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vorgelegt von

M.A., Marburg Universität, 2012

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aus Ägypten

Juni, 2019

Dedicated to

My mother, Karima.

My wife, Salma.

My daughters, Amina and Malika.

Erstgutachter:	Prof. Dr. Dieter Nautz
	Professur für Ökonometrie, Freie Universität Berlin.
Zweitgutachter:	Prof. Dr. Lars Winkelmann
	Professur für Empirische Makroökonomie, Freie Universität Berlin.

Tag der Disputation: 12. Juli 2019

Danksagung

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Ehrenwörtliche Erklärung

Ich habe die vorgelegte Dissertation selbst verfasst und dabei nur die von mir angegebenen Quellen und Hilfsmittel benutzt. Alle Textstellen, die wörtlich oder sinngemäß aus veröffentlichten oder nicht veröffentlichten Schriften entnommen sind, sowie alle Angaben, die auf mündlichen Auskünften beruhen, sind als solche kenntlich gemacht.

Berlin, den 20. Juni 2019

Eigenanteil der Leistung

Diese Dissertation besteht aus drei Arbeitspapieren, von denen eins in Zusammenarbeit mit meinem Koautor Dieter Nautz entstanden ist. Der Eigenantiel an Konzeption, Durchführung und Berichtsabfassung der Kapital lässt sich folgendermaßen zusammenfassen:

1. Hanoma, Ahmed:

   "Anchoring Inflation Expectations From Below: New Evidence From the European Commission's Consumer Survey",

   Eigenanteil 100%.

2. Hanoma, Ahmed und Nautz, Dieter:

   "The Information Content of Market-Based Measures for the Long-Term Inflation Expectations of Professionals: Evidence from a MIDAS Analysis",

   Eigenanteil 50%.

3. Hanoma, Ahmed:

   "Whither Egypt Monetary Policy? An Analysis of the Post 2005 Progressions",

   Eigenanteil 100%.

Liste der Vorpublikationen

Publikationen in referierten Fachzeitschriften

Ahmed Hanoma and Dieter Nautz. (2019). The Information Content of Market-Based Measures for the Long-Term Inflation Expectations of Professionals: Evidence from a MIDAS Analysis, Applied Economics. https://doi.org/10.1080/00036846.2019.1616071

Vorpublikationen von Kapitel 2

Zusammenfassung

Die drei Kapitel dieser Arbeit beschäftigen sich mit einem gemeinsamen Thema, dem Verständnis der Dynamik von Inflation und Inflationserwartungen. Es folgt eine Zusammenfassung der Resultate der einzelnen Kapitel.

Kapitel 1: Anchoring Inflation Expectations From Below: New Evidence from the European Commission's Consumer Survey

Die Inflationsraten in den Mitgliedsstaaten der Eurozone sind seit der globalen Finanzkrise außergewöhnlich niedrig. Dieses Kapitel untersucht den Effekt dieser Entwicklung auf den Grad der Verankerung von Inflationserwartungen der Konsumenten. Dafür schlagen wir ein neues Verankerungsmaß vor, das auf den aggregierten qualitativen Erwartungen aus der Verbraucherbefragung der Europäischen Kommission beruht. Dieser Indikator offenbart signifikante Heterogenität zwischen den Mitgliedsstaaten der Eurozone. Daher verwenden wir eine Panel Regression, um zu untersuchen, ob die Inflationserwartungen in verschiedenen Inflationsumfeldern unterschiedlich stark verankert sind. Die Ergebnisse zeigen, dass der Grad der Verankerung besonders schwach ist, wenn die Inflation unterhalb des Preisstabilitätsziels der Europäischen Zentral Bank ist. Abweichungen vom Zentralbankziel haben lediglich negative Auswirkungen auf die Verankerung der Konsumentenerwartungen, wenn die Inflation kontinuierlich niedrig ist. Alles deutet darauf hin, dass in

diesem Umfeld der Grad der Verankerung bei Konsumenten zurückgegangen ist.

Kapitel 2: The Information Content of Market-Based Measures for the Long-Term Inflation Expectations of Professionals: Evidence from a MIDAS Analysis

Langfristige Inflationserwartungen aus dem Survey of Professional Forecasters sind eine wichtige Informationsquelle für die Geldpolitik, welche jedoch lediglich quartalsweise veröffentlicht werden. In diesem Kapitel wird der Informationsgehalt von täglich verfügbaren marktbasierten Instrumenten, wie inflationsgebundenen Swaps und Breakeven-Inflationsraten, für das nächste Befragungsergebnis untersucht. Mit einem Mixed Data Sampling Ansatz zeigen wir, dass professionelle Prognostiker die tägliche Dynamik von marktbasierten Instrumenten in ihre langfristigen Inflationserwartungen einfließen lassen. Wir schlagen einen täglichen Indikator für die Erwartungen der professionellen Prognostiker vor, der alternative Indikatoren übertrifft, die die Hochfrequenzdynamik von marktbasierten Instrumenten ignorieren. Diesen neuen Indikator nutzen wir um neue Evidenz für die Verankerung von Inflationserwartungen in den Vereinigten Staaten zu liefern.

Kapitel 3: Whither Egypt Monetary Policy? An Analysis of the Post 2005 Progressions

Ein Blick auf die Literatur zum monetären Konjunkturzyklus Ägyptens offenbart mehrere Anomalien bezüglich der Effektivität, Richtung und Bedeutung verschiedener monetärer Transmissionskanäle, einschließlich der Hauptkanäle über Zinsraten und Wechselkurse. Dieses Kapitel modelliert ägyptische Geldpolitik während der Übergangszeit zum expliziten Inflationsziel und berücksichtigt die ausländische Komponente, welche bisher in der Literatur vernachlässigt wurde. Unser Ergebnis liefert eine Lösung für die in der Literatur

gezeigten Anomalien. Erstens, der dynamische Einfluss von heimischen Zinsraten auf die Inflationsrate ist plausibel und stärker als zuvor. Das ist ein notwendiger Schritt für die Implementierung des neuen Inflationszielregimes der ägyptischen Zentralbank. Zweitens, der Effekt der Wechselkurse auf Makrovariablen ist immer noch genauso stark wie zuvor, obwohl ihre Rolle als nominaler Anker 2003 offiziell gelockert wurde. Drittens, die Auswirkungen von außenpolitischen Schocks auf die heimische Wirtschaft ist nicht geringer als die von innenpolitischen.

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An Overview

This thesis consists of three chapters. A common theme across these chapters is to understand and evaluate the dynamics of inflation and expectations. In the following, the results of the individual chapters are presented.

Chapter 1: Anchoring Inflation Expectations From Below: New Evidence From the European Commission's Consumer Survey

Inflation rates in the euro-area member states have been remarkably low in the aftermath of the global financial crisis. This chapter investigates the effects of this evolution in the inflation environment on the degree of consumers' inflation expectations anchoring. For that, we propose a new anchoring measure based on the aggregate qualitative expectations answers from the European Commission's consumer survey. Our indicator reveals a significant heterogeneity across euro-area countries. Therefore, we employ panel regressions to test the extent to which consumers' expectations are well anchored by comparing across various inflation environments. We find that the degree of anchoring is particularly weak when inflation is below the ECB price stability target. The deviations of inflation from the target only exerts a negative impact on the anchoring degree of consumers' expectations when inflation is low or persistently so. For the European Central Bank, this alerts that the degree of consumers' anchoring has deteriorated in the recent period of low inflation than

was the case when inflation rates were more often around the price stability target across the euro area.

Chapter 2: The Information Content of Market-Based Measures for the Long-Term Inflation Expectations of Professionals: Evidence from a MIDAS Analysis

Long-term inflation expectations taken from the Survey of Professional Forecasters are a major source of information for monetary policy. Unfortunately, they are published only on a quarterly basis. This chapter investigates the daily information content of market-based measures, such as inflation-linked swaps and breakeven inflation rates, for the next survey outcome. Using a Mixed Data Sampling approach, we establish that professional forecasters account for the daily dynamics of market-based measures when they submit their long-term inflation expectations. We propose a daily indicator of professionals' expectations which outperforms alternative indicators that ignore the high-frequency dynamics of market-based measures. To illustrate the usefulness of the new indicator, we provide new evidence on the (re-)anchoring of U.S. inflation expectations.

Chapter 3: Whither Egypt Monetary Policy? An Analysis of the Post 2005 Progressions

A review of the monetary business-cycle literature on Egypt reveals several anomalies with respect to the effectiveness, direction and magnitude, of various monetary transmission mechanisms, such as interest rate and exchange rate. This chapter models Egypt's monetary policy during the transition period to explicit inflation targeting in the last decade while directly consider the foreign component of that policy which has been marginalized in early literature. Our results deliver solutions to the anomalies reported in prior evidence. First,

the dynamic impact of domestic interest rate on inflation rate is now plausible and much stronger than reported before. This is an imperative step forward to implementing inflation-targeting regime proposed by the Central Bank of Egypt. Second, the effects of exchange rate on main macroeconomic variables are still as strong as reported in previous periods despite that the latter was officially relaxed as a nominal anchor since 2003. Third, the leverage of foreign policy shocks on economy is no less than that of domestic shocks.

Chapter 1

Anchoring Inflation Expectations From Below: New Evidence from the European Commission's Consumer Survey

1.1 Introduction

Lifting inflation and inflation expectations up to target is the new monetary policy challenge after the global financial crisis. It is now imperative for central banks in advanced economies to consistently manage inflation expectations to avoid the potential de-anchoring risks from below. Ehrmann (2015) underlines that inflation expectations of professionals in advanced inflation-targeting countries are found to be less anchored if inflation is persistently below the target. By comparing across periods when inflation is below, above, or around target, Ehrmann emphasizes that expectations of professionals are more responsive to past inflation experience, and so de-anchored, when inflation is low. Professionals' inflation expectations get, however, extremely dis-anchored only when inflation is persistently low for several consecutive months. The latter result agrees with the implications of the recent theoretical framework developed by Bianchi and Melosi (2018) on the anti-inflationary determination of monetary policy over time. The authors find that it is only when central banks deviate persistently from conducting active policy, and so inflation deviates from target, that agents' expectations turn dis-anchored as uncertainty cannot then be contained.

The aim of this chapter is to assess whether - and to what extent - inflation expectations of consumers in the euro area are persistently (de)-anchored from below. We advance on Ehrmann (2015) in multiple ways. First, we propose a new indicator for measuring anchoring based on the aggregate qualitative expectations from the European Commission's (EC) Business and Consumer Survey (BCS). With a direct measure at hand, we assess the dependence of consumers' expectations anchoring on deviations of inflation from the target in the spirit of Bianchi and Melosi (2018). Second, unlike the analysis of Ehrmann that relies on the expectations of a limited number of professional forecasters polled by the Consensus Economics, we build our research on the survey by the European Commission that conditions on an extensive base of 30,000 households by whom economic decisions are made. Third, while all countries in the euro area share a common inflation target, each inflation-targeting economy in Ehrmann's sample has its own. Fourth, given the importance recent period for evaluating the anchoring of consumers' inflation expectations from below, we extend the sample of Ehrmann which ends in 2014 by four years.

Recent empirical evidence confirms the usefulness of households inflation expectations from various perspectives. Consumers' expectations are crucial to understand the dynamics of observed inflation, resolve households' spending decisions, and for gauging public's confidence of the central bank. For evaluating the degree of consumers' expectations anchoring, the previous literature has either used individual data (see e.g., Lamla and Draeger (2013) and Easaw et al. (2013)) or macro data (see e.g., Van der Cruijsen and Demertzis (2011) and Łyziak and Paloviita (2017)). The individual qualitative responses of the European Commission's consumer survey have not been, until now, publicly accessible. In the same time, early studies on the euro area had opted for quantifying the aggregate expectations answers. The existing evidence on the benefits of using quantification techniques is yet discouraging, see e.g. Breitung and Schmeling (2013) or Lolić and Sorić (2018). Therefore, we refrain from quantifying survey aggregate qualitative expectations.

Questions of consumer surveys are designed to be qualitative for a purpose. [1] It is early documented in the literature that uncertainty attached to directional price changes given by consumers is much lower than it would be if they were asked to give direct numerical forecasts, see Jonung (1986) and Pesaran and Weale (2006). [2] This result has been confirmed by recent empirical evidence on the euro area which shows that consumers' quantitative expectations, despite being upward biased, are largely consistent with their directional counterparts, see e.g. Biau et al. (2010) and Arioli et al. (2017). [3] Thus, it is not surprising that more than 80% of participating central banks in the survey by the Bank of England and the National Bank of Poland in 2009, see Kokoszczyński and Łyziak (2009), reported using *direct qualitative* inflation expectations measures sourced from non-expert surveys. [4] The participants stated using direct measures of consumer surveys, among other purposes, for evaluating central bank credibility (71%) and for communicating with the public (81%).

[1] There are still some other surveys that question consumers to give direct quantitative expectations, see for instance, the Swedish Household Survey and the New York Fed's Survey of Consumer Expectations.

[2] The finding of this branch of literature is that asking for quantitative expectations might yield more precise but not necessarily more accurate replies, a dilemma known as "the truth elicitation problem", see Łyziak (2010a).

[3] Since 2003, consumers in the BCS have been inquired to give quantitative projections about inflation besides their qualitative replies. Neither aggregate nor anonymized quantitative answers is publicly available.

[4] Interestingly, the share of the surveyed central banks that reported using market-based measures of inflation expectations, such as breakeven inflation rates and inflation swap rates, is even smaller by 12.5%.

The European Commission summarizes aggregate consumers' inflation expectations by an Expectations Balance (EB) which indicates the direction but not the level of expectations. This balance is not designed to measure the degree of expectations anchoring as it also excludes replies that are not relevant for measuring the direction of expectations, such as the do not know answer. We aim to construct an indicator that can directly measure consumers' anchoring by using the aggregate qualitative responses. We propose an anchoring balance that not only duly incorporates all the information related to anchoring that are ignored by the EB but also infers the level of anchoring by comparing consumers' qualitative expectations and the observed inflation. The proposed anchoring balance re-classifies individual response categories of consumers on inflation expectations in relation with actual inflation when it is below, above, or around the target, for each country in the euro area.

Our anchoring indicator reveals sizeable heterogeneity across euro-area countries. Thus, we use panel regressions to assess the degree of consumers' inflation expectations anchoring from below. We examine the dependence of consumers' expectations anchoring on the lagged realized inflation deviations from the target by comparing across three environments, when inflation is around target, persistently low, or persistently high. Our results confirm that consumers' expectations are particularly de-anchored when inflation is below target. It is not only that the degree of anchoring exhibits an overall negative level shift when inflation is low but also that it exclusively and negatively responds to deviations of inflation from the target. The economic significance of the overall impact is substantial, with reductions in the anchoring balance that reach to 20%. These results confirm the findings of Ehrmann (2015) on the anchoring of professionals' inflation expectations. From policy-making prospective, our results alert a recent decline in the anchoring of consumers' expectations compared with earlier periods when inflation was mainly around the target.

The remainder of the chapter is organized as follows. Section 1.2 describes the inflation expectations data. We then propose a new anchoring indicator and discuss its characteristics during the recent period of low inflation. Section 1.3 estimates panel regressions to investigate the dependence of the anchoring indicator on the deviations of inflation from target. Section 1.4 offers some concluding remarks.

1.2 Measuring the Anchoring of Consumers' Inflation Expectations

1.2.1 The European Commission's Business and Consumer Survey

The European Commission's Business and Consumer Survey is widely noted by academics, practitioners, and policy makers. [5] The survey's history is prolonged and dates back to 1985. Our sample is, yet, restricted to start along with the foundation of the European Monetary Union in 1999. The survey has a harmonized methodology across all euro-area countries. [6] Each month, more than 30,000 households in the euro area are interviewed about their next-year expectations of inflation. [7] This is a huge number of forecasters compared to, e.g., the number for the euro-area in a professional survey such as the Consensus Economics (25), or a peer consumer survey like the New York Fed (1200). The forward-looking question on inflation, Q6, is the focus here. Q6, as per tradition in consumer surveys, is phrased with respect to *prices* and not *inflation*, see e.g. the Michigan Survey of Consumers.

Q6: Inflation Expectations

"By comparison with the past 12 months, how do you expect that consumer prices will develop over the next 12 months? They will: (PP) increase more rapidly; (P) increase at the same rate; (E) increase at a slower rate; (M) stay about the same; (MM) fall; (N) don't know."

The mapping between consumer prices and inflation rates is explained by the European Commission and the European Central Bank, see e.g. the ECB Bulletin of May 2007, Łyziak (2010b) or Dias et al. (2010) for more details. Responses of the inflation expectations question, Q6, then read as: (PP) inflation will increase, (P) inflation will be constant, (E) inflation will decrease, (M) inflation will be zero, and (MM) inflation will be negative.

[5] The BCS survey has been extensively used in the previous literature to evaluate the rationality of consumers' expectations, analyse their cross-sectional spending behaviour, and to evaluate monetary policy effectiveness and central bank credibility, see Arioli et al. (2017) for a comprehensive review.

[6] Due to data limitations, Ireland, Cyprus, and Malta are excluded from the analysis. For more details about the survey the reader is invited to visit the following links at the commission's website https://ec.europa.eu/: Individual Questionnaires; Time Series Data; Methodology Manual; Release Dates.

[7] The individual surveys are conducted by computer-assisted telephone interviews (CATI). As exceptions, Germany, Latvia, and Slovakia undertake interviews in a face to face (F2F) setting, Austria combines CATI with online interviews, while Lithuania uses a mixture of CATI, F2F, and web modes.

1.2.2 Measuring Expectations and the Directional Balance

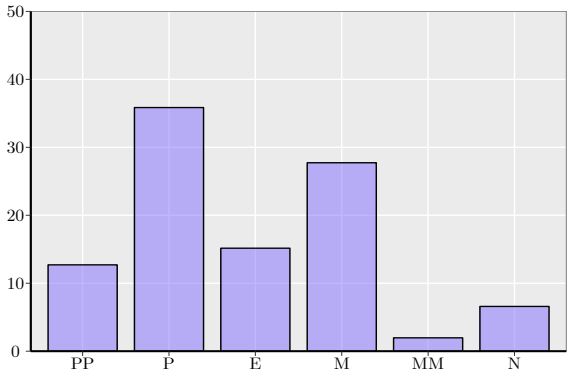
The European Commission summarizes Q6 by an "Expectations Balance" (EB) which measures the difference between the weighted proportion of respondents stating that inflation will increase or stay the same and those expecting that inflation will be zero or negative over the next year. The balance, $EB = (PP + 0.5P) - (MM + 0.5M)$, hence equals -100% when all consumers predict negative inflation and $+100\%$ if they all expect inflation to increase. To distinguish moderate from extreme replies, the commission attributes half the weight given to extreme answers (PP and MM) to less-extreme responses (P and M); while discards the information content of (E and N). Note that the EB provides information on the directional change in expectations irrespective of the level of expected inflation.

Figure 1.1 plots the distribution of Q6 weighted average replies along with the EB for the euro area. Because of their large shares, the (P) and (M) answers, govern the overall trend of the directional balance. The latter can surprisingly well capture the course of future inflation, at times with lag. Table A1.1 depicts large differences in consumers' replies, and thus in the directional balance, all over the euro area. For instance, despite being the most common answer with an average share of 37%, inflation will be constant (P) accounts only for 23% in Italy while it reaches double that value in Austria. The (PP), (M) and (MM) responses exhibit similar patterns of cross-country heterogeneity even though the last is of a trivial magnitude. These differences may be overlooked if we only consider the euro-wide weighted averages when evaluating the degree of anchoring.

