Essays in applied macroeconomics

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Sommario

Nel primo capitolo ho analizzato l'effetto delle news macroeconomiche (errori di previsione dei mercati relativi al flusso di dati sui fondamentali macroeconomici) sul tasso di cambio giornaliero Euro/Dollaro. Ho preso in considerazione un gran numero di annunci macroeconomici in tempo reale riguardanti sia gli Stati Uniti che la zona euro, e le aspettative dei mercati finanziari riportate da Bloomberg. Riguardo la zona euro, ho anche studiato gli annunci riguardanti i dati dei singoli paesi, per i quattro paesi più grandi (Germania, Francia, Spagna, Italia). I risultati per l'intero campione (1999-2012) mostrano che sia le news associate alla zona euro, sia quelle associate agli Stati Uniti hanno un impatto significativo sul tasso di cambio giornaliero Euro/Dollaro. Inoltre, l'effetto delle news riguardanti la zona euro è aumentato dalla crisi del 2008, per diventare più consistente di quello delle news riguardo dati statunitensi.

Nel secondo capitolo ho studiato il flusso dei dati congiunturali per l'economia messicana. Ho ricostruito il flusso delle pubblicazioni dei dati macroeconomici che sono monitorati puù di frequente dai mercati finanziari, commentatori economici e policy makers. Facendo riferimento alla letteratura su "nowcasting" (predirre il presente), ho modellizzato i dati in un modello di previsione che puù essere aggiornato ad ogni pubblicazione di un nuovo dato macroeconomico. Il modello può essere utilizzato per valutare lo stato dell'economia messicana in tempo reale, studiando l'importanza dei dati macroeconomici inclusi nell'analisi, e produce previsioni la cui accuratezza è comparabile a quella delle previsioni istituzionali e su base discrezionale.

Abstract

In the first chapter I evaluate the effect of macroeconomic "news" (market now-cast errors related to the flow of data releases on macroeconomic fundamentals) on the daily USD/EUR exchange rate. I consider a large number of real-time macroeconomic announcements from both the US and the euro-zone, and the related market expectations as reported by Bloomberg. For the euro-zone I also study country level announcements for the four biggest economies (Germany, France, Italy, Spain). The results for the whole sample (1999-2012) show that both the "news" associated to euro-zone releases and those associated to US ones have a significant impact on the USD/EUR exchange rate. However, the effect of the euro-zone "news" has become larger since the 2008 crisis and it is now more sizeable than that of the US "news".

In the second chapter I study the flow of conjunctural data for the Mexican economy. I reconstruct the flow of releases that are most frequently monitored by market participants, economic commentators and policy makers. Following the literature on nowcasting, I jointly analyse the macroeconomic data in a model that is continuously updated as new data get released. The model can be used to assess the current macroeconomic conditions (predicting the present) of the Mexican economy and to evaluate the importance of each macroeconomic data release. Moreover, it produces forecasts whose accuracy is similar to the one of institutional and judgemental forecasts.

Chapter 1

The impact of macroeconomic news on the euro-dollar exchange rate

1.1 Introduction

In this chapter I study the impact of macroeconomic news from the US and from the euro area on the USD/EUR exchange rate, to understand to what extent US and European fundamentals have been driving its determination and to evaluate how their relative importance has changed over time. To this aim, I estimate the effects on the daily USD/EUR rate of a large number of macroeconomic news from the US, the Euro-zone as an aggregate and from its four biggest economies (Germany, France, Italy, Spain)[1]. I evaluate whether there is a difference in effects before and after the crisis of 2008, and I characterize the dynamics of the relative importance

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[1]I just consider the effect on the changes in the level of the exchange rate, and not on its volatility. For a survey on this other strand of literature see Neely (2011).

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of US and euro area news after 2008 using a rolling estimation of the model. As a validation of the results, I use a test of out-of-sample predictive power, considered a very tough test also using realized value of the predictors since the work of Meese and Rogoff (1983). The results of this work can be summarized as follows. First, macroeconomic news events from the euro area as an aggregate and from its four bigger countries are important for the USD/EUR rate determination in the eyes of market operators. Second, their importance has been remarkably increasing after 2008, becoming more relevant than news from the US in recent times: the "great recession" and the European sovereign debt crisis might have shaped market operators' perception of the importance of European macroeconomic fundamentals for the determination of the USD/EUR rate.

The existence of a link between macroeconomic fundamentals and exchange rates has been called into question since the seminal work of Meese and Rogoff (1983), and many studies confirmed the difficulty of using fundamentals to forecast the exchange rates in the short and the medium run[2]. Analyzing the impact of macroeconomic news has become a standard approach to assess the presence, strength and characteristics of such a link: if macroeconomic fundamentals and exchange rates are connected and markets are efficient, the unexpected part of a macroeconomic release should have an impact on the exchange rates, as the agents revise their expectations and

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[2]See Rossi (2013) for a review.

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adjust their position on the market[3]. Therefore, the event study approach is now a well recognized methodology for identification of causal relationships in the macro-finance literature, as it constitutes a good example of a "pseudo-natural experiment"(Gürkaynak and Wright, 2013).

The earliest contributions that studied how unexpected innovations in fundamentals affect exchange rates focused on news about current account, interest rates, money and output (among the others Mussa, 1979; Dornbusch, Branson, Kenen, Houthakker, Hall, Lawrence, Perry, Fellner, Brainard and von Furstenburg, 1980; Frenkel, 1981; Edwards, 1982, 1983). The news variables were constructed as the innovations in the interest rate differential or as innovation of econometrics models (ARIMA or VAR), mainly using monthly or daily data. The shared conclusion was that unexpected movements in fundamentals account for a considerable part of the behavior of exchange rates, but those studies suffered from two main limits: they considered only few economic variables and they could not use real-time data, therefore they could not take into account all the actual information available to market operators.

To overcome these problems, other researchers constructed the "news" variables as the differences between the median response of surveys about expectations of macroeconomic data and the actual releases, and this def-

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[3]Different approaches in explaining the short-term movements of the exchange rates study the effect of technical trading (e.g. Cheung and Chinn, 2001) and of the order flow (among the others Evans and Lyons, 2008, 2012; Rime, Sarno and Sojli, 2010). However, also technical trading and order flow dynamics can be associated to macroeconomic news about fundamentals, as shown in Evans and Lyons (2002) and Love and Payne (2008).

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inition became the benchmark. Using weekly or daily data, some works focused on the impact of news about monetary variables (Cornell, 1982; Engel and Frankel, 1984; Hardouvelis, 1984, 1988), trade balance (Hardouvelis, 1988; Hogan, Melvin and Roberts, 1991; Aggarwal and Schirm, 1992; Deravi, Gregorowicz and Hegji, 1992) and inflation (Hardouvelis, 1988; Tandon and Urich, 1987), but finding conflicting results. In order to better disentangle the news' effects, a number of authors used intra-daily data (Almeida, Goodhart and Payne, 1998; Andersen, Bollerslev, Diebold and Vega, 2003; Dominguez and Panthaki, 2006; Pearce and Solakoglu, 2007; Andersen, Bollerslev, Diebold and Vega, 2007). Overall, they documented that macroeconomic surprises do have a statistically significant impact on the level of spot exchange rates, stressing the strong importance of news about real variables.

However, as also pointed out by Almeida et al. (1998) and Ehrmann and Fratzscher (2005), if an announcement is fundamental for the determination of the exchange rate, its impact should show some degree of persistence and should not rapidly die out in a few minutes: this is a very reasonable rationale for the use of daily data. Galati and Ho (2003) was the first of a series of studies studying the impact of real-time macroeconomic news on the daily USD/EUR rate, finding that only the impact of some announcements from the US and two from Germany were statistically significant[4]. Similarly, Ehrmann and Fratzscher (2005) found significant

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[4]They used a limited sample (1999-2000) and nine news about US economy, four about Germany, one about aggregate euro area and one about France,

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influence of news about real and nominal variables from US and one about German economy (IFO), but just considering the period 1999-2003. Simpson et al. (2005) documented significant reactions of six exchange rate pairs to 23 US announcements, and Ferraro, Rogoff and Rossi (2012) compared the predictive power of macroeconomic news from the US with the one of oil price, finding that the latter performs much better. Also Goldberg and Grisse (2013) used just US announcements, and discovered a significant time variation in the responses of USD/EUR rate. Ehrmann, Osbat, Strasky and Uusküla (2013) found little power of fundamentals in explaining exchange rate movements in the period 2009-2011, but considering just US announcements and German and Italian industrial production, and Swanson and Williams (2013) found instead a significant reaction to US and German news, not affected by the zero lower bound. Finally, Altavilla, Giannone and Modugno (2014), looking at news from the US, document significant effects of six announcements on the trade-weighted US dollar but no evidence of their persistence.

This work contributes to the literature in two ways. First, to my knowledge this is the first work evaluating the impact on the daily USD/EUR exchange rate of a large number of real-time macroeconomic announcements from the euro area and from its bigger countries, providing empirical evidence of the great importance of European macroeconomic fundamentals for its determination. The second contribution concerns the study of the

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relative importance of US and European data releases in the eyes of market operators, documenting a gradual shift of the attention from US to European macroeconomic fundamentals.

1.2 The empirical model and the data

1.2.1 The model

Following the common practice of related literature, I define macroeconomic "news" the unexpected component of a release, that is the difference between the median of a survey of expectations among market participants and the actual value of the macroeconomic announcement. As in Balduzzi, Elton and Green (2001) I standardize the news, in order to have comparable results among the variables and to interpret the regression coefficient as the change in the exchange rate associated to a change of one-standard deviation in the news. Therefore, the "news" variable I use in the econometric analysis is the following:

$$X_{i,t} = \frac{A_{i,t} - S_{i,t}}{\sigma_i} \tag{1.1}$$

Where $X_{k,t}$ is the standardized k-th news at time t, $A_{i,t}$ is the value of the real-time announcement i on day t, $S_{i,t}$ is the value of the median of the survey relative to the announcement i on day t, σ_i is the standard deviation of the news i in the sample[5].

