Indl Production	1.091***	1.210***	1.203***	1.154***	1.177***	1.171***	1.101***	1.128***	1.140***
	(0.388)	(0.329)	(0.326)	(0.328)	(0.341)	(0.350)	(0.325)	(0.333)	(0.328)
Unem. rate	0.071	0.074*	0.076*	0.083*	0.082*	0.084*	0.083*	0.076*	0.080*
	(0.052)	(0.045)	(0.046)	(0.044)	(0.045)	(0.046)	(0.044)	(0.044)	(0.043)
inflation	0.003	0.008	0.007	0.008	0.008	0.007	0.006	0.008	0.007
	(0.021)	(0.024)	(0.025)	(0.022)	(0.024)	(0.026)	(0.024)	(0.023)	(0.022)
Price of crude oil	0.118	0.199*	0.172*	0.150	0.143	0.157	0.139	0.148	0.147
	(0.123)	(0.106)	(0.097)	(0.099)	(0.103)	(0.113)	(0.102)	(0.100)	(0.101)
Price of food	-0.170	-0.301	-0.425	-0.199	-0.219	-0.224	-0.260	-0.235	-0.230
	(0.237)	(0.213)	(0.263)	(0.219)	(0.230)	(0.244)	(0.232)	(0.225)	(0.224)
$Q5$	-0.007	-0.003	-0.000	-0.004	-0.002	-0.002	-0.000	-0.004	-0.003
	(0.007)	(0.004)	(0.001)	(0.004)	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)
$Q3$	-0.005	-0.003	-0.001	-0.003	-0.002	-0.002	0.002	-0.001	-0.002
	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
$Q1$	-0.011**	-0.001	-0.000	-0.005**	-0.001	-0.000	-0.010**	-0.010**	-0.003
	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.005)	(0.005)	(0.003)
$Q2$	0.002	-0.001	0.001	0.000	-0.001	-0.001	0.003	0.000	0.001
	(0.005)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.004)	(0.003)	(0.003)
$Q4$	0.003	0.004**	0.003**	0.003	0.002	0.002	-0.000	0.003	0.002
	(0.003)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$Q7$	-0.002	-0.001	0.000	-0.002	0.000	-0.000	-0.001	-0.000	-0.001
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
interest rate lags (2)	0.902***	0.901***	0.904***	0.899***	0.901***	0.900***	0.902***	0.901***	0.901***
	(0.034)	(0.035)	(0.034)	(0.033)	(0.033)	(0.034)	(0.033)	(0.033)	(0.033)
Indl production lags (2)	2.071*	2.354**	2.338**	2.251**	2.317**	2.369*	2.204**	2.340**	2.278**
	(1.204)	(1.165)	(1.127)	(1.087)	(1.148)	(1.273)	(1.099)	(1.160)	(1.139)
Unem. rate lags (2)	-0.005	0.022	0.038	0.041	0.065	0.038	0.050	0.042	0.054
	(0.073)	(0.071)	(0.068)	(0.067)	(0.071)	(0.073)	(0.062)	(0.068)	(0.063)
inflation lags (2)	0.020	0.040	0.042	0.038	0.043	0.041	0.036	0.041	0.040
	(0.030)	(0.035)	(0.036)	(0.032)	(0.035)	(0.040)	(0.036)	(0.034)	(0.032)
Price of crude oil lags (2)	0.772***	0.726***	0.657***	0.720***	0.676***	0.735***	0.654***	0.688***	0.693***
	(0.276)	(0.270)	(0.234)	(0.269)	(0.244)	(0.273)	(0.238)	(0.255)	(0.258)
Price of food lags (2)	0.720*	0.722*	0.731*	0.779*	0.855**	0.861*	0.743*	0.861**	0.801*
	(0.438)	(0.386)	(0.384)	(0.412)	(0.403)	(0.446)	(0.425)	(0.392)	(0.420)
$Q5$ lags (2)	0.009	0.005	0.001	0.006	0.003	0.003	0.002	0.006*	0.005
	(0.006)	(0.004)	(0.001)	(0.004)	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)
$Q3$ lags (2)	0.004	0.000	0.001	0.002	0.001	0.001	-0.003	-0.000	0.000
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.002)
$Q1$ lags (2)	0.013***	0.005**	0.001	0.006**	0.001	0.000	0.010**	0.010**	0.003
	(0.005)	(0.002)	(0.003)	(0.002)	(0.003)	(0.001)	(0.004)	(0.005)	(0.004)
$Q2$ lags (2)	-0.006	-0.002	-0.004**	-0.002	0.000	0.001	-0.003	-0.001	-0.001
	(0.006)	(0.003)	(0.002)	(0.003)	(0.003)	(0.001)	(0.004)	(0.004)	(0.004)
$Q4$ lags (2)	0.002	0.001	0.001	0.001	0.002	-0.000	0.004	0.001	0.002
	(0.003)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
$Q7$ lags (2)	0.002	0.001	-0.000	0.002	-0.000	-0.000	0.001	-0.000	0.001
	(0.003)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)
Constant	0.087	0.148**	0.082	0.101	0.088	0.111*	0.102	0.086	0.104
	(0.083)	(0.063)	(0.060)	(0.081)	(0.072)	(0.062)	(0.067)	(0.071)	(0.085)
Observations	3,643	3,519	3,522	3,567	3,567	3,277	3,567	3,567	3,567
adjusted R squared	0.966	0.966	0.966	0.968	0.968	0.966	0.968	0.968	0.968

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 1985:1-2015:3. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). We are estimating equation (1.1), regressing country-specific interest rates on macroeconomic variables and on individual type specific beliefs that contains balances based on the responses to the questions Q1 to Q7 which are described in Tables A4 - A6.

Table A32: Estimation results for equation (1.1) before the Crisis using real-time data.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
Indl Production	1.266**	1.592***	1.530***	1.370***	1.506***	1.502***	1.431***	1.362***	1.436***
	(0.620)	(0.513)	(0.510)	(0.502)	(0.523)	(0.554)	(0.505)	(0.521)	(0.510)
Unem. rate	0.140	0.138*	0.151**	0.167**	0.179**	0.164**	0.166**	0.159**	0.164**
	(0.086)	(0.074)	(0.074)	(0.071)	(0.072)	(0.076)	(0.071)	(0.073)	(0.071)
inflation	0.003	0.017	0.018	0.012	0.015	0.012	0.014	0.012	0.016
	(0.030)	(0.033)	(0.034)	(0.030)	(0.033)	(0.038)	(0.032)	(0.034)	(0.030)
Price of crude oil	0.063	0.175	0.154	0.126	0.107	0.128	0.101	0.119	0.111
	(0.156)	(0.131)	(0.131)	(0.126)	(0.135)	(0.149)	(0.128)	(0.127)	(0.130)
Price of food	0.048	-0.260	-0.272	-0.059	-0.058	-0.048	-0.195	-0.087	-0.099
	(0.446)	(0.441)	(0.487)	(0.430)	(0.466)	(0.490)	(0.505)	(0.445)	(0.454)
$Q5$	-0.012	-0.004	-0.002	-0.006	-0.003	-0.003	0.000	-0.006	-0.006
	(0.011)	(0.006)	(0.003)	(0.008)	(0.004)	(0.004)	(0.003)	(0.006)	(0.008)
$Q3$	-0.010	-0.007	-0.003	-0.007	-0.003	-0.003	0.003	-0.003	-0.004
	(0.007)	(0.005)	(0.004)	(0.007)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
$Q1$	-0.013**	0.000	0.001	-0.005	-0.000	-0.001	-0.014*	-0.015*	-0.004
	(0.007)	(0.003)	(0.003)	(0.004)	(0.003)	(0.002)	(0.008)	(0.008)	(0.004)
$Q2$	0.005	-0.001	0.004	-0.000	0.000	-0.001	0.007	0.003	0.004
	(0.009)	(0.004)	(0.004)	(0.005)	(0.004)	(0.003)	(0.006)	(0.007)	(0.006)
$Q4$	0.005	0.006**	0.005*	0.007	0.002	0.003	-0.002	0.005	0.003
	(0.005)	(0.003)	(0.002)	(0.005)	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)
$Q7$	-0.002	-0.001	0.001	-0.001	0.001	0.000	-0.001	0.001	-0.001
	(0.004)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)
interest rate lags (2)	0.891***	0.889***	0.895***	0.887***	0.890***	0.889***	0.889***	0.888***	0.887***
	(0.040)	(0.044)	(0.041)	(0.040)	(0.040)	(0.043)	(0.040)	(0.041)	(0.041)
Indl production lags (2)	2.437	3.307*	3.281*	2.992*	3.110	3.082	2.934	3.066	2.996
	(1.966)	(1.896)	(1.965)	(1.795)	(1.928)	(2.115)	(1.860)	(1.895)	(1.923)
Unem. rate lags (2)	-0.023	0.020	0.051	0.076	0.099	0.057	0.098	0.080	0.078
	(0.113)	(0.098)	(0.099)	(0.096)	(0.110)	(0.112)	(0.091)	(0.103)	(0.095)
inflation lags (2)	0.009	0.038	0.040	0.035	0.044	0.034	0.034	0.041	0.040
	(0.040)	(0.048)	(0.050)	(0.041)	(0.049)	(0.057)	0.048	(0.048)	(0.042)
Price of crude oil lags (2)	0.473	0.393	0.317	0.407	0.311	0.432	0.322	0.362	0.361
	(0.323)	(0.327)	(0.262)	(0.325)	(0.268)	(0.338)	(0.279)	(0.315)	(0.288)
Price of food lags (2)	-0.251	-0.348	-0.253	-0.144	-0.120	0.031	-0.115	-0.056	-0.156
	(0.808)	(0.677)	(0.661)	(0.753)	(0.729)	(0.725)	(0.722)	(0.736)	(0.778)
$Q5$ lags (2)	0.015	0.009	0.004	0.010	0.005	0.006*	0.003	0.009	0.009
	(0.010)	(0.006)	(0.003)	(0.007)	(0.004)	(0.003)	(0.003)	(0.006)	(0.007)
$Q3$ lags (2)	0.011**	0.003	0.003	0.006	0.002	0.004	-0.003	0.003	0.003
	(0.005)	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)	(0.006)	(0.004)	(0.003)
$Q1$ lags (2)	0.012*	0.005	-0.002	0.005	-0.000	-0.001	0.010	0.011	0.002
	(0.007)	(0.003)	(0.007)	(0.004)	(-0.005)	(0.002)	(0.007)	(0.008)	(0.006)
$Q2$ lags (2)	-0.008	-0.001	-0.005	-0.001	0.003	0.002	-0.002	0.002	-0.001
	(0.009)	(0.006)	(0.004)	(0.005)	(0.005)	(0.002)	(0.007)	(0.007)	(0.006)
$Q4$ lags (2)	0.001	0.001	-0.000	0.001	0.002	-0.001	0.006	-0.000	0.002
	(0.005)	(0.004)	(0.002)	(0.003)	(0.003)	(0.002)	(0.004))	(0.004)	(0.004)
$Q7$ lags (2)	0.003	0.002	0.000	0.003	-0.001	0.000	0.002	-0.000	0.002
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Constant	0.532**	0.583**	0.523**	0.511**	0.570**	0.435	0.578**	0.552**	0.541**
	(0.236)	(0.281)	(0.217)	(0.251)	(0.235)	(0.272)	(0.235)	(0.245)	(0.260)
Observations	2,457	2,336	2,336	2,381	2,381	2,171	2,381	2,381	2,381
adjusted R squared	0.947	0.947	0.947	0.950	0.950	0.948	0.950	0.950	0.950

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 1985:1-2008:6. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). We are estimating equation (1.1), regressing short term interest rates on macroeconomic variables and on individual type specific beliefs that contains balances based on the responses to the questions Q1 to Q7 which are described in Tables A4 - A6.

Table A33: Estimation results for equation (1.1) since the Crisis using real-time data.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
Indl Production	-0.151	-0.165	-0.159	-0.128	-0.178	-0.157	-0.185	-0.159	-0.128
	(0.146)	(0.145)	(0.156)	(0.148)	(0.149)	(0.155)	(0.150)	(0.149)	(0.143)
Unem. rate	0.017	0.017	0.011	0.015	0.013	0.011	0.014	0.015	0.018
	(0.026)	(0.026)	(0.026)	(0.027)	(0.026)	(0.027)	(0.025)	(0.026)	(0.026)
inflation	0.017***	0.015***	0.016***	0.016***	0.017***	0.015***	0.017***	0.016***	0.018***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Price of crude oil	0.001	-0.016	0.007	0.006	-0.007	-0.006	-0.004	0.005	-0.002
	(0.046)	(0.045)	(0.047)	(0.047)	(0.047)	(0.048)	(0.047)	(0.046)	(0.046)
Price of food	-0.804***	-0.822***	-0.790***	-0.795***	-0.803***	-0.794***	-0.796***	-0.820***	-0.800***
	(0.174)	(0.180)	(0.174)	(0.180)	(0.176)	(0.188)	(0.173)	(0.174)	(0.174)
$Q5$	-0.000	0.000	0.000	-0.000	-0.000	0.000	0.000	-0.001	-0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q3$	0.002**	0.002**	0.001	0.002**	0.001	0.001***	0.001	0.002***	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q1$	0.001	0.001	-0.000	-0.001	0.001	0.001	0.002	0.000	0.000
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q2$	-0.002	-0.001	0.000	0.000	-0.003***	-0.000	-0.003***	-0.002	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q4$	-0.002**	-0.000	-0.001	-0.002***	-0.001	-0.001**	-0.001	-0.002**	-0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q7$	-0.001*	-0.001*	-0.000	-0.001**	-0.001**	-0.000	-0.001*	-0.001*	-0.002***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
interest rate lags (2)	0.949***	0.947***	0.952***	0.949***	0.948***	0.952***	0.950***	0.949***	0.948***
	(0.016)	(0.016)	(0.017)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Indl production lags (2)	0.011	0.021	0.029	-0.002	0.029	0.022	0.025	-0.001	-0.002
	(0.142)	(0.139)	(0.149)	(0.144)	(0.144)	(0.149)	(0.144)	(0.144)	(0.141)
Unem. rate lags (2)	-0.014	-0.015	-0.012	-0.015	-0.011	-0.011	-0.012	-0.012	-0.015
	(0.025)	(0.025)	(0.026)	(0.026)	(0.025)	(0.026)	(0.025)	(0.025)	(0.026)
inflation lags (2)	0.015*	0.013*	0.016**	0.017**	0.016*	0.016*	0.016**	0.016**	0.017**
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Price of crude oil lags (2)	0.224*	0.221*	0.205	0.241**	0.193	0.244**	0.207*	0.227*	0.210*
	(0.124)	(0.117)	(0.128)	(0.119)	(0.123)	(0.124)	(0.124)	(0.124)	(0.119)
Price of food lags (2)	0.511***	0.618***	0.518***	0.550***	0.497***	0.571***	0.507***	0.565***	0.513***
	(0.119)	(0.124)	(0.119)	(0.124)	(0.119)	(0.127)	(0.115)	(0.121)	(0.120)
$Q5$ lags (2)	0.001	0.001	-0.000	0.001	0.001	0.000	0.000	0.001	0.001
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q3$ lags (2)	-0.002***	-0.002**	-0.001	-0.002**	-0.001	-0.001**	-0.001	-0.003***	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q1$ lags (2)	0.003*	0.002**	0.001	0.002**	0.002	0.001	0.003*	0.003**	0.003*
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
$Q2$ lags (2)	-0.001	-0.000	-0.001*	-0.001	0.001	0.000	-0.000	-0.000	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q4$ lags (2)	0.002*	0.001	0.001	0.002*	0.001	0.001	0.001	0.002*	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q7$ lags (2)	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Constant	0.674	0.736*	0.657	0.663	0.686	0.710	0.750*	0.757*	0.630
	(0.426)	(0.422)	(0.432)	(0.426)	(0.424)	(0.442)	(0.448)	(0.443)	(0.419)
Observations	1,144	1,141	1,144	1,144	1,144	1,067	1,144	1,144	1,144
adjusted R squared	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990	0.990