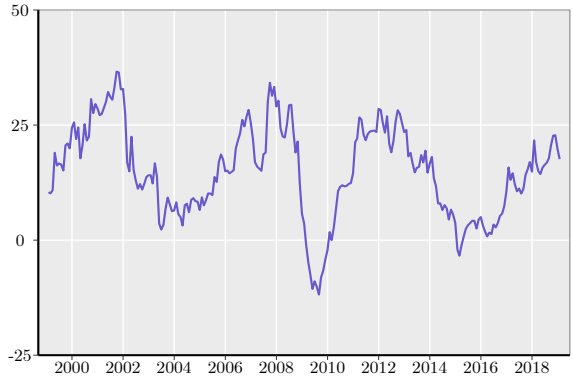
The expectations balance, despite being able to reveal the tendency of expected inflation, is not designed to measure the degree of inflation expectations anchoring. The objective here is to modify the EB to be suitable for measuring the degree anchoring while keep using the aggregate qualitative expectations. We propose an anchoring indicator that has the following features. First, it duly incorporate all the information related to anchoring, such as the do not know answer. Second, it infers the level of anchoring by establishing a connection between the qualitative expectations and observed inflation rates. Third, it is designed to be country-specific to account for possible heterogeneities across the euro area.

Figure 1.1 The Distribution of Q6 Replies and the Expectations Balance in the Euro Area [%]

(a) The Distribution of Question 6 Replies



(b) The Evolution of Expectations Balance



Notes: The aggregate shares represent a weighted average of the individual country replies' based on their relative contribution to the euro-area wide private final consumption expenditure at 2005 prices.
Source: The European Commission's BCS: 1999-01:2019-01.

1.2.3 Measuring Anchoring Using Consumers' Qualitative Expectations

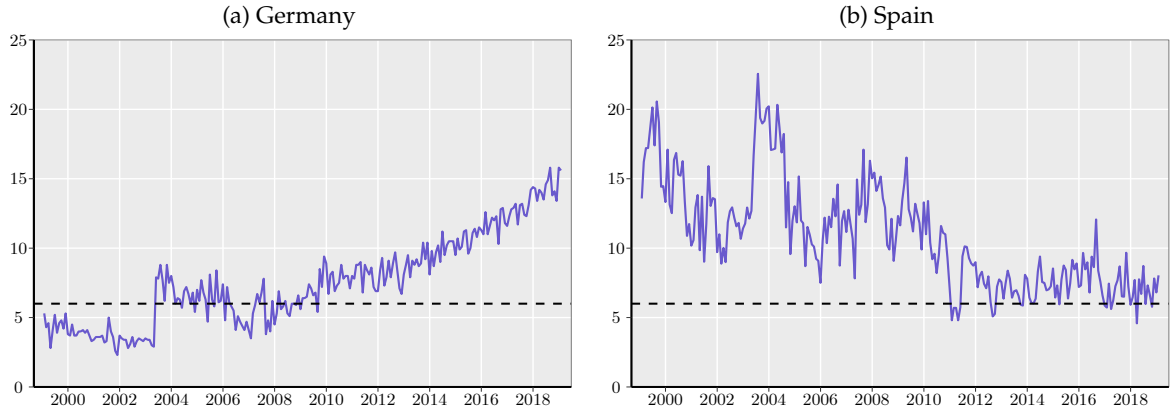
The Importance of the Don't Know Answer for Measuring Anchoring

The information content of the don't know answer (N) is obviously relevant for any statistic indicating the degree of anchoring. In any case, the presence of a non-negligible fraction of consumers who are completely uninformed or unsure about future inflation developments is incompatible with the notion of anchored inflation expectations. The anchoring literature exploits (N) to gauge the degree of consumers' non-informedness, see e.g. Binder (2017). [8] Empirically, (N) is also relevant. In many countries, there are periods where (N) is a large fraction. If expectations are firmly anchored, the segment of (N) should be small and stable. Unfortunately, this is not the case across all countries. As per Figure 1.2a, the share of (N) has persistently elevated by the double over the past 15 years in Germany. [9] In contrast, Figure 1.2b displays a clear downward trend of (N) in Spain after the global economic crisis. Despite differences in level and trend, the share of (N) in both countries still highlights major de-anchoring events, e.g. the cash change-over and the financial crisis.

[8] The author used the don't know share to test whether the Fed communications are transmitted effectively to consumers or not. See also Van der Cruijsen et al. (2015) for the case of Dutch households.

[9] The persistence of the upward trend of (N) in Germany is surprising given that the survey interviews are conducted face to face compared with the computer-assisted telephone interviews in Spain.

Figure 1.2 The Share of Don't Know Answer (N) in Selected Countries [%]



Notes: The horizontal dashed line signifies the overall average share of (N) across countries and over time.
Source: The European Commission's BCS: 1999-01:2019-01.

For Anchoring, Q6-Replies Must Depend on the Inflation Regime

It can be shown that the directional balance does not infer the level of inflation expectations. The same value of the balance can be assigned to two distinct levels of inflation. Establishing a link between the qualitative expectations and observed inflation is hence a prerequisite for measuring anchoring. The inflation will decrease (E) answer, which is also excluded by the directional balance, provides an interesting example. To illustrate, suppose that inflation is high and consumers expect it to fall that would indicate a re-anchoring while it would suggest a de-anchoring if inflation is already low. This example shows that the interpretation of (E), and similarly all other answers, depends on the prevailing inflation regime. Therefore, Q6 answers have to be regime specific in order to infer the anchoring degree.

The central idea here is to re-classify the reply-categories of the expectations question in relation to consumers' inflation experience over the past 12 months for each country, as per design of Q6. It is clear that the interpretation of inflation will increase (PP), stay constant (P), or will decrease (E) responses for anchoring depends on the prevailing inflation regime. Unlike these three answers which may exert a re-anchoring or a de-anchoring impact based on the current inflation episode, expecting that inflation will be negative (MM), zero (M), or don't know (N) is always undesirable through the lens of anchoring.

1.2.4 Toward a Direct Measure of Expectations Anchoring

Defining Inflation Regimes

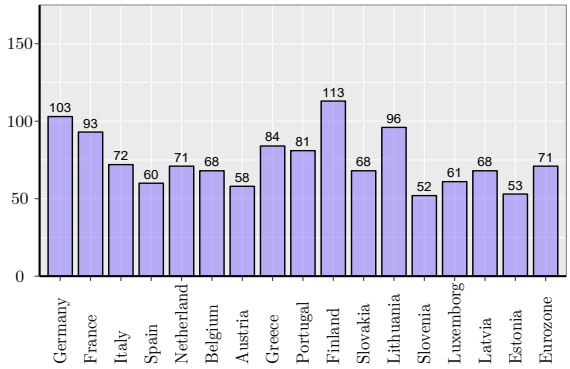
So far we showed that any anchoring measure based on Q6-answers has first to account for all replies, including (E) and (N), and second to compare these answers with the country-specific inflation regimes over the past year. We first define inflation regimes in the euro area. Periods of low and high inflation in the euro area are defined as a deviation by ±0.5 percentage points from the ECB target. The chosen corridor width of 1.4% to 2.4% ensures that there are enough observations in each inflation regime. It also considers that the ECB inflation target of below but close to 2% is the same for all euro-area member states. Ehrmann (2015) had to define a wider corridor of ±1 percentage points to account for heterogeneity of inflation dynamics across inflation-targeting countries in his sample.

Out of 3856 observations (16*241), there have been 1201/1135/1520 months in the euro area where inflation is below, within, or above corridor. The distribution of inflation across various regimes show interesting variability across countries. In the time where inflation in Austria has mainly stayed within corridor for 142 out of 241 months, inflation in Finland and Estonia has for the majority of time been below (113) and above (173) corridor, respectively. Over time, many countries have experienced extended periods of low inflation since 2009. These periods are, however, not necessarily simultaneous across all euro-area members and are also not exclusively restricted to the phase after the financial crisis.

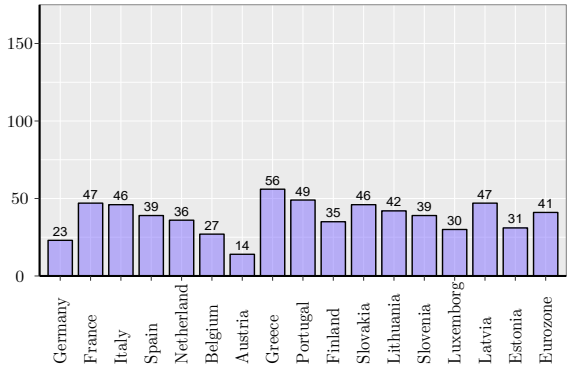
In the aftermath of the financial crisis, inflation rates in the euro-area countries have not only become lower but also more persistent. Figure 1.3c counts the number of months where inflation has been below target zone since 2009. The fraction of months where inflation has been below corridor surged from 30% of the total sample to 50% in the sample's second half. Greece, Portugal and Italy are three extreme cases, where inflation has been below corridor in 83, 79, and 71 out of 121 months, respectively. Moreover, inflation has been low for long. Figure 1.3b counts the number of months for which inflation has persistently been below corridor since 1999. With exception of Finland, Figure 1.3b barely changes if we restrict the sample to start in 2009. A similar pattern cannot be found for high inflation.

Figure 1.3 A New Challenge: The Era of Low Inflation in the Euro-Area Countries

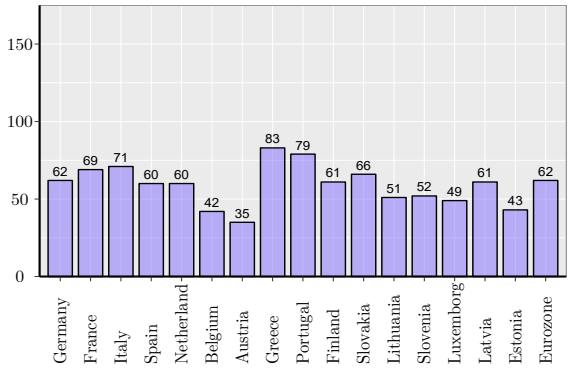
(a) Number of Months with Inflation Below Corridor
1999-01 : 2019-01



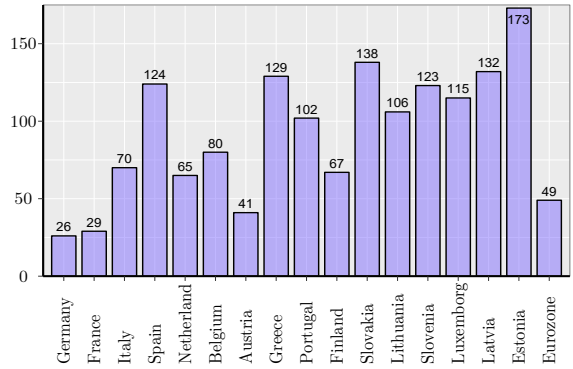
(b) Maximum Number of Consecutive Months with Inflation Below Corridor
1999-01 : 2019-01



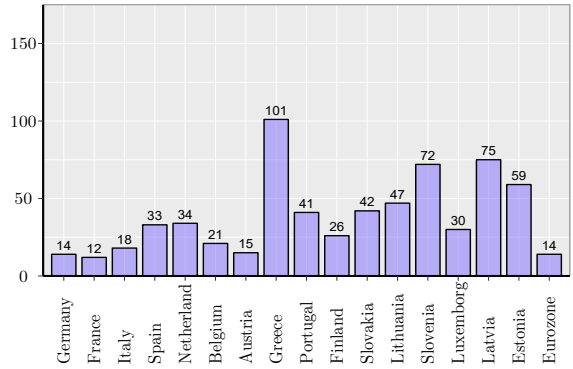
(c) Number of Months with Inflation Below Corridor
2009-01 : 2019-01



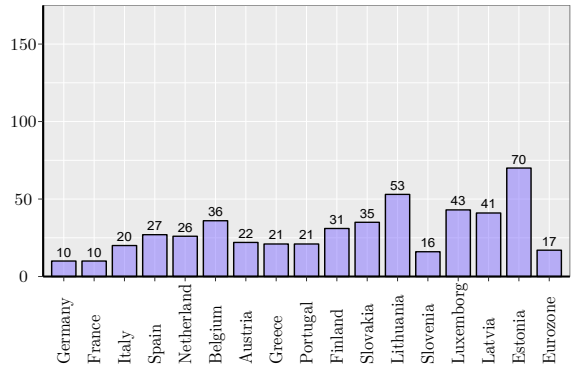
(d) Number of Months with Inflation Above Corridor
1999-01 : 2019-01



(e) Maximum Number of Consecutive Months with Inflation Above Corridor
1999-01 : 2019-01



(f) Number of Months with Inflation Above Corridor
2009-01 : 2019-01



Notes: The figure counts the (maximum) number of months with inflation below (above) defined corridor since 1999 (2009), by country. The figure for the euro area covers the weighted average HICP.
Source: Author's calculations based on Eurostat: 1999-01:2019-01.

Specifying Weighting Scheme

If inflation is above corridor, the first best re-anchoring answer the ECB would expect from consumers is that inflation will decrease (E). Yet, consumers anticipating that inflation will not further increase (P) may be adequate given the persistence of inflation across the euro area. The transition to negative (MM) or even higher (PP) inflation is a clear de-anchoring sign while moving from too high (+2.4%) to zero inflation (M) is also not desirable. In the spirit of the EB, we attribute half the weight given to the most-favourable answer to the less-supportive replies from an anchoring prospective. Accordingly, if everybody would answer (E) when inflation is high, anchoring would be optimal. Although current inflation does not meet the target, all consumers expect inflation to revert to the corridor.

When inflation is below corridor, affirming that future inflation will increase again (PP) is the re-anchoring reply the ECB would like to hear from consumers. Still, predicting that inflation will not further deteriorate (P) might imply a stabilizing behaviour. Expecting that inflation will decrease (E), be zero (M), or even negative (MM) is an obvious pattern of de-anchoring. Consumers' expectations would be perfectly re-anchored if they all would agree on answer (PP) when inflation is relatively low. However, a complete de-anchoring is settled if expectations coincide on a negative future inflation (MM). Answer (P) represents a midway when expectations are not shortly heading to re- or de-anchoring.

Not leaving the corridor in the future (P) **if inflation is already around the ECB target**, would be ultimate for expectations anchoring. Going up (PP) or down (E) for a little would be also useful if inflation lies in the lower or the upper half of the corridor. Expecting that inflation will hit the zero level (M) or will be even negative (MM) would imply extreme de-anchoring given that inflation is already around target. In this regime, not only expectations will remain anchored if consumers reply by (P) but also inflation is currently well anchored. Across all inflation regimes, expectations might also be dis-anchored not because consumers do not respond in a favourable way but for the reason that they are entirely non-informed. In the worst case scenario, expectations would be completely de-anchored if all consumers declared their non-informedness about future inflation developments.

Table 1.1 The Baseline Specification of the Anchoring Balance

Inflation Episode	Anchoring Indicator
$\pi_{MA} > 2.4\%$	$(-1.0\ PP + 0.5\ P + 1.0\ \mathbf{E} - 0.5\ M - 1.0\ MM - 1.0\ N)$
$1.9\% < \pi_{MA} \leq 2.4\%$	$(-0.5\ PP + 1.0\ \mathbf{P} + 0.5\ E - 0.5\ M - 1.0\ MM - 1.0\ N)$
$1.4\% \leq \pi_{MA} \leq 1.9\%$	$(+0.5\ PP + 1.0\ \mathbf{P} - 0.5\ E - 0.5\ M - 1.0\ MM - 1.0\ N)$
$\pi_{MA} < 1.4\%$	$(+1.0\ \mathbf{PP} + 0.5\ P - 1.0\ E - 0.5\ M - 1.0\ MM - 1.0\ N)$

Notes: π_{MA} is the moving average country-specific year-on-year inflation rates over the past twelve months. In the baseline specification, 1.4% and 2.4% represent the lower and the upper boundaries of the corridor regime which is centred around the euro-area common target of below but close to 2.0%. The responses of the forward-looking question on inflation expectations read as follows: (PP) inflation will increase, (P) inflation will be constant, (E) inflation will decrease, (M) inflation will be zero, (MM) inflation will be negative, while (N) don't know. Compare Section 1.2.1.

Table 1.1 sums up the main specification of the proposed anchoring balance. In the spirit of the directional balance we weight each answer based on how likely it will be consistent with the prospective (re-)anchoring direction of expectations relative to prevailing inflation. Accordingly, the weights do not have to add up to the same total across all inflation regimes. We also establish lower and upper corridor areas around the ECB target. This specification not only provides a fine symmetry between qualitative expectations responses and inflation episodes but also generates a smooth transition across various inflation regimes. [10]

Expecting that inflation will increase (PP), stay constant (P), or decrease (E) are not only obvious (re)-anchoring replies if inflation is below, within, or above corridor but also the largest replies that might govern the value of any anchoring statistic. Similarly, negative inflation (MM) and don't know (N) are clear cut responses but from the de-anchoring side. Therefore, it is not so important how to weight (MM) as it has a marginal empirical value in any case. What remains is to check the robustness of our main results for two natural variants of (M) "all over the regimes" and (P) "if outside corridor" replies, see Table A1.2 in the appendix for details. These two variants can be seen as lower and upper bounds of the baseline balance. Despite that the weights are chosen in a simple way, in the spirit of the EB, they are plausible. The reader is invited to choose the weights in a different way.

[10] Alternatively, one may merge the upper and the lower regions of corridor into a single regime. Specifying the weights for answers (PP) and (E) is then hard, as both of them has to take the same weight, which is somehow a strict assumption. In any case, the results of this alternative are similar.

1.2.5 Anchoring Balance Stylized Facts

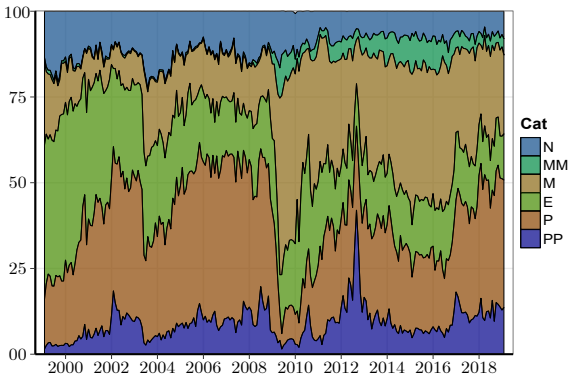
Unlike the expectations balance, our proposed Anchoring Balance (AB) can directly measure the level of anchoring by combining directional expectations with inflation experience of consumers *relative to the target*: the larger the balance value the better the anchoring degree. If positive, the AB reveals that a greater share of consumers are expecting inflation to stay in (or revert again to) the corridor over the next year than those stating that it will leave it and those who are informed. The AB then takes the value of $+100\%$ if expectations are perfectly (re-)anchored around target while it drops to -100% if they are completely de-anchored. By assessing anchoring in real time, our AB is capable of signalling possible changes in the way consumers respond to macroeconomic news or policy announcements.

Figure 1.4 is used as an example to illustrate the broad features of our proposed indicator. First, the distribution of raw answers in Figure 1.4a suggests that consumers have been long divided about the state of anchoring in Spain. The small value of our indicator, that is close to zero on average, has clearly reflected that pattern as per Figure 1.4b. Interestingly, this low balance score not only considers uncertain consumers but also those giving anti-anchoring expectations. Second, the degree of anchoring gets particularly low during major events in the euro area, such as the global financial crisis and the recent period of weak inflation. This seems common across the euro area. Figures A1.2a and A1.2b in the appendix display the complete record of the proposed balance across all euro-area countries.