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[5]Due to the presence of some outliers I performed the same analysis standardizing the news using the interquartile range, but results do not change significantly. Those results

The specification of the econometric model is the following:

$$\Delta(\ln e_t) = \alpha + \gamma\Delta(\ln e_{t-1}) + \sum_{i=k}^{K} \beta_i X_{i,t} + \delta^m MON + ... + \delta^f FRI + \epsilon_t \quad (1.2)$$

Where e_t is the spot USD/EUR rate, MON, TUE, WED, THU and FRI are dummy variables included to take into account for day-of-the-week effects. As argued by Gürkaynak and Wright (2013), Ordinary Least Squares is an appropriate estimation method in this framework, "assuming that there is no other shock before the announcement but within the event study window affecting the agents' expectations about the news". In our case the condition is respected, and due to the presence of heteroskedasticity of the residuals[6] I estimate the equation using Ordinary Least Squares with Newey-West standard errors. The results are robust to a change of the maximum number of lags, here fixed at 12. Given the definition of the USD/EUR rate, a positive regression coefficient indicates that a positive news (actual value higher than expected) is associated to a depreciation of the US dollar with respect to the euro.

1.2.2 Data description

Exchange rate are daily spot USD to EUR, from 1st January 1999 to 31st December 2012, downloaded from Datastream Thompson Reuters. I

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are available upon request.

[6]A Breusch-Pagan test rejects the null hypothesis of homoskedasticity at 1% level.

consider the daily frequency as the more appropriate to study the markets' reactions showing some persistence, looking for those effects that do not die out in a few minutes after the announcement. Moreover, there is evidence of leakage of German data, which could affect the results using intra-daily data (Andersen, Bollerslev, Diebold and Vega, 2003; Ehrmann and Fratzscher, 2005). Exchange rate data have been recorded at 18:00 (EST), in order to take into account the releases of the whole day in Europe and in the US.

Regarding macroeconomic variables, I include in the analysis a large number of real-time announcements from the euro area and from its bigger countries. Despite the global relevance of this currency pair, the existence of an extensive literature about the impact of macroeconomic news on exchange rates and the attention that the markets put every day on many European data, there is no work taking into account more than a few macroeconomic news events from the individual countries or not considering Germany as a proxy for the whole euro area. Many news events about aggregated data or coming from the largest economies of the euro area are invariably disregarded, but it is important to take them into account. Those large countries are indeed important to determine the path of the euro area economy as a whole: The GDP of Spain, France and Italy together account for more than 48% of the GDP of the euro area[7]. Moreover, despite a substantial synchronization of business cycles within the euro area, there is still a considerable degree of asymmetry in the propagation of shocks and

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[7]Source: OECD.

in the transmission of monetary policy, and a substantial heterogeneity in the pattern of some macroeconomic aggregates which it has been increasing since the last crisis (Boivin, Giannoni and Mojon, 2008; Giannone, Lenza and Reichlin, 2009; Barigozzi, Conti and Luciani, 2013; Santis and Surico, 2013; Estrada, Galí and López-Salido, 2013). Finally, some aggregate data are released after the corresponding data referring to the countries (e.g. Industrial Production). The effect of news can be underestimated if one takes into consideration just the aggregate data, since agents can review their expectations after being surprised by the news referring to the countries.

Macroeconomic announcements are taken from Bloomberg, the most popular platform for financial information in real time, and this choice has three advantages. First, Bloomberg is among the most important sources of information for financial operators trading in real time: it is reasonable to assume that a variable not reported on Bloomberg is not considered important by market operators. Second, Bloomberg provides real-time, non-revised data, an essential feature in this context (Ehrmann and Fratzscher, 2005). Third, it provides the results of surveys conducted among a list of economists before the announcements, that can be updated until the publication of the actual release. These surveys provide important information about markets' expectations, and can be used to construct the "news" looking at the difference with the actual data. Those

three features help in approximate as much as possible the real time environment faced by market operators every day, and to construct the news as the unexpected part of the most monitored macroeconomic releases.

Foreign exchange market operators are exposed to a huge daily flow of real-time economic information. To choose the announcements to include in the model I consider some market measures of their relative importance. The main measure comes from Bloomberg as well: each economic series has a Bloomberg "relevance indicator", that is the percentage of users that receive an alert in correspondence of a new release. To have another benchmark I also consider the classification given by Forex Factory, the most viewed Forex-related website[8], which provides a list of the upcoming macroeconomic announcements and classify them according to their expected impact on the related exchange rate[9]. The two indicators could be seen as thermometers of the importance of the macroeconomic announcements for FX market operators. Therefore, there is neither the need of using a model selection approach, nor having any prior knowledge from economic theory about their relevance. I consider as "important" the variables that are present on Bloomberg with a high relevance index (higher than >66%), or are classified as "medium-impact" or "high-impact" variables

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[8]According to Alexa.com, on June 9th 2014 it is the #1 most viewed forex-related website, and the #1,014 most viewed website in the world.

[9]They classify the announcements as being of low, medium or high impact. Comparing their classification to the one given by other websites, e.g. Forex.com, there are no substantial differences.

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by Forex Factory. Among these series, I include all the variables that are available in Bloomberg with their median value of survey expectations[10].

While almost all previous studies that analysed the effects of macroeconomic news on the euro used German news as a proxy for euro area news[11], I take into consideration announcements referring to the euro area as a whole, Germany, France, Italy and Spain. Especially after the crisis of 2008-2009, macroeconomic data referring to these big European countries have been closely monitored by financial newspapers, specialized websites and commentators any time the USD/EUR rate is taken into consideration. To sum up, I consider a time span of 3638 working days and 67 macroeconomic announcements, 28 about US economy and 39 about the aggregate euro area, Germany, France, Italy and Spain. Table 1.1 and 1.2 describe the macroeconomic announcements.

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[10]The only exception is French Unemployment rate: the relevance indicator is not available on Bloomberg because the series is discontinued in 2007, but given its importance it has been introduced in the analysis. From 2007 onwards, I use French ILO Unemployment rate.

[11]Exceptions are Galati and Ho (2003), who also use German and French data, and Evans and Speight (2010). However, Galati and Ho (2003) just use one French, two German announcements and one about aggregated euro area, and the analysis in Evans and Speight (2010) is conducted using 5-minute returns.

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Name	Bl. Relevance	FF impact	Reporting lag	Frequency	Start date
ADP Employment Change	76.85	High	-1/7	Monthly	Aug-06
Advance Retail Sales	88.89	High	11/16	Monthly	Jan-99
Building Permits	61.57	High	16/22	Monthly	Aug-02
Capacity Utilization	60.28	Medium	14/18	Monthly	Jan-99
Change in Non-Farm Payroll	98.15	High	1/10	Monthly	Jan-99
Chicago PMI	77.78	Medium	-5/0	Monthly	Jan-99
Consumer Confidence	95.37	High	-6 / 0	Monthly	Jan-99
Core CPI	74.81	High	13/23	Monthly	Jan-01
Core PPI	68.15	Medium	8/31	Monthly	Jan-99
CPI	93.52	Medium	13/23	Monthly	Jan-99
Current Account	69.44	Medium	73/82	Quarterly	Mar-99
Durable Goods Orders	90.74	Medium	22/29	Monthly	Jan-99
FOMC Rate Decision	97.22	High	-	-	Jan-01
GDP QoQ (Advance)	96.30	High	28/30	Quarterly	Jan-99
GDP QoQ (Preliminary)	96.30	High	58/62	Quarterly	Feb-99
GDP QoQ (Final)	96.30	Medium	80/92	Quarterly	Mar-99
Housing Starts	87.96	Medium	16/22	Monthly	Mar-99
Import Price Index	87.96	Medium	7/18	Monthly	Jan-99
Industrial Production	86.11	Medium	14/18	Monthly	Jan-99
Initial Jobless claims	99.07	High	5	Weekly	Jan-99
ISM Manufacturing PMI	94.44	High	1/4	Monthly	Jan-99
New Home Sales	89.81	High	23/31	Monthly	Jan-99
Phil. Fed Mfg. Index	75.00	High	-16/-10	Monthly	Jan-99
PPI	68.15	High	8/32	Monthly	Jan-99
Retail Sales Less Autos	62.22	High	11/16	Monthly	Jan-99
Trade Balance	81.48	High	38/52	Monthly	Jan-99
Unemployment Rate	88.33	High	1/10	Monthly	Jan-99
UoM Consumer Sentiment	92.59	High	-24/-10	Monthly	May-99

Table 1.1: US Macroeconomic announcements. "Bloomberg relevance" is the percentage of users that receive an alert in corrispondence of the macroeconomic announcement. "FF impact" is the expected impact of a news about the annoucement, given by the website www.forex-factory.com. The "Reporting lag" indicates the minimum and maximum number of days between the macroeconomic announcement and the end of the reference period.

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Country	Name	Bl. Relevance	FF impact	Reporting lag	Frequency	Start date
EUR	ECB interest rate	97.67	High	-	Monthly	Mar-99
EUR	GDP	95.35	Medium	59/76	Quarterly	Jun-01
EUR	CPI	93.02	Medium	14/31	Monthly	Oct-99
EUR	M3	88.37	Medium	25/32	Monthly	Nov-01
EUR	Retail Sales	65.12	Medium	43/69	Monthly	Apr-01
EUR	Industrial Production	62.79	Medium	42/63	Monthly	Apr-01
EUR	PPI	59.52	Medium	32/37	Monthly	Apr-01
EUR	CPI Core	55.81	Medium	33/67	Monthly	Jan-05
EUR	Trade balance	39.53	Medium	31/62	Monthly	Mar-05
EUR	Unemployment rate	72.09	Medium	27/38	Monthly	Nov-01
FRA	Manufacturing PMI	96.97	Medium	1/4	Monthly	Apr-06
FRA	Industrial Production	90.91	Medium	40/82	Monthly	Jan-99
FRA	CPI	87.88	-	10/26	Monthly	Jan-99
FRA	GDP	81.82	Medium	40/45	Quarterly	Feb-99
FRA	Unemployment rate	-	-	27/68	M/Q	Jan-99
FRA	PPI	44.12	-	26/32	Montlhy	Jan-00
GER	ZEW Economic Sentiment	98.25	High	-23/-6	Monthly	Aug-01
GER	Ifo Business Climate	96.42	High	-10/-2	Monthly	Feb-04
GER	Manufacturing PMI	89.47	High	-11/3	Monthly	Apr-05
GER	Ifo Expectations	89.29	-	-10/-2	Monthly	Feb-04
GER	Ifo Current Assessment	83.93	-	-10/-2	Monthly	Feb-04
GER	GDP	82.46	Medium	41/69	Quarterly	Feb-99
GER	CPI	73.68	Medium	-7/1	Monthly	Mar-99
GER	Unemployment rate	71.93	Medium	-3/9	Monthly	Jan-99
GER	Industrial Production	70.18	Medium	43/58	Monthly	Jan-99
GER	Retail Sales	61.40	Medium	31/48	Monthly	Jan-99
GER	PPI	56.14	Medium	17/36	Monthly	Jan-99
ITA	Business confidence	97.22	-	-9/40	Monthly	May-00
ITA	Industrial Production	91.67	Medium	38/48	Monthly	Apr-99
ITA	Consumer confidence	86.11	-	-10/9	Monthly	Jun-01
ITA	CPI	83.33	-	-3/5	Monthly	Feb-01
ITA	GDP	77.78	Medium	39/81	Quarterly	Jun-99
ITA	Manufacturing PMI	75.00	Medium	1/4	Monthly	Jul-04
ITA	Retail Sales	69.44	-	48/62	Monthly	Apr-03
SPA	CPI	93.33	-	-1/16	Monthly	Aug-00
SPA	Unemployment Change	90.00	Medium	2/10	Monthly	Jan-99
SPA	GDP	80.00	Medium	42/62	Quarterly	Dec-01
SPA	Industrial output	70.00	Medium	38/57	Monthly	Jun-99

Table 1.2: Euro area announcements. Columns definitions are the same as in Table 1.1.