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 2008:10-2015:3. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). We are estimating equation (1.1), regressing short term interest rates on macroeconomic variables and on individual type specific beliefs that contains balances based on the responses to the questions Q1 to Q7 which are described in Tables A4 - A6.

Table A34: Estimation results for equation (1.2) whole sample using real-time data.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
$Q5$	-0.006	-0.005	-0.002	-0.006	-0.003	-0.001	-0.003	-0.005	-0.003
	(0.006)	(0.004)	(0.002)	(0.005)	(0.003)	(0.002)	(0.003)	(0.004)	(0.005)
$Q3$	-0.011**	-0.008**	-0.005**	-0.006**	-0.006*	-0.001	-0.007	-0.004	-0.008*
	(0.005)	(0.004)	(0.002)	(0.003)	(0.004)	(0.002)	(0.005)	(0.003)	(0.004)
$Q1$	-0.000	0.002	0.003	-0.003	0.001	-0.004	-0.001	-0.008*	0.003
	(0.008)	(0.003)	(0.003)	(0.005)	(0.004)	(0.003)	(0.005)	(0.005)	(0.007)
$Q2$	0.004	-0.001	0.007*	0.004	0.005	-0.001	0.008*	0.006	0.005
	(0.005)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.005)	(0.004)	(0.004)
$Q4$	0.009**	0.012***	0.004	0.007**	0.005	0.004	0.006**	0.005**	0.005*
	(0.004)	(0.004)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)
$Q7$	0.002	0.000	0.003	-0.001	0.005*	-0.001	0.002	0.002	0.001
	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
inflation	0.070*	0.074*	0.076*	0.071*	0.072*	0.073*	0.075*	0.076*	0.073*
	(0.040)	(0.041)	(0.041)	(0.040)	(0.040)	(0.043)	(0.042)	(0.042)	(0.041)
interest rate lag	0.844***	0.837***	0.841***	0.836***	0.840***	0.832***	0.839***	0.840***	0.839***
	(0.062)	(0.066)	(0.066)	(0.065)	(0.065)	(0.067)	(0.065)	(0.065)	(0.065)
$Q5$ lag	0.011*	0.010**	0.005**	0.010**	0.006*	0.004*	0.006**	0.008*	0.007
	(0.006)	(0.004)	(0.002)	(0.005)	(0.003)	(0.002)	(0.003)	(0.004)	(0.006)
$Q3$ lag	0.010**	0.003	0.002	0.003	0.005	0.002	0.004	0.003	0.006
	(0.005)	(0.003)	(0.002)	(0.003)	(0.004)	(0.002)	(0.004)	(0.002)	(0.004)
$Q1$ lag	-0.001	0.002	-0.003	0.003	-0.004	-0.001	-0.001	0.003	-0.006
	(0.008)	(0.003)	(0.004)	(0.003)	(0.005)	(0.002)	(0.004)	(0.004)	(0.006)
$Q2$ lag	-0.002	0.003	-0.007**	0.001	0.000	0.007*	-0.000	0.002	0.003
	(0.005)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)
$Q4$ lag	0.000	-0.003	0.003*	0.000	-0.000	-0.001	-0.000	-0.001	-0.001
	(0.003)	(0.004)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
$Q7$ lag	0.001	-0.000	-0.002	0.001	-0.004	0.002	-0.001	-0.001	-0.000
	(0.003)	(0.002)	(0.003)	(0.002)	(0.004)	(0.002)	(0.002)	(0.003)	(0.003)
inflation lag	0.119***	0.123***	0.124***	0.122***	0.124***	0.128***	0.126***	0.127***	0.126***
	(0.044)	(0.045)	(0.044)	(0.045)	(0.043)	(0.048)	(0.045)	(0.044)	(0.044)
Constant	0.191**	0.302***	0.170	0.237*	0.192*	0.110	0.204*	0.170*	0.242**
	(0.097)	(0.107)	(0.117)	(0.126)	(0.114)	(0.075)	(0.105)	(0.092)	(0.108)
Observations	4,254	3,973	3,984	4,056	4,044	3,718	4,061	4,074	4,088
adjusted R squared	0.939	0.931	0.931	0.936	0.936	0.932	0.935	0.936	0.936

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 1985:1-2015:3. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). We are estimating equation (1.1), regressing short term interest rates on macroeconomic variables and on individual type specific beliefs that contains balances based on the responses to the questions Q1 to Q7 which are described in Tables A4 - A6.

Table A35: Estimation results for equation (1.2) before the Crisis using real-time data.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
$Q5$	-0.011	-0.008	-0.005	-0.011	-0.004	-0.004	-0.004	-0.007	-0.005
	(0.010)	(0.006)	(0.004)	(0.008)	(0.004)	(0.004)	(0.004)	(0.006)	(0.008)
$Q3$	-0.018*	-0.011**	-0.008**	-0.009*	-0.007	-0.001	-0.008	-0.004	-0.010*
	(0.009)	(0.006)	(0.004)	(0.005)	(0.004)	(0.003)	(0.006)	(0.004)	(0.006)
$Q1$	-0.000	0.001	0.006	-0.005	-0.000	-0.010*	-0.002	-0.013*	0.003
	(0.013)	(0.005)	(0.005)	(0.009)	(0.004)	(0.005)	(0.006)	(0.008)	(0.010)
$Q2$	0.011	-0.001	0.017**	0.007	0.007	-0.002	0.012*	0.014**	0.010
	(0.009)	(0.006)	(0.008)	(0.006)	(0.004)	(0.006)	(0.007)	(0.007)	(0.006)
$Q4$	0.010	0.016**	0.004	0.009*	0.005	0.006	0.006*	0.004	0.005
	(0.006)	(0.007)	(0.004)	(0.005)	(0.005)	(0.005)	(0.003)	(0.004)	(0.005)
$Q7$	0.004	0.002	0.005	0.001	0.008**	-0.001	0.004	0.004	0.003
	(0.004)	(0.002)	(0.003)	(0.003)	(0.004)	(0.004)	(0.002)	(0.003)	(0.003)
inflation	0.080	0.091	0.093	0.086	0.085	0.089	0.089	0.089	0.086
	(0.058)	(0.062)	(0.061)	(0.060)	(0.060)	(0.065)	(0.062)	(0.062)	(0.059)
interest rate lag	0.821***	0.816***	0.820***	0.814***	0.818***	0.807***	0.817***	0.816***	0.815***
	(0.067)	(0.071)	(0.070)	(0.070)	(0.070)	(0.072)	(0.070)	(0.071)	(0.070)
$Q5$ lag	0.019*	0.013**	0.009**	0.017**	0.008**	0.008**	0.010***	0.012*	0.011
	(0.010)	(0.006)	(0.004)	(0.008)	(0.004)	(0.004)	(0.004)	(0.006)	(0.008)
$Q3$ lag	0.020**	0.006	0.005	0.007	0.007	0.005	0.006	0.006	0.010*
	(0.009)	(0.005)	(0.004)	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)
$Q1$ lag	-0.013	-0.001	-0.010	-0.001	-0.009	-0.004	-0.005	-0.002	-0.013
	(0.015)	(0.005)	(0.008)	(0.004)	(0.008)	(0.003)	(0.005)	(0.008)	(0.009)
$Q2$ lag	0.003	0.005	-0.012**	0.003	0.002	0.012*	0.002	0.007	0.008
	(0.009)	(0.007)	(0.005)	(0.005)	(0.004)	(0.006)	(0.005)	(0.008)	(0.006)
$Q4$ lag	-0.003	-0.005	0.003	-0.000	-0.001	-0.004	-0.000	-0.004	-0.003
	(0.006)	(0.006)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)
$Q7$ lag	-0.000	-0.001	-0.004	0.001	-0.007	0.003	-0.002	-0.003	-0.001
	(0.004)	(0.003)	(0.004)	(0.003)	(0.005)	(0.003)	(0.003)	(0.004)	(0.004)
inflation lag	0.149**	0.158**	0.164**	0.161**	0.156**	0.172**	0.161**	0.162**	0.159**
	(0.064)	(0.069)	(0.066)	(0.068)	(0.062)	(0.077)	(0.067)	(0.066)	(0.066)
Constant	0.752***	0.955***	0.906**	0.911***	0.877**	0.585**	0.933***	0.868**	0.913***
	(0.276)	(0.332)	(0.413)	(0.319)	(0.436)	(0.276)	(0.351)	(0.362)	(0.319)
Observations	3,050	2,771	2,780	2,852	2,840	2,595	2,857	2,870	2,884
R-squared a	0.913	0.902	0.901	0.909	0.909	0.904	0.907	0.908	0.909

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 1985:1-2008:6. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). Here, we identify the type specific monetary policy surprise based on individual beliefs regarding the economy based on the information set of consumer type k, at time t in country i. We are estimating equation (1.2), regressing short term interest rates on individual type specific beliefs that contains balances based on the responses to the following questions: Q1 How has the financial situation of your household changed over the last 12 months? Q2 How do you expect the financial position of your household to change over the next 12 months? Q3 How do you think the general economic situation in the country has changed over the past 12months? Q4 How do you expect the general economic situation in this country to develop over the next 12 months? Q5 How do you think that consumer prices have developed over the past 12 months? and Q7 How do you expect the number of people unemployed in this country to change over the next 12 months?

Table A36: Estimation results for equation (1.2) since the Crisis using real-time data.

VARIABLES	total con	Low inc	High inc	Low edu	High edu	unem	full time	30-49	50-64
$Q5$	0.000	0.000	0.000	0.000	-0.000	0.000	0.001	-0.000	-0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q3$	0.001	0.001*	0.001	0.001**	0.000	0.001**	0.000	0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q1$	0.000	0.001	-0.000	-0.002	0.001	0.000	0.001	-0.000	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q2$	-0.003**	-0.001	-0.000	0.000	-0.003***	-0.000	-0.004***	-0.002**	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q4$	-0.002*	-0.000	-0.001	-0.002**	-0.001	-0.001**	-0.001	-0.002**	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q7$	-0.002**	-0.001**	-0.001	-0.001***	-0.002***	-0.000	-0.002**	-0.002**	-0.002***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
inflation	0.020***	0.020***	0.021***	0.022***	0.020***	0.022***	0.020***	0.021***	0.021***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)
interest rate lags (2)	0.950***	0.950***	0.953***	0.949***	0.950***	0.951***	0.951***	0.950***	0.950***
	(0.018)	(0.018)	(0.019)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
$Q5$ lags (2)	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.001	-0.000	0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q3$ lags (2)	-0.002**	-0.001*	-0.001	-0.002**	-0.000	-0.001	-0.001	-0.001*	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Q1$ lags (2)	0.002	0.001	0.001	0.003**	0.001	0.000	0.003*	0.002*	0.003*
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
$Q2$ lags (2)	0.000	-0.000	-0.001	-0.001	0.001	0.000	0.000	0.001	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
$Q4$ lags (2)	0.002	0.001	0.001**	0.002*	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Q7$ lags (2)	0.002	0.002*	0.001	0.001*	0.002*	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
inflation lags (2)	0.019**	0.020***	0.022***	0.023***	0.020***	0.023***	0.020***	0.020***	0.021***
	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)
Constant	0.001	0.023	-0.004	-0.008	-0.011	0.012	-0.011	-0.009	0.005
	(0.016)	(0.029)	(0.013)	(0.022)	(0.013)	(0.025)	(0.013)	(0.014)	(0.018)
Observations	1,161	1,158	1,161	1,161	1,161	1,083	1,161	1,161	1,161
adjusted R squared	0.990	0.990	0.990	0.990	0.990	0.989	0.990	0.990	0.990

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors in parentheses. Results are for 2008:10-2015:3. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). Here, we identify the monetary policy surprise based on individual beliefs regarding the economy based on the information set of consumer type k, at time t in country i. We are estimating equation (1.2), regressing short term interest rates on individual type specific beliefs that contains balances based on the responses to the following questions: Q1 How has the financial situation of your household changed over the last 12 months? Q2 How do you expect the financial position of your household to change over the next 12 months? Q3 How do you think the general economic situation in the country has changed over the past 12months? Q4 How do you expect the general economic situation in this country to develop over the next 12 months? Q5 How do you think that consumer prices have developed over the past 12 months? and Q7 How do you expect the number of people unemployed in this country to change over the next 12 months?