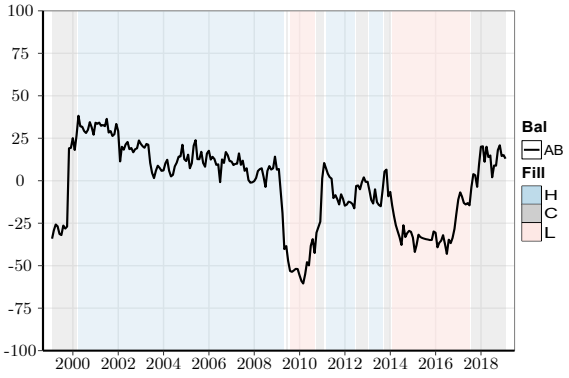
On the impact of the regimes and the weights we find that: First, the changes in the AB result mainly from the variations in survey replies as per Figure 1.4a and not only from the changes in inflation regimes as shown in the background of Figure 1.4b. For instance, the AB had actually declined in early 2009 even before inflation turns low a few months later. This early and persistent decline in the AB came mainly from the sharp increase in the inflation will be zero (M) reply, by triple-fold, and the fact that the negative inflation (MM) reply had turned positive. This all had happened before inflation moved from high to low passing by the corridor regime. Second, as shown in Figures A1.2a and A1.2b, it is the level but not the evolution that differs across the AB baseline, lower, and upper bounds.

Figure 1.4 The Response Shares and the Anchoring Balance in Spain [%]

(a) Distribution of Q6 Responses



(b) Baseline Anchoring Balance



Notes: In Figure 1.4a, the replies of Q6 read as: (PP) inflation will increase, (P) inflation will be constant, (E) inflation will decrease, (M) inflation will be zero, (MM) inflation will be negative, while (N) I don't know. In Figure 1.4b, the black line represents the proposed baseline anchoring balance. The background, takes the red (blue) color if the moving average year-on-year inflation rate over the past twelve months is less (greater) than 1.4% (2.4%) while the color is grey when inflation is in between 1.4% and 2.4%.
Source: Author's calculations based on the European Commission's BCS and Eurostat: 1999-01:2019-01.

After discussing the main characteristics of our anchoring indicator, we now give an overview over the outcomes of inflation and corresponding anchoring across the euro area as per Table A1.1. Across the euro area, inflation has been 2.3% on average. Despite sharing a common target of 1.9%, inflation rates across the euro area are heterogeneous with respect to that target; with inflation in Slovakia (3.8%) and Germany (1.5%) showing the maximum and the minimum rates, respectively. Across regimes, average inflation in the euro area has been deep below the lower limit when it is low (0.4%) and far above the upper limit when it is high (4.2%). Inflation is more stable when it is around rather than far from the target.

For anchoring, the average of baseline balance has not exceeded 5%. Yet, this euro-wide average hides differences among different countries. By country, the lowest balance scores have been reserved for Greece (-12.5%) and Italy (-10.9%). The evolution of inflation and the distribution of expectation replies is surprisingly different in the two distressed countries. On the other side, consumers in countries with higher anchoring levels, such as Austria and the Netherlands, are typically better informed about inflation expectations. Across regimes, the AB level reaches its maximum when inflation is within the corridor (13.9%) and drops to 5.7% (-5.7%) when it moves above (below) the corridor, respectively.

1.3 Anchoring Consumers' Inflation Expectations from Below

To demonstrate the usefulness of our proposed indicator we revisit the literature on inflation expectations anchoring in the euro area. We test the extent to which the anchoring degree responds to the lagged realized inflation deviations from the target across different inflation regimes, when inflation is below, above, or within the specified target zone.

1.3.1 The Impact of Inflation Deviations from Target on the Anchoring Degree

Inflation Deviations as a Potential Driver of the Degree of Anchoring

It is well established in the early anchoring literature that inflation expectations, when firmly anchored, should not respond to movements in realized inflation. This hypothesis has been examined by, e.g., Levin et al. (2004), Strohsal et al. (2016) and Ciccarelli et al. (2017). With an observed measure of anchoring at hand, it is possible to directly regress this indicator on the lagged deviations of inflation from the ECB target. If consumers believe that central bank's policy is credible, then transitory deviations of inflation from target ought to have no impact on anchoring, and so inflation should eventually return to its long-term objective. Nevertheless, central bank's excessive tolerance to inflation deviations from the target could entail greater risks in the long term, when repeatedly perceived by consumers.

In line with Ehrmann (2015), Equation 1.1 measures the likely impact of deviations of lagged realized inflation from the target in absolute terms ($|\pi_{i,t-1} - 1.9|$) on the proposed anchoring balance ($AB_{i,t}$) across various inflation environments. For this, we create a set of dummies ($D_{i,t}^{L,J}$ and $D_{i,t}^{H,J}$) to determine the low and the high inflation regimes. For instance, the dummy for low inflation ($D_{i,t}^{L,J}$) takes the value of 1 if the year-on-year inflation rate is below the lower bound of 1.4% for at least $J = 1, 3, 6$, and 9 consecutive months, and 0 otherwise. The high-inflation dummy ($D_{i,t}^{H,J}$) takes the value of 1 if inflation is above the upper bound of 2.4% for at least $J = 1, 3, 6$, and 9 consecutive months, and 0 otherwise. The persistence of inflation within a distinct inflation regime is measured by (J).

Equation 1.1 describes the underlying panel regression of the baseline model:

$$AB_{i,t} = \alpha_i + \alpha_t + \beta_1^J |\pi_{i,t-1} - 1.9| + \beta_2^J D_{i,t}^{L,J} + \beta_3^J D_{i,t}^{L,J} |\pi_{i,t-1} - 1.9| + \beta_4^J D_{i,t}^{H,J} + \beta_5^J D_{i,t}^{H,J} |\pi_{i,t-1} - 1.9| + \varepsilon_{i,t};$$

$$\text{for } J = 1,3,6,9: \quad D_{i,t}^{L,J} = \begin{cases} 1, & \text{if } \pi_{i,t} < 1.4 \\ 0, & \text{otherwise} \end{cases} \quad \text{and} \quad D_{i,t}^{H,J} = \begin{cases} 1, & \text{if } \pi_{i,t} > 2.4 \\ 0, & \text{otherwise} \end{cases} \tag{1.1}$$

where $(AB_{i,t})$ is the anchoring level of consumer expectations for country (i) in month (t), $i = 1, ..., 16$ and $t = 1999M01, ..., 2019M01$ with a total sample of 3856 monthly observations. The absolute deviations of lagged realized inflation from target, which is in our case fixed at 1.9% across all euro countries, is denoted by $(|\pi_{i,t-1} - 1.9|)$. $(D_{i,t}^{L,J})$ and $(D_{i,t}^{H,J})$ are dummy variables for times of low and high inflation, respectively. The individual fixed effects (α_i) control for possible country-specific differences that could influence the degree of anchoring, while (α_t) is a time fixed effects to account for common events in anchoring across euro area. The models are estimated using Least Squares with the Driscoll and Kraay (1998) standard errors, which allow for cross-sectional correlations, heteroskedasticity and autocorrelation up to a given maximum lag order. In our monthly sample it is set to 12 lags.

Given the short horizon of the inflation expectations used in our analysis, it is likely that the anchoring balance may respond to the temporal deviations of inflation from the target. This response, if existent, is expected to be negative or insignificant. The assumption here is that the larger the absolute deviation is, positive or negative, the larger the negative impact on anchoring. Yet, Ehrmann (2015) argues that the strength of this impact depends mainly on the prevailing inflation regime. More specifically, if Ehrmann's findings for professionals' inflation expectations also hold for consumers' counterparts then the shift dummy for low inflation $(D_{i,t}^{L,J})$ should be negative where that of high inflation $(D_{i,t}^{H,J})$ should be insignificant or negative but with a smaller absolute value. The sign of the interaction dummies for the low $D_{i,t}^{L,J} |\pi_{i,t-1} - 1.9|$ and the high $D_{i,t}^{H,J} |\pi_{i,t-1} - 1.9|$ inflation regimes should be negative but with the restriction that the value for the low regime is larger in absolute.

Understanding the (De)-anchoring of Consumers' Expectations from Below

Table 1.2 displays regression results of the baseline model with individual (IE) or individual and time (IE + TE) fixed effects. If included alone, the absolute deviations of lagged realized inflation from the target exerts a negative impact on the anchoring level, as per column (1). By making a distinction between low and high inflation regimes, columns 2 to 5, we confirm the findings of Ehrmann (2015) that the negative effect of absolute inflation deviations from the target on anchoring is driven by periods of low inflation. The large increase in R^2 implies that this distinction is relevant for explaining anchoring, at least for the model with IE.

The excess degree of consumers' expectations de-anchoring if inflation is below target can be explained by two factors. First, the degree of anchoring exhibits a downward level shift, as pointed by β_2, when inflation is low. This negative level shift gets particularly large when inflation remains low for long; the size of the shift expands by 50% over nine months. Second, the degree of anchoring responds mainly to the lagged deviations of inflation from the target, measured by $\beta_1 + \beta_3$, only when inflation is low. The joint significance test that $\beta_1 + \beta_3 = 0$ can be rejected at 1% significance level. Yet, the magnitude of $\beta_1 + \beta_3$ decays when inflation rate gets persistently low. This magnitude is still economically substantial. Imagine that inflation has been below the target by 0.1% for three months, say from 1.4% to 1.3%, the anchoring degree then drops by 1 percentage point; this is quite large given that the average anchoring balance is 5%. The same implications can not be drawn for the high inflation episode, neither statistically nor from an economic prospective.

Our findings for consumers' expectations anchoring do not only confirm the empirical results of Ehrmann (2015) for professional' forecasters but also are highly consistent with the foundations of the theoretical general equilibrium model developed by Bianchi and Melosi (2018) to assess the welfare implications of central bank transparency. The authors establish that only under persistent deviations of inflation from the target agents' expectations turn de-anchored as uncertainty gets high. We find that the impact of inflation deviations from the target on anchoring is asymmetric. Expectations of consumers respond to deviations of inflation from the target only when inflation is low or persistently so.

Table 1.2 Benchmark Model with Individual (and Time) Fixed Effects: 1999M01:2019M01

	(1) Overall		(2) Low-High: at least 01M		(3) Low-High: at least 03M		(4) Low-High: at least 06M		(5) Low-High: at least 09M	
	IE	IE+TE	IE	IE+TE	IE	IE+TE	IE	IE+TE	IE	IE+TE
$\beta 1$	-2.51***	-2.60***	3.72	4.12*	-0.08	-0.73	-3.00	-3.14	-2.97	-1.55
	(0.91)	(0.61)	(2.42)	(2.44)	(2.45)	(2.40)	(2.11)	(1.92)	(1.90)	(2.02)
$\beta 2$			-5.46***	-3.46**	-5.56**	-3.19	-6.54**	-3.40	-8.17**	-5.16**
			(2.05)	(1.66)	(2.54)	(2.00)	(2.94)	(2.31)	(3.28)	(2.51)
$\beta 4$			-2.30	-2.79*	-1.79	-2.67*	-2.06	-3.04*	-2.68	-3.33*
			(1.48)	(1.47)	(1.60)	(1.46)	(1.91)	(1.75)	(2.07)	(1.71)
$\beta 3$			-12.78***	-9.16***	-9.02***	-4.72**	-5.95***	-2.45	-5.46***	-3.53*
			(2.21)	(2.18)	(2.29)	(2.21)	(2.03)	(2.19)	(1.56)	(2.05)
$\beta 5$			-5.22**	-6.09**	-1.50	-1.30	1.40	1.10	1.46	-0.37
			(2.37)	(2.37)	(2.37)	(2.37)	(1.97)	(1.89)	(1.88)	(2.03)
$p(\beta_1 + \beta_3 = 0)$			0.000	0.002	0.000	0.002	0.000	0.002	0.000	0.002
$p(\beta_1 + \beta_5 = 0)$			0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
R-squared	0.04	0.33	0.22	0.36	0.22	0.35	0.22	0.35	0.23	0.36
No. of Obs.	3786		3786		3786		3786		3786	

Notes: Table 1.2 presents the baseline panel regression with individual (or individual and time) fixed effects: $AB_{i,t} = \alpha_i + \alpha_t + \beta_1 |\pi_{i,t-1} - 1.9| + \beta_2 D^{L,J}_{i,t} + \beta_3 D^{L,J}_{i,t} |\pi_{i,t-1} - 1.9| + \beta_4 D^{H,J}_{i,t} + \beta_5 D^{H,J}_{i,t} |\pi_{i,t-1} - 1.9| + \varepsilon_{i,t}$ where $D^{L,J}_{i,t}$ and $D^{H,J}_{i,t}$ are dummies for times of low and high inflation, respectively. Columns 2 to 5 show the results for inflation when it is persistently within a specific regime for at least 1, 3, 6, and 9 consecutive months. The numbers in parentheses are for the Driscoll and Kraay (1998) standard errors that allow for cross-sectional correlation, heteroskedasticity and autocorrelation up to a maximum lag order of twelve months. The country list includes 16 countries of the euro area. Due to data limitations, Ireland, Cyprus, and Malta are excluded. Statistical significance at the 1%, 5%, and 10% levels are denoted by $(^{***})$, $(^{**})$, and $(^{*})$, respectively.

Since several member states in the euro area have simultaneously experienced with low inflation rates since 2009, as we have learned from section 1.2.4, we need to make sure that these observations are independent. Adding a time fixed effect to the individual fixed effect in the baseline model, for robustness, would do the task. Table 1.2 demonstrates that the results are not only qualitatively but also quantitatively comparable. The estimates still are of a large economic magnitude and a standard statistical significance. This implies that our results do not rely on the common anchoring progressions across the euro area. Table A1.3 confirms that our baseline outcomes are comparably robust when we use panel-corrected rather than Driscoll and Kraay standard errors, see appendix for details.

Even after accounting for cross-country correlations by using Driscoll and Kraay (1998) standard errors and including a time fixed effect one might argue that the previous results are still driven by cross-country common developments, just like the recent period of weak inflation after the financial crisis. To distinguish the importance of these recent observations we restrict the sample to start from January 2009. Interestingly, Table 1.3 shows that the shift dummy for the low inflation regime is no longer statistically significant. This means that the de-anchoring impact of the low inflation regime after the financial crisis comes only from the deviations of inflation from target. The magnitude of this impact is not only comparable to that of the baseline model but also robust when inflation is persistently low.

Table 1.3 Model with Individual (and Time) Fixed Effects after the Financial Crisis: 2009M01:2019M01

	(1) Overall		(2) Low-High: at least 01M		(3) Low-High: at least 03M		(4) Low-High: at least 06M		(5) Low-High: at least 09M	
	IE	IE+TE	IE	IE+TE	IE	IE+TE	IE	IE+TE	IE	IE+TE
$\beta 1$	-8.70***	-3.78***	2.47	4.05	-1.33	-0.36	-1.00	0.17	-6.13***	-2.51
	(1.75)	(1.34)	(3.86)	(3.72)	(3.22)	(3.07)	(2.11)	(2.13)	(1.83)	(2.52)
$\beta 2$			-3.50	-1.10	-3.80	-1.01	-4.85	-1.48	-5.84	-2.26
			(2.48)	(2.23)	(2.89)	(2.46)	(3.48)	(2.98)	(3.69)	(2.89)
$\beta 4$			-1.85	-2.96*	-0.68	-2.20	-0.87	-2.77	-3.00	-4.44
			(2.18)	(1.51)	(2.88)	(1.92)	(3.49)	(2.25)	(4.48)	(2.94)
$\beta 3$			-12.11***	-8.82***	-8.26***	-4.71*	-8.10***	-5.07***	-3.22*	-2.40
			(3.62)	(3.21)	(2.99)	(2.60)	(1.89)	(1.89)	(1.65)	(2.38)
$\beta 5$			-5.27	-5.32	-1.90	-1.25	-2.10	-1.62	3.27	1.40
			(3.90)	(3.79)	(2.94)	(2.89)	(2.08)	(2.38)	(2.20)	(2.86)
$p(\beta_1 + \beta_3 = 0)$			0.0002	0.0002	0.000	0.0002	0.0002	0.0002	0.000	0.0002
$p(\beta_1 + \beta_5 = 0)$			0.0022	0.362	0.0052	0.317	0.0072	0.368	0.031	0.513
R-Squared	0.18	0.46	0.278	0.47	0.28	0.468	0.288	0.47	0.28	0.471
No. of Obs.	1936		1936		1936		1936		1936	

Notes: Table 1.3 presents the baseline panel regression with individual (or individual and time) fixed effects: $AB_{i,t} = \alpha_i + \alpha_t + \beta_1 |\pi_{i,t-1} - 1.9| + \beta_2 D_{i,t}^{L,J} + \beta_3 D_{i,t}^{L,J} |\pi_{i,t-1} - 1.9| + \beta_4 D_{i,t}^{H,J} + \beta_5 D_{i,t}^{H,J} |\pi_{i,t-1} - 1.9| + \varepsilon_{i,t}$ where $D_{i,t}^{L,J}$ and $D_{i,t}^{H,J}$ are dummies for times of low and high inflation, respectively. Columns 2 to 5 show the results for inflation when it is persistently within a specific regime for at least 1, 3, 6, and 9 consecutive months. The numbers in parentheses are for the Driscoll and Kraay (1998) standard errors that allow for cross-sectional correlation, heteroskedasticity and autocorrelation up to a maximum lag order of twelve months. The country list includes 16 countries of the euro area. Due to data limitations, Ireland, Cyprus, and Malta are excluded. Statistical significance at the 1%, 5%, and 10% levels are denoted by $(^{***})$, $(^{**})$, and $(^{*})$, respectively.

Tables A1.4 and A1.5 show the results of two sensitivity tests. The first tackles the impact of the size of inflation deviations from the target on anchoring while the second investigates the degree of expectations de-anchoring for the lower and the upper bounds of the baseline anchoring. In the first test, instead of subtracting the inflation rate from the target of 1.9%, we reduce the corridor's lower bound to 0.9% while increasing its upper bound to 2.9%. Table A1.4 confirms that larger absolute deviations of inflation from the target exert stronger negative impacts on anchoring. The impact of inflation deviations from the target on the upper and the lower bounds of anchoring is similar to the baseline balance except that the dummy for the high inflation regime is now significant as per table A1.5.

1.4 Conclusion

This chapter provides empirical evidence that consumers' inflation expectations anchoring has deteriorated in the recent period of low inflation compared with the previous periods when inflation and inflation expectations were more aligned with the ECB target. To reach previous conclusion, we first construct a new anchoring indicator based on the aggregate qualitative expectations responses from the European Commission's consumer survey. Our indicator then reveals significant heterogeneity across euro-area countries with respect to the anchoring level. For that reason, we employ panel regressions to test the extent to which consumers' expectations are well anchored by comparing across various inflation episodes. We find that the degree of anchoring is particularly weak when inflation is below target. The deviations of inflation from the target only exert a de-anchoring impact on consumers' expectations when inflation is low. The de-anchoring impact of inflation deviations from the target is also robust when inflation is persistently below the target. For future research, it is interesting to understand why does expectations of professionals and consumers are particularly de-anchored from below and not from above. An interesting explanation comes from Swanson (2015) who argues for the importance of perceived impotence of central banks for explaining the pattern of expectations de-anchoring from below.