1.3 Results: The effects of macroeconomic news

1.3.1 Effects over the whole sample

In Table 1.3 I present the results using the whole sample, considering all announcements from January 1999 to December 2012. Not surprisingly the R^2 are small (around 0.05), in line with the results of the previous literature. Nevertheless, the analysis show that the reaction of the markets to macroeconomic news in both currency areas is remarkable, especially regarding news about real variables.

News from the US

Looking at US macroeconomic announcements, there is just one announcement among nominal variables with a statistically significant effect on the USD/EUR rate, the FOMC rate decision, but it should be considered more as a control variable, since there are just four events in which the news is different from zero[12]. Regarding the effects of real variables, positive news events about US GDP growth and about other indicators related to growth prospects (Capacity Utilization and Change in Non-farm Payrolls) has a positive, significant impact on the dollar.

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[12]I do not take into account the effect of non-standard monetary policy, to be consistent with the measurement of market expectations of the other variables. A comprehensive discussion on the effects of monetary policy announcements and the effects of non-conventional monetary policy, is an important issue per se and is not treated in the present work. The interested reader, among the others, might look at Neely (2010)

	1999-2012	
	Coeff.	s.e.
US - Nominal		
US - CPI	-0.026	[0.07]
US - CPI Core	0.040	[0.07]
US - FOMC rate	-0.193 **	[0.09]
US - Import Price Index	-0.014	[0.06]
US - PPI Core	0.016	[0.05]
US - PPI	0.061	[0.05]
US - real		
US - ADP Employment Change	-0.122	[0.08]
US - Building Permits	-0.081	[0.07]
US - Capacity Utilization	-0.131 *	[0.08]
US - Change in Nonfarm Payrolls	-0.250 ***	[0.06]
US - Current Account	-0.059	[0.09]
US - Durable Goods Orders	-0.017	[0.06]
US - GDP (Advance)	-0.242 **	[0.1]
US - GDP (Final)	0.049	[0.06]
US - GDP (Preliminary)	-0.043	[0.08]
US - Housing Starts	0.069	[0.06]
US - Industrial Production	0.004	[0.07]
US - Initial Jobless Claims	0.011	[0.03]
US - New Home Sales	-0.048	[0.04]
US - Retail Sales	-0.030	[0.05]
US - Retail Sales Less Autos	-0.001	[0.07]
US - Trade Balance	-0.074	[0.07]
US - Unemployment rate	0.139 **	[0.05]
US - surveys		
US - Chicago Purchasing Manager	-0.084	[0.06]
US - Consumer Confidence	-0.108 *	[0.06]
US - ISM Manufacturing PMI	-0.149 ***	[0.06]
US - Phil. Fed. Mfg. Index	-0.022	[0.05]
US - U. of Michigan Conf.	0.018	[0.05]
EUR - nominal		
EUR - CPI	-0.019	[0.06]
EUR - CPI Core	-0.050	[0.05]
EUR - ECB interest rate	0.128 **	[0.06]
EUR - M3	0.032	[0.05]
EUR - PPI	-0.042	[0.06]
FRA - CPI	-0.076	[0.06]
FRA - PPI	-0.004	[0.06]
GER - CPI	0.028	[0.03]
GER - PPI	-0.081	[0.06]
ITA - CPI	-0.051	[0.06]
SPA - CPI	0.053	[0.04]

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	1999-2012		
	Coeff.		**s.e.**
EUR - real			
EUR - GDP	0.319	*	[0.2]
EUR - Industrial Production	0.062		[0.04]
EUR - Retail Sales	0.058		[0.07]
EUR - Trade Balance	-0.122	*	[0.07]
EUR - Unemployment rate	-0.126	*	[0.07]
FRA - GDP	0.000		[0.08]
FRA - Industrial Production	0.008		[0.07]
FRA - Unemployment	-0.119	**	[0.05]
GER - GDP	-0.322	*	[0.2]
GER - Industrial Production	-0.008		[0.05]
GER - Retail Sales	-0.114	**	[0.05]
GER - Unemployment rate	-0.166	***	[0.06]
ITA - GDP	0.114	*	[0.06]
ITA - Industrial Production	0.073		[0.09]
ITA - Retail Sales	0.062		[0.05]
SPA - GDP	-0.104		[0.08]
SPA - Industrial Output	0.087		[0.06]
SPA - Unemployment	0.144	*	[0.08]
EUR - surveys			
EUR - PMI Mfg.	0.036		[0.1]
FRA - PMI Mfg.	0.017		[0.09]
GER - IFO Business Climate	0.108		[0.3]
GER - IFO Current Assessment	-0.030		[0.2]
GER - IFO Expectations	0.015		[0.2]
GER - PMI Mgf.	-0.016		[0.09]
GER - ZEW Survey	-0.087		[0.06]
ITA - Business Confidence	0.068		[0.07]
ITA - Consumer Confidence	-0.059		[0.06]
ITA - PMI Mfg.	0.136	**	[0.06]
Er t-1	-0.022		[0.02]
MON	-0.046	**	[0.02]
TUE	0.020		[0.03]
WED	-0.003		[0.03]
THU	0.043	*	[0.02]
FRI	0.001		[0.03]
R^2=0,043			
N=3637			
DW=2.01			

Table 1.3: The table shows results of regression (2) over the sample 1999-2012. Coefficients are estimated with OLS with Newey West standard errors. Stars indicate significance level: * for 10%, ** for 5%, *** for 1%.

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The signs of the effects are consistent with most of the findings of previous literature: positive news about those variables indicates an unexpected strengthening in the economic activity and appreciate the dollar. In particular, one standard deviation unexpected change in Capacity Utilization appreciates the dollar by 0.13%, one in Non-Farm Payrolls by 0.25% and one in GDP (Advance) by 0.24%. The negative and significant effect of news about the Unemployment rate (0.14%) is in line with these results. Surveys are closely monitored by the market on a daily basis, for their timeliness and their capacity to effectively capture the general mood of investors and consumers about the present state of the economy, and being also useful to assess current economic conditions Giannone, Reichlin and Small (2008). The ISM Manufacturing Purchasing Managers Index is a extensively monitored indicator, and the results of the present analysis confirm that positive news of one standard deviation about PMI actually appreciates the dollar by 0.15% in the sample considered. News about Consumer Confidence also moves significantly the exchange rate by 0.11% in the same direction.

News from the euro area

The results indicate the importance for the determination of the daily USD/EUR rate of many macroeconomic announcements from the euro area as an aggregate and from its four bigger countries, Germany, France, Italy and Spain. This contrasts with the findings of Ehrmann, Osbat, Strasky and Uusküla (2013) and Cagliesi, Della Bina, Tivegna et al. (2014), the only

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recent studies that take into account news from euro area countries, although they consider different samples, set of variables and estimation methods.

Looking at the response of the exchange rate to news about nominal variables, I find that only news about the ECB monetary policy rate has a significant effect on the USD/EUR rate, as an expected tightening of monetary policy appreciates the euro, and this is consistent with a portfolio balance approach and in line with previous literature.

Real European variables seem to be more important to foreign exchange market operators than nominal ones. A news about euro area GDP moves the USD/EUR in the expected direction: the euro in response to positive news by 0.32%. A higher than expected value of the unemployment rate in the euro area is associated with a significant negative reaction of the European currency by 0.14%, and similar results hold for news about French and German Unemployment rates. I find also a negative impact of a positive news about the Trade Balance. Positive German GDP and Retail Sales news events are associated with negative changes of the euro, and positive news about Italian GDP leads to an appreciation of 0.11% of the euro with respect to the dollar. It is noteworthy that European GDP and German GDP are systematically released on the same day since February 2005, and they are considerably correlated (around 75% from 2005 to 2012). In order to better identify the effect of news about German GDP, I try to isolate their effect using a two-step procedure. In the first step, I run a regression of news about German GDP on news about the European GDP, from February

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2005 to December 2012. In the second step, I regress the log-change in the Euro-Dollar exchange rate on the residual of the first regression, that is the part of German GDP news that is not explained by the European GDP news. Results confirm that the coefficient is significant and with a negative sign, as in the regression performed using the whole panel of macroeconomic news: a positive news about German GDP depreciates the euro[13].

The only significant response of the exchange rates to news about European surveys is the one to Italian PMI (13.6%). It is worth noting that, over the whole sample, also news about the German IFO Survey has not a statistically significant impact on the USD/EUR. The variable is a very important leading indicator and has often been considered crucial in assessing the economic condition of Germany and of euro area as a whole. Moreover, it is among the few European variables that previous literature found having a significant impact on the daily USD/EUR rate (Ehrmann and Fratzscher, 2005). In contrast, news about IFO Business climate has not impact on the euro-dollar exchange rate in the larger sample taken into consideration in this study.

1.3.2 The crisis and the relative importance of US and euro area

Since the crisis might have changed the reaction of foreign exchange market operators, I split the available data in two sub-samples, considering the

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[13]see the Appendix for details on the two-step regression.

second quarter of 2008 the starting point of the crisis period[14]. A simi-
lar analysis has been done in Cagliesi, Della Bina, Tivegna et al. (2014),
but using intra-daily data, GARCH estimation and also interest rates and
stock market returns, finding significant changes in the responses, and by
Fratzscher (2009), who also found substantial changes in the reactions, but
in a cross-section of 54 bilateral exchange rates against the US dollar, using
only US macroeconomic news and data up to 2009[15]. In Table 1.4 I present
the differences of the impact of macroeconomic news on USD/EUR rate in
the two periods; the results show significant differences in the effects before
and after the crisis. It emerges that US macroeconomic news events are
less important in the second sub-sample, while the effects of macroeconomic
news from the euro area are stronger than in the previous period.