Table A37: Estimation results of equation (1.3) with monetary policy surprises obtained from equation (1.1) using country-specific interest rates on deposits, without regime change.

VARIABLES	total con π_t^e	Low inc π_t^e	High inc π_t^e	Low edu π_t^e	High edu π_t^e	unem π_t^e	full-time π_t^e	30-49 π_t^e	50-64 π_t^e
m surp lag	0.005	0.004	0.001	0.000	0.005	0.010	0.005	-0.003	0.006
	(0.008)	(0.010)	(0.009)	(0.010)	(0.009)	(0.013)	(0.008)	(0.008)	(0.009)
π^e lags (6)	0.863***	0.836***	0.853***	0.852***	0.861***	0.775***	0.872***	0.865***	0.854***
	(0.014)	(0.017)	(0.018)	(0.016)	(0.014)	(0.023)	(0.014)	(0.014)	(0.015)
π_t	0.038***	0.031***	0.035***	0.039***	0.032***	0.041***	0.036***	0.035***	0.036***
	(0.008)	(0.011)	(0.013)	(0.010)	(0.008)	(0.014)	(0.008)	(0.009)	(0.009)
lagged π (1)	0.016**	0.029**	0.018	0.024**	0.018**	0.022	0.020**	0.018**	0.025***
	(0.008)	(0.011)	(0.012)	(0.010)	(0.008)	(0.014)	(0.008)	(0.008)	(0.009)
Observations	1,949	1,977	1,983	1,983	2,000	1,805	2,000	2,000	2,000
$adj.\ R^2$	0.906	0.828	0.857	0.859	0.891	0.711	0.898	0.895	0.879

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of the monetary surprise (constructed under the assumption that individuals are well informed), on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The number of lags included for each variable are shown in brackets for case of total consumers. The optimal lag length for inflation expectations varies across consumer types. For high educated, full-time working consumers, ages 30-49 and 50-64 we use 3 lags, for low/high income and low educated consumers we use 4 lags, and for unemployed we use 5 lags.

Table A38: Estimation results of equation (1.3) with monetary policy surprises obtained from equation (1.1) using country-specific interest rates on deposits.

VARIABLES	total con π_t^e	Low inc π_t^e	High inc π_t^e	Low edu π_t^e	High edu π_t^e	unem π_t^e	full-time π_t^e	30-49 π_t^e	50-64 π_t^e
m surp lag pre-Cr (1)	0.002	-0.005	-0.007	-0.006	-0.004	0.008	-0.003	-0.019	0.005
	(0.011)	(0.016)	(0.012)	(0.014)	(0.011)	(0.017)	(0.011)	(0.012)	(0.013)
m surp lag after (1)	-0.017	-0.014	-0.034**	0.007	-0.022*	-0.024	-0.005	-0.003	-0.018
	(0.012)	(0.015)	(0.015)	(0.012)	(0.012)	(0.027)	(0.010)	(0.010)	(0.014)
π^e lags pre-Cr (2)	0.750***	0.772***	0.675***	0.754***	0.728***	0.676***	0.735***	0.716***	0.735***
	(0.018)	(0.024)	(0.018)	(0.019)	(0.019)	(0.033)	(0.017)	(0.017)	(0.020)
π^e lags after (6)	0.900***	0.835***	0.875***	0.834***	0.891***	0.794***	0.899***	0.889***	0.890***
	(0.016)	(0.020)	(0.022)	(0.018)	(0.017)	(0.032)	(0.017)	(0.016)	(0.019)
π_t pre-Cr	0.008	0.005	0.000	0.012	-0.016	-0.002	0.001	0.001	-0.006
	(0.011)	(0.019)	(0.011)	(0.014)	(0.011)	(0.018)	(0.011)	(0.011)	(0.012)
π_t after	0.043***	0.034***	0.038*	0.035***	0.040***	0.047**	0.039***	0.036***	0.046***
	(0.011)	(0.013)	(0.020)	(0.013)	(0.011)	(0.021)	(0.012)	(0.012)	(0.013)
lagged π pre-Cr (1)	0.011	0.004	0.010	-0.002	-0.002	-0.002	0.005	0.004	0.002
	(0.011)	(0.020)	(0.012)	(0.014)	(0.011)	(0.019)	(0.010)	(0.011)	(0.012)
lagged π after (1)	0.007	0.022	-0.001	0.020	0.003	0.017	0.006	0.007	0.013
	(0.011)	(0.014)	(0.018)	(0.014)	(0.011)	(0.021)	(0.011)	(0.012)	(0.013)
after dummy	0.006	0.056	-0.043	0.098**	-0.054	-0.516***	-0.027	0.013	0.010
	(0.035)	(0.044)	(0.046)	(0.041)	(0.037)	(0.078)	(0.037)	(0.036)	(0.040)
Observations	1,811	1,865	1,871	1,933	1,871	1,689	1,902	1,933	1,871
$adj.\ R^2$	0.911	0.834	0.859	0.863	0.895	0.713	0.903	0.899	0.884

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized.We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of the monetary surprise (constructed under the assumption that individuals are well informed),on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). The number of lags included for each variable are shown in brackets for the case of total consumers. The optimal lag length for inflation expectations varies across consumer types. In the pre-Crisis period, we use 2 lags for high-income and low-educated consumers, full time workers and ages 30-49, and 3 lags for low-income and high-educated consumers, the unemployed and ages 50-64. Post-Crisis, we use 2 lags for low educated, ages 30-49, 3 lags for high educated, full-time workers, 4 lags for low- and high income consumers and ages 50-64, and 5 lags for the unemployed.

Table A39: Estimation results of equation (1.4) with monetary policy surprises obtained from equation (1.2) using country-specific interest rates on deposits, without regime change.

VARIABLES	total con π_t^e	Low inc π_t^e	High inc π_t^e	Low edu π_t^e	High edu π_t^e	unem π_t^e	full-time π_t^e	30-49 π_t^e	50-64 π_t^e
m surp lag (1)	0.010	0.012	0.007	0.010	0.012	0.021	0.012	0.004	0.013
	(0.008)	(0.010)	(0.009)	(0.010)	(0.009)	(0.013)	(0.008)	(0.009)	(0.009)
π^e lags (6)	0.863***	0.837***	0.853***	0.852***	0.862***	0.776***	0.872***	0.865***	0.855***
	(0.014)	(0.017)	(0.018)	(0.016)	(0.014)	(0.023)	(0.014)	(0.014)	(0.015)
π_t	0.038***	0.031***	0.035***	0.039***	0.032***	0.040***	0.036***	0.035***	0.036***
	(0.008)	(0.011)	(0.013)	(0.010)	(0.008)	(0.014)	(0.008)	(0.008)	(0.009)
lagged π (1)	0.016**	0.029**	0.018	0.024**	0.018**	0.022	0.020**	0.018**	0.025***
	(0.008)	(0.011)	(0.011)	(0.010)	(0.008)	(0.014)	(0.008)	(0.008)	(0.009)
Observations	1,949	1,977	1,983	1,983	2,000	1,805	2,000	2,000	2,000
$adj.\ R^2$	0.906	0.828	0.857	0.859	0.891	0.711	0.898	0.895	0.879

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of the type specific monetary surprise (constructed based on consumers beliefs), on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The number of lags included for each variable are shown in brackets for case of total consumers. The optimal lag length for inflation expectations varies across consumer types. For high-educated, full-time working consumers, ages 30-49 and ages 50-64 we use 3 lags, for low/high income and low educated we use 4 lags, and for unemployed we use 6 lags.

Table A40: Estimation results of equation (1.4) with monetary policy surprises obtained from equation (1.2) using country-specific interest rates on deposits.

VARIABLES	total con π_t^e	Low inc π_t^e	High inc π_t^e	Low edu π_t^e	High edu π_t^e	unem π_t^e	full-time π_t^e	30-49 π_t^e	50-64 π_t^e
m surp lag pre-Cr (1)	-0.001	-0.010	-0.009	-0.005	-0.008	0.007	-0.007	-0.020*	-0.000
	(0.011)	(0.016)	(0.012)	(0.014)	(0.011)	(0.017)	(0.011)	(0.012)	(0.013)
m surp lag after (1)	-0.028**	-0.024	-0.054***	-0.005	-0.032**	-0.024	-0.024*	-0.025*	-0.035**
	(0.013)	(0.017)	(0.016)	(0.016)	(0.013)	(0.030)	(0.013)	(0.014)	(0.015)
π^e lags pre-Cr (2)	0.750***	0.772***	0.675***	0.760***	0.728***	0.675***	0.742***	0.731***	0.735***
	(0.018)	(0.024)	(0.018)	(0.019)	(0.019)	(0.033)	(0.018)	(0.018)	(0.020)
π^e lags after (6)	0.900***	0.835***	0.874***	0.852***	0.890***	0.793***	0.901***	0.899***	0.889***
	(0.016)	(0.020)	(0.022)	(0.020)	(0.017)	(0.031)	(0.017)	(0.017)	(0.019)
π_t pre-Cr	0.008	0.004	0.000	0.010	-0.016	-0.002	-0.002	-0.003	-0.006
	(0.011)	(0.019)	(0.011)	(0.014)	(0.011)	(0.018)	(0.010)	(0.011)	(0.012)
π_t after	0.043***	0.034***	0.038*	0.041***	0.040***	0.047**	0.040***	0.036***	0.047***
	(0.011)	(0.013)	(0.020)	(0.013)	(0.011)	(0.021)	(0.012)	(0.012)	(0.013)
lagged π pre-Cr (1)	0.010	0.004	0.010	-0.003	-0.002	-0.002	0.004	0.004	0.002
	(0.011)	(0.020)	(0.012)	(0.014)	(0.011)	(0.019)	(0.010)	(0.011)	(0.012)
lagged π after (1)	0.007	0.021	-0.002	0.021	0.002	0.017	0.005	0.006	0.012
	(0.011)	(0.014)	(0.018)	(0.014)	(0.011)	(0.021)	(0.012)	(0.012)	(0.013)
after dummy	0.006	0.056	-0.041	-0.371***	-0.391***	-0.516***	-0.029	-0.341***	0.010
	(0.035)	(0.044)	(0.046)	(0.063)	(0.050)	(0.078)	(0.038)	(0.053)	(0.040)
Observations	1,811	1,865	1,871	1,871	1,871	1,689	1,871	1,871	1,871
$adj.\ R^2$	0.911	0.834	0.860	0.863	0.896	0.713	0.901	0.897	0.884

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of type specific monetary surprise (constructed based on consumers beliefs), on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). The number of lags included for each variable are shown in brackets for the case of total consumers. The optimal lag length for inflation expectations varies across consumer types. In the pre-Crisis period, we use 2 lags for high-income consumers and low-educated consumers, and 3 lags for low-income, high educated, the unemployed, full-time workers, ages 30 -49 and ages 50-64. Post-Crisis, we use 4 lags for low/high-income, low/high-educated, full-time workers, ages 30-49 and ages 50-64, and 5 lags for the unemployed.

Table A41: Estimation results of equation (1.3) with monetary policy surprises obtained from equation (1.1) using real-time data, without regime change.

VARIABLES	total con π_t^e	Low inc π_t^e	High inc π_t^e	Low edu π_t^e	High edu π_t^e	unem π_t^e	full-time π_t^e	30-49 π_t^e	50-64 π_t^e
m surp lags (2)	-0.002	-0.019**	-0.013	-0.014*	-0.005	-0.015	-0.009	-0.012*	-0.009
	(0.008)	(0.009)	(0.009)	(0.008)	(0.009)	(0.010)	(0.007)	(0.007)	(0.008)
π^e lags (6)	0.900***	0.867***	0.882***	0.890***	0.891***	0.824***	0.897***	0.898***	0.890***
	(0.009)	(0.011)	(0.011)	(0.010)	(0.009)	(0.015)	(0.009)	(0.009)	(0.010)
π_t	0.033***	0.030***	0.034***	0.034***	0.031***	0.038***	0.032***	0.033***	0.033***
	(0.006)	(0.008)	(0.009)	(0.007)	(0.006)	(0.010)	(0.006)	(0.006)	(0.007)
lagged π (1)	0.007	0.021**	0.012	0.015**	0.013**	0.014	0.014**	0.011*	0.014**
	(0.006)	(0.008)	(0.008)	(0.007)	(0.006)	(0.010)	(0.006)	(0.006)	(0.007)
Observations	3,520	3,408	3,389	3,439	3,464	3,120	3,464	3,464	3,464
$adj.\ R^2$	0.910	0.846	0.861	0.871	0.881	0.736	0.891	0.896	0.883

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of the monetary surprise (constructed under the assumption that individuals are well informed), on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The number of lags included for each variable are shown in brackets for case of total consumers. The optimal lag length for inflation expectations varies across consumer types. For low income, high educated, full-time working consumers, ages 30-49 and 50-64 we use 3 lags, for high income and low educated consumers we use 4 lags, and for unemployed we use 5 lags.

Table A42: Estimation results of equation (1.3) with monetary policy surprises obtained from equation (1.1) using real-time data.