1.5 Appendix A1

Table A1.1 Overall, Across Regime, and Across Country Mean and Standard Deviation of Q6 Raw Responses, Constructed Anchoring Balance, and YoY Inflation Rates [%]

	PP	P	E	M	MM	N	π^{YoY}	AB^L	AB^C	AB^U
						Mean				
Average	16.7	37.3	15.9	22.2	2.2	5.8	2.3	-8.1	4.6	26.8
Low	13.2	32.2	14.9	30.3	3.3	6.2	0.4	-18.5	-5.7	24.6
Corridor	14.8	38.8	15.5	23.8	1.9	5.1	1.9	6.1	13.9	37.7
High	20.9	40.2	16.9	14.6	1.5	5.9	4.2	-10.7	5.7	20.3
Low03	13.0	31.7	14.9	30.6	3.3	6.3	0.3	-20.0	-6.9	23.7
Low06	13.1	31.3	14.9	30.9	3.4	6.4	0.3	-21.0	-7.8	23.1
Low09	12.9	30.8	15.1	31.3	3.4	6.5	0.2	-22.2	-9.0	22.3
High03	21.2	40.3	16.9	14.3	1.5	5.9	4.3	-11.1	5.6	19.9
High06	21.5	40.5	17.0	13.6	1.4	5.9	4.4	-11.7	5.5	19.1
High09	21.7	40.5	17.1	13.4	1.4	5.9	4.5	-12.7	4.9	18.3
Austria	16.1	46.6	11.3	22.4	1.8	1.7	1.8	12.1	21.9	44.3
Belgium	14.6	34.4	17.5	25.7	2.0	5.8	2.0	-5.4	3.6	29.2
Germany	12.9	39.9	15.0	23.7	0.9	7.6	1.5	-1.3	8.2	31.9
Estonia	22.0	38.7	17.5	11.8	1.4	8.6	3.5	-16.7	1.1	12.9
Greece	20.3	30.9	12.1	23.0	3.3	10.3	2.1	-26.2	-12.5	10.6
Spain	8.9	30.6	22.5	23.9	3.1	10.8	2.2	-15.3	-2.8	21.2
Finland	12.4	45.1	13.9	24.5	2.9	1.3	1.7	-5.3	11.4	35.9
France	10.4	41.8	13.3	28.0	1.2	5.3	1.5	4.0	13.0	41.0
Italy	12.7	23.3	12.9	41.7	3.1	6.3	1.8	-17.3	-10.9	30.7
Lithuania	30.8	36.2	19.7	9.0	1.1	3.1	2.4	-7.5	8.0	17.0
Luxembourg	11.8	35.9	18.2	27.0	1.7	5.3	2.2	-6.4	6.1	33.2
Latvia	16.0	39.1	20.6	12.7	2.2	9.5	3.6	-10.5	5.0	17.7
Netherlands	14.7	38.4	15.6	25.0	3.3	3.0	1.9	5.1	14.7	39.6
Portugal	19.1	34.2	19.3	22.5	1.5	3.4	2.0	-7.9	5.0	27.5
Slovenia	21.2	41.4	11.5	19.7	2.6	3.6	3.4	-13.8	1.9	21.6
Slovakia	24.4	40.3	13.6	13.2	2.1	6.3	3.8	-17.6	0.1	13.4
						STDEV				
Average	10.4	10.5	6.7	12.1	2.5	4.1	2.2	25.2	20.9	19.3
Low	8.6	10.1	5.8	10.8	2.9	4.4	0.8	22.0	20.2	15.3
Corridor	8.3	10.1	6.6	10.0	2.1	3.6	0.3	24.9	19.6	16.7
High	11.5	9.5	7.3	9.5	2.3	4.0	2.3	22.8	18.7	20.5

Notes: Q6 replies read as: (PP) inflation will increase, (P) inflation will be constant, (E) inflation will decrease, (M) inflation will be zero, (MM) inflation will be negative, and (N) don't know. π^{YoY} is the year-on-year inflation while AB^L, AB^U, AB^C are the lower, upper, and baseline AB.
Source: Author's calculations based on the European Commission's BCS & Eurostat: 1999-01:2019-01.

Table A1.2 An Alternative Specification for the Anchoring Balance

Inflation Episode	Anchoring Indicator
$\pi_{MA} > 2.4\%$	$(-1.0\ PP - 0.5\ P + 1.0\ \mathbf{E} + 0.5\ M - 1.0\ MM - 1.0\ N)$
$1.9\% < \pi_{MA} \leq 2.4\%$	$(-0.5\ PP + 1.0\ \mathbf{P} + 0.5\ E + 0.5\ M - 1.0\ MM - 1.0\ N)$
$1.4\% \leq \pi_{MA} \leq 1.9\%$	$(+0.5\ PP + 1.0\ \mathbf{P} - 0.5\ E + 0.5\ M - 1.0\ MM - 1.0\ N)$
$\pi_{MA} < 1.4\%$	$(+1.0\ \mathbf{PP} - 0.5\ P - 1.0\ E + 0.5\ M - 1.0\ MM - 1.0\ N)$

Notes: π_{MA} is the moving average country-specific year-on-year inflation rates over the past twelve months. In the baseline specification, 1.4% and 2.4% represent the lower and the upper boundaries of the corridor regime which is centred around the euro-area common target of below but close to 2.0%. The responses of the forward-looking question on inflation expectations read as follows: (PP) inflation will increase, (P) inflation will be constant, (E) inflation will decrease, (M) inflation will be zero, (MM) inflation will be negative, while (N) I don't know. The changes for the lower bound are highlighted with blue while that for the upper bound are marked with red. Compare Table 1.1.

Table A1.3 Alternative Model with Panel-Corrected Standard Errors: 1999M01 to 2019M01

	(1) Overall	(2) Low-High: at least 01M	(3) Low-High: at least 03M	(4) Low-High: at least 06M	(5) Low-High: at least 09M
β_1	-2.60***	4.12**	-0.73	-3.14**	-1.55
	(0.20)	(2.02)	(1.63)	(1.33)	(1.12)
β_2		-3.46***	-3.19***	-3.40***	-5.16***
		(0.97)	(1.12)	(1.20)	(1.26)
β_4		-2.79***	-2.67***	-3.04***	-3.33***
		(0.87)	(0.94)	(1.00)	(1.02)
β_3		-9.16***	-4.72***	-2.45*	-3.53***
		(1.91)	(1.63)	(1.40)	(1.22)
β_5		-6.09***	-1.30	1.10	-0.37
		(1.99)	(1.61)	(1.33)	(1.12)
$\beta_1 + \beta_3 = 0$		0.000	0.000	0.000	0.000
$\beta_1 + \beta_5 = 0$		0.000	0.000	0.000	0.000
R-Squared	0.46	0.48	0.48	0.48	0.48
No. of Obs.	3786	3786	3786	3786	3786

Notes: Table A1.3 presents the alternative panel regression with panel-corrected standard errors: $AB_{i,t} = \alpha_i + \beta_1 |\pi_{i,t-1} - 1.9| + \beta_2 D^{L,J}_{i,t} + \beta_3 D^{L,J}_{i,t} |\pi_{i,t-1} - 1.9| + \beta_4 D^{H,J}_{i,t} + \beta_5 D^{H,J}_{i,t} |\pi_{i,t-1} - 1.9| + \varepsilon_{i,t}$ where $D^{L,J}_{i,t}$ and $D^{H,J}_{i,t}$ are dummies for times of low and high inflation, respectively. Columns 2 to 5 show the results for inflation when it is persistently within a specific regime for at least 1, 3, 6, and 9 consecutive months. The numbers in parentheses are for panel-corrected standard errors. These standard errors and the variance-covariance estimates assume that the disturbances are, by default, heteroskedastic and contemporaneously correlated across panels. The country list includes 16 states of the euro area. Due to data limitations, Ireland, Cyprus, and Malta are excluded. Statistical significance at the 1%, 5%, and 10% levels are denoted by (***), (**), and (*), respectively.

Table A1.4 Model with Individual (and Time) Fixed Effects for Wider Corridor: 1999M01:2019M01

	(1) Overall		(2) Low-High: at least 01M		(3) Low-High: at least 03M		(4) Low-High: at least 06M		(5) Low-High: at least 09M	
	IE	IE+TE	IE	IE+TE	IE	IE+TE	IE	IE+TE	IE	IE+TE
β_1	-1.76**	-2.36***	8.78***	6.89***	4.68**	2.92	1.78	0.74	0.37	0.35
	-0.76	(0.64)	(2.41)	(2.46)	(2.18)	(2.18)	(1.82)	(1.58)	(1.57)	(1.69)
β_2			-10.45***	-5.12***	-10.80***	-4.97**	-11.61***	-5.14**	-13.27***	-7.33***
			(2.37)	(1.89)	(2.70)	(2.24)	(3.00)	(2.55)	(3.15)	(2.46)
β_4			-2.30	-3.60**	-1.54	-3.15**	-1.51	-3.23*	-2.38	-4.10**
			(1.50)	(1.48)	(1.63)	(1.46)	(1.89)	(1.68)	(2.08)	(1.82)
β_3			-17.85***	-12.13***	-13.60***	-8.42***	-10.55***	-6.42***	-8.66***	-5.56**
			(2.17)	(2.18)	(2.35)	(2.18)	(2.49)	(2.38)	(2.11)	(2.44)
β_5			-10.09***	-8.72***	-6.07***	-4.79**	-3.21*	-2.63	-1.73	-2.15
			(2.41)	(2.45)	(2.07)	(2.13)	(1.76)	(1.59)	(1.54)	(1.70)
$p(\beta_1 + \beta_3 = 0)$			0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.000
$p(\beta_1 + \beta_5 = 0)$			0.004	0.004	0.003	0.004	0.003	0.004	0.004	0.004
R-Squared	0.02	0.32	0.20	0.35	0.20	0.35	0.20	0.35	0.21	0.35
No. of Obs.	3786		3786		3786		3786		3786	

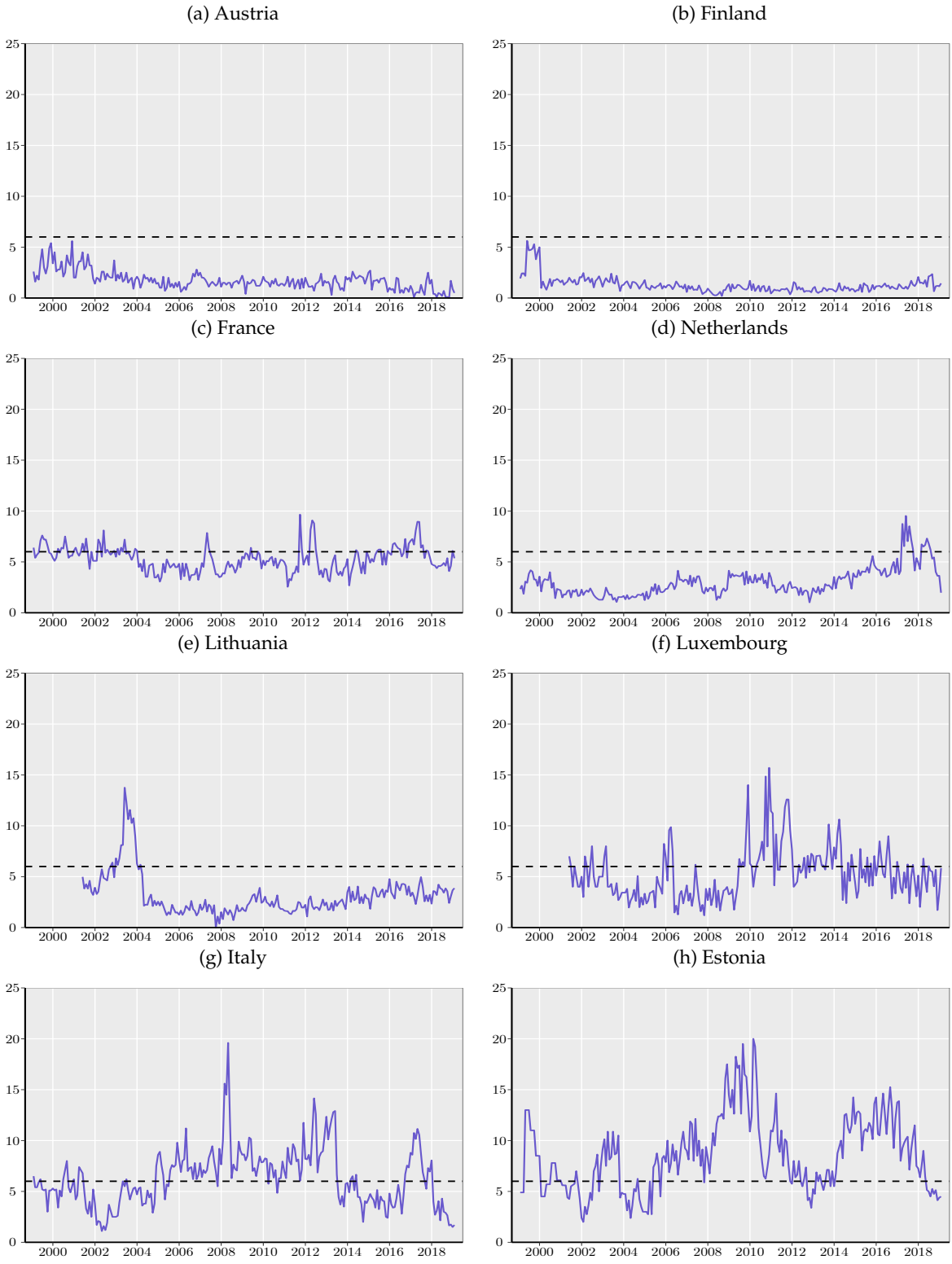
Notes: Table A1.4 presents the baseline panel regression with individual (or individual and time) fixed effects: $AB_{i,t} = \alpha_i + \alpha_t + \beta_1 |\pi_{i,t-1} - 1.9| + \beta_2 D^{L,J}_{i,t} + \beta_3 D^{L,J}_{i,t} |\pi_{i,t-1} - 1.9| + \beta_4 D^{H,J}_{i,t} + \beta_5 D^{H,J}_{i,t} |\pi_{i,t-1} - 1.9| + \varepsilon_{i,t}$ where $D^{L,J}_{i,t}$ and $D^{H,J}_{i,t}$ are dummies for times of low and high inflation, respectively. Columns 2 to 5 show the results for inflation when it is persistently within a specific regime for at least 1, 3, 6, and 9 consecutive months. The numbers in parentheses are for the Driscoll and Kraay (1998) standard errors that allow for cross-sectional correlation, heteroskedasticity and autocorrelation up to a maximum lag order of twelve months. The country list includes 16 countries of the euro area. Due to data limitations, Ireland, Cyprus, and Malta are excluded. Statistical significance at the 1%, 5%, and 10% levels are denoted by $(^{***})$, $(^{**})$, and $(^{*})$, respectively.

Table A1.5 Model with Individual Fixed Effects for the Upper and the Lower Bounds: 1999M01:2019M01

	(1) Overall		(2) Low-High: at least 01M		(3) Low-High: at least 03M		(4) Low-High: at least 06M		(5) Low-High: at least 09M	
	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
β_1	-4.09***	-3.13***	9.13**	5.99***	1.54	0.51	-3.38	-2.49	-5.40**	-3.07*
	(1.15)	(0.80)	(3.65)	(2.25)	(3.66)	(2.32)	(3.02)	(1.75)	(2.64)	(1.64)
β_2			-8.76***	-3.15**	-9.29**	-3.31*	-10.95**	-4.28*	-13.31***	-5.27**
			(2.99)	(1.58)	(3.67)	(1.97)	(4.38)	(2.27)	(4.69)	(2.53)
β_4			-6.44***	-5.92***	-6.24***	-6.09***	-7.41***	-6.78***	-9.38***	-7.90***
			(1.87)	(1.29)	(2.07)	(1.43)	(2.59)	(1.62)	(3.00)	(1.92)
β_3			-18.32***	-10.52***	-10.72***	-5.22**	-5.60*	-2.11	-3.04	-1.30
			(3.45)	(1.95)	(3.51)	(2.14)	(3.17)	(1.93)	(2.50)	(1.57)
β_5			-11.73***	-8.16***	-4.20	-2.71	0.75	0.31	2.99	1.06
			(3.56)	(2.07)	(3.60)	(2.22)	(2.86)	(1.63)	(2.61)	(1.62)
$p(\beta_1 + \beta_3 = 0)$			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$p(\beta_1 + \beta_5 = 0)$			0.000	0.001	0.000	0.001	0.001	0.002	0.001	0.002
R-Squared	0.08	0.09	0.20	0.13	0.20	0.13	0.20	0.13	0.21	0.13
No. of Obs.	3786		3786		3786		3786		3786	

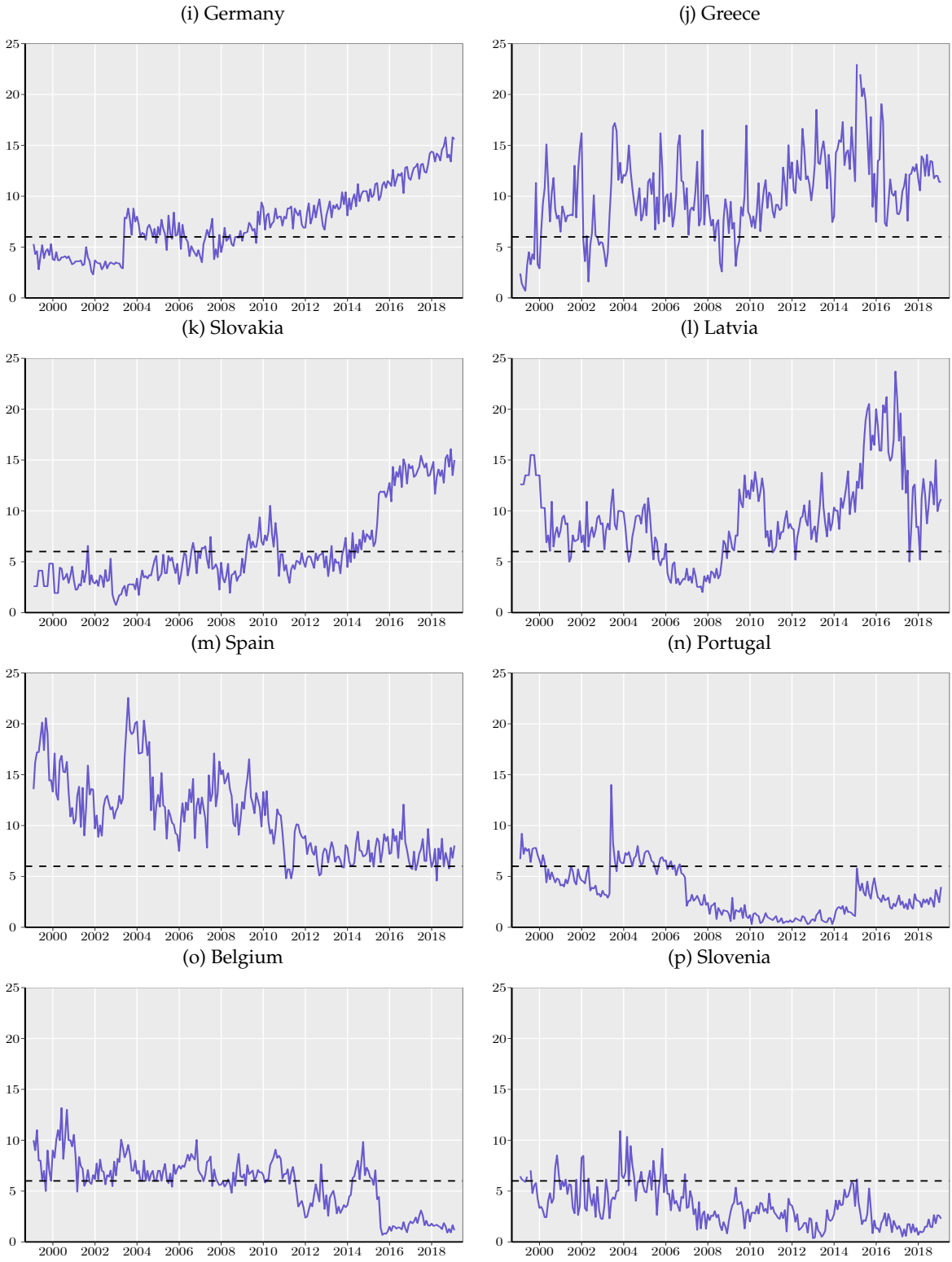
Notes: Table A1.5 presents the panel regression with individual fixed effects for the upper and lower bounds: $AB_{i,t} = \alpha_i + \beta_1 |\pi_{i,t-1} - 1.9| + \beta_2 D_{i,t}^{L,J} + \beta_3 D_{i,t}^{L,J} |\pi_{i,t-1} - 1.9| + \beta_4 D_{i,t}^{H,J} + \beta_5 D_{i,t}^{H,J} |\pi_{i,t-1} - 1.9| + \varepsilon_{i,t}$ where $D_{i,t}^{L,J}$ and $D_{i,t}^{H,J}$ are dummies for times of low and high inflation, respectively. Columns 2 to 5 show the results for inflation when it is persistently within a specific regime for at least 1, 3, 6, and 9 consecutive months. The numbers in parentheses are for the Driscoll and Kraay (1998) standard errors that allow for cross-sectional correlation, heteroskedasticity and autocorrelation up to a maximum lag order of twelve months. The country list includes 16 countries of the euro area. Due to data limitations, Ireland, Cyprus, and Malta are excluded. Statistical significance at the 1%, 5%, and 10% levels are denoted by $(^{***})$, $(^{**})$, and $(^{*})$, respectively.