	1999-2008		2008-2012	
	Coeff.	s.e.	Coeff.	s.e.
US - nominal				
US - CPI	0.011	[0.07]	0.002	[0.1]
US - CPI Core	0.004	[0.05]	0.063	[0.1]
US - FOMC rate	-0.123 ***	[0.04]	-0.462 ***	[0.1]
US - Import Price Index	0.080	[0.06]	-0.171	[0.1]
US - PPI Core	-0.068	[0.05]	0.065	[0.07]
US - PPI	0.080	[0.05]	-0.038	[0.09]
US - real				
US - ADP Employment Change	-0.006	[0.2]	-0.157 *	[0.08]
US - Building Permits	-0.169 **	[0.07]	0.158	[0.2]
US - Capacity Utilization	-0.040	[0.07]	-0.420 **	[0.2]
US - Change in Nonfarm Payrolls	-0.274 ***	[0.07]	-0.160	[0.1]
US - Current Account	-0.164 *	[0.09]	0.088	[0.2]
US - Durable Goods Orders	-0.041	[0.07]	0.011	[0.09]
US - GDP (Advance)	-0.200	[0.1]	-0.557 ***	[0.1]
US - GDP (Final)	0.161 *	[0.09]	-0.096	[0.09]
US - GDP (Preliminary)	-0.038	[0.08]	-0.065	[0.1]
Continued on Next Page...				

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[14]I consider the business cycle dating of the NBER for the US and of the CEPR for
the euro area, see www.nber.org and www.cepr.org.

[15]The crisis period in Fratzscher (2009) starts in the third quarter of 2008.

	1999-2008		**2008-2012**	
	Coeff.	s.e.	Coeff.	s.e.
US - Housing Starts	0.102	[0.07]	-0.041	[0.1]
US - Industrial Production	-0.061	[0.07]	0.198	[0.2]
US - Initial Jobless Claims	0.016	[0.03]	-0.031	[0.05]
US - New Home Sales	-0.089 *	[0.05]	0.029	[0.1]
US - Retail Sales	-0.038	[0.07]	0.098	[0.2]
US - Retail Sales Less Autos	-0.062	[0.08]	-0.034	[0.2]
US - Trade Balance	-0.123 **	[0.05]	0.013	[0.1]
US - Unemployment rate	0.153 **	[0.06]	0.133	[0.1]
US - surveys				
US - Chicago Purchasing Manager	-0.110 *	[0.06]	-0.047	[0.1]
US - Consumer Confidence	-0.133 **	[0.06]	-0.088	[0.1]
US - ISM Manufacturing PMI	-0.243 ***	[0.06]	0.092	[0.1]
US - Phil. Fed. Mfg. Index	-0.071	[0.06]	0.093	[0.08]
US - U. of Michigan Conf.	-0.020	[0.06]	0.088	[0.07]
EUR - nominal				
EUR - CPI	-0.029	[0.07]	0.100	[0.09]
EUR - CPI Core	-0.063	[0.07]	-0.124	[0.08]
EUR - ECB interest rate	0.131 *	[0.08]	0.059	[0.06]
EUR - M3	-0.027	[0.06]	0.098	[0.08]
EUR - PPI	0.073	[0.07]	-0.141 *	[0.08]
FRA - CPI	-0.109	[0.07]	0.048	[0.09]
FRA - PPI	0.002	[0.08]	-0.057	[0.1]
GER - CPI	-0.018	[0.04]	0.091	[0.09]
GER - PPI	0.001	[0.06]	-0.133	[0.1]
ITA - CPI	-0.016	[0.07]	-0.088	[0.1]
SPA - CPI	0.023	[0.05]	0.032	[0.04]
EUR - real				
EUR - GDP	0.177 **	[0.08]	1.258 **	[0.6]
EUR - Industrial Production	0.053	[0.05]	0.058	[0.08]
EUR - Retail Sales	0.043	[0.08]	0.067	[0.1]
EUR - Trade Balance	0.095	[0.06]	-0.263 ***	[0.09]
EUR - Unemployment rate	-0.065	[0.08]	-0.188 *	[0.1]
FRA - GDP	0.005	[0.09]	-0.104	[0.2]
FRA - Industrial Production	0.027	[0.04]	-0.044	[0.1]
FRA - Unemployment	-0.076	[0.06]	-0.211	[0.1]
GER - GDP	-0.008	[0.1]	-1.395 ***	[0.5]
GER - Industrial Production	0.015	[0.06]	-0.015	[0.1]
GER - Retail Sales	-0.095 *	[0.05]	-0.147	[0.1]
GER - Unemployment rate	-0.07	[0.05]	-0.154 **	[0.08]
ITA - GDP	0.154 **	[0.08]	0.092	[0.1]
ITA - Industrial Production	-0.055	[0.07]	0.234	[0.2]
ITA - Retail Sales	0.039	[0.08]	0.090	[0.08]
SPA - GDP	-0.109	[0.1]	-0.116	[0.08]
SPA - Industrial Output	0.076	[0.07]	0.083	[0.1]
SPA - Unemployment	0.046	[0.05]	0.253 *	[0.2]
Continued on Next Page. . .				

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	1999-2008		2008-2012	
	Coeff.	s.e.	Coeff.	s.e.
EUR - surveys				
EUR - PMI Mfg.	0.119	[0.1]	0.305	[0.3]
FRA - PMI Mfg.	-0.012	[0.1]	-0.178	[0.2]
GER - IFO Business Climate	-0.297 **	[0.1]	0.537	[0.5]
GER - IFO Current Assessment	0.141	[0.09]	-0.255	[0.3]
GER - IFO Expectations	0.162 *	[0.09]	-0.183	[0.3]
GER - PMI Mgf.	-0.092	[0.09]	-0.113	[0.2]
GER - ZEW Survey	0.000	[0.07]	-0.145	[0.1]
ITA - Business Confidence	-0.036	[0.08]	0.236 **	[0.1]
ITA - Consumer Confidence	-0.094 *	[0.05]	0.020	[0.1]
ITA - PMI Mfg.	-0.145 **	[0.07]	0.158 *	[0.08]

1999-2008: $N = 2410$, $R^2 = 0.062$
2008-2012: $N = 1226$, $R^2 = 0.092$

Table 1.4: The table shows results of regression (2) over the samples 1999 - March 2008 and April 2008 - 2012. The coefficients (here the ones relative to the European variables, real and surveys) are estimated with OLS with Newey West standard errors. Stars indicate significance level: * for 10%, ** for 5%, *** for 1%.

Regarding US real variables, positive effects of news about US GDP are present and strong in the second sub-sample (0.55%), and markets do not react significantly to the first release in the first sub-sample. However, they react negatively to positive news in the final release. Other announcements with a positive and statistically significant effect from 2008 onwards are ADP Employment change (0.16%) and Capacity Utilization (0.42%), with the expected sign (positive surprises about the state of the economy appreciate the dollar). Interestingly, news events about US variables considered very important in the literature have no significant impact in the sample 2008-2012. It is the case of news about the Unemployment rate, Change in Non-Farm Payrolls, Building Permits, Trade Balance and Current Account. All these announcements have positive and statistically significant effects

in the first sub-sample, not in the second one. The same consideration applies to important surveys, like the Manufacturing Purchasing Managers Index and Consumer Confidence. News about US nominal variables do not have a significant effect in either of the sub-samples, considering news about FOMC rate decisions as a control variable. These results could be interpreted as a signal that the attention of EUR/USD market operators to macroeconomic news from the US has decreased over time.

Regarding the response to news from the euro area, the main message is that their impact is higher since the second quarter of 2008, and that news about real variables are getting more importance than news about nominal ones. In the sample 1999-2008 the markets reacted significantly to news about euro area GDP, Italian GDP, and German Retail Sales and Unemployment rate. However, also responses to news about real variables are also significant in the sample 2008-2012, and remarkably with a higher impact. It is the case of news about euro area GDP and Trade Balance, and to news about German GDP and Unemployment in Spain. Moreover, the announcements that gain importance after the start of the crisis seem to be important because of the economic information they convey and not for their timeliness. For example, euro area GDP, Trade balance and Unemployment rate are variables that are released with a considerable delay after the reference period, but they are very important to the eyes of market operators[16].

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[16]I also performed the same analysis conducted in Ehrmann and Fratzscher (2005), regressing the absolute value of the coefficients and the p-values on the minimum and
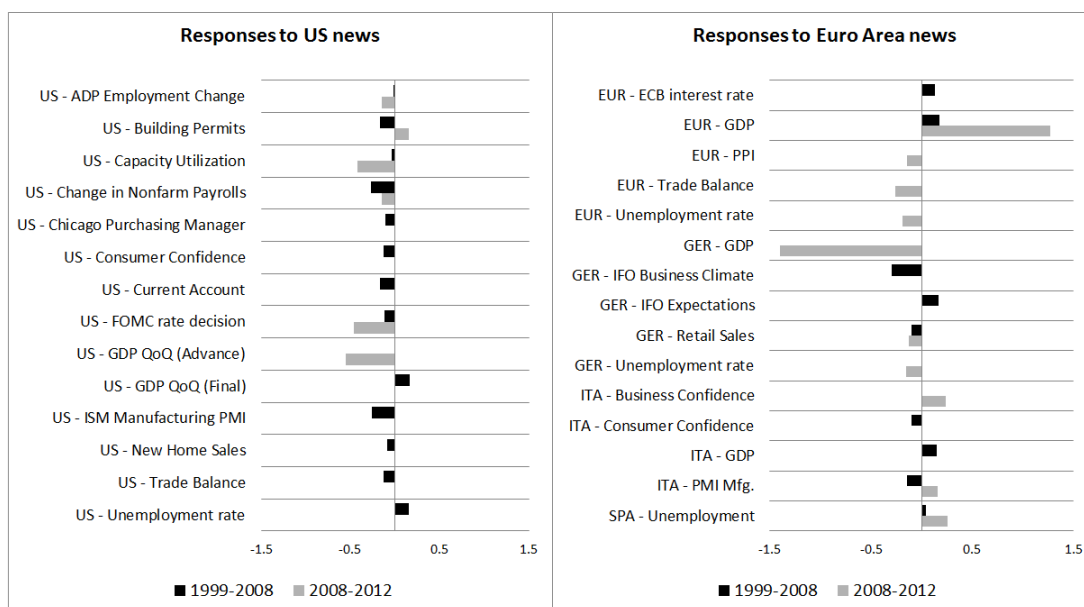
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Responses to US news