VARIABLES	total con π_t^e	Low inc π_t^e	High inc π_t^e	Low edu π_t^e	High edu π_t^e	unem π_t^e	full-time π_t^e	30-49 π_t^e	50-64 π_t^e
m surp lags pre-Cr (2)	0.004	-0.017*	-0.011	-0.011	-0.001	-0.013	-0.006	-0.010	-0.007
	(0.010)	(0.010)	(0.011)	(0.010)	(0.011)	(0.013)	(0.008)	(0.009)	(0.010)
m surp lag after (1)	-0.009	-0.014	-0.037**	-0.009	-0.023	0.005	-0.030**	-0.029*	-0.010
	(0.016)	(0.017)	(0.019)	(0.018)	(0.014)	(0.023)	(0.014)	(0.015)	(0.015)
π^e lags pre-Cr (2)	0.846***	0.847***	0.784***	0.840***	0.832***	0.796***	0.835***	0.825***	0.826***
	(0.009)	(0.012)	(0.010)	(0.010)	(0.010)	(0.016)	(0.010)	(0.009)	(0.010)
π^e lags after (6)	0.947***	0.865***	0.952***	0.884***	0.940***	0.856***	0.948***	0.957***	0.953***
	(0.014)	(0.018)	(0.022)	(0.018)	(0.015)	(0.029)	(0.016)	(0.016)	(0.017)
π_t pre-Cr	0.018***	0.023**	0.016**	0.022***	0.011	0.021*	0.016**	0.018***	0.016**
	(0.006)	(0.010)	(0.007)	(0.008)	(0.007)	(0.011)	(0.007)	(0.007)	(0.007)
π_t after	0.042***	0.030**	0.042**	0.037***	0.039***	0.047**	0.038***	0.034***	0.046***
	(0.011)	(0.013)	(0.020)	(0.013)	(0.011)	(0.021)	(0.012)	(0.013)	(0.014)
lagged π pre-Cr (1)	0.002	0.011	0.009	0.003	0.007	0.005	0.008	0.005	0.004
	(0.007)	(0.010)	(0.008)	(0.008)	(0.007)	(0.011)	(0.007)	(0.007)	(0.008)
lagged π after (1)	0.005	0.019	0.001	0.019	-0.001	0.018	0.001	0.004	0.012
	(0.011)	(0.014)	(0.018)	(0.014)	(0.011)	(0.022)	(0.012)	(0.012)	(0.013)
after dummy	-0.377***	-0.384***	-0.427***	-0.457***	-0.388***	-0.340***	-0.391***	-0.388***	-0.391***
	(0.051)	(0.066)	(0.059)	(0.065)	(0.054)	(0.086)	(0.050)	(0.056)	(0.056)
Observations	3,366	3,255	3,263	3,313	3,352	2,948	3,352	3,313	3,313
adj. R^2	0.912	0.849	0.864	0.874	0.884	0.735	0.895	0.897	0.886

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of the monetary surprise (constructed under the assumption that individuals are well informed), on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). The number of lags included for each variable are shown in brackets for the case of total consumers. The optimal lag length for inflation expectations varies across consumer types. In the pre-Crisis period, we use 2 lags for high-income and low-educated consumers, 3 lags for low-income and high-educated consumers, full-time working ones, ages 30-49 and ages 50-64, and 6 lags for the unemployed. Post-Crisis, we use 3 lags for high-educated, full-time working consumers, 4 lags for low- and high-income consumers, ages 30-49 and ages 50-64, and 5 lags for the unemployed.

Table A43: Estimation results of equation (1.4) with monetary policy surprises obtained from equation (1.2) using real-time data, without regime change.

VARIABLES	total con π_t^e	Low inc π_t^e	High inc π_t^e	Low edu π_t^e	High edu π_t^e	unem π_t^e	full-time π_t^e	30-49 π_t^e	50-64 π_t^e
m surp lag (1)	0.022***	0.028**	0.013	0.022*	0.029**	-0.006	0.017*	0.012	0.025**
	(0.007)	(0.014)	(0.010)	(0.012)	(0.014)	(0.010)	(0.010)	(0.008)	(0.012)
π^e lags (6)	0.908***	0.879***	0.888***	0.909***	0.900***	0.863***	0.905***	0.911***	0.904***
	(0.008)	(0.007)	(0.011)	(0.009)	(0.009)	(0.013)	(0.009)	(0.009)	(0.009)
π_t	0.034***	0.030***	0.030***	0.032***	0.030***	0.033***	0.030***	0.030***	0.032***
	(0.005)	(0.007)	(0.008)	(0.006)	(0.006)	(0.009)	(0.006)	(0.006)	(0.006)
lagged π (1)	0.010*	0.021***	0.012	0.014**	0.015**	0.019**	0.013**	0.011*	0.013**
	(0.005)	(0.007)	(0.008)	(0.007)	(0.006)	(0.009)	(0.006)	(0.006)	(0.006)
Observations	4,089	3,791	3,808	3,892	3,870	3,455	3,934	3,924	3,939
$adj.\ R^2$	0.911	0.856	0.864	0.884	0.880	0.761	0.889	0.900	0.891

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of the type specific monetary surprise (constructed based on consumers beliefs), on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The number of lags included for each variable are shown in brackets for case of total consumers. The optimal lag length for inflation expectations varies across consumer types. For full-time working consumers, ages 30-49 and ages 50-64 we use 3 lags, for low/high income and low/high educated we use 4 lags, and for unemployed we use 6 lags.

Table A44: Estimation results of equation (1.4) with monetary policy surprises obtained from equation (1.2) using real-time data.

VARIABLES	total con π_t^e	Low inc π_t^e	High inc π_t^e	Low edu π_t^e	High edu π_t^e	unem π_t^e	full-time π_t^e	30-49 π_t^e	50-64 π_t^e
m surp lag pre-Cr (1)	0.026***	0.033**	0.019*	0.027*	0.033**	-0.008	0.021*	0.016	0.035*
	(0.009)	(0.016)	(0.011)	(0.014)	(0.016)	(0.011)	(0.011)	(0.011)	(0.019)
m surp lag after (1)	-0.020	-0.027	-0.061**	-0.024	-0.040**	0.014	-0.038*	-0.036*	-0.030
	(0.022)	(0.022)	(0.025)	(0.022)	(0.019)	(0.032)	(0.020)	(0.019)	(0.020)
π^e lags pre-Cr (3)	0.854***	0.876***	0.824***	0.896***	0.850***	0.856***	0.863***	0.865***	0.867***
	(0.008)	(0.016)	(0.012)	(0.011)	(0.010)	(0.013)	(0.010)	(0.009)	(0.010)
π^e lags after (6)	0.960***	0.837***	0.942***	0.851***	0.941***	0.836***	0.931***	0.935***	0.928***
	(0.014)	(0.017)	(0.021)	(0.016)	(0.015)	(0.028)	(0.015)	(0.015)	(0.016)
π_t pre-Cr	0.023***	0.025***	0.017**	0.023***	0.015**	0.016*	0.018***	0.018***	0.022***
	(0.006)	(0.009)	(0.007)	(0.007)	(0.007)	(0.009)	(0.006)	(0.006)	(0.007)
π_t after	0.041***	0.029**	0.032	0.036***	0.037***	0.045**	0.035***	0.033***	0.043***
	(0.011)	(0.012)	(0.021)	(0.012)	(0.011)	(0.021)	(0.012)	(0.012)	(0.013)
lagged π pre-Cr (1)	0.007	0.013	0.010	0.004	0.010	0.012	0.007	0.006	0.005
	(0.006)	(0.009)	(0.007)	(0.007)	(0.007)	(0.010)	(0.007)	(0.006)	(0.007)
lagged π after (1)	0.002	0.016	-0.007	0.015	-0.002	0.016	0.002	0.001	0.008
	(0.011)	(0.014)	(0.018)	(0.014)	(0.012)	(0.021)	(0.012)	(0.012)	(0.013)
after dummy	-0.475***	-0.395***	-0.465***	-0.511***	-0.464***	-0.397***	-0.443***	-0.436***	-0.430***
	(0.052)	(0.064)	(0.075)	(0.063)	(0.055)	(0.080)	(0.050)	(0.055)	(0.056)
Observations	3,949	3,678	3,696	3,780	3,758	3,325	3,836	3,826	3,782
$adj.\ R^2$	0.914	0.860	0.868	0.888	0.883	0.764	0.893	0.904	0.894

Notes: *** p<0.01, ** p<0.05, * p<0.1 Murphy-Topel standard errors in parentheses. All reported coefficients are standardized. We consider inflation expectations of total consumers and demographic subgroups of consumers which are: low and high income, unemployed and full time workers, ages between 30 - 49 and 50 - 64 on lagged values of type specific monetary surprise (constructed based on consumers beliefs), on lagged values of inflation expectations and on contemporaneous and lagged values of actual inflation for the period 1985:1-2015:3. We include yearly dummies and country dummies. The lag length is optimally chosen in the context of a panel model following the sequential approach of General to Specific from Han, Phillips and Sul (2017). The number of lags included for each variable are shown in brackets for the case of total consumers. The optimal lag length for inflation expectations varies across consumer types. In the pre-Crisis period, we use 3 lags for low-income consumers, full-time working ones, ages 30-49 and 50-64, 4 lags for high-income consumers, low and high educated consumers and 6 lags for the unemployed. Post-Crisis, we use 3 lags for full-time working consumers and ages 30-49, 4 lags for low/high income and low/high edcated consumers and ages 50-64, and 5 lags for the unemployed.

.2 Appendix B

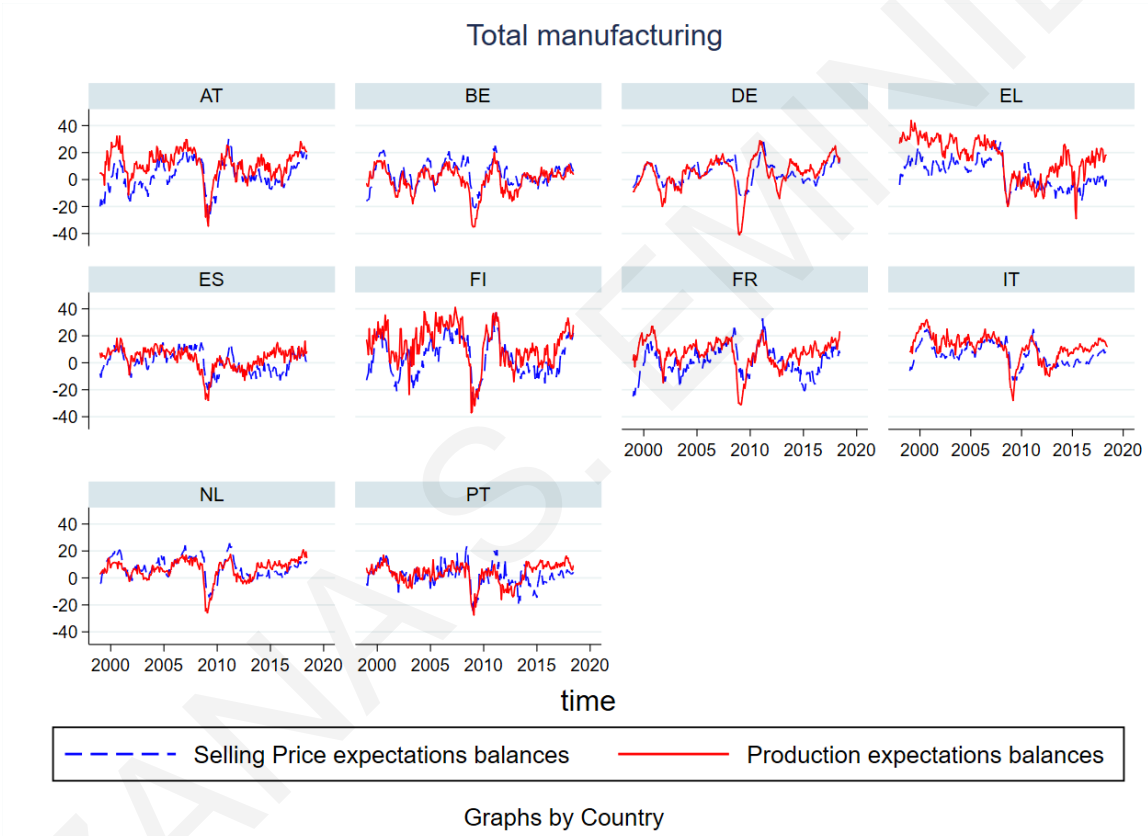
Changes in three official ECB's interest rates at Governing Council Meetings.