Figure A1.1a Q6: The Share of Don't Know Answer (N) in the Euro-Area Members States [%]



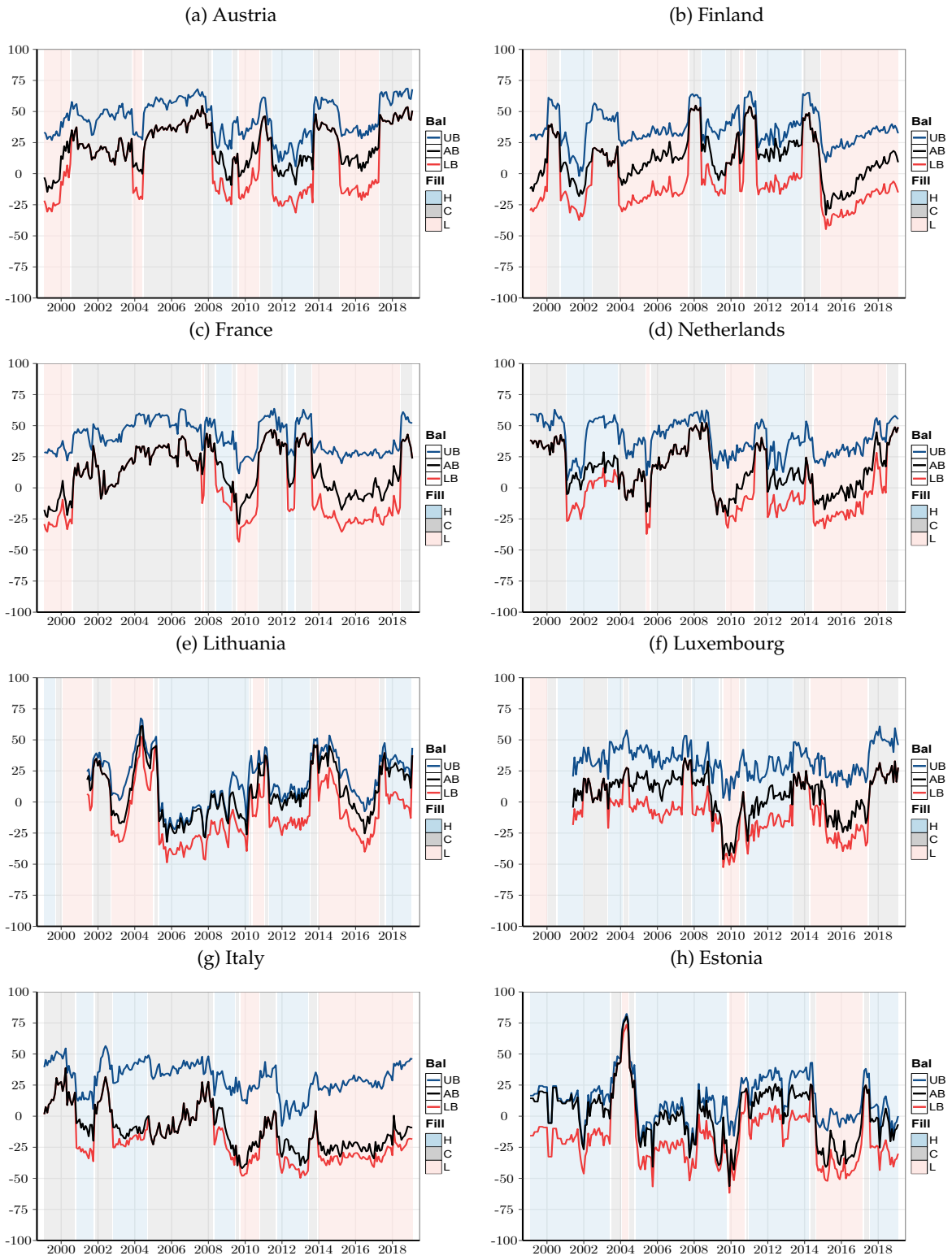
Notes: The horizontal dashed line represents the overall average of (N) across countries and over time.
Source: The European Commission's BCS: 1999-01:2019-01.

Figure A1.1b Q6: The Share of Don't Know Answer (N) in the Euro-Area Members States [%]



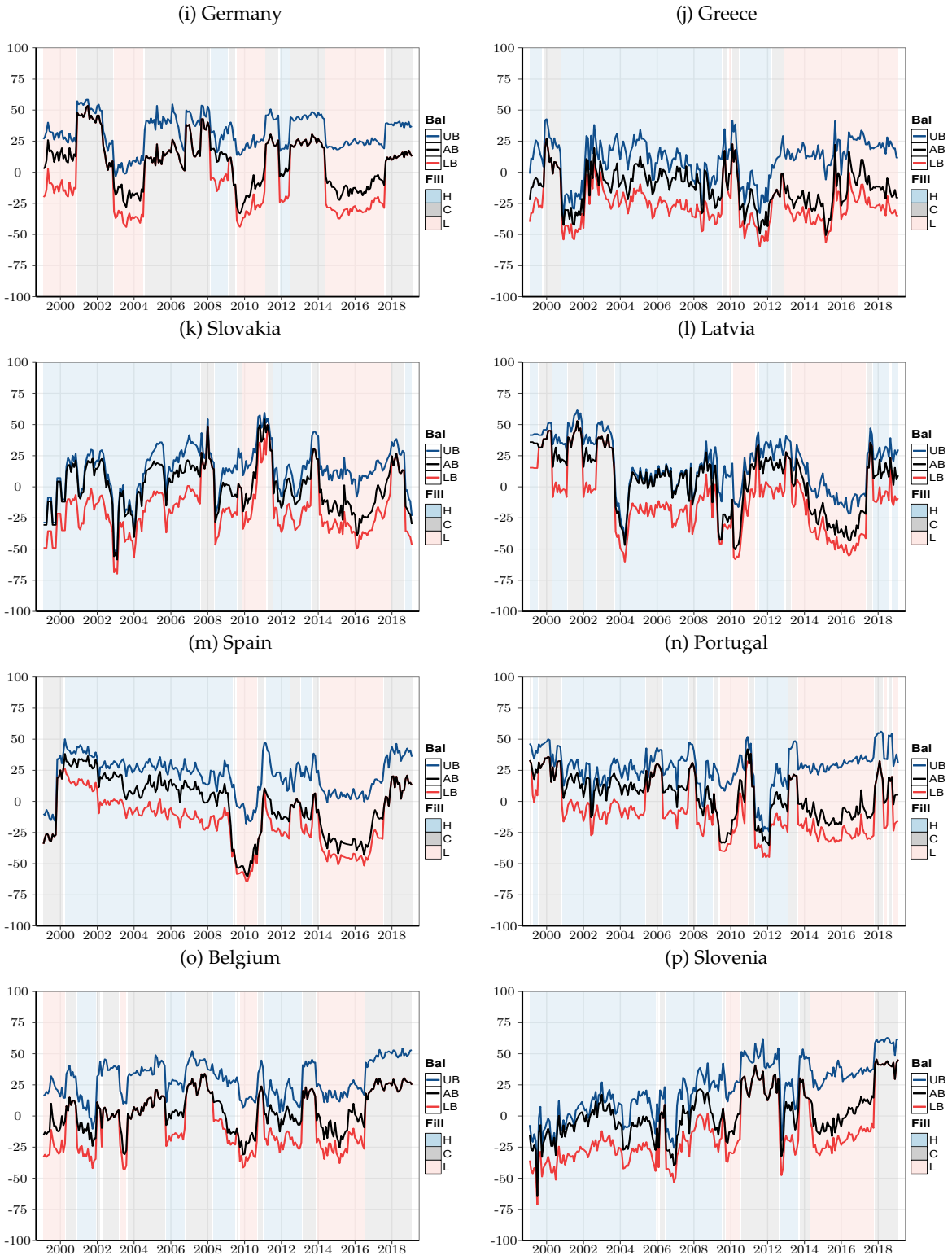
Notes: The horizontal dashed line represents the overall average of (N) across countries and over time.
Source: The European Commission's BCS: 1999-01:2019-01.

Figure A1.2a The Baseline, Upper, and Lower Anchoring Balance in the Euro Area [%]



Notes: Inflation regimes in the background are $H : \pi_{MA} > 2.4\%$, $L : \pi_{MA} < 1.4\%$, $C : 1.4\% \leq \pi_{MA} \leq 2.4\%$. π_{MA} is the moving average y-o-y inflation rate over the past year. AB is the baseline anchoring balance where UB and LB are the upper and the lower bounds, respectively. Compare Table 1.1 and A1.2.
Source: Author's calculations based on the European Commission's BCS and Eurostat: 1999-01:2019-01.

Figure A1.2b The Baseline, Upper, and Lower Anchoring Balance in the Euro Area [%]



Notes: Inflation regimes in the background are $H : \pi_{MA} > 2.4\%$, $L : \pi_{MA} < 1.4\%$, $C : 1.4\% \leq \pi_{MA} \leq 2.4\%$. π_{MA} is the moving average y-o-y inflation rate over the past year. AB is the baseline anchoring balance where UB and LB are the upper and the lower bounds, respectively. Compare Table 1.1 and A1.2.
Source: Author's calculations based on the European Commission's BCS and Eurostat: 1999-01:2019-01.

Chapter 2

The Information Content of Market-Based Measures for the Long-Term Inflation Expectations of Professionals: Evidence from a MIDAS Analysis

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Chapter 3

Whither Egypt Monetary Policy?

An Analysis of the Post 2005 Progressions

3.1 Introduction

A quick review of the monetary business cycle literature on Egypt in the past decade reveals three prime observations. First, there is not a single work that explores the effectiveness of monetary transmission mechanism against essential developments in the monetary policy setup since 2005. Second, quite a few previous studies have directly tackled the impact of foreign policy shocks on domestic economy despite that the latter is fairly small and widely open. Third, earlier empirical evidence on monetary transmission mechanisms have spotted several anomalies with respect to the effectiveness, direction and magnitude, of key monetary transmission channels, such as interest rate and exchange rate.

As for the first point, previous studies on the effectiveness of monetary policy channels that cover earlier periods up to 2009 have found that *interest rate as compared to exchange rate was away less effective yet promising channel in propagating monetary policy shocks to domestic economy*, see for example Abdel-Baki (2010), Billmeier and Al-Mashat (2007) and Hachicha and Lee (2009). The motivation here is to assess the capacity of those two particular transmission channels following several progressions in the monetary policy setting in favour of the interest rate. These developments come at the background of the announcement by the Central Bank of Egypt "henceforth, CBE" in 2005 to adopt an explicit inflation targeting regime once meeting its prerequisites.

The second point aims at providing a rigorous assessment of the influence of unanticipated foreign policy shocks on domestic economy which has been long under researched in early empirical evidence, see e.g. Awad et al. (2011) and Moursi and El Mossallamy (2010). This minimal attention to the impact of foreign policy shocks on monetary policy might have resulted in potential misspecification of the respective transmission channels. A fact that may explain the inconsistency of many of the previous estimates on monetary transmission mechanisms with expectations of well-established monetary policy evidence. Mabrouk and Hassan (2012) provides a comprehensive review in this regard.

Therefore, the third point is meant to develop a robust identification scheme that resolves monetary policy anomalies observed in prior evidence. Here, only three relevant puzzles regarding

the identification of monetary policy shocks are highlighted. Price puzzle, a case in which prices incorrectly increase subsequent to a positive interest rate impulse. This is documented e.g. by Hachicha and Lee (2009). Liquidity puzzle, where a positive innovation to one of the monetary aggregates is associated with a rise rather than a decline in nominal interest rate. This puzzle is spotted for instance by Awad (2010). Exchange rate puzzle, in which monetary contraction is correlated with local currency depreciation instead of appreciation. Billmeier and Al-Mashat (2007) among others have also identified this puzzle.

The present chapter, based on that, tries to handle the above limitations in the early literature by (i) hiring a recent, long enough and stable data set that covers the major developments in the monetary policy setup since the beginning of 2005 until the end of 2015 (ii) building up a Structural Vector Autoregressive "thereafter, SVAR" model that models domestic monetary policy while directly considering the impacts of foreign policy shocks (iii) proposing a non-recursive identification scheme that combines theoretical foundations, econometric procedures and specific policy setup to identify shocks and hence solving underlying anomalies frequently reported in the early empirical literature.

The chapter results deliver solutions to the anomalies reported in prior evidence. First, the dynamic impact of domestic interest rate on inflation rate is now plausible and much stronger than reported before. This is an imperative step forward to implementing inflation targeting regime proposed by the CBE. Second, the effects of exchange rate on core macroeconomic variables are still as strong as reported in previous periods despite that the latter was officially relaxed as a nominal anchor in 2003. Third, the leverage of foreign policy shocks on domestic economy is no less than that of domestic shocks. The world interest rate and global commodity prices shocks are highly significant, provide correct signs, and have strong and persistent effects on the domestic economy.

Following this brief introduction, section 3.2 reviews the related early evidence and displays the recent developments in monetary policy framework. Section 3.3 describes the data set, modelling strategy and the identification scheme. Section 3.4 discusses the fundamental results of the baseline model while section 3.5 debates plausible identification schemes. Section 3.6 concludes and drives policy implications.

3.2 Monetary Transmission Mechanism in Egypt

3.2.1 Early Evidence and Recent Developments

Over the past decade, several studies have examined the competence of Egypt monetary policy mainly in a closed economy setup. This stream of literature has largely *deliberated the significance of monetary transmission channels, mostly exchange rate and interest rate, on domestic economy macro dynamics assuming little or no role for external shocks*. In other words, this stock of research has been attentive to observe how, when and by how much monetary policy shocks could alter key economic variables. As a sample see Abdel-Baki (2010), Awad (2010), Billmeier and Al-Mashat (2007), Hachicha and Lee (2009), Hassan (2003), Moursi et al. (2007), Noureldin (2005) and Rabanal (2005).

These studies share some common features that are linked to our proposed investigation. First, recursive VAR technique was repeatedly exercised to evaluate the efficacy of monetary policy which comes with a drawback of order-dependence identification structure. Second, the data sets employed in these studies have two limitations. The time span is short and stale and so does not fully account for the changes in the policy setup after 2005. Many articles extrapolate a variable or more to be used in the analysis along with all relevant problems. Third, some of these studies propose strict assumptions about economy structure which do not necessarily match the extant monetary policy design at that specific time.

The key message of that branch of literature was that quantitative measures were more adequate to communicate monetary policy actions to economy than price instruments. This outcome is consistent with monetary policy design and banking sector structure at that time as monetary policy was designed to realize a synchronized set of inconsistent objectives. [1] That dissonant crew of objectives has obliged the CBE to use incompatible set of tools. The set comprised quantitative and price instruments such as open market operations, discount rate, reserve requirements, government securities, REPOs and reverse REPOs, see among others Galal (2003) and Mabrouk and Hassan (2012).

[1] These objects embraced attaining high output growth rate, low inflation rate and stable exchange rate, all that within an open economy framework that allows for free capital mobility, see Galal (2003).

The structure of banking sector at that time, dominated by large state-owned banks with huge portfolios of non-performing loans, has further detached the link between policy rate changes and expected macro outcomes, inflation rate was not an exception. Exchange rate was also used as nominal anchor for monetary policy up to 2003 and so plans were designed to retain domestic currency stability against major foreign currencies, indeed the US dollar. The fragility of monetary policy was further exacerbated by a series of unfavorable external jolts. Only in 1997, domestic economy was hit by two serious shocks, the Asian crisis and the Luxor terrorist attack, that drought the main sources of foreign currency reserves from tourism and workers remittances, see for instance Abdel-Baki (2010).

Against this background, monetary policy setup has witnessed some improvements that might support a stronger role for interest rate. Since early 2000, the CBE has gradually moved toward targeting inflation besides stabilizing exchange rate. This has started in 2001 by the introduction of overnight currency inter-bank market, which has helped to fortify the linkage between overnight inter-bank rate and bank rates, see Hachicha and Lee (2009). Two years later the CBE has abolished the exchange rate as a nominal anchor before it officially announces adopting inflation targeting as a prime objective once satisfying its prerequisites in 2005. Within the to be established targeting regime, interest rate is expected to play a more effective role, being easy to implement and to communicate to market participants.

Three other progressions might further consolidate the effectiveness of interest rate channel. First, the downward trend in the non-performing loans ratio which might signal a betterment of the quality of credit portfolio in the banking sector. Second, tightening the spread between lending and borrowing inter-bank rates and thence the interest rate. Both improvements may work on reducing the institutional inefficiency in the entire banking system, see Abdel-Baki (2014). [2] Third, the piecemeal yet persistent liberation of the value of domestic currency against main international currencies which might give the CBE more flexibility to target fluctuations in inflation rate by leveling interest rate. [3]

[2] According to the World Bank, non-performing loans as percent of total bank loans has persistently declined over 2000-2015, with a minimum of 7.2% in 2015, average of 15.6% and a maximum of 26.5% in 2005. A similar pattern applies to interest rate spread with a ratio of 3.8% in 2000 to 6.6% in 2006 back to 4.6% in 2015.

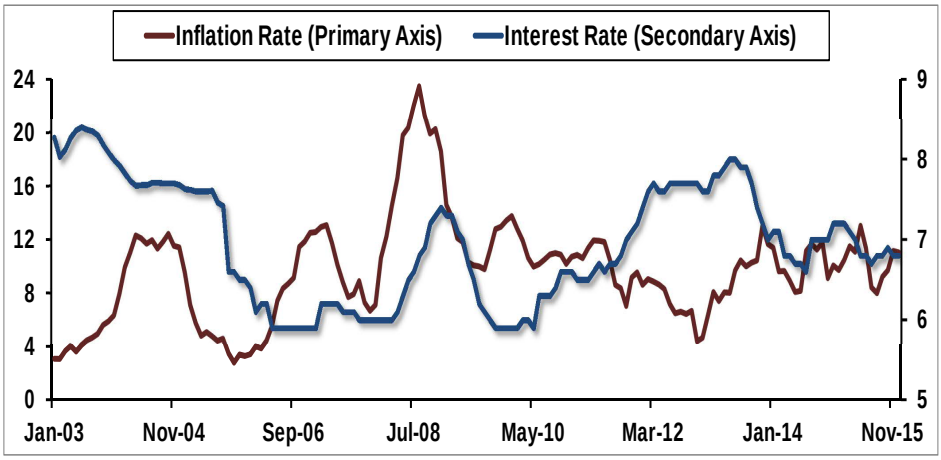
[3] As per the World Bank calculations, Egypt nominal effective exchange rate has shown a gradual and incessant decline over the period from 2000 to 2015, depreciating on average by 0.17% on a monthly basis.