US - ADP Employment Change
US - Building Permits
US - Capacity Utilization
US - Change in Nonfarm Payrolls
US - Chicago Purchasing Manager
US - Consumer Confidence
US - Current Account
US - FOMC rate decision
US - GDP QoQ (Advance)
US - GDP QoQ (Final)
US - ISM Manufacturing PMI
US - New Home Sales
US - Trade Balance
US - Unemployment rate

-1.5   -0.5   0.5   1.5

■ 1999-2008   ▪ 2008-2012

Responses to Euro Area news

EUR - ECB interest rate
EUR - GDP
EUR - PPI
EUR - Trade Balance
EUR - Unemployment rate
GER - GDP
GER - IFO Business Climate
GER - IFO Expectations
GER - Retail Sales
GER - Unemployment rate
ITA - Business Confidence
ITA - Consumer Confidence
ITA - GDP
ITA - PMI Mfg.
SPA - Unemployment

-1.5   -0.5   0.5   1.5

■ 1999-2008   ▪ 2008-2012

Figure 1.1: I plot the coefficients the regression (1.2), for the two sub-samples 1999-2008 and 2008-2012, if they are statistically significant at least in one sub-sample at 10%. The black histograms indicate the coefficients relative to 1999-2008, the gray histograms indicate the coefficients relative to 2008-2012.

Also the reaction of the exchange rate to surveys announcements has changed after 2008. The case of German IFO is noteworthy, since it is considered one of the most important surveys in Europe. News events about IFO surveys used to have an impact on the USD/EUR rate before 2008, although with contrasting signs. In the sub-sample starting in 2008 their effects are not statistically significant.

In most of the cases, the signs of the coefficients are consistent with the economic intuition: unexpected improvements of the current economic

maximum release lags. The regressions confirm that in our sub-sample the timeliness is not important for the relevance of macroeconomic news. Results are available upon request.

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situation lead to an appreciation of the euro, and vice-versa. It is interesting to remark that, after 2008, unexpected good announcements about German GDP have a very strong, significant and negative impact on the euro. A tentative explanation would be that, given the higher heterogeneity within the euro area, markets started to perceive a higher tension between the "core" and the "periphery" (Italy, Spain), since good news from the former and bad news from the latter moves down the common currency. A stronger divergence of the biggest economies, for example, would imply stronger tensions and difficulties in choosing the optimal common monetary policy[17], and even a higher perceived risk of the break up of the euro, especially during the sovereign debt crisis in 2010-2011.

Looking at the broader picture in an easy way, in Table 1.5, I report different R^2 for different regressions, in which I use just US announcements, or just euro area announcements, or both, before and after the crisis. R^2 almost doubles in the second sub-sample, and it is higher when taking into consideration both US and euro area variables.

R^2	1999-2012	1999-2008	2008-2012
US	0.02	0.04	0.03
euro area	0.02	0.02	0.06
US and EA	0.04	0.06	0.09

Table 1.5: The table shows R^2 of different regressions, taking into consideration only variables from US, only variables from euro area, or both.

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[17]The asymmetry of the reactions to the common monetary policy has been recently studied in Barigozzi, Conti and Luciani (2013).

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A comparison of the R^2 shows that since the beginning of the crisis the USD/EUR markets react more to macroeconomic news, in particular to news about euro area. Almost the 10% of the daily movements of the spot daily USD/EUR rate is explained by the macroeconomic news included in the analysis. News from euro area explain the 6%, while in the sample before the crisis US macroeconomic news made the lion's share. To better evaluate how the relative importance of US and euro area news has changed over time, I performed a rolling exercise: Starting from 2002 and using 6-year windows[18], I estimate the model using either only US news or only euro area news. In Figure 1.2 I report the rolling R^2 of the regressions: what emerges is the decreasing relevance of news from the US, and the increasing relevance of news from the euro area. More in detail, in Figure 1.3 and Figure 1.4 I report the rolling OLS coefficients associated to six US news events and to six euro area news events, using the same rolling windows: the tendency of US (EUR) annoucements to be less (more) relevant for the USD/EUR pair is clear. A possible explanation of these results might be related to the consideration of the euro as a mature currency by FX operators, also with respect to the US dollar: after 2008 its relative price is not explained mainly by US (or, at most, German) announcements, as described in Andersen, Bollerslev, Diebold and Vega (2003), and Ehrmann and Fratzscher (2005), but also by news about the biggest economies of the euro area and about the euro area aggregate.

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[18]The result is robust using different lenghts of the windows.

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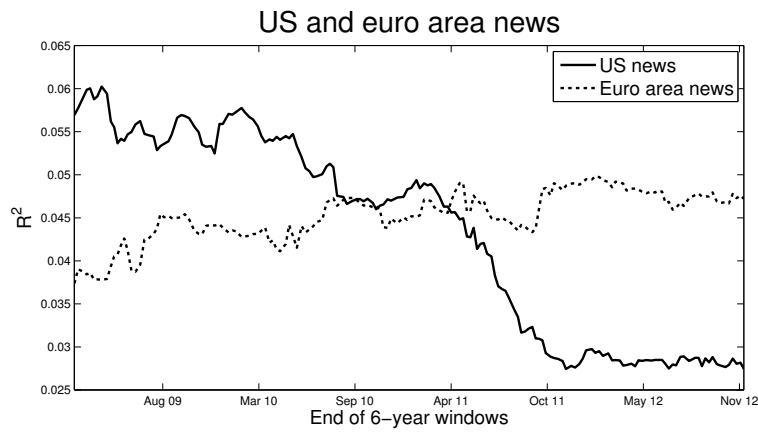
Figure 1.2: The figure shows the R^2 of the OLS estimation of equation 1.2, using 6-year rolling windows and starting from January 2002, using either only US macroeconomic news or only euro area macroeconomic news.

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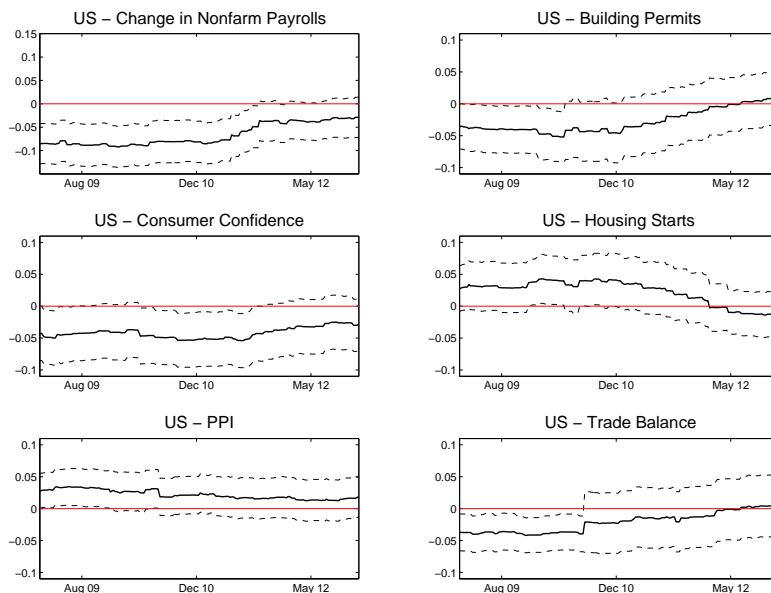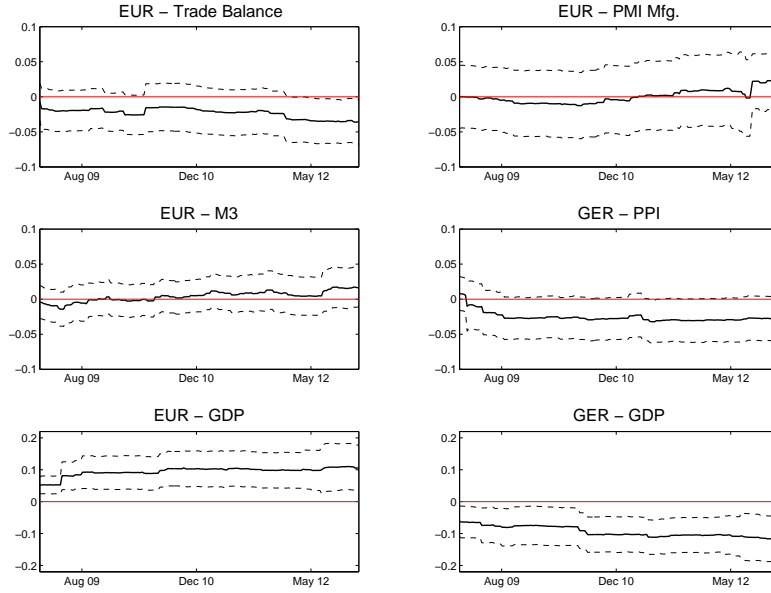
Figure 1.3: The figure shows the coefficients relative to six US announcements and the 90% confidence bands, from rolling OLS estimations of equation 1.2 (Newey West stardard errors). The estimation is performed using US and euro area news and 6-year rolling windows from January 2002.

1.3.3 Model validation: predictive ability of the news

To assess the validity of the model and of the results, in this section I test the predictive ability of US and euro area macroeconomic news in forecasting the daily USD/EUR exchange rate. I evaluate the out of sample performance using realized macroeconomic news, that is using news up to day t to predict the exchange rate of the same day t. When forecasting exchange rates, beating a random walk is a very tough test also using realized values of the predictors, an issue acknowledged in the

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Figure 1.4: The figure shows the coefficients relative to six euro area announcements and the 90% confidence bands, from rolling OLS estimations of equation 1.2 (Newey West stardard errors). The estimation is performed using US and euro area news and 6-year rolling windows from January 2002.

literature since the seminal work of Meese and Rogoff (1983). A similar exercise has been done in Ferraro, Rogoff and Rossi (2012) using daily US announcements and oil prices, stressing the utility of this approach to gauge the presence of a link between the exchange rate and its possible predictors also with daily data. In order to mimic more accurately the "real time" environment, I performed the test standardizing the news in a rolling fashion. At every t , the news is now defined as:

$$X_{i,t} = \frac{A_{i,t} - S_{i,t}}{\sigma_{i,t}}$$

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Where $A_{i,t}$ is the real-time announcement i on day t, $S_{i,t}$ is the median of the Bloomberg's survey for the announcement i on day t, $\sigma_{i,t}$ is the standard deviation of the news i from the beginning of the sample up to t.