Date	MRO	MLF	DF	DMRO	DMLF	DDF	Date	MRO	MLF	DF	DMRO	DMLF	DDF
4/3/1999	3.00	4.50	2.00	0	0	0	11/1/2007	3.50	4.50	2.50	0	0	0
18/3/1999	3.00	4.50	2.00	0	0	0	8/2/2007	3.50	4.50	2.50	0	0	0
8/4/1999	2.50	3.50	1.50	-0.5	1	0.5	8/3/2007	3.75	4.75	2.75	0.25	0.25	0.25
22/4/1999	2.50	3.50	1.50	0	0	0	12/4/2007	3.75	4.75	2.75	0	0	0
6/5/1999	2.50	3.50	1.50	0	0	0	10/5/2007	3.75	4.75	2.75	0	0	0
20/5/1999	2.50	3.50	1.50	0	0	0	6/6/2007	4.00	5.00	3.00	0.25	0.25	0.25
2/6/1999	2.50	3.50	1.50	0	0	0	5/7/2007	4.00	5.00	3.00	0	0	0
17/6/1999	2.50	3.50	1.50	0	0	0	2/8/2007	4.00	5.00	3.00	0	0	0
1/7/1999	2.50	3.50	1.50	0	0	0	6/9/2007	4.00	5.00	3.00	0	0	0
15/7/1999	2.50	3.50	1.50	0	0	0	4/10/2007	4.00	5.00	3.00	0	0	0
29/7/1999	2.50	3.50	1.50	0	0	0	8/11/2007	4.00	5.00	3.00	0	0	0
26/8/1999	2.50	3.50	1.50	0	0	0	6/12/2007	4.00	5.00	3.00	0	0	0
9/9/1999	2.50	3.50	1.50	0	0	0	10/1/2008	4.00	5.00	3.00	0	0	0
23/9/1999	2.50	3.50	1.50	0	0	0	7/2/2008	4.00	5.00	3.00	0	0	0
7/10/1999	2.50	3.50	1.50	0	0	0	6/3/2008	4.00	5.00	3.00	0	0	0
21/10/1999	2.50	3.50	1.50	0	0	0	10/4/2008	4.00	5.00	3.00	0	0	0
4/11/1999	3.00	4.00	2.00	0.5	0.5	0.5	8/5/2008	4.00	5.00	3.00	0	0	0
18/11/1999	3.00	4.00	2.00	0	0	0	5/6/2008	4.00	5.00	3.00	0	0	0
2/12/1999	3.00	4.00	2.00	0	0	0	3/7/2008	4.25	5.25	3.25	0.25	0.25	0.25
15/12/1999	3.00	4.00	2.00	0	0	0	7/8/2008	4.25	5.25	3.25	0	0	0
5/1/2000	3.00	4.00	2.00	0	0	0	4/9/2008	4.25	5.25	3.25	0	0	0
20/1/2000	3.00	4.00	2.00	0	0	0	2/10/2008	4.25	5.25	3.25	0	0	0
3/2/2000	3.25	4.25	2.25	0.25	0.25	0.25	8/10/2008	3.75	4.75	2.75	-0.5	-0.5	-0.5
17/2/2000	3.25	4.25	2.25	0	0	0	6/11/2008	3.25	3.75	2.75	-0.5	-1	0
2/3/2000	3.25	4.25	2.25	0	0	0	4/12/2008	2.50	3.00	2.00	-0.75	-0.75	-0.75
16/3/2000	3.50	4.50	2.50	0.25	0.25	0.25	15/1/2009	2.00	3.00	1.00	-0.5	0	-1
30/3/2000	3.50	4.50	2.50	0	0	0	5/2/2009	2.00	3.00	1.00	0	0	0
13/4/2000	3.50	4.50	2.50	0	0	0	5/3/2009	1.50	2.50	0.50	-0.5	-0.5	-0.5
27/4/2000	3.75	4.75	2.75	0.25	0.25	0.25	2/4/2009	1.25	2.25	0.25	-0.25	-0.25	-0.25
11/5/2000	3.75	4.75	2.75	0	0	0	7/5/2009	1.00	1.75	0.25	-0.25	-0.5	0
25/5/2000	3.75	4.75	2.75	0	0	0	4/6/2009	1.00	1.75	0.25	0	0	0
8/6/2000	4.25	5.25	3.25	0.5	0.50	0.50	2/7/2009	1.00	1.75	0.25	0	0	0
21/6/2000	4.25	5.25	3.25	0	0	0	6/8/2009	1.00	1.75	0.25	0	0	0
6/7/2000	4.25	5.25	3.25	0	0	0	3/9/2009	1.00	1.75	0.25	0	0	0
20/7/2000	4.25	5.25	3.25	0	0	0	8/10/2009	1.00	1.75	0.25	0	0	0
3/8/2000	4.25	5.25	3.25	0	0	0	5/11/2009	1.00	1.75	0.25	0	0	0
31/8/2000	4.50	5.50	3.50	0.25	0.25	0.25	3/12/2009	1.00	1.75	0.25	0	0	0
14/9/2000	4.50	5.50	3.50	0	0	0	14/1/2010	1.00	1.75	0.25	0	0	0
5/10/2000	4.75	5.75	3.75	0.25	0.25	0.25	4/2/2010	1.00	1.75	0.25	0	0	0
19/10/2000	4.75	5.75	3.75	0	0	0	4/3/2010	1.00	1.75	0.25	0	0	0
2/11/2000	4.75	5.75	3.75	0	0	0	8/4/2010	1.00	1.75	0.25	0	0	0
16/11/2000	4.75	5.75	3.75	0	0	0	6/5/2010	1.00	1.75	0.25	0	0	0
30/11/2000	4.75	5.75	3.75	0	0	0	10/6/2010	1.00	1.75	0.25	0	0	0
14/12/2000	4.75	5.75	3.75	0	0	0	8/7/2010	1.00	1.75	0.25	0	0	0
4/1/2001	4.75	5.75	3.75	0	0	0	5/8/2010	1.00	1.75	0.25	0	0	0
18/1/2001	4.75	5.75	3.75	0	0	0	2/9/2010	1.00	1.75	0.25	0	0	0
1/2/2001	4.75	5.75	3.75	0	0	0	7/10/2010	1.00	1.75	0.25	0	0	0
15/2/2001	4.75	5.75	3.75	0	0	0	4/11/2010	1.00	1.75	0.25	0	0	0
1/3/2001	4.75	5.75	3.75	0	0	0	2/12/2010	1.00	1.75	0.25	0	0	0
15/3/2001	4.75	5.75	3.75	0	0	0	13/1/2011	1.00	1.75	0.25	0	0	0
29/3/2001	4.75	5.75	3.75	0	0	0	3/2/2011	1.00	1.75	0.25	0	0	0
11/4/2001	4.75	5.75	3.75	0	0	0	3/3/2011	1.00	1.75	0.25	0	0	0
26/4/2001	4.75	5.75	3.75	0	0	0	7/4/2011	1.25	2.00	0.50	0.25	0.25	0.25
10/5/2001	4.50	5.50	3.50	-0.25	-0.25	-0.25	5/5/2011	1.25	2.00	0.50	0	0	0
23/5/2001	4.50	5.50	3.50	0	0	0	9/6/2011	1.25	2.00	0.50	0	0	0
7/6/2001	4.50	5.50	3.50	0	0	0	7/7/2011	1.50	2.25	0.75	0.25	0.25	0.25
21/6/2001	4.50	5.50	3.50	0	0	0	4/8/2011	1.50	2.25	0.75	0	0	0
5/7/2001	4.50	5.50	3.50	0	0	0	8/9/2011	1.50	2.25	0.75	0	0	0
19/7/2001	4.50	5.50	3.50	0	0	0	6/10/2011	1.50	2.25	0.75	0	0	0
2/8/2001	4.50	5.50	3.50	0	0	0	3/11/2011	1.25	2.00	0.50	-0.25	-0.25	-0.25
30/8/2001	4.25	5.25	3.25	-0.25	-0.25	-0.25	8/12/2011	1.00	1.75	0.25	-0.25	-0.25	-0.25
13/9/2001	4.25	5.25	3.25	0	0	0	12/1/2012	1.00	1.75	0.25	0	0	0
17/9/2001	3.75	4.75	2.75	-0.5	-0.5	-0.5	9/2/2012	1.00	1.75	0.25	0	0	0
27/9/2001	3.75	4.75	2.75	0	0	0	8/3/2012	1.00	1.75	0.25	0	0	0
11/10/2001	3.75	4.75	2.75	0	0	0	4/4/2012	1.00	1.75	0.25	0	0	0
25/10/2001	3.75	4.75	2.75	0	0	0	3/5/2012	1.00	1.75	0.25	0	0	0
8/11/2001	3.25	4.25	2.25	-0.5	-0.5	-0.5	6/6/2012	1.00	1.75	0.25	0	0	0
6/12/2001	3.25	4.25	2.25	0	0	0	5/7/2012	0.75	1.50	0.00	-0.25	-0.25	-0.25
3/1/2002	3.25	4.25	2.25	0	0	0	2/8/2012	0.75	1.50	0.00	0	0	0
7/2/2002	3.25	4.25	2.25	0	0	0	6/9/2012	0.75	1.50	0.00	0	0	0
7/3/2002	3.25	4.25	2.25	0	0	0	4/10/2012	0.75	1.50	0.00	0	0	0
4/4/2002	3.25	4.25	2.25	0	0	0	8/11/2012	0.75	1.50	0.00	0	0	0
2/5/2002	3.25	4.25	2.25	0	0	0	6/12/2012	0.75	1.50	0.00	0	0	0
6/6/2002	3.25	4.25	2.25	0	0	0	10/1/2013	0.75	1.50	0.00	0	0	0
4/7/2002	3.25	4.25	2.25	0	0	0	7/2/2013	0.75	1.50	0.00	0	0	0
1/8/2002	3.25	4.25	2.25	0	0	0	7/3/2013	0.75	1.50	0.00	0	0	0

12/9/2002	3.25	4.25	2.25	0	0	0	4/4/2013	0.75	1.50	0.00	-0.25	-0.5	0
10/10/2002	3.25	4.25	2.25	0	0	0	2/5/2013	0.50	1.00	0.00	0	0	0
7/11/2002	3.25	4.25	2.25	0	0	0	6/6/2013	0.50	1.00	0.00	0	0	0
5/12/2002	2.75	3.75	1.75	-0.5	-0.5	-0.5	4/7/2013	0.50	1.00	0.00	0	0	0
9/1/2003	2.75	3.75	1.75	0	0	0	1/8/2013	0.50	1.00	0.00	0	0	0
6/2/2003	2.75	3.75	1.75	0	0	0	5/9/2013	0.50	1.00	0.00	0	0	0
6/3/2003	2.50	3.50	1.50	-0.25	-0.25	-0.25	2/10/2013	0.50	1.00	0.00	0	0	0
3/4/2003	2.50	3.50	1.50	0	0	0	7/11/2013	0.25	0.75	0.00	-0.25	-0.25	0
8/5/2003	2.50	3.50	1.50	0	0	0	5/12/2013	0.25	0.75	0.00	0	0	0
5/6/2003	2.00	3.00	1.00	-0.5	-0.5	-0.5	9/1/2014	0.25	0.75	0.00	0	0	0
10/7/2003	2.00	3.00	1.00	0	0	0	6/2/2014	0.25	0.75	0.00	0	0	0
31/7/2003	2.00	3.00	1.00	0	0	0	6/3/2014	0.25	0.75	0.00	0	0	0
4/9/2003	2.00	3.00	1.00	0	0	0	3/4/2014	0.25	0.75	0.00	0	0	0
2/10/2003	2.00	3.00	1.00	0	0	0	8/5/2014	0.25	0.75	0.00	0	0	0
6/11/2003	2.00	3.00	1.00	0	0	0	5/6/2014	0.15	0.40	-0.10	-0.1	-0.35	-0.1
4/12/2003	2.00	3.00	1.00	0	0	0	3/7/2014	0.15	0.40	-0.10	0	0	0
8/1/2004	2.00	3.00	1.00	0	0	0	7/8/2014	0.15	0.40	-0.10	0	0	0
5/2/2004	2.00	3.00	1.00	0	0	0	4/9/2014	0.05	0.30	-0.20	-0.1	-0.1	-0.1
4/3/2004	2.00	3.00	1.00	0	0	0	2/10/2014	0.05	0.30	-0.20	0	0	0
1/4/2004	2.00	3.00	1.00	0	0	0	6/11/2014	0.05	0.30	-0.20	0	0	0
6/5/2004	2.00	3.00	1.00	0	0	0	4/12/2014	0.05	0.30	-0.20	0	0	0
3/6/2004	2.00	3.00	1.00	0	0	0	22/1/2015	0.05	0.30	-0.20	0	0	0
1/7/2004	2.00	3.00	1.00	0	0	0	5/3/2015	0.05	0.30	-0.20	0	0	0
5/8/2004	2.00	3.00	1.00	0	0	0	15/4/2015	0.05	0.30	-0.20	0	0	0
2/9/2004	2.00	3.00	1.00	0	0	0	3/6/2015	0.05	0.30	-0.20	0	0	0
7/10/2004	2.00	3.00	1.00	0	0	0	16/7/2015	0.05	0.30	-0.20	0	0	0
4/11/2004	2.00	3.00	1.00	0	0	0	3/9/2015	0.05	0.30	-0.20	0	0	0
2/12/2004	2.00	3.00	1.00	0	0	0	22/10/2015	0.05	0.30	-0.20	0	0	0
13/1/2005	2.00	3.00	1.00	0	0	0	3/12/2015	0.05	0.30	-0.30	0	0	-0.1
3/2/2005	2.00	3.00	1.00	0	0	0	21/1/2016	0.05	0.30	-0.30	0	0	0
3/3/2005	2.00	3.00	1.00	0	0	0	10/3/2016	0.00	0.25	-0.40	-0.05	-0.05	-0.1
7/4/2005	2.00	3.00	1.00	0	0	0	21/4/2016	0.00	0.25	-0.40	0	0	0
4/5/2005	2.00	3.00	1.00	0	0	0	2/6/2016	0.00	0.25	-0.40	0	0	0
2/6/2005	2.00	3.00	1.00	0	0	0	21/7/2016	0.00	0.25	-0.40	0	0	0
7/7/2005	2.00	3.00	1.00	0	0	0	8/9/2016	0.00	0.25	-0.40	0	0	0
4/8/2005	2.00	3.00	1.00	0	0	0	20/10/2016	0.00	0.25	-0.40	0	0	0
1/9/2005	2.00	3.00	1.00	0	0	0	8/12/2016	0.00	0.25	-0.40	0	0	0
6/10/2005	2.00	3.00	1.00	0	0	0	19/1/2017	0.00	0.25	-0.40	0	0	0
3/11/2005	2.00	3.00	1.00	0	0	0	9/3/2017	0.00	0.25	-0.40	0	0	0
1/12/2005	2.25	3.25	1.25	0.25	0.25	0.25	27/4/2017	0.00	0.25	-0.40	0	0	0
12/1/2006	2.25	3.25	1.25	0	0	0	8/6/2017	0.00	0.25	-0.40	0	0	0
2/2/2006	2.25	3.25	1.25	0	0	0	20/7/2017	0.00	0.25	-0.40	0	0	0
2/3/2006	2.50	3.50	1.50	0.25	0.25	0.25	7/9/2017	0.00	0.25	-0.40	0	0	0
6/4/2006	2.50	3.50	1.50	0	0	0	26/10/2017	0.00	0.25	-0.40	0	0	0
4/5/2006	2.50	3.50	1.50	0	0	0	14/12/2017	0.00	0.25	-0.40	0	0	0
8/6/2006	2.75	3.75	1.75	0.25	0.25	0.25	25/1/2018	0.00	0.25	-0.40	0	0	0
6/7/2006	2.75	3.75	1.75	0	0	0	8/3/2018	0.00	0.25	-0.40	0	0	0
3/8/2006	3.00	4.00	2.00	0.25	0.25	0.25	26/4/2018	0.00	0.25	-0.40	0	0	0
31/8/2006	3.00	4.00	2.00	0	0	0	14/6/2018	0.00	0.25	-0.40	0	0	0
5/10/2006	3.25	4.25	2.25	0.25	0.25	0.25							
2/11/2006	3.25	4.25	2.25	0	0	0							
7/12/2006	3.50	4.50	2.50	0.25	0.25	0.25							