On the contrary, *the evident excess liquidity in the banking sector still represents a challenge that might inhibits effectiveness of the interest rate channel*. For instance, during the period from 2006 to 2014, the growth rate in total banks deposits was more than double that of the total banks loans. As a result, the loans to deposits ratio among banks fell from 60% to 40% during the same period. This ratio is not only one of the lowest in the Middle East and North Africa region but also far below emerging markets average, e.g. 116% in Latin America, see Global-Capital (2015). Indeed, this low loans to deposits ratio may highlight an inefficiency in the intermediation function of the whole banking sector.

Two factors may explain this deficiency in the banking system. On the demand side, the expansion of treasury bills market driven by the government need to finance huge budget deficit along with the banks target to maintain high profits with low risk. On the supply side, the growth in deposits flow due to increased remittances and enhanced financial inclusion, see Global-Capital (2015). Kandil (2011) argues that the weak responsiveness of demand for credit to changes in interest rate may lessen the effectiveness of the potential monetary policy actions which might in turn discourage the central bank efforts to control supply-side inflationary pressures by increasing interest rates.

Figure 3.1 displays the evolution of interest rate and inflation rate in the period from 2003 to 2015. It is obvious that the CPI inflation rate does respond to the changes in interest rate, nonetheless, with a lag that decreases overtime, particularly since 2004. For instance, the central bank was able to reduce inflation rate to a single digit by the end of 2012 through tightening monetary policy throughout 2011 till early 2012. However, an observable disconnection between both variables can be spotted in other periods. For example, in the period of global financial crisis, the CBE opted to adopt an easing policy to stimulate economic growth while implementing non-traditional measures to arrest resulting inflationary pressures, see for example Kandil (2011).

Figure 3.1 Developments of Interest Rate and Inflation Rate: 2003–2015



Notes: Three months weighted average deposit interest rate and annual percentage change in monthly CPI.
Source: *International Monetary Fund*.

3.2.2 Domestic Economy and Integration Engines

There is a huge stock of literature that has identified sizable spillovers from advanced to small but open economies. On the impact of international commodity prices, Rahman (2015) shows that OECD trade price shocks explain large share of price and output variations in Bangladesh. Similarly, Kilinc and Tunc (2014) find that positive shocks to global commodity prices can significantly increase inflation rate in Turkey. For the influence of oil prices, Brown and Yücel (2002) identified a negative direct impact of oil price on output, sectoral asymmetric impact and an indirect impact on other goods prices. For advanced economies, Cuñado and de Gracia (2003) find that oil prices have enduring effect on inflation rate but a transitory and asymmetric impact on output of the European countries. Cologni and Manera (2008) showed also that for the G7 economies, except for Japan and the United Kingdom, oil prices have a major influence on inflation rate.

To quantify the effects of US monetary policy on large economies, Kim and Roubini (2000) proved that federal funds shocks explain sizable part of output and price variations in the other G6 countries. Reinhart and Reinhart (2001) and Frankel and Rubini (2001) made the same inference yet for developing markets. Likewise, Neumeyer and Perri (2005) found significant input of external interest rate impulses on business cycle of developing

economies. Addedly, Uribe and Yue (2006) untied the link between world interest rate, country spreads and emerging-markets. Once more, Maćkowiak (2007) proved that US interest rate affects output and prices of emerging markets besides its typical effects on the latter exchange and interest rates. By region, Canova (2005) clarified the role of financial channel in transmitting US monetary shocks to Latin American markets while Allegret et al. (2012) attained similar findings for East Asian countries.

Conversely, merely two articles have modeled the foreign constituent of Egypt monetary policy. Using a DSGE model, Moursi and El Mossallamy (2010) examined monetary policy in Egypt between 2002 and 2008. The authors though employed certain hypotheses which do not really match the policy scheme in tactic at that time. [4] Awad et al. (2011) likewise inspected the effects of US policy shocks on domestic economy during the period 1998-2009, divided into: 1998-2002 and 2004-2009. The current study varies from the latter in two aspects. First, the former work is built on recursive VAR structure and hence certain proper restrictions are not applied. [5] Second, the approximation of global shocks by US impulses, e.g. supply and demand, has shown several empirical limitations, see e.g. Canova (2005).

Despite being marginalized in prior evidence, foreign shocks are expected to have intense impacts on domestic economy. It is clear that Egypt is too small relative to world economy. Therefore, Egypt has a little say on determining the world interest rate, prices or income. This fact has two implications. First, CBE takes world interest rates as given despite the fact that domestic indicators are highly responsive to unanticipated deviations in these rates, see Kandil (2011). Second, as international flows of finance and trade denote a large fraction of Egypt output; exchange rate plays a key role not only in defining the extent of foreign policy shocks impacts on home economy but also in determining the responsiveness of these variables to domestic policies, see e.g. Li et al. (2010). The previous characteristics of Egypt economy are reflected in the modelling strategy per the following section.

[4] E.g., they presumed that the CBE directly target inflation via leveling expectations. This is tough assumption given the CBE inability to steer agents expectations due to existent credibility gap, see Awad (2010). They have also sit a less representative weight for exchange rate in CBE reaction function. Empirically, it is broadly notarized that monetary authority in that period at least and in fear of imported inflation have retained an implicit target of exchange rate, see Billmeier and Al-Mashat (2007).

[5] To identify monetary policy shock the author placed M_2 after domestic interest rate in VAR ordering; which implies that CBE cannot instantly respond to money supply shocks, which was not the case.

3.3 Modeling Egypt Small and Open Economy

The broad lines of our modelling scheme follow Kim and Roubini (2000), except for some deviations, resulting from data limitations or intended to reflect Egypt's distinctive policy setup, which are then borrowed from recent comparable literature.

3.3.1 Variables Selection and Sample Size

The main model includes seven variables that are typical in small open economy models. Domestic variables are net exports X_t^{EG} as a measure of economic activity, broad money aggregate $M2_t^{EG}$, consumer prices P_t^{EG}, interest rate R_t^{EG} [6] and nominal effective trade weighted exchange rate E_t^{RW} which captures the average value of pound against a weighted basket of main traders currencies. [7] Foreign variables include global commodity price index P_t^{RW} and a weighted average of interest rates in major trading partners R_t^{RW}. Global commodity prices is used to signify foreign inflationary supply shocks while foreign interest is to explicate foreign monetary policy shocks. Both variables along with exchange rate are introduced to control for the exogenous component of domestic monetary policy.

This set of variables differs in two ways from Kim and Roubini (2000). First, I use net exports rather than industrial production owing to incompleteness of this monthly series for Egypt which is only available from 2004 onward on irregular and lagged basis. The use of net exports is motivated by the Mundell Fleming model implications for the small economy's trade balance movements to large economy's shocks as proposed by Ncube et al. (2013). Second, I replace the world price of oil by the global commodity price index for grains. This is more appropriate to replicate distinct features of Egypt economy as fuel prices are heavily regulated by government and so have no direct association with global crude prices. Conversely, Egypt is one of the largest grains importers in the world. As a

[6] In their analysis of monetary transmission mechanism in Egypt, Billmeier and Al-Mashat (2007) argued that the short term interest rate is the best tool to reflect the economy monetary stance. This chapter adopts the same argument and employs the weighted average interest rate for deposits less than three months.

[7] Despite the historical peg of Egypt pound to the US dollar, this bilateral rate cannot solely capture significant developments against other currencies. Therefore, in the baseline estimations we employ trade weighted nominal effective exchange rate while bilateral exchange rates are kept for the robustness checks.

case in point, Egypt is the first wheat importer in the world with an average growth rate of imports of 5% annually during the past 15 years, see USDA (2016).

As shown in Figure A3.1 the sample used in estimation covers the interval from January 2005 until December 2015. *This period is quite homogeneous in terms of the monetary policy setup employed as motivated in the background and so should have a widely settled macro dynamics*. As a robustness measure a longer sample that extends from 1997 to 2015 is estimated. The results of this alternative model are not satisfactory in terms of the estimated residuals properties and the stationarity of regressions over time which gives further credit to the baseline model specification, see Table A3.2. The primary data sources are the International Financial Statistics (IFS) and the Euro-money Institutional Investor Company (CEIC) for Egypt data and the Federal Reserve Bank of St. Louis (FRED) for the United States data other than the European Central Bank (ECB) for the data on the Euro Area. All estimation exercises are done using Maximum Likelihood method.

Table A3.1 demonstrates that, except for interest rates which is measured in percentages, all other variables which are specified in logarithm are integrated of order one. Therefore, a first difference of logarithm is applied to those variables but for interest rates which are kept in percentages. *By employing this transformation we not only attain variables stationarity but also gain some specification merit. For instance, inflation rate not price level will be then used effectively in the CBE reaction function in moral of Taylor rule.* As deterministic regressors; constant, seasonal dummy and impulse dummy are augmented in the baseline model. The time dummy is deployed to capture variables' variations after the global economic crisis and so takes the value of 1 starting from January 2009 until December 2015 and 0 otherwise. The addition of these regressors ensures that the interpretation of the model variables responses to proposed policy shocks are free from potential structural changes.

The proposals of Schwarz and Final Prediction Error criteria form the basis for optimal lag length selection, which turned out to be two months for the baseline model after setting maximum lag length to 12 months. The estimated unrestricted VAR models are [i] system stationary verified by the moduli of all eigenvalues of the system polynomial being less than unity [ii] regression stationary (see Figure A3.2) since the null hypothesis of a stable param-

eters cannot be rejected for all individual regression equations in the system [iii] residuals properties are satisfactory at the frequently reported significance levels (at least significance level of 5% is satisfied), serially uncorrelated as proved by Portmanteau test or Breusch and Godfrey LM test and conditionally heteroscedastic as per the results of multivariate ARCH-LM test (for details, check Table A3.2).

3.3.2 Egypt Context and Restrictions Scheme

In the model, structural shocks are identified by imposing restrictions on the contemporaneous correlations of the SVAR system to replicate Egypt's macro-economic dynamics. The identification scheme outlined in Equation 3.8 consists of four main blocks. [8] The first two equations clarifies money market equilibrium, the third and fourth equations describes domestic goods market, equations five and six represent exogenous shocks while the last equation is reserved for exchange rate market.

$$R_t^{EG} = \alpha_{10} + \alpha_{12} \triangle \log M_{2t}^{EG} + \alpha_{16} R_t^{RW} + \alpha_{17} \triangle \log E_t^{RW} + f_1 Z_{t-1} + \xi_{R_t^{EG}} \tag{3.1}$$

$$\triangle \log M_{2t}^{EG} = \alpha_{20} + \alpha_{21} R_t^{EG} + \alpha_{23} \triangle \log P_t^{EG} + \alpha_{24} \triangle \log X_t^{EG} + f_2 Z_{t-1} + \xi_{\triangle \log M_{2t}^{EG}} \tag{3.2}$$

For the money market block, the same restrictions as of Kim and Roubini (2000) are assumed. In Equation 3.1, money supply is assumed to be the CBE reaction function, which sets interest rate after observing present values of reserve money, foreign interest and exchange rate plus all the variables lagged values $f_1 Z_{t-1}$. [9] Pound depreciation is seen by the CBE as a driver for inflation, a fact that may prompt it to raise interest rate in response. [10]

[8] To construct our AB-SVAR model, the following notations are coined: ϵ_{Z_t} and ξ_{Z_t} are used to describe reduced form and structural form residuals, respectively. α_{ij} represents the jth parameter in the ith equation while f_i is a liner function of the model lagged variables in the ith equation, where $i = 1, 2, .., 6, 7$. To enhance readability, the impulse and the seasonal dummies are not included in the model equations.

[9] The CBE intends to implement inflation targeting system to anchor monetary policy once its main prerequisites are met. Now, it meets its inflation targets by steering short term interest rates, observing developments in credit and money supply, and other factors, such as output gap forecast, that may influence prices.

[10] The CBE has been for a long period of time, explicitly in the period of fixed exchange rate regime and implicitly in the time after exchange rate partial liberalization, concerned about the effects of pound depreciation on domestic prices, that is why exchange rate is augmented in the CBE reaction function.

Home monetary policy shock $\xi_{R_t^{EG}}$ is assumed to be driven by the CBE preferences. [11] In Equation 3.2, the demand for real money balances is specified by the standard quantity of money theory, where by it hangs on domestic income, domestic prices (to get real income) along with the nominal interest rate that represents opportunity cost of holding money in addition to all the variables lagged values $f_2 Z_{t-1}$. The shock of money market $\xi_{\triangle \log M_{2_t}^{EG}}$ largely originates from exogenous changes in the velocity of money.

$$\triangle \log P_t^{EG} = \alpha_{30} + \alpha_{34} \triangle \log X_t^{EG} + \alpha_{35} \triangle \log P_t^{RW} + f_3 Z_{t-1} + \xi_{\triangle \log P_t^{EG}} \tag{3.3}$$

$$\triangle \log X_t^{EG} = \alpha_{40} + \alpha_{43} \triangle \log P_t^{EG} + \alpha_{45} \triangle \log P_t^{RW} + \alpha_{47} \triangle \log E_t^{RW} + f_4 Z_{t-1} + \xi_{\triangle \log X_t^{EG}} \tag{3.4}$$

On the demand side of real market, domestic prices in Equation 3.3 is a function of the current values of net exports and foreign prices in addition to the lagged values of model variables $f_3 Z_{t-1}$. This domestic demand shock $\xi_{\triangle \log P_t^{EG}}$ is designed to mirror exogenous fiscal policy effects of revenues or expenditures, wage-push inflation, and other demand side factors. On the supply side of real market, economic activity measured by net exports in Equation 3.4 depends on the concurrent values of domestic and foreign prices plus exchange rate besides the lagged values of model variables $f_4 Z_{t-1}$. Prices can affect real economic activity via altering production costs. In this design, net exports not aggregate output is used, not to obscure the sensitivity of certain output components to the aggregation process, see Ncube et al. (2013). This domestic supply shock $\xi_{\triangle \log X_t^{EG}}$ should reflect exogenous changes in productivity, mark-ups, and other supply factors.

$$\triangle \log P_t^{RW} = \alpha_{50} + f_5 Z_{t-1} + \xi_{\triangle \log P_t^{RW}} \tag{3.5}$$

$$R_t^{RW} = \alpha_{60} + \alpha_{65} \triangle \log P_t^{RW} + f_6 Z_{t-1} + \xi_{R_t^{RW}} \tag{3.6}$$

$$\triangle \log E_t^{RW} = \alpha_{70} + \alpha_{71} R_t^{EG} + ... + \alpha_{76} R_t^{RW} + f_7 Z_{t-1} + \xi_{\triangle \log E_t^{RW}} \tag{3.7}$$

[11] Official Egypt data on foreign trade and prices are produced on a monthly basis, while monetary aggregates data are usually available within the month. Hence, it is more likely that Monetary Policy Committee (MPC) when meets monthly to decide on policy rates will be having at least a preliminary version of such data.

The identification structure of foreign shocks block is also similar to Kim and Roubini (2000). Equation 3.5 and Equation 3.6 clearly show that foreign interest $\xi_{R_t^{RW}}$ and price $\xi_{\triangle \log P_t^{RW}}$ shocks are specified as contemporaneously exogenous to any of Egypt's variables. Yet, foreign interest rate is a concurrent function of foreign prices. This is consistent with our specification that Egypt is small economy compared to the rest of world economy. In Equation 3.7, exchange rate shock $\xi_{\triangle \log E_t^{RW}}$ might be seen as external demand shock, since unexpected changes in foreign demand are passed on through exchange rate movements, e.g., an unanticipated decline in external demand may lead to an unpredictable depreciation in the Egyptian pound price. Accordingly, for domestic goods, foreign trade shock can be specified as partially dependent on exchange rate which in turn depend instantaneously on all the system variables besides their lagged values $f_7 Z_{t-1}$.

$$\begin{pmatrix} 1 & \alpha_{12} & 0 & 0 & 0 & \alpha_{16} & \alpha_{17} \\ \alpha_{21} & 1 & \alpha_{23} & \alpha_{24} & 0 & 0 & 0 \\ 0 & 0 & 1 & \alpha_{34} & \alpha_{35} & 0 & 0 \\ 0 & 0 & \alpha_{43} & 1 & \alpha_{45} & 0 & \alpha_{47} \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & \alpha_{65} & 1 & 0 \\ \alpha_{71} & \alpha_{72} & \alpha_{73} & \alpha_{74} & \alpha_{75} & \alpha_{76} & 1 \end{pmatrix} \begin{pmatrix} \epsilon_{R_t^{EG}} \\ \epsilon_{\log M_t^{EG}} \\ \epsilon_{\log P_t^{EG}} \\ \epsilon_{\log X_t^{EG}} \\ \epsilon_{\log P_t^{RW}} \\ \epsilon_{R_t^{RW}} \\ \epsilon_{\log E_t^{RW}} \end{pmatrix} = \begin{pmatrix} \beta_{11} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \beta_{22} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \beta_{33} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \beta_{44} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \beta_{55} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \beta_{66} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \beta_{77} \end{pmatrix} \begin{pmatrix} \xi_{R_t^{EG}} \\ \xi_{\log M_t^{EG}} \\ \xi_{\log P_t^{EG}} \\ \xi_{\log X_t^{EG}} \\ \xi_{\log P_t^{RW}} \\ \xi_{R_t^{RW}} \\ \xi_{\log E_t^{RW}} \end{pmatrix} \tag{3.8}$$

As the main model is over-identified, only 70 restriction $K^2 + K(K-1)/2$ are required while 73 restriction are imposed on matrices A and B, it is then necessary to test for over-identification. The Likelihood Ratio test results for the baseline model reported in Table A3.3 show that the null hypothesis of over-identification cannot be rejected at all conventional significance levels, meaning that the proposed identification structure is not rejected.

3.4 Fundamental Results of the Baseline Model

The dynamic responses of the model variables to the main shocks, namely R_t^{EG}, $\triangle \log E_t^{RW}$, R_t^{RW} and $\triangle \log P_t^{RW}$, along with two standard errors Hall's confidence bands generated from 3000 random draws are presented in Figures 3.2 – 3.5. At the bottom of each sub-figure, the legend lists the source of structural shock along with the respondent variable in a time horizon of four years.

3.4.1 Domestic Shocks and Economy Macrodynamics

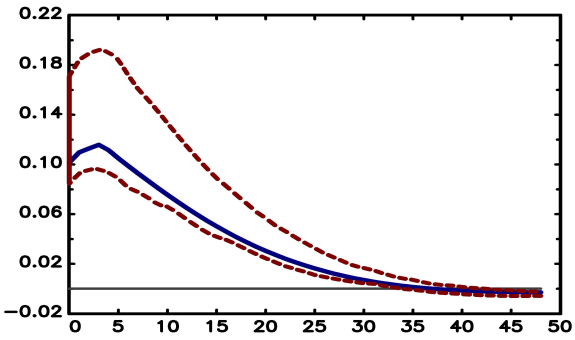
The results of impulse response functions to the exchange rate shock strongly agree with early evidence. Figure 3.2 highlights two major findings regarding the impacts of exchange rate on domestic economy in 2005–2015 as compared to 1996–2005 as in Billmeier and Al-Mashat (2007). First, unanticipated rise in nominal effective exchange rate (appreciation) still leads to strong and persistent decline in consumer prices with a similar magnitude as of the one reported in the previous study. Second, the counter-intuitive significant and enduring positive response of output to exchange rate appreciation in Billmeier and Al-Mashat (2007) has disappeared in our model. Exchange rate has only a positive effect on output upon impact but insignificant zero impact thereafter. [12]

These findings are further supported by observing the CBE reactions to the movements in exchange rate. The latter promptly increases interest rate upon exchange rate depreciation with the target to reduce broad money aggregates (in Figure 3.2, interest rate declines as exchange rate appreciates). These impulse responses uphold the wide believe that domestic monetary authorities still intervene in the foreign exchange market, at least on irregular basis, to insure nominal exchange rate stability. This *empirically propped* evidence refutes the strict conclusion by Awad (2010) that the CBE has relaxed its implicit exchange rate target in the period following 2003. It is also more supportive to the observed relationship between exchange rate and interest rate in Egypt.