The forecasting evaluation of the model is performed as follows. Define a window W_j of data, divided in an in-sample part W^{in} in which I estimate the parameters, and an out of sample part W^{out} in which I evaluate the forecasting performance of the models. At each repetition j I estimate the parameters by OLS up to t, the end of W^{in}, and I use the estimates to predict the log-change in the exchange rate in $t+1$, conditionally to the realized value of macroeconomic news in $t+1$. I move W^{in} one day forward, and I estimate and forecast again, until the end of W^{out}. I then move the window W_j forward by 22 working days, and I repeat the whole rolling exercise with a new window W_{j+1}. The forecasting equation is the following:

$$\Delta(\ln e_{t+1}^f) = \alpha + \hat{\gamma}_t \Delta(\ln e_t) + \sum_{i=k}^{K} \hat{\beta}_{t,i} X_{k,t+1} + \hat{\delta}_t^M MON + ... + \hat{\delta}_t^F FRI + \epsilon_{t+1}$$

(1.3)

Where $\Delta(\ln e_{t+1}^f)$ is the forecast of the daily log-change of spot USD/EUR rate, $\hat{\gamma}_t$, $\hat{\beta}_{t,i}$, $\hat{\delta}_t^M$, ... , $\hat{\delta}_t^F$ are OLS estimates in the rolling sample.

To test the validity of the model I evaluate its predictive ability against the toughest benchmark (Rossi, 2013), a random walk without drift (hence-

forth RW). I look at the rolling Diebold-Mariano statistics (Diebold and Mariano, 1995), plotted in Figure 1.5, Figure 1.6 and Figure 1.7. If the statistic is below the 95 % confidence interval, the model performs better than the random walk in the out-of-sample window considered[19].

Doing the a rolling analysis I can evaluate if the predictive ability varies over time. The first in-sample window starts in January 2001 and ends in the beginning of 2010, the out of sample evaluation window is approximately 20 months[20], and the distance between consequent windows is one month (22 working days).

In Figure 1.5 I present the results using both news from the euro area and from the US. The model performs better than the benchmark up to the out of sample window starting January 2009, but from that period onwards the improvement over the random walk model is not always statistically significant.

In order to understand which are the macroeconomic news events that help more in prediction, I repeated the analysis using either only US news or euro area news. Figure 1.6 shows the result using just US surprises: there is no statistical evidence that they perform better than the random walk almost in any period, and this is in line with the results of Ferraro, Rogoff and Rossi (2012). On the contrary, euro area news help in predicting the USD/EUR

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[19]An alternative, similar procedure is to look at difference between the MSFE of the forecast from the model and the MSFE of the forecast using the RW, in a rolling-window fashion as well. If the difference is significantly lower than zero, the models perform better. Results are qualitatively confirmed and presented in the Appendix.

[20]The result are robust to the choice of the window size, an issue raised by Rossi and Inoue (2012). Results with different windows are available on request.
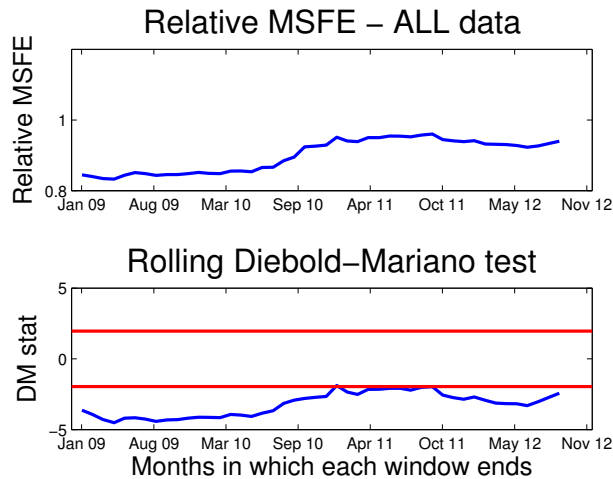
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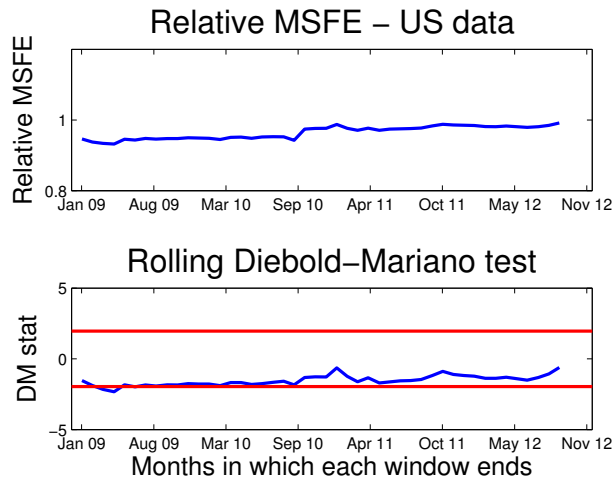Figure 1.5: Results with both US and euro area news used as predictors. Initial window W_1: December 2001 - December 2008, out of sample window approximately equal to 20 months. In the upper chart, the MSFE of the model relative to the random walk without drift. In the lower chart, the blue line is the Diebold-Mariano statistics, and red continuous lines indicate the 95% confidence bands. On the x-axes, the months in which the windows W_j end.

rate using realized fundamentals in most of the sample considered, as shown in Figure 1.7. This confirms the importance of news coming from the euro area, validating the results of the analysis presented in the previous section.
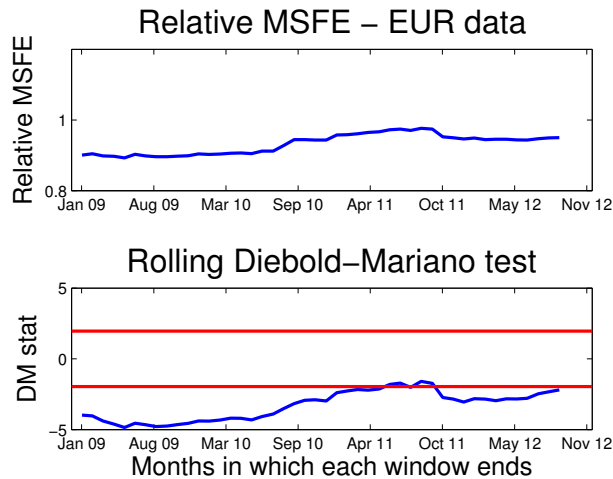
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Figure 1.6: Results with US news used as predictors. Initial window W_1: December 2001 - December 2008, out of sample window approximately equal to 20 months. In the upper chart, the MSFE of the model relative to the random walk without drift. In the lower chart, the blue line is the Diebold-Mariano statistics, and red continuous lines indicate the 95% confidence bands. On the x-axes, the months in which the windows W end.

1.4 Conclusions

In this chapter I evaluated the impact of macroeconomic news coming from the US and from the Euro Area on the daily spot USD/EUR rate. I define as "news" the difference between what markets expect and the actual release of a macroeconomic variables. Taking into consideration 67 announcements, 28 about US economy and 39 about the aggregate euro area, Germany, France, Italy and Spain, I have provided evidence of the importance of Euro Area announcements to the eyes of market operators, especially after the start of the crisis of 2008-09. Through a rolling estimation of the model, I documented a gradual shift of the attention from US to

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Figure 1.7: Results with euro area news used as predictors. Initial window W_1: December 2001 - December 2008, out of sample window approximately equal to 20 months. In the upper chart, the MSFE of the model relative to the random walk without drift. In the lower chart, the blue line is the Diebold-Mariano statistics, and red continuous lines indicate the 95% confidence bands. On the x-axes, the months in which the windows W_j end.

European fundamentals, and the results are confirmed by a model validation

through an out-of-sample exercise, in the spirit of Meese and Rogoff (1983).

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Chapter 2

Nowcasting Mexican GDP

2.1   Introduction

In this chapter I reconstruct and interpret the macroeconomic informa-
tion flow relevant to assess the state of Mexican economy. Due to a sig-
nificant publication delay of GDP, released several weeks after the end of
the reference quarter, it is important to interpret the flow of macroeconomic
indicators that are available at higher frequency, in order to have reliable
short-term forecasts of the state of GDP that are constantly updated as
new information is available. Policy makers, for example, design and imple-
ment decisions also on the basis of the current state on the economy, and
market participants might take it into account setting up their investment

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plans. Private and institutional sources provide a flow of macroeconomic data almost every day: the issue is to interpret properly the new information, in a process of signal extraction that copes with its complexity. To this aim, I analyse the data flow through the lens of a model of short-term forecasting based on dynamic factor models, following the developments in the "nowcasting" approach.

Factor models permit to summarize the information of many indicators that are more timely than GDP, without incurring in the "curse of dimensionality". The idea is to estimate a few common factors that drive the co-movements among a large number of variables (Forni, Hallin, Lippi and Reichlin, 2000; Stock and Watson, $2002a$). Based on factor models and Kalman filtering techniques, the nowcasting approach (for a review see Banbura et al., 2011, 2013) can deal with the characteristics of a ragged edge of an expanding dataset, since the variables are releases in a non synchronous way. The approach permits to efficiently estimate the latent factors and to update the forecasts in real-time, whenever new macroeconomic data is released (Giannone, Reichlin and Small, 2008; Doz, Giannone and Reichlin, 2011, 2012; Bańbura and Modugno, 2014). Moreover, it allows to gauge the marginal contribution given by any single macroeconomic release, estimating its real-time information content. This

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methodology has been proven to be effective in many empirical applications, being to applied to many countries[1]. Following this strand of literature, I construct a nowcasting model of the Mexican real GDP, taking into account Mexican as well as US macroeconomic releases. I include the variables using a market-oriented approach, considering important the indicators closely followed by the markets and policy makers. The model is estimated using quasi-maximum likelihood and Kalman filtering techniques, and I conduct a pseudo-real time evaluation of its forecasting performance from 2006 to 2013.