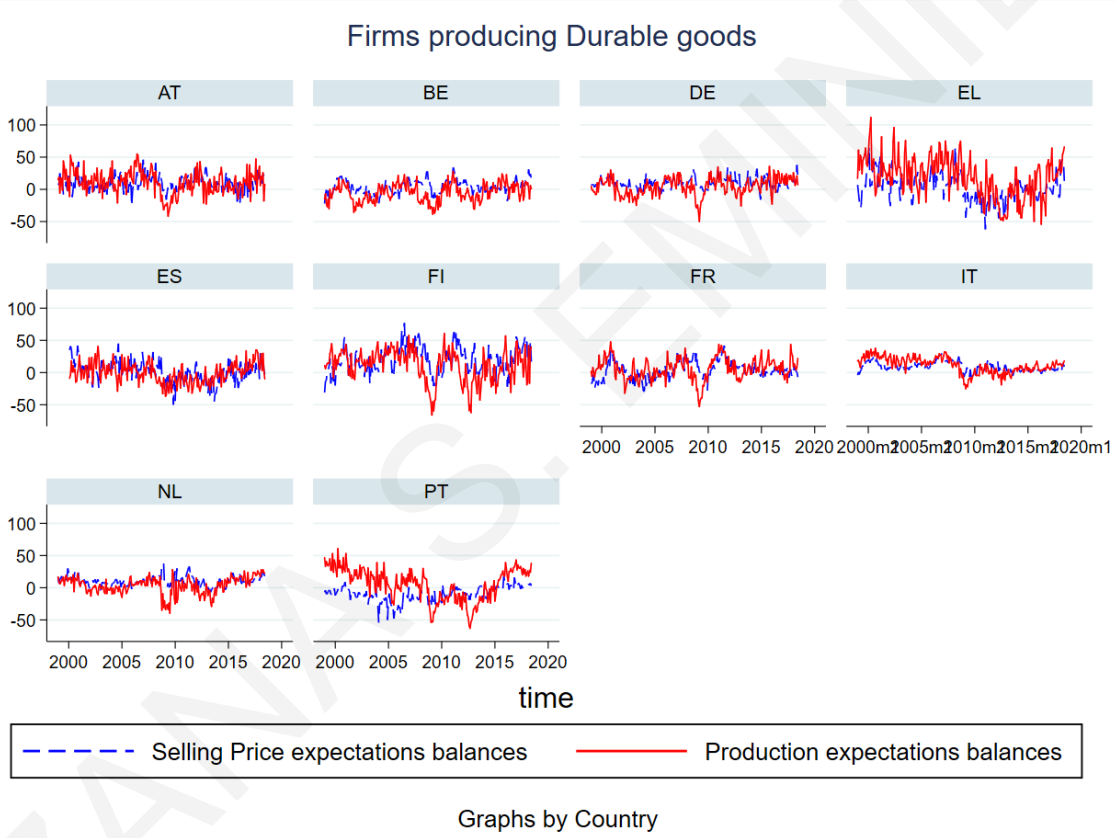
Table B1: Changes in three official ECB's interest rates at Governing Council Meetings.

Figure B1: Selling price and Production expectations balances.



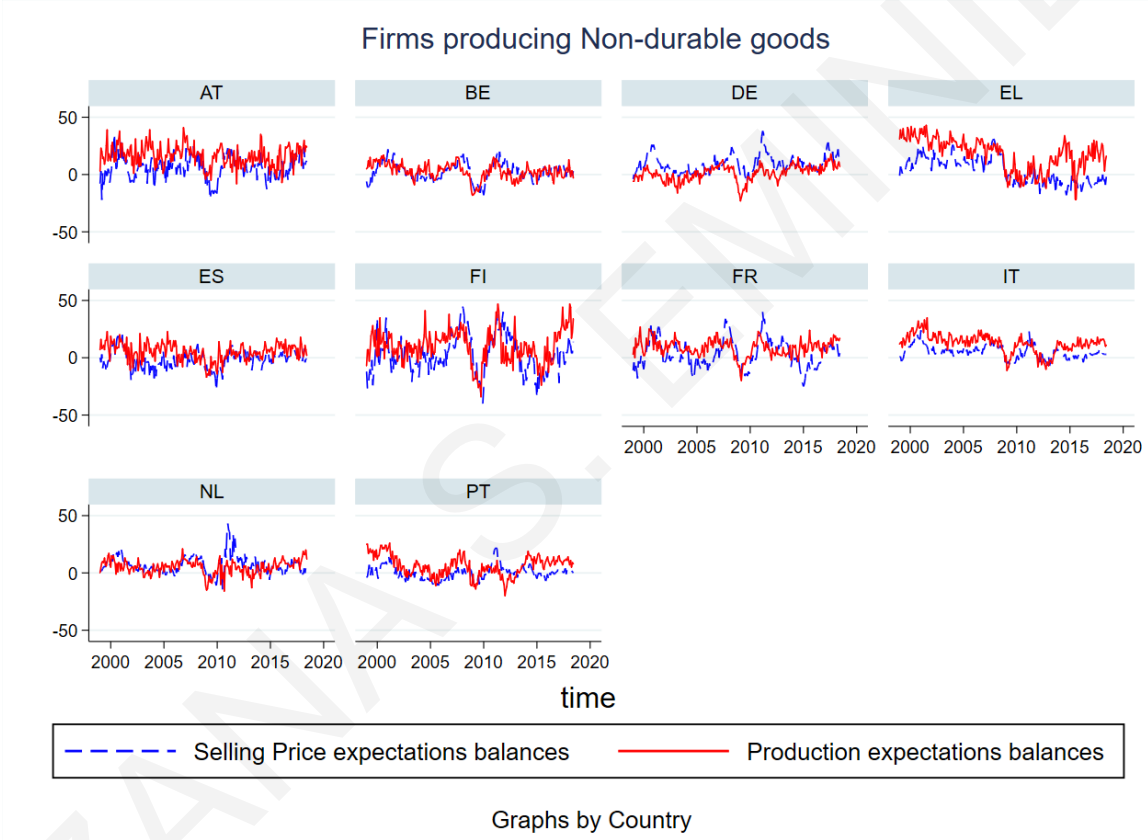
Expectations balances for 10 euro area economies. Countries included are: Austria (AT), Belgium (BE), Germany (DE), Greece (EL), Spain (ES), Finland (FI), France (FR), Italy (IT), the Netherlands (NL) and Portugal (PT).

Figure B2: Selling price and Production expectations balances.



Expectations balances for 10 euro area economies. Countries included are: Austria (AT), Belgium (BE), Germany (DE), Greece (EL), Spain (ES), Finland (FI), France (FR), Italy (IT), the Netherlands (NL) and Portugal (PT).

Figure B3: Selling price and Production expectations balances.



Expectations balances for 10 euro area economies. Countries included are: Austria (AT), Belgium (BE), Germany (DE), Greece (EL), Spain (ES), Finland (FI), France (FR), Italy (IT), the Netherlands (NL) and Portugal (PT).

Figure B4: Selling price expectations' responses to interest rate hike innovation for firms producing durable goods.

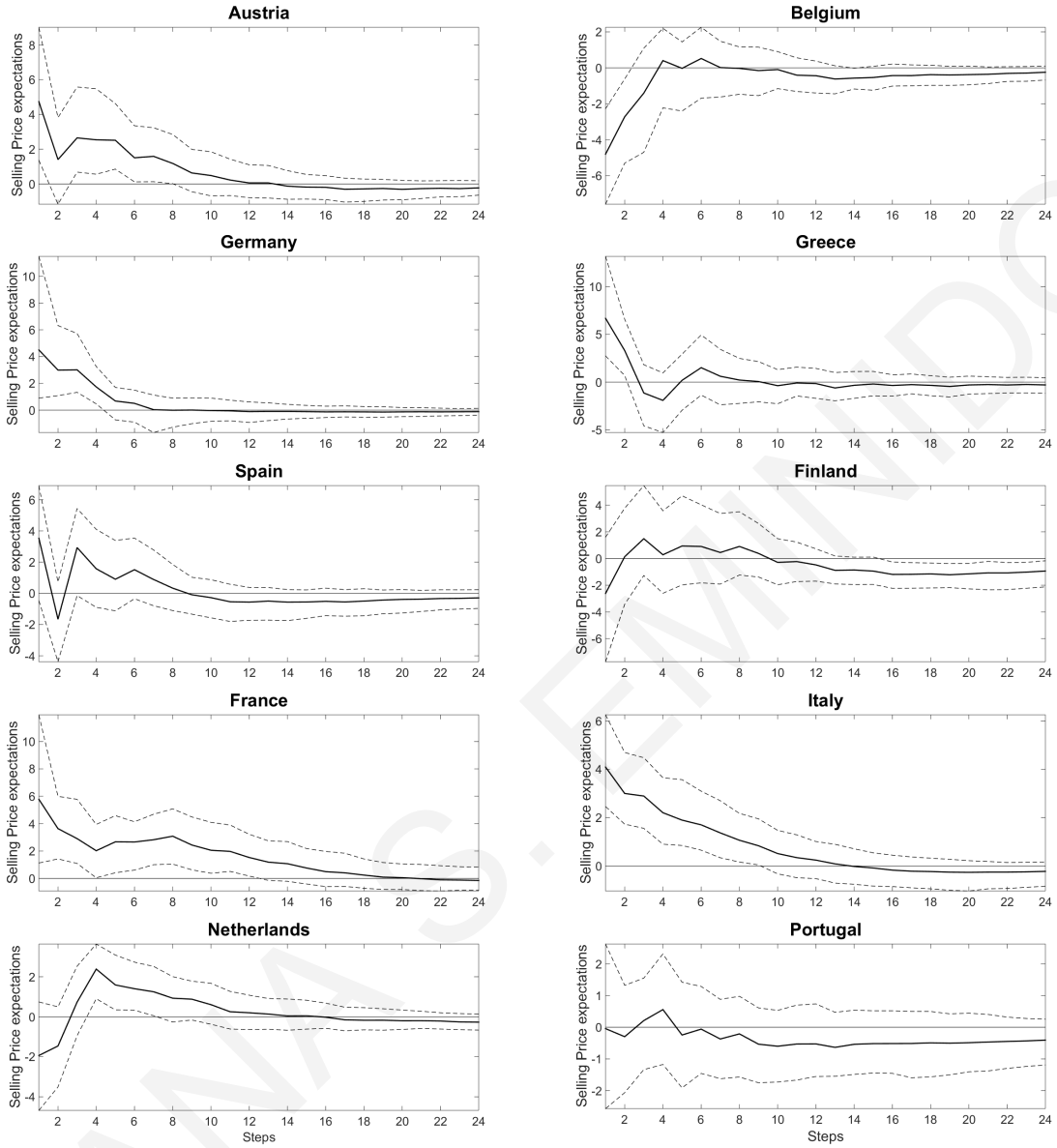


Figure B5: Selling price expectations' responses to M1 expansion for firms producing durable goods.

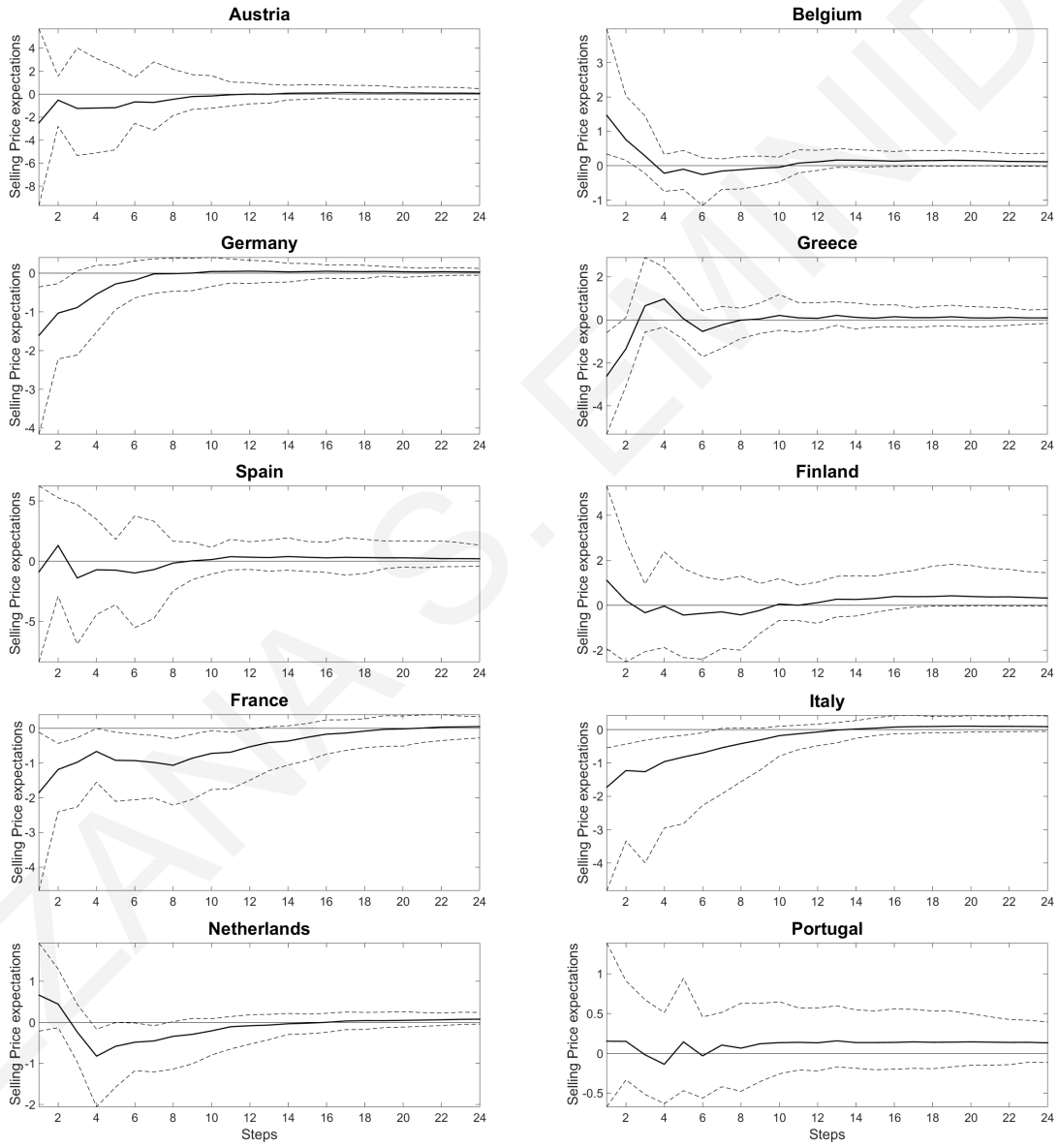


Figure B6: Production expectations' responses to interest rate hike innovation for firms producing durable goods.