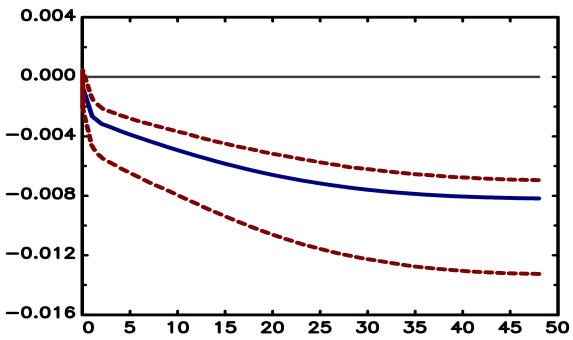
[12] These responses are highly robust to the use of different inflation measures, consumer price index or wholesale price index, or alternative exchange rate indicators, bilateral, nominal and effective.

Figure 3.2 Impulse Responses of the Nominal Effective Exchange Rate

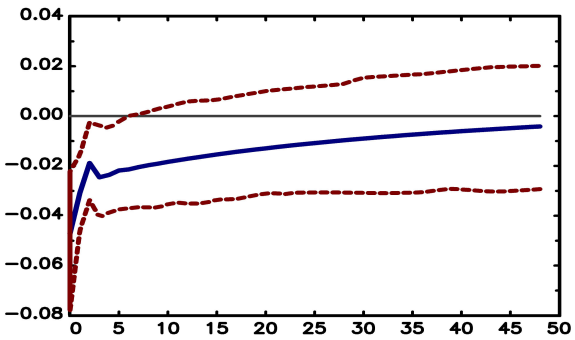
(a) R_t^{EG} Non-cumulative Response to $\triangle\, log\, E_t^{RW}$ Impulse



(b) $\triangle\, log\, P_t^{EG}$ Cumulative Response to $\triangle\, log\, E_t^{RW}$ Impulse



(c) $\triangle\, log\, X_t^{EG}$ Cumulative Response to $\triangle\, log\, E_t^{RW}$ Impulse



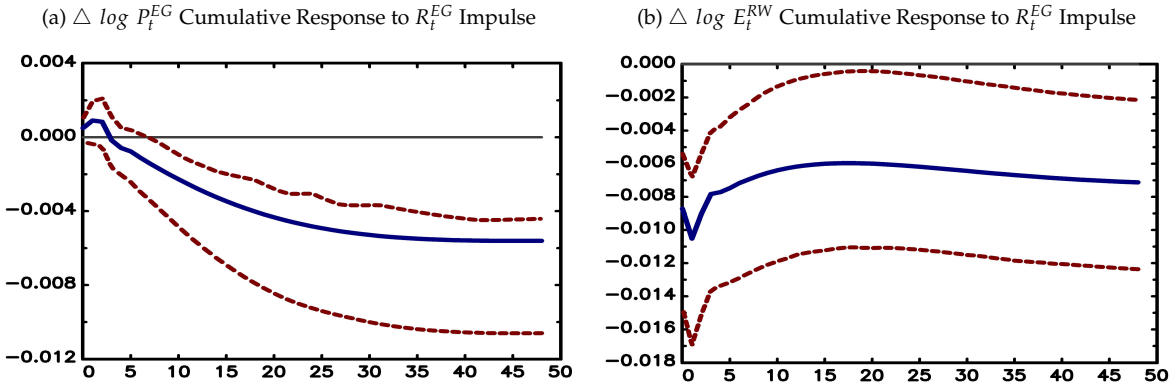
Notes: Structural One SD Innovation ± Two SE Hall's Percentile Confidence Bands.

The effects of interest rate on domestic economy have mildly fortified from 2005 to 2015 relative to preceding periods. Figure 3.3 demonstrates that an unexpected positive impulse to the domestic interest rate leads to a significant and prolonged decline in the domestic prices for the full time horizon. This moderate but persistent deflationary impact of interest rate on consumer prices declares huge improvement from the muted and insignificant impact documented in earlier periods, see Billmeier and Al-Mashat (2007) [1996–2005], Hachicha and Lee (2009) [1977–2006] and Abdel-Baki (2010) [1991–2009] among others. [13] The absence of price puzzle is a confirming sign of well identifying monetary policy, see Sims (1998), Christiano et al. (1999) and Kim and Roubini (2000).

[13] On a side but important note, the insignificant immediate response of inflation rate to domestic interest rate impulse may confirm the lagged impact of the latter on the first observed in Figure 3.1.

Nevertheless, the domestic interest rate has not acquired the entire intensity essential to be a fundamental monetary transmission channel. One indication is the weak and transitory depreciation impact of domestic interest rate impulse on nominal effective exchange rate. As per the uncovered interest parity condition (UIPC), an unanticipated upsurge in domestic interest rate that creates temporary domestic interest premium, should lead to a persistent depreciation in domestic currency relative to foreign currencies, i.e. a decline in nominal effective exchange rate. From Figure 3.3 it is clear that this is not the scenario here since the positive shock to interest rate is only associated with a small kink in exchange rate upon impact but insignificant effect subsequently.

Figure 3.3 Impulse Responses of the Domestic Interest Rate



Notes: Structural One SD Innovation ± Two SE Hall's Percentile Confidence Bands.

3.4.2 Foreign Shocks and the Domestic Economy

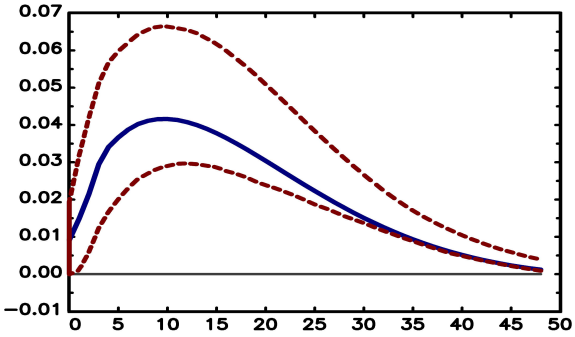
The responses of domestic variables to the world interest shock are highly comparable to the results of peer studies. Figure 3.4 displays a potent positive association between foreign and domestic interest rates; the latter increases strongly within the first year upon a positive impulse to the first. This pattern is highly rhythmic to the result reported in Li et al. (2010) between Canada and the US and between South Africa and the US in Ncube et al. (2012). Two reasons may explain this relationship. First, changes in world interest rate can directly moves Egypt's interest rate as a small and open economy; R_t^{RW} can explain up to 10% of R_t^{EG} variance in a two years horizon as per variance decomposition. Second, to ensure exchange market stability, the CBE may adjust interest rate accordingly, e.g. increase domestic interest

to sterilize the inflationary impact of the increase in foreign interest rate.

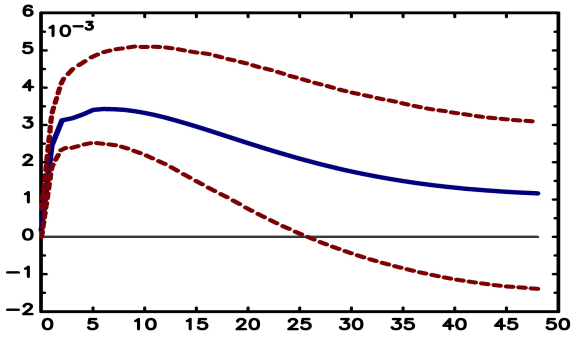
Moreover, the shock has an appreciation effect on exchange rate that is significant and persistent. Driven by the immediate increase in exchange rate and interest rate upon the shock, net exports show a modest but significant decline for almost one year before recovering to its pre-shock level. The impact on prices is also reliable though of a weak economic magnitude, domestic prices of consumers rise sluggishly but significantly in response to foreign interest impulse. Again, R_t^{RW} can illustrate up to 9% and 5% of variances of $\triangle \log P_t^{EG}$ and $\triangle \log E_t^{RW}$, respectively.

Figure 3.4 Impulse Responses of the Foreign Interest Rate

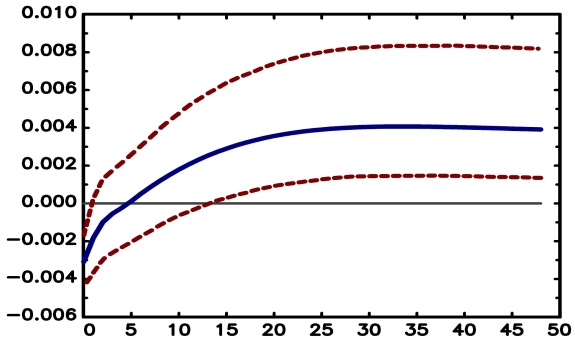
(a) R_t^{EG} Non-cumulative Response to R_t^{RW} Impulse



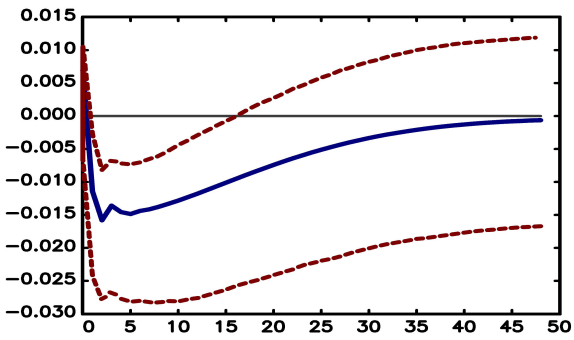
(b) $\triangle$ *log* P_t^{EG} Cumulative Response to R_t^{RW} Impulse



(c) $\triangle$ *log* E_t^{EG} Cumulative Response to R_t^{RW} Impulse



(d) $\triangle$ *log* X_t^{EG} Cumulative Response to R_t^{RW} Impulse



Notes: Structural One SD Innovation ± Two SE Hall's Percentile Confidence Bands.

In general, these results widely match the findings of Kim and Roubini (2000) and Li et al. (2010) on the impact of US monetary shocks on the G7-non-US economies and Canada, consecutively. Here, we adopt two measures to ensure that the previous results are not driven by the zero lower bound [1] *a weighted average shadow interest rate* that captures unconven-

tional policy impacts in the post-crisis period while have conventional effects in ex-crisis periods is used, see Wu and Xia (2016) [2] the main model is re-estimated limiting the sample to the end of 2009; the new model results are qualitatively analogous to those of the main model, see the results in Figure A3.4.

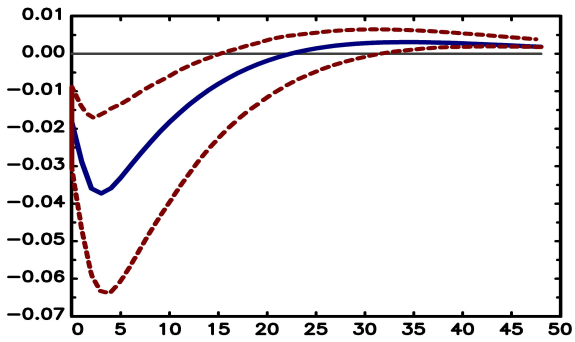
The results of the world commodity prices shock show also broad consistence with comparable results on developing countries. In Figure 3.5, exchange rate shows a significant and incessant depreciation following a positive impulse to the global grain price index. Yet, the extent of the shock on exchange rate is fairly moderate in terms of economic significance; the variance decomposition exercise shows that $\triangle \log P_t^{RW}$ can explain up to 6% of the variations in $\triangle \log E_t^{RW}$ in a three months horizon. This is quite expected given that the bills of imported grains do not only represent a major source of trade account deficit but also have a sizeable share in the domestic consumption and hence price baskets.

Upon impact, the world commodity prices shock causes the nominal exchange rate to depreciate, domestic prices to increase, net exports to rise sluggishly before it returns promptly to its pre-shock level, and domestic interest rate to increase after a quarter of declining. The size of these responses is quite reasonable given that the index includes prices of grains only. Again, these results are highly correlated with comparable evidence on developing countries, such as the impacts of commodity prices on Turkey by Kilinc and Tunc (2014) and the effects of OECD import prices on Bangladesh by Rahman (2015).

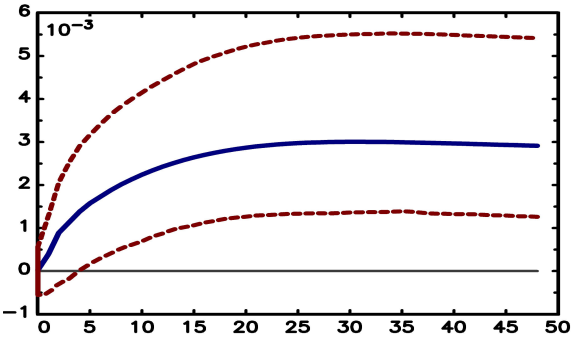
The impulse response results are further backed by the results of variance decomposition exercise. First, the impacts of domestic prices lagged values on its current variations are very dominant (idiosyncratic) in the short run but declining over the long run, which may indicate that the CBE has been more concerned to contain inflationary waves during the period of study. Second, unexpected shocks to global commodity prices can explain one tenth of net exports variations upon impact while world monetary policy shocks can illustrate a like part of domestic prices fluctuations. Third, the two foreign shocks have large explanatory impact on exchange rate variations all over the forecast horizons.

Figure 3.5 Impulse Responses of the Global Commodity Prices

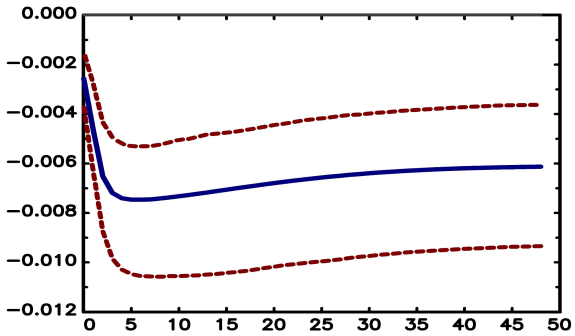
(a) R_t^{EG} Non-cumulative Response to $\triangle\ log\ P_t^{RW}$ Impulse



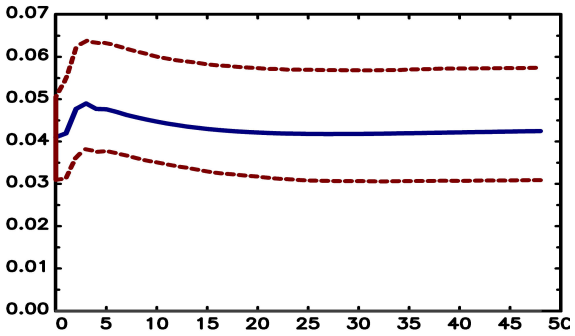
(b) $\triangle\ log\ P_t^{EG}$ Cumulative Response to $\triangle\ log\ P_t^{RW}$ Impulse



(c) $\triangle\ log\ E_t^{RW}$ Cumulative Response to $\triangle\ log\ P_t^{RW}$ Impulse



(d) $\triangle\ log\ Y_t^{EG}$ Cumulative Response to $\triangle\ log\ P_t^{RW}$ Impulse



Notes: Structural One SD Innovation ± Two SE Hall's Percentile Confidence Bands.

3.5 Robustness Checks and Sensitivity Analysis

3.5.1 Validity of Identification Scheme to Plausible Specifications

Imposing concurrent restrictions to identify shocks in SVAR models has various advantages. A one particular quality is the capability to test for controversial restrictions based on economic theory or empirical research, see for example Christiano et al. (2006). This section verifies three alternative model specifications with other plausible restrictions. These alternative models are still over-identified, since the number of restrictions in models (a_1) and (a_2) increases by one while in model (a_3) it is the same number as in the main model. Again, the likelihood ratio test results for these models in Table A3.3 show that the null hypothesis of over-identification cannot be rejected at 5% significance level.

In the first alternative model a_1, the CBE is allowed to respond immediately to the changes in net exports; this might be driven by the CBE target to promote net exports or stabilize economic growth in certain periods, see Kandil (2011). In the second model a_2, global commodity prices just as the world interest rate is specified to have prompt impact on the CBE reaction function as suggested by Kim and Roubini (2000). The trend of rising commodity prices after 2007 for instance may give credit to this specification. In the third model a_3, exchange rate has an instant pass-through effect on domestic prices, i.e. these prices respond immediately to unexpected fluctuations in nominal exchange rate but not to the trade balance movements, see Goldberg and Knetter (1996) [14].

$$R_t^{EG} = \alpha_{10} + \alpha_{12} \triangle \log M2_t^{EG} + \alpha_{14} \triangle \log X_t^{EG} + \alpha_{16} R_t^{RW} + \alpha_{17} \triangle \log E_t^{RW} + f_1 Z_{t-1} + \xi_{R_t^{EG}} \tag{a_1}$$

$$R_t^{EG} = \alpha_{10} + \alpha_{12} \triangle \log M2_t^{EG} + \alpha_{15} \triangle \log P_t^{RW} + \alpha_{16} R_t^{RW} + \alpha_{17} \triangle \log E_t^{RW} + f_1 Z_{t-1} + \xi_{R_t^{EG}} \tag{a_2}$$

$$\triangle \log P_t^{EG} = \alpha_{30} + \alpha_{35} \triangle \log P_t^{RW} + \alpha_{37} \triangle \log E_t^{RW} + f_3 Z_{t-1} + \xi_{\triangle \log P_t^{EG}} \tag{a_3}$$

The results of the schemes presented in Equations a_1 and a_2 are qualitatively and quantitatively similar to those of the baseline model with very minor variations in the ranges of confidence intervals around the response functions. The scheme in Equation a_3 still yield qualitatively comparable results yet with weaker responses of the monetary policy reaction function than those of the baseline model as shown in Figure A3.3. *In general these outcomes indicate that the baseline model is robust to plausible restrictions plans*. This reliability is further confirmed by twofold evidence, the overall results consistency with predictions of small open economy models and the absences of frequently reported anomalies.

[14] Please note that in this specification the value of the coefficient α_{34} for the variable $\triangle \log X_t^{EG}$ is restricted to zero not to coincide with the specification of the net exports equation.

3.5.2 Robustness of Modelling Design to Alternative Measures

To distinguish which aspects contribute to the validity of our results we do some robustness checks. The reduced form main VAR model is re-estimated using different lag orders. Sensible alternative variables are also tested, for example M_0 instead of M_2 and wholesale prices rather than consumer prices. These models yield broadly compatible results in terms of system stability and residuals properties. They also generate qualitatively but not quantitatively similar outcomes to those of the main model which provides superior performance as per economic and statistical standards. This indicates that our baseline model is rather robust to the use of substitute functional forms.

The robustness of results to the use of other identification schemes is also inspected. Specifically, the recursive system of Peersman and Smets (2001) as adopted by Awad et al. (2011) is estimated as an alternative to the non-recursive system employed. This identification plan yields inadequate results in terms of direction, significance and magnitude of various impulse responses. These results suggest that the use of non-recursive system allows us to adopt a more plausible identification structure and so eliminates the potential anomalies frequently observed in empirical investigations using typical Choleski decomposition, see for example Cushman and Zha (1997).