Some recent papers have the objective of producing a short-term forecasting model of Mexican GDP. Coutino (2005) presents forecast based on several Mexican monthly indicators, but his technique does not allow neither a real-time updating nor an evaluation of the impact of the different indicators. The VAR-based model presented in Guerrero, C. and Esperanza (2013) allow to have an estimate of GDP that is more timely than the official release, but it can be estimated at least 15 days after the end of the

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[1]Among the others Rünstler, Barhoumi, Benk, Cristadoro, Den Reijer, Jakaitiene, Jelonek, Rua, Ruth and Van Nieuwenhuyze (2009), Angelini, Camba-Mendez, Giannone, Reichlin and Rünstler (2011) for the Euro Area, D'Agostino, McQuinn and Derry (2008) and Liebermann (2012) for Ireland, Matheson (2010) for New Zealand, Marcellino and Schumacher (2010) for Germany, Barhoumi, Darné and Ferrara (2010) for France, Aastveit and Trovik (2012) and Luciani and Ricci (2014) for Norway, Bragoli, Metelli and Modugno (2014) for Brasil.

reference quarter, therefore not being a "nowcast" but a "back-cast". The use of indicators external to the country is a practice rarely used in the nowcasting literature[2]. However, the empirical evidence of spillovers and synchronization between Mexican and US business cycles suggests that a forecasting model of the Mexican economy should take the relationship with the US into account. Among the others, Torres and Vela (2003) document the synchronization of US and Mexican business cycle and the role of trade, while Cuevas, Messmacher and Werner (2002), Kose, Towe and Meredith (2004), Chiquiar and Ramos-Francia (2005), Lederman, Maloney, Maloney and Serven (2005), Bayoumi and Swiston (2008) and Miles and Vijverberg (2011) evaluate the impact of NAFTA on the synchronization, documenting evidence of its importance. Hernández (2004) finds evidence of a common trend and a common cycle between Mexican and US GDP, and the correlation of business cycles is confirmed in later work by Mejía-Reyes and Campos-Chávez (2011). Regarding possible spillovers from the US to Mexican economy, Sosa (2008) finds a high impact of US shocks on Mexico in the post-NAFTA period, with a major role played by US Industrial Production and by the indicators about the automotive sector.

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[2]among the exceptions, see for example de Antonio Liedo (2014).

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The closest paper to the present work is Liu, Matheson and Romeu (2012), in which they nowcast the GDP of several Latin American countries, including Mexico, using a dynamic factor model based on Giannone, Reichlin and Small (2008). They use a panel of 129 variables referring to the Mexican economy and 8 indicators about the US[3], compare their results with other model-based forecast, and they show that the use of external indicators (they add 11 commodity prices[4] and 8 US variables) does not help improve the accuracy of the nowcast in the sample 2005-2010, a result defined as "surprising" by the authors themselves. There are some differences between their approach and the one of the present work, other than the time span of the sample and the macroeconomic indicators that have been used in the analysis. First, they estimated the dynamic factor model with a two-step procedure described in Giannone, Reichlin and Small (2008) and Doz, Giannone and Reichlin (2011), that consists in estimating the factors in a balanced panel using principal components, and then exploiting the information contained in the end of the sample using a Kalman smoother. My estimation approach is different, being based

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[3]They compare the performance of a forecast based on dynamic factor models to the performance of forecasts based on quarterly autoregressive model, pooled bridge equations, bivariate VARs and Bayesian VAR: they document that the nowcast based on dynamic factor models has the best performance among the techniques considered.

[4]Petroleum, Copper, Soy Gold, Metals, Industrials, Food, Fats and oils, Coffee, Sugar, Livestock

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on a Maximum Likelihood estimation in an Expectation-Maximization algorithm, following Doz, Giannone and Reichlin (2012) and Bańbura and Modugno (2014). Moreover, Liu et al. (2012) do not measure directly the relevance of the US variables, while I explicitly evaluate the impact of the information coming from the US on the nowcast updates. The possibility given by the most recent nowcasting methodology to evaluate the marginal contribution of macroeconomic releases is essential to gauge which indicators help to better assess the state of the economy, and in my case also to evaluate the relevance of the information coming from the United States.

The main contributions of the present work can be summarized as follows: first, interpreting the Mexican and US macroeconomic data flow, I evaluate the importance of each data release and the relevance of the information accessible to markets participants and policy makers in order to assess the state of the Mexican economy. Second, I find that the information coming from US indicators helps in reducing the forecast errors and has an important role in the updating process of a nowcasting model for Mexican GDP. This a reasonable result, given the strong relationship between Mexican and US business cycle that has been documented in the literature.

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Finally, I find that a nowcasting model constructed using a medium-scale dataset of real macroeconomic indicators from Mexico and from the US performs well in out of sample with respect to judgemental benchmarks. The latter result confirms the usefulness of model-based nowcast based on dynamic factor models in tracking the state of the economy, filtering out and interpreting the relevant information contained in the flow of macroeconomic releases.

2.2 The model

The main objective of the nowcasting approach is to extract the relevant information about the state of the economy contained in indicators that are more timely than the target variable (here the quarterly GDP growth), and to funnel it into an estimate that can be updated at every data release. For example, if GDP relative to the first quarter of the year is released on the 5th week after the end of the reference period, the first official release will be know only in the middle of May. However, in the meantime there is a lot of available information that can be exploited using other indicators that are released at higher frequencies. If those indicators are indeed correlated

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with GDP, taking them into account may give some information about the current state of GDP several weeks before its first release. Continuing with the same example, the forecaster might take into consideration data relative to the months of January, February and March about the production side of the economy (e.g. the Industrial Production Index), about labor market (e.g. the unemployment rate), or about the external sector (Import, Export). Moreover, it is possible to exploit the timely information contained in "soft data": surveys like the Purchasing Managers Index for the United States has been shown to be extremely useful in predicting GDP. Instead of just combining the information available at mixed frequency, using for example bridge equations models (Baffigi, Golinelli and Parigi, 2004), the nowcasting approach offers a unified framework to interpret the flow of macroeconomic information at any point in time. Moreover, since the variables are jointly modelled, it allows to obtain forecasts for any indicator of interest.

A first issue to tackle is dealing with a large number of variables, capturing the relevant information of macroeconomic data in a parsimonious way. Factor models exploit the information of very rich datasets without incurring in the "curse of dimensionality". The main idea is that the variables are linked to some unobserved factors that can be consistently estimated. It is indeed possible to express the behaviour of many macroeconomic vari-

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ables through a few factors that drive their co-movements (Forni et al., 2000; Stock and Watson, 2002). A second issue is dealing with the ragged edge of an expanding dataset, given that macroeconomic releases are available in a non-synchronous way. Consider the case in which, in a given point in time, data about US Purchasing Managers Index relative to month t is released, while data about Industrial Production is available just up to month $t-1$. If the forecaster wants to take advantage of the new information, a technical device must be used to cope with the unbalanced panel. In general, the data that would be disregarded using a balanced panel would be mostly very timely indicators as the surveys; the forecaster would not profit of their timeliness, which represent indeed a valuable help in nowcasting GDP. A dynamic factor model, and the use of Kalman filters and smoothers are natural techniques to handle these two main features of the data.

In the seminal paper of Giannone, Reichlin and Small (2008) the estimation is performed following the method described in Doz, Giannone and Reichlin (2011), using a two-step estimation: first, the factors are estimated using principal components on a balanced panel, and then Kalman filtering techniques help cope with the ragged edge. In the present work I rely on the nowcasting methodology further developed in Bańbura and Modugno (2014), to handle missing data and using a Maximum Likelihood Estimation

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in an Expectation-Maximization algorithm, whose desirable properties of consistency and robustness in this framework have been proven in Doz, Giannone and Reichlin (2012).

The dynamic factor model used in this work can be described as follows. The variables are assumed to have a factor structure:

$$x_t = \mu + \Lambda f_t + \epsilon_t \tag{2.1}$$

Where x_t is a vector of standardized stationary monthly variables, f_t are unobserved common factors with zero mean and unit variance, Λ are the factor loadings and ϵ_t a vector of idiosyncratic components of dimension N and μ is a constant.

The dynamics of the factors is modelled as a Vector Autoregressive process with p lags, in which A is an $r \times r$ matrix with all roots of $det(I_r - Az)$ outside the unit circle, and ϵ_t follows an $AR(1)$ process and is uncorrelated with f_t at any leads and lags:

$$f_t = A_t f_{t-1} + ... + A_p f_{t-p} + u_t; \; u_t \; i.i.d. \sim \mathcal{N}(0, Q) \tag{2.2}$$

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The idiosyncratic component is modelled as following:

$$\epsilon_{i,t} = \tilde{\epsilon}_{i,t} + \xi_{i,t}; \qquad \xi_{i,t} \sim \text{i.i.d.} \, \mathcal{N}(0, \kappa) \tag{2.3}$$

$$\tilde{\epsilon}_{i,t} = \alpha_i \tilde{\epsilon}_{i,t-1} + e_{i,t}; \qquad e_{i,t} \sim \text{i.i.d.} \, \mathcal{N}(0, \sigma_i^2) \tag{2.4}$$

To deal with the mixed frequency of macroeconomic data, given that I use all monthly indicators and a quarterly GDP, I follow the approximation of Mariano and Murasawa (2003), including the quarterly variable in the model as a monthly partially-unobserved variable. For any variable y_t, defined at the highest frequency present in the model, define y_t^k its "counterpart" which is observed every k periods. That means that the observations of the lower frequency variables are periodically missing. In the case of the present work y_t is the difference of natural logarithm of GDP, and since the highest frequency of the model is monthly, we have that its counterpart is y_t^3. Define as z_t the non-transformed series corresponding to y_t, in our example the level of GDP. The approximation is the following:

$$y_t^3 = log(z_t^3) - log(z_{t-3}^3) \approx y_t + 2y_{t-1} + 3y_{t-2} + 2y_{t-3} + y_{t-4} \tag{2.5}$$

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with $t = 3, 6, 9, \dots$.