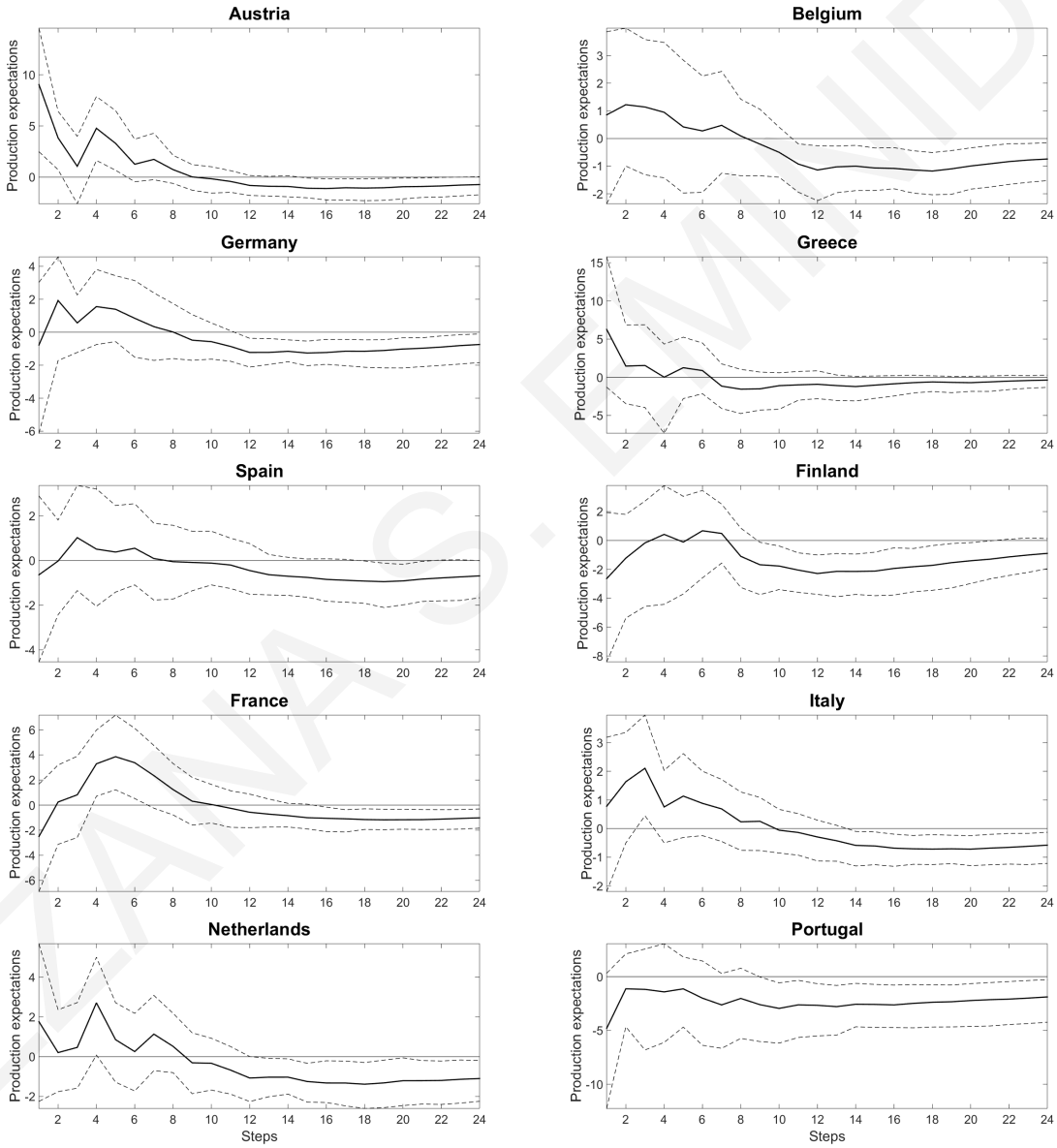


Figure B7: Production expectations' responses to M1 expansion for firms producing durable goods.

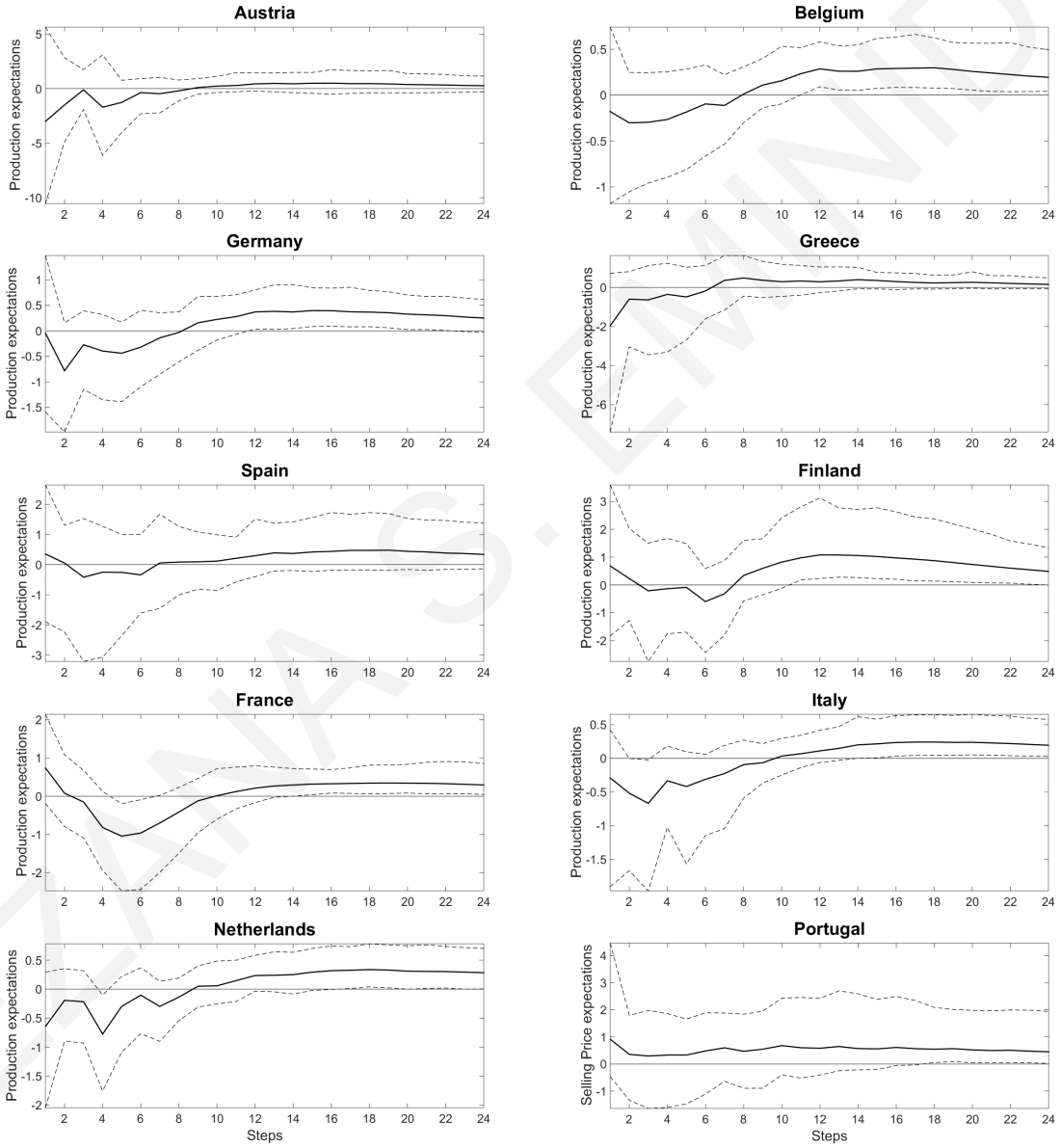


Figure B8: Selling price expectations' responses to interest rate hike innovation for firms producing non-durable goods.

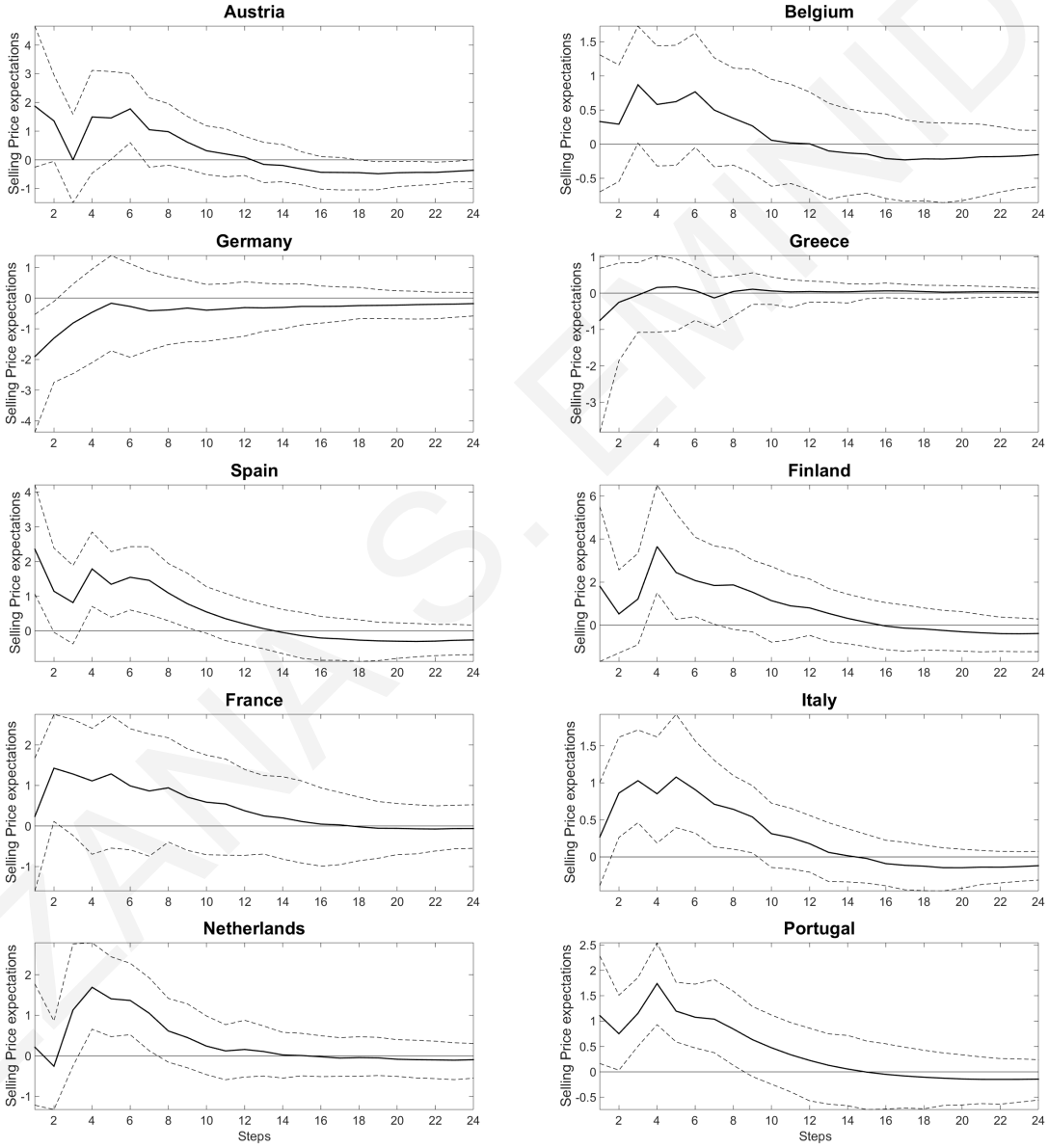


Figure B9: Selling price expectations' responses to M1 expansion for firms producing non-durable goods.