We further investigate the usage of prolonged sample 1997–2015 to estimate the main model. Though, it has been verified by the Chow test that the system parameters are unstable for the period before mid 2003; the null hypothesis of constant VAR coefficients over time can be rejected. This result provides further statistical support to our selected period of estimation which proved to be more homogeneous in view of the structure of economic policy at that time. Ultimately, we have estimated the main model limiting the sampling period to the end of 2009 to make sure that model results are not driven by the Zero Lower Bound. Qualitatively, the outcomes of this model as shown in Figure A4 are relatively analogous to those of the baseline model .

3.6 Conclusions

Using SVAR approach with non-recursive structure seems appropriate to assess the effects of unanticipated policy shocks on Egypt's economy. Imposing concurrent restrictions produces sound results that add to current literature on monetary business cycle of Egypt in two ways [i] solving the puzzles evidenced in earlier works and updating the estimates on the impacts of interest rate and exchange rate channels against recent advancements in favour of the first [ii] providing a delicate analysis of the influence of world interest rate and global commodity prices on domestic macroeconomic dynamics, the analysis of foreign component of home monetary policy that has been nearly absent in prior literature.

The model findings also offer a set of policy implications such as [1] the CBE has to continue the banking sector reform efforts to ensure competition and reduce interest rate spread. Monetary policy then may be able to anchor inflation expectations through adopting more proactive interest rate policy instead of the current moderate and lagged impact of interest rate on domestic economy (yet, far better than earlier periods) [2] the success of this policy, though, rests not only on the existence of truthful domestic settings but also on favourable external conditions, which have its own direct impacts on domestic economy besides its indirect impacts on determining the efficiency of domestic policies.

This is particularly true for Egypt in the present time, since it has shown signs of deeper integration with the world economy. Impulse response functions of the foreign block propose that Egypt economy is highly responsive to policy shocks coming from global economy. For example, positive impulse to the foreign interest increase domestic prices and so distort the CBE efforts to curb inflation aside from its adverse impacts on home growth prospects due to its negative effect on net exports upon exchange rate appreciation [3] this further highlight the prominent role of exchange rate in magnifying the effects of foreign shocks on domestic economy in spite of (officially) relaxing its position as a nominal anchor. Model results clearly show that changes caused by foreign shocks are transmitted into domestic economy at first through nominal exchange rate, then to price indices, and lastly but significantly, to the real side of economy, i.e. the tradable goods sector.

3.7 Appendix A3

Table A3.1 ADF Test Results of Individual Series in the Baseline Model

	R^{EG}	M_2^{EG}	P^{EG}	X^{EG}	P^{RW}	R^{RW}	E_{RW}^{EG}
Series in Logarithmic Levels							
ADF Test Statistic	-3.52	-1.93	-1.65	-0.47	-1.17	-3.04	-2.23
P-Value	0.04	0.61	0.72	0.88	0.91	0.14	0.48
Deterministic Regressors	C+T	C+T	C+T	C	C+T	C+T	C+T
Maximum Lag Length	12	12	12	12	12	12	12
Series in Logarithmic Difference							
ADF Test Statistic	...	-3.78	-4.01	-6.30	-4.94	...	-4.11
P-Value	...	0.02	0.01	0.01	0.01	...	0.01
Deterministic Regressors	C	C	C	–	C	C	C
Maximum Lag Length	11	11	11	11	11	11	11

Notes: The ADF test estimates the model: $y'_t = \phi y_{t-1} + \beta_1 y'_{t-1} + \beta_2 y'_{t-2} + ... + \beta_k y'_{t-k}$, where $y'_t = y_t - y_{t-1}$ is the first-differenced series and k is the number of lags. To test for unit root, all variables are specified in logarithmic levels except for interest rates which are specified in percentages. Trend and constant are included as deterministic regressors for all series except for net exports series that has a constant only. The maximum lag length is set to 12 months. In logarithmic difference specification, the number of lags is reduced by one and the trend is dropped. The null-hypothesis for the ADF test is that the series is non-stationary. Thus, large p-values indicate non-stationarity while small p-values suggest stationarity.

Table A3.2 Results of the Residuals Diagnostic Tests of the Reduced Form Models

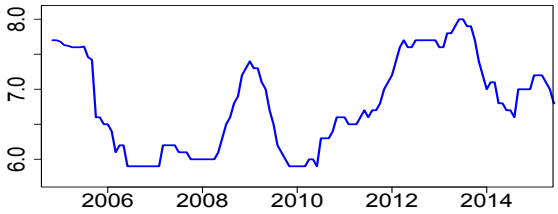
	Portmanteau Test	Breusch-Godfrey-LMF	Multivariate-ARCH-LM
Baseline Model			
Test Stat	525.5	1.167	3175
P-Value	0.129	0.093	0.306
DF	490.0	196/495	3136
Alternate Model			
Test Stat	774.0	1.421	3200
P-Value	0.011	0.001	0.205
DF	686.0	196/495	3136

Table A3.3 Likelihood Ratio Test of Over-Identifying Restrictions

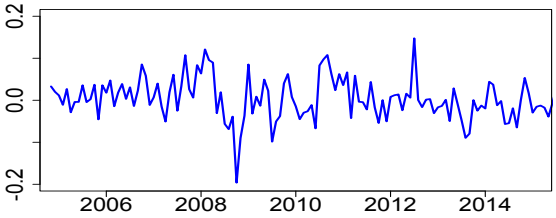
	Baseline	Sensitivity (1)	Sensitivity (2)	Sensitivity (3)
$\chi^2_{(k)}$	$2.57_{(3)}$	$1.25_{(2)}$	$1.68_{(2)}$	$7.60_{(3)}$
α	0.46	0.54	0.43	0.05

Figure A3.1 Plots of the Model's Time Series 2005M01:2015M12

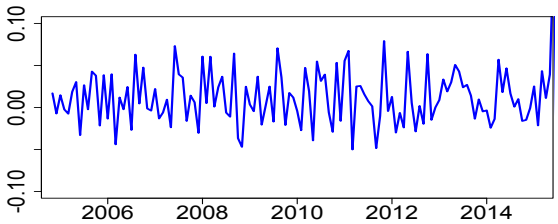
(a) Egypt Interest Rate (R^{EG})



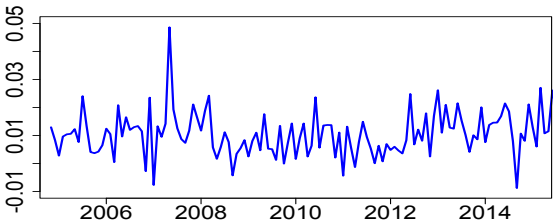
(b) Egypt Inflation Rate ($\triangle \log P^{EG}$)



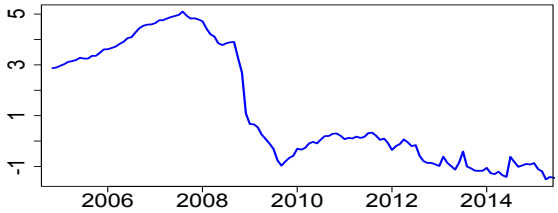
(c) Egypt M0 Growth Rate ($\triangle \log M_0^{EG}$)



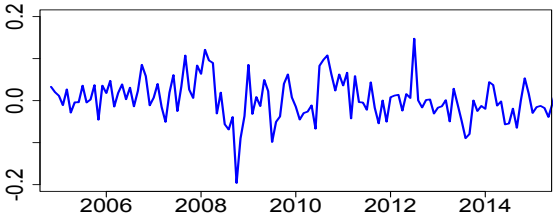
(d) Egypt M2 Growth Rate ($\triangle \log M_2^{EG}$)



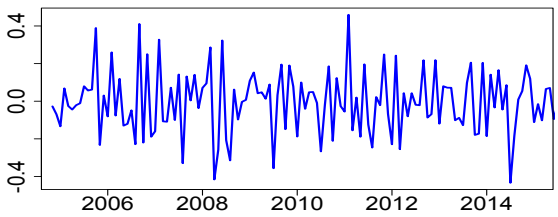
(e) World Interest Rate (R^{RW})



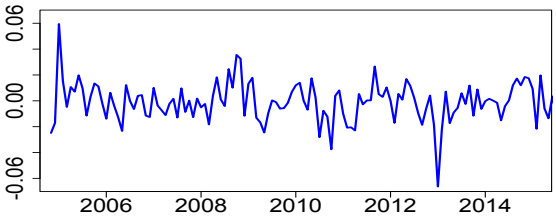
(f) World Prices Growth Rate ($\triangle \log P^{RW}$)



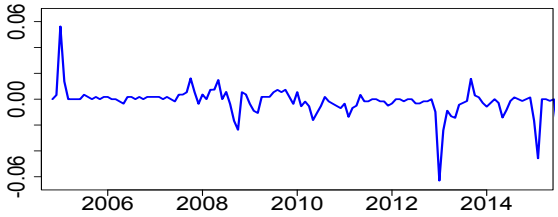
(g) Egypt Net-Exports Growth ($\triangle \log Y^{EG}$)



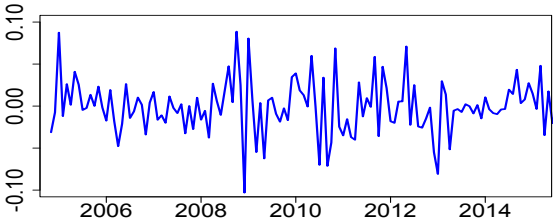
(h) NEER Growth Rate ($\triangle \log E_{RW}^{EG}$)



(i) EGP-USD Growth Rate ($\triangle \log E_{US}^{EG}$)



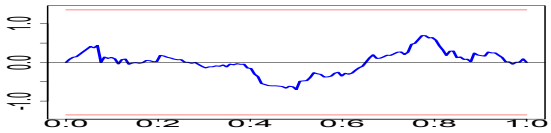
(j) EGP-EUR Growth Rate ($\triangle \log E_{EA}^{EG}$)



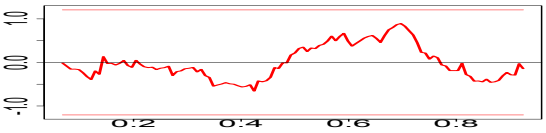
Source: International Monetary Fund.

Figure A3.2 Results of Empirical Fluctuation Processes of OLS-CUSUM and OLS-MOSUM

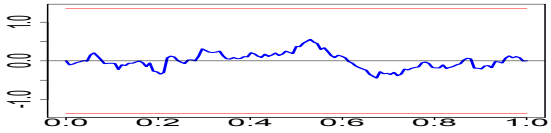
(a) OLS-CUSUM of R^{EG} Equation



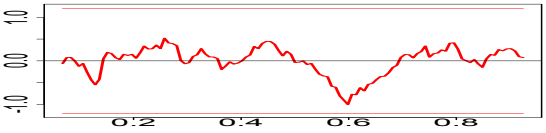
(b) OLS-MOSUM of R^{EG} Equation



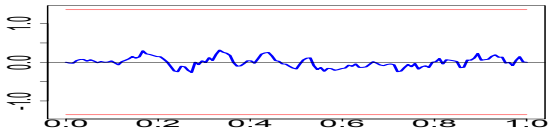
(c) OLS-CUSUM of $\triangle \log M_2^{EG}$ Equation



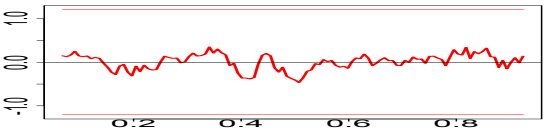
(d) OLS-MOSUM of $\triangle \log M_2^{EG}$ Equation



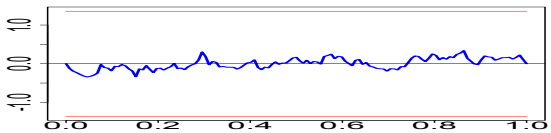
(e) OLS-CUSUM of $\triangle \log P^{EG}$ Equation



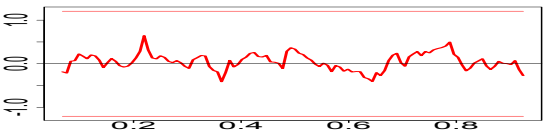
(f) OLS-MOSUM of $\triangle \log P^{EG}$ Equation



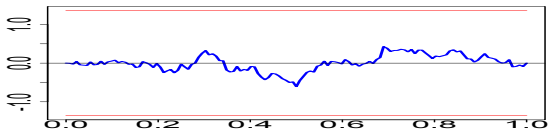
(g) OLS-CUSUM of $\triangle \log Y^{EG}$ Equation



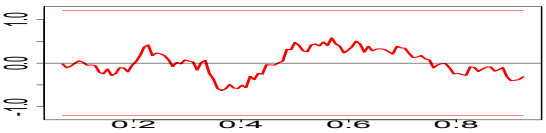
(h) OLS-MOSUM of $\triangle \log Y^{EG}$ Equation



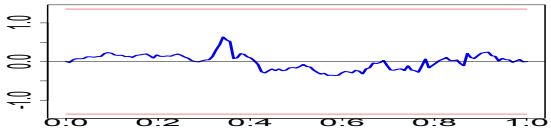
(i) OLS-CUSUM of $\triangle \log P^{RW}$ Equation



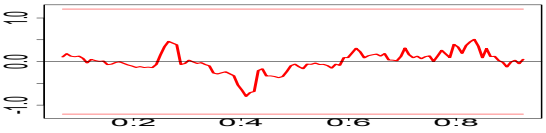
(j) OLS-MOSUM of $\triangle \log P^{RW}$ Equation



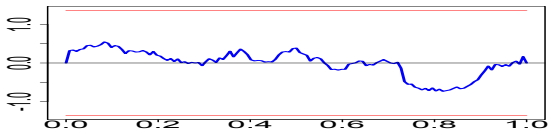
(k) OLS-CUSUM of R^{RW} Equation



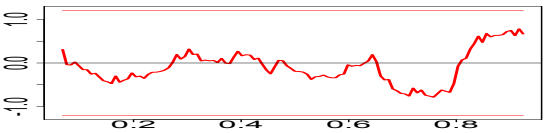
(l) OLS-MOSUM of R^{RW} Equation



(m) OLS-CUSUM of $\triangle \log E_{EG}^{RW}$ Equation



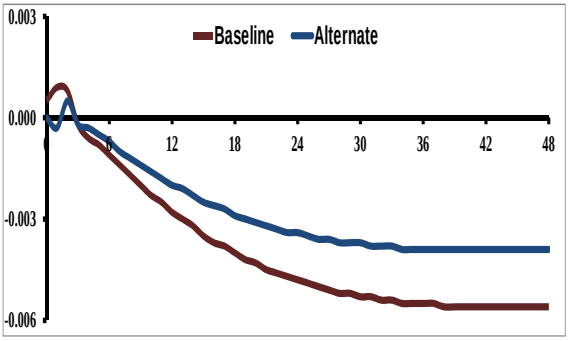
(n) OLS-MOSUM of $\triangle \log E_{EG}^{RW}$ Equation



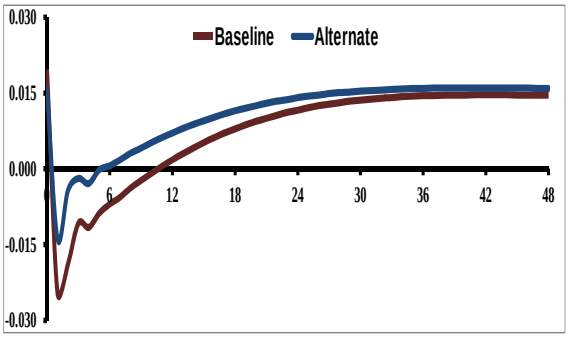
Notes: To assess structural stability of the main model, empirical fluctuation processes are computed to capture fluctuations in CUmulative and MOving SUMs (CUSUMs or MOSUMs) of OLS residuals. Under H_0 of parameter stability resulting EFP exhibit limited fluctuations while under H_1 of structural change EFP change over data window. In general, the plots do not show excessive fluctuations (no boundary crossing), except for one visible small peak in the exchange rate process after the Arab Spring in 2011.

Figure A3.3 Model a_3: Cumulative Impulse Responses of Domestic Interest Rate

(a) $\triangle \log P_{DL}^{EG}$ Response to R_P^{EG} Impulse



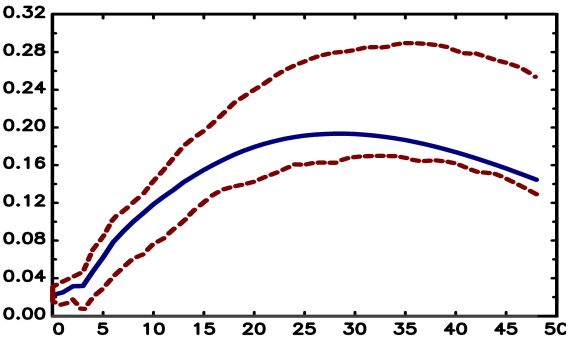
(b) $\triangle \log Y_{DL}^{EG}$ Response to R_P^{EG} Impulse



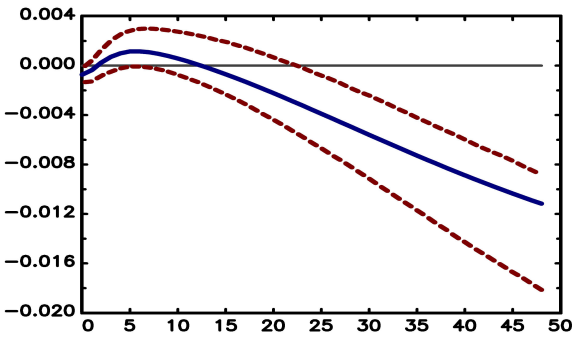
Notes: Structural One SD Innovation ± Two SE Hall's Percentile Confidence Bands.

Figure A3.4 Alternative Model Results for the Period 2000M01–2009M12

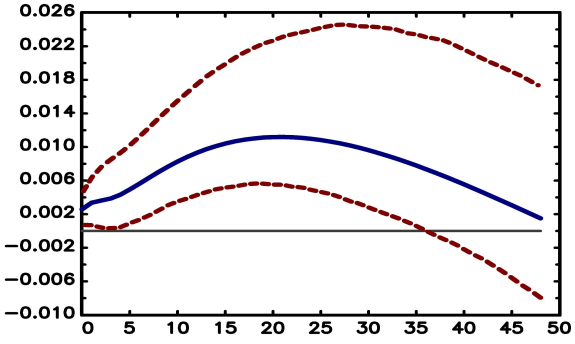
(a) R_t^{EG} Response to R_t^{RW} Impulse



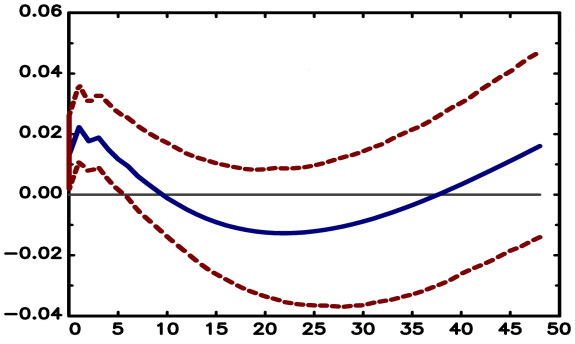
(b) $\triangle \; log \; P_t^{EG}$ Response to R_t^{RW} Impulse



(c) $\triangle \; log \; E_t^{EG}$ Response to R_t^{RW} Impulse



(d) $\triangle \; log \; X_t^{EG}$ Response to R_t^{RW} Impulse



Notes: Structural One SD Innovation ± Two SE Hall's Percentile Confidence Bands.

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