The final model to be estimated has the following state space form:

$$
\begin{bmatrix} y_t^M \\ y_t^Q \end{bmatrix} = \begin{bmatrix} \Lambda_M & 0 & 0 & 0 & 0 & I_n & 0 & 0 & 0 & 0 & 0 \\ 1 & 2 & 3 & 2 & 1 & 0 & 1 & 2 & 3 & 2 & 1 \end{bmatrix} \begin{bmatrix} f_t \\ f_{t-1} \\ f_{t-2} \\ f_{t-3} \\ f_{t-4} \\ \epsilon_t^M \\ \epsilon_t^Q \\ \epsilon_{t-1}^Q \\ \epsilon_{t-2}^Q \\ \epsilon_{t-3}^Q \\ \epsilon_{t-4}^Q \end{bmatrix} + \begin{bmatrix} \xi t^M \\ \xi t^Q \end{bmatrix}
$$

$$(2.6)$$

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$$
\begin{bmatrix}
f_t \\
f_{t-1} \\
f_{t-2} \\
f_{t-3} \\
f_{t-4} \\
\epsilon_t^M \\
\epsilon_t^Q \\
\epsilon_{t-1}^Q \\
\epsilon_{t-2}^Q \\
\epsilon_{t-3}^Q \\
\epsilon_{t-4}^Q
\end{bmatrix}
=
\begin{bmatrix}
A_1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
I_r & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & I_r & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & I_r & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & I_r & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \alpha_M & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & \alpha_Q & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0
\end{bmatrix}
\begin{bmatrix}
f_{t-1} \\
f_{t-2} \\
f_{t-3} \\
f_{t-4} \\
f_{t-5} \\
\epsilon_{t-1}^M \\
\epsilon_{t-1}^Q \\
\epsilon_{t-2}^Q \\
\epsilon_{t-3}^Q \\
\epsilon_{t-4}^Q \\
\epsilon_{t-5}^Q
\end{bmatrix}
+
\begin{bmatrix}
u_t \\
0 \\
0 \\
0 \\
0 \\
0 \\
e_t^M \\
e_t^Q \\
0 \\
0 \\
0 \\
0
\end{bmatrix}
$$

$$(2.7)$$

Where y_t^M is the vector of monthly variables, y_t^Q the quarterly variable (GDP), Λ_Q and Λ_M the factor loadings for monthly and quarterly variables, ϵ_t^M and ϵ_t^Q the idiosyncratic components relative to monthly and quarterly variables at time t, α_M is a diagonal matrices of dimension $N-1$ with the $AR(1)$ coefficients of the idiosyncratic component relative to the monthly variables on the diagonal, and α_Q is the $AR(1)$ coefficient of the idiosyncratic component of the quarterly variable.

The model is estimated using Maximum Likelihood. To initialize the estimation, the factors are estimated using principal components analysis; then, the estimation is performed using and Quasi-Maximum Likelihood and Kalman filtering techniques within an Expectation-Maximization (EM) algorithm. The EM algorithm has been proposed in order to estimate a model with latent data, and then has been extensively applied to factors estimation (see Dempster, Laird and Rubin, 1977; Shumway and Stoffer, 1982; Watson and Engle, 1983). The algorithm consists in the iteration of two steps: In the first step, the expectation of the conditional log-likelihood is calculated using the estimated values coming from the previous iteration; in the second step the resulting expected log-likelihood is maximized to obtain the estimates of the parameters to be used in the following iteration. The conditional moments of the factors in the first step can be retrieved using the Kalman smoother. The iteration is performed until convergence is achieved, depending on the stopping rule used. Even if the model does not allow for cross-correlation in the idiosyncratic component, the consistency of a Quasi-Maximum Likelihood estimator with an EM algorithm is proven in Doz, Giannone and Reichlin (2012), who show that it is also feasible for large cross-sections.

The Maximum Likelihood estimation of the dynamic factor model is

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performed once a year, and the updates of the factors, the forecast and the construction of the news are performed at any new release. The number of lags p is set to two[5]. Determining the number of factors is still a debated question in the literature; I fix the number of factors to one, as being the simplest choice, since previous works have shown that a small number of factors is sufficient for forecasting purposes (Stock and Watson, 2002*b*). The results are qualitatively the same choosing two factors. Actually the forecasting performance improves using two factors but I use the simplest possible specification, since their interpretation might be controversial and the magnitude of the gain could not justify the increase in the parametrization of the model. As a stopping rule for the iteration in the Expectation-Maximization algorithm, if ℓ_i is the conditional log-likelihood at iteration i, I stop when $\frac{\ell_{i+1}-\ell_i}{(|\ell_{i+1}|+|\ell_i|)/2} < 10^{-4}$.

2.3 Data

I include the variables in the model following a market-oriented approach[6]. I consider only surveys and real variables, since nominal and fi-

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[5]the results are robust to a change the number of lags, and available on request.

[6]An approach already followed in Luciani and Ricci (2014) and in Bragoli, Metelli and Modugno (2014).

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nancial variables have been proven to be not effective in improving the precision of short-term forecast of GDP in this framework (Banbura, Giannone, Modugno and Reichlin, 2013). I take into consideration what market operators, statistical agencies, and the specialized press consider the key variables for assessing the condition of the Mexican economy. As a starting point, I choose the variables reported on Bloomberg, one of the major sources of information for investors, traders and market operators. I also include some variables that were commented in Bloomberg in the past, given the importance they might have had, in the eyes if market operators, to assess the conditions of the Mexican economy (e.g. Truck sales). For each variable Bloomberg reports a "relevance index", that is the ratio of alerts requested for new releases of that variables over the total alerts. The index could be seen as a measure of the importance assigned by financial markets operators to that indicator. Moreover, I also take into consideration the variables that are considered as "high impact" in ForexFactory.com, the most viewed forex-related website in the world. Finally, I consider the indicators that frequently appear in the public debate about Mexican economy on the main local media, and some variables that should be taken into account given their relevance in the analysis of the latest statistical reports of the INEGI (Instituto Nacional de Estadística y Geografía) and of the Bank of Mexico.

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The dataset is composed by 29 monthly variables and the quarterly Mexican GDP, and is described in Table 2.1. The dimension of the dataset is consistent with the results of Bańbura and Modugno (2014), who show that in the nowcasting framework small and medium scale models perform better than large scale ones.

	Series	Source	Start date	Unit	Transf.	Lag
Mexico	IMEF Bus.Clim. Index: Mfg	IIEEM	Jan-04	INDEX	Level	3
Mexico	IMEF Bus.Clim. Index: Nonmfg	IIEEM	Jan-04	INDEX	Level	3
Mexico	Consumer Confidence	INEGI	Apr-01	INDEX	Level	4
Mexico	Producer Confidence Index	INEGI	Jan-04	Units	YoY	4
Mexico	Opinion Survey: Mfg. Orders	INEGI	Jan-04	INDEX	Level	4
Mexico	Total Vehicle Production	AMIA	Jan-91	Units	YoY	10
Mexico	Industrial Production	INEGI	Jan-91	INDEX	MoM	13
Mexico	Total Vehicle Exports	AMIA	Jan-91	Units	YoY	13
Mexico	Unemployment Rate	INEGI	Apr-00	%	M diff	22
Mexico	Petroleum Exports: Crude	INEGI	Jan-91	US$	MoM	24
Mexico	Imports	INEGI	Jan-91	US$	MoM	24
Mexico	Exports	INEGI	Jan-91	US$	MoM	24
Mexico	Production of Crude Petroleum	INEGI	Jan-91	Units	MoM	26
Mexico	Automobile Sales	AMIA	Jan-91	Units	MoM	37
Mexico	Truck Sales: Total	AMIA	Jan-95	Units	YoY	37
Mexico	Retail Sales	INEGI	Jan-94	INDEX	MoM	52
Mexico	Gross Domestic Product	INEGI	Jan-91	Mil.Pesos	QoQ	55
Mexico	Trade Balance: United States	INEGI	Jan-93	US$	YoY	57
US	UoM: Cons. Sentiment	Un. of Mich.	Jan-91	INDEX	Level	-3
US	Conference Board: Cons. Conf.	CB	Jan-91	INDEX	Level	-3
US	ISM Mfg: PMI Composite Index	ISM	Jan-91	INDEX	Level	1
US	Employees on Nonfarm Payrolls	BLS	Jan-91	Units	M diff	5
US	Retail Sales	CENSUS	Jan-91	US$	MoM	13
US	Industrial Production	FRB	Jan-91	%	MoM	16
US	Capacity Utilization	FRB	Jan-91	%	M diff	16
US	Housing Starts	CENSUS	Jan-91	Units	MoM	18
US	Wholesalers: Sales: Automotive	CENSUS	Jan-92	US$	MoM	40
US	Car Imports	CENSUS	Jan-91	US$	YoY	41
US	Truck Imports	CENSUS	Jan-91	US$	YoY	41

Table 2.1: The table describes the variables included in the model, the sources, the starting dates if their availability, the transformations and the units of measure. The "Lag" column indicates the average number of days between the macroeconomic announcement and the end of the reference period.

Regarding Mexican surveys, I include Consumer Confidence, Producer

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Confidence, and a survey about Manufacturing Orders, all very timely indicators. Moreover, I include two surveys about Business Climate conducted by the Instituto Mexicano de Ejecutivos de Finanzas (IMEF). Even though their Bloomberg relevance index is low, those two indicators (Manufacturing and Non-Manufacturing) are widely followed by economic commentators, in newspapers and specialized websites. They are the Mexican version of the "Purchasing Managers Index" published by the Institute for Supply Management in the US, as their construction explicitly follows the same methodology.

As for standard macroeconomic indicators about Mexican production and internal demand I consider Industrial Production and Retail Sales; it is worth noticing that Industrial Production has a Bloomberg relevance index even higher than the one of GDP. I include two indicators relative to the automotive sector (Automobile sales and Truck sales), given the importance of the automotive sector for the Mexican economy[7] end Mexican exports. The trade sector is particularly important in Mexico. The trade balance historically fluctuates around zero, but trade has a major role in the economy since exports represents the 31.7% of GDP[8]. The main trade partner

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[7]Mexico is the 7th world producer of vehicles, 6th for commercial vehicles.
[8]Data relative to 2010-2014, World Bank.

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are the United States, which absorb 79% of Mexican exports: the trade surplus with the US amounts to 53,8 Billions of USD[9]. The largest shares of exports are represented by vehicles, electronic and mechanical components (often linked to the automotive sector), and oil. However, the trade balance relative to the first to categories is almost neutral. Therefore, in addition to imports and exports, I include in the model indicators for oil production and exports, vehicle production and exports, and the trade balance with the United States. The final list of Mexican variables consists of 18 indicators.

Regarding US data, I look at a set of variables considered standard in forecasting literature and by practitioners assessing the behaviour of US economy. As regards real variables I include GDP, Industrial Production, Capacity Utilization, Retail Sales, Housing Starts, Personal Consumption