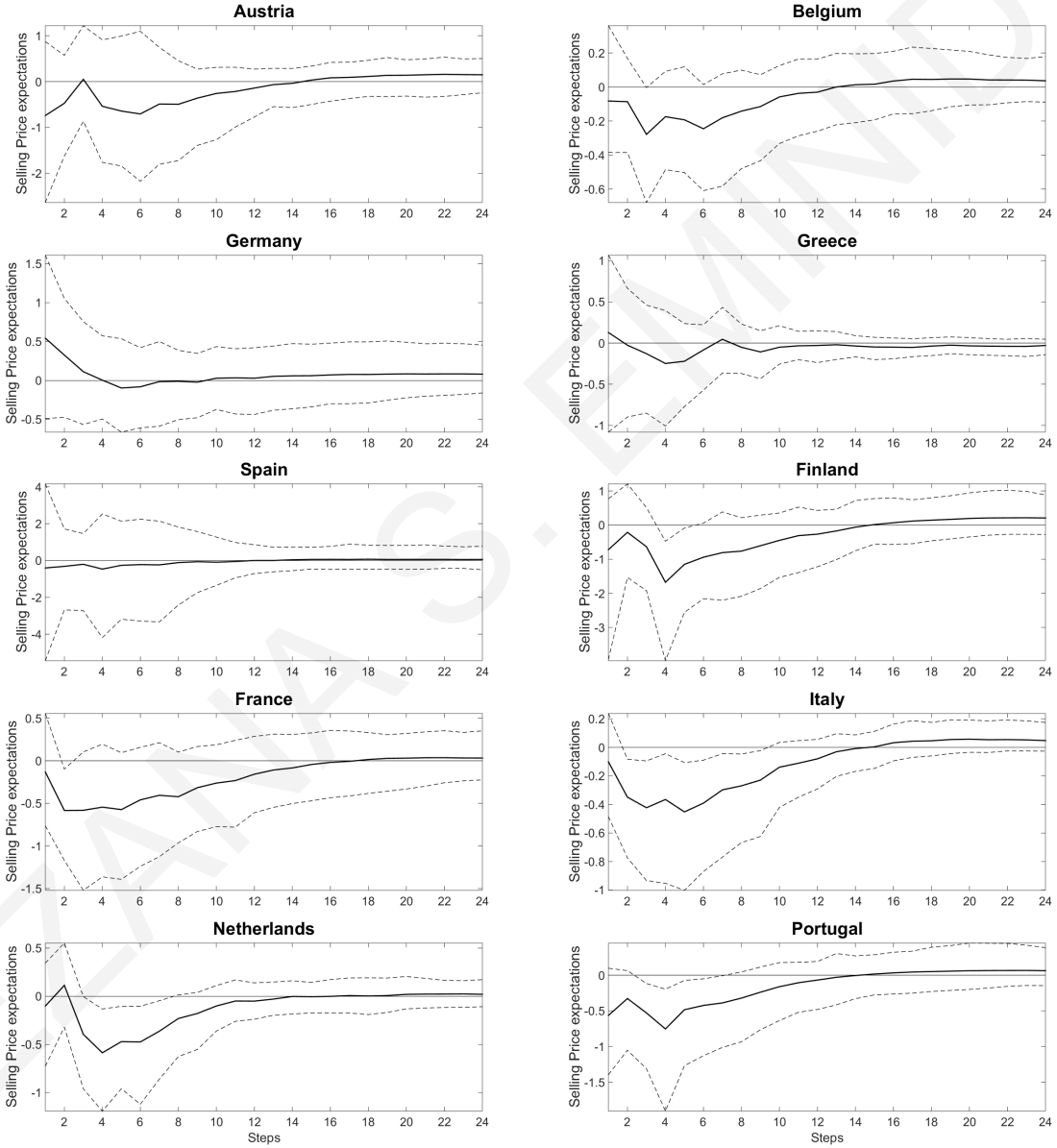


Figure B10: Production expectations' responses to interest rate hike innovation for firms producing non-durable goods.

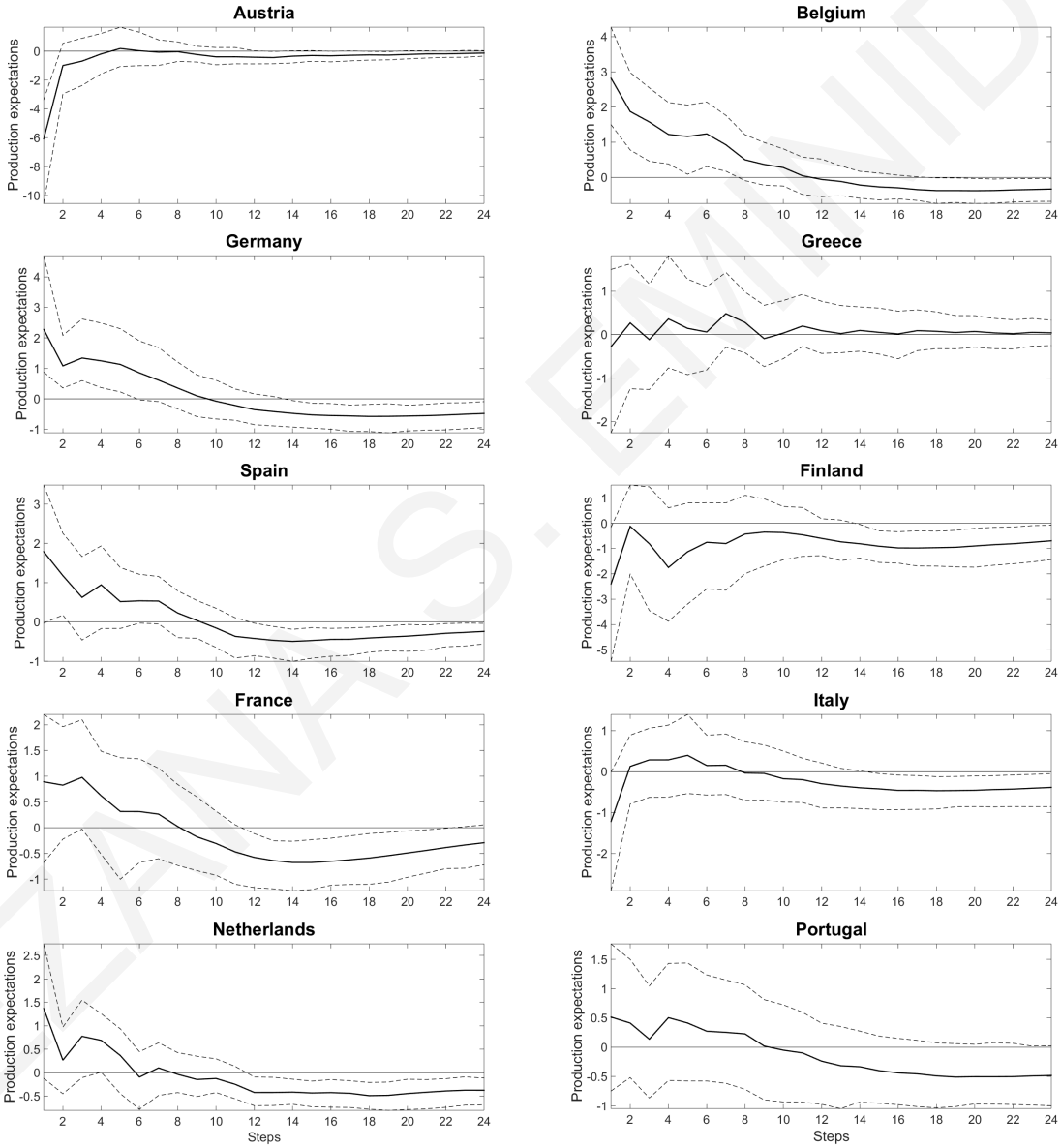
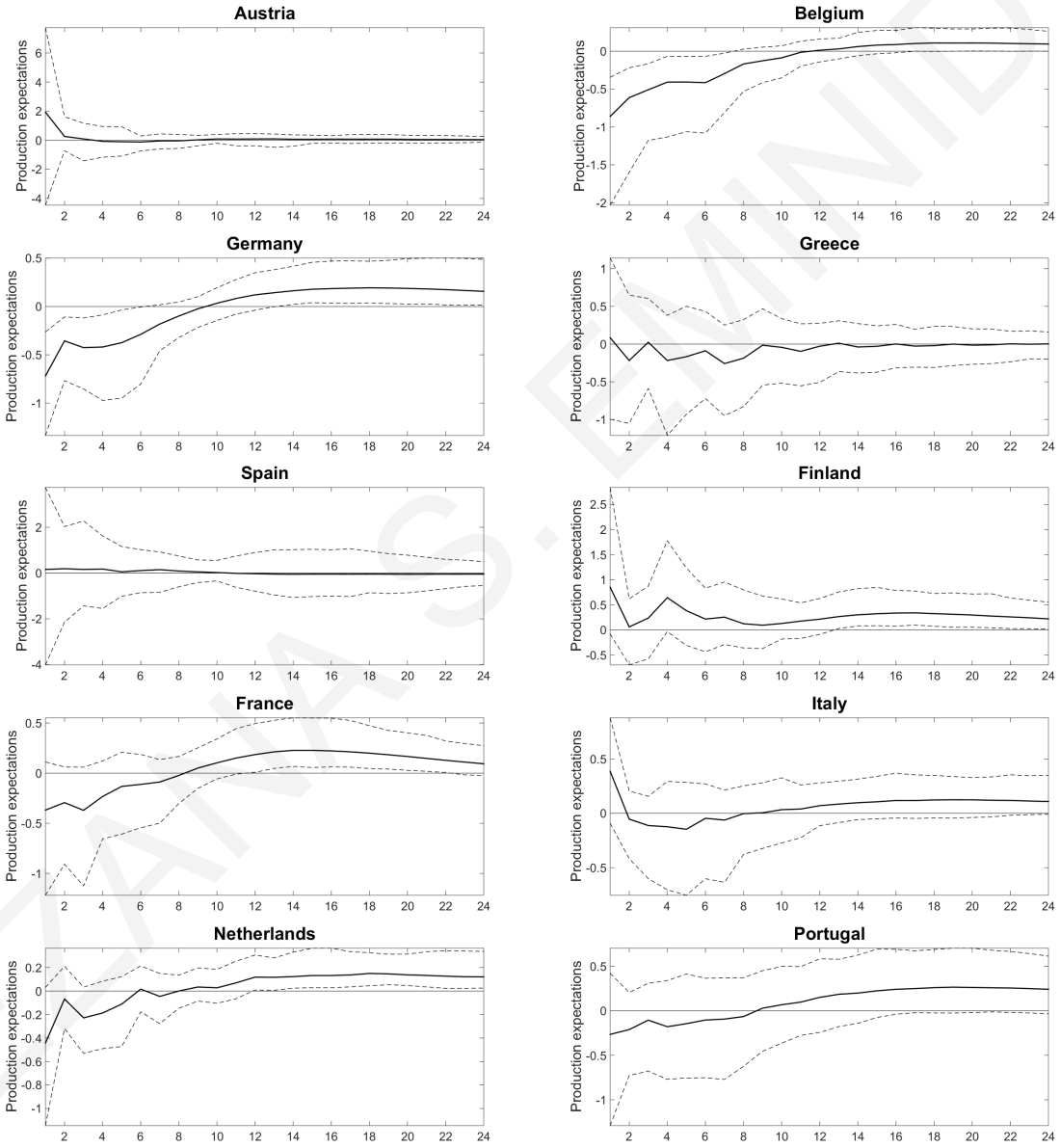


Figure B11: Production expectations' responses to M1 expansion for firms producing non-durable goods.



.3 Appendix C

Table C1: Changes in the federal funds rate around FOMC meetings (Δ ff) and level of the federal funds rate before any changes made in meeting m (ff_b)

Announcement day	**(Δ ff)**	**(ff_b)**	**Announcement day**	**(Δ ff)**	**ff_b**	**Announcement day**	**(Δ ff)**	**(ff_b)**
31/1/2006	0.25	4.25	26/1/2011	0	0.125	27/1/2016	0	0.375
28/3/2006	0.25	4.5	15/3/2011	0	0.125	16/3/2016	0	0.375
10/5/2006	0.25	4.75	27/4/2011	0	0.125	27/4/2016	0	0.375
29/6/2006	0.25	5	22/6/2011	0	0.125	15/6/2016	0	0.375
8/8/2006	0	5.25	9/8/2011	0	0.125	27/7/2016	0	0.375
20/9/2006	0	5.25	21/9/2011	0	0.125	21/9/2016	0	0.375
25/10/2006	0	5.25	2/11/2011	0	0.125	2/11/2016	0	0.375
12/12/2006	0	5.25	13/12/2011	0	0.125	14/12/2016	0.25	0.375
31/1/2007	0	5.25	25/1/2012	0	0.125	31/1/2017	0	0.625
21/3/2007	0	5.25	13/3/2012	0	0.125	15/3/2017	0.25	0.625
9/5/2007	0	5.25	25/4/2012	0	0.125	3/5/2017	0	0.875
28/6/2007	0	5.25	20/6/2012	0	0.125	14/6/2017	0.25	0.875
7/8/2007	0	5.25	1/8/2012	0	0.125	26/7/2017	0	1.125
18/9/2007	-0.5	5.25	13/9/2012	0	0.125	20/9/2017	0	1.125
31/10/2007	-0.25	4.75	24/10/2012	0	0.125	1/11/2017	0	1.125
11/12/2007	-0.25	4.5	12/12/2012	0	0.125	13/12/2017	0.25	1.125
21/1/2008	-0.75	4.25	30/1/2013	0	0.125	31/1/2018	0	1.375
30/1/2008	-0.5	3.5	20/3/2013	0	0.125	21/3/2018	0.25	1.375
18/3/2008	-0.75	3	1/5/2013	0	0.125	2/5/2018	0	1.625
30/4/2008	-0.25	2.25	19/6/2013	0	0.125	13/6/2018	0.25	1.625
25/6/2008	0	2	31/7/2013	0	0.125	1/8/2018	0	1.875
5/8/2008	0	2	18/9/2013	0	0.125	26/9/2018	0.25	1.875
16/9/2008	0	2	30/10/2013	0	0.125	8/11/2018	0	2.125
7/10/2008	-0.5	2	18/12/2013	0	0.125	19/12/2018	0.25	2.125
29/10/2008	-0.5	1.5						
16/12/2008	-0.875	1						
28/1/2009	0	0.125	29/1/2014	0	0.125			
18/3/2009	0	0.125	19/3/2014	0	0.125			
29/4/2009	0	0.125	30/4/2014	0	0.125			
24/6/2009	0	0.125	18/6/2014	0	0.125			
12/8/2009	0	0.125	30/7/2014	0	0.125			
23/9/2009	0	0.125	17/9/2014	0	0.125			
4/11/2009	0	0.125	29/10/2014	0	0.125			
16/12/2009	0	0.125	17/12/2014	0	0.125			
27/1/2010	0	0.125	28/1/2015	0	0.125			
16/3/2010	0	0.125	18/3/2015	0	0.125			
28/4/2010	0	0.125	29/4/2015	0	0.125			
23/6/2010	0	0.125	17/6/2015	0	0.125			
10/8/2010	0	0.125	29/7/2015	0	0.125			
21/9/2010	0	0.125	17/9/2015	0	0.125			
3/11/2010	0	0.125	28/10/2015	0	0.125			
14/12/2010	0	0.125	16/12/2015	0.25	0.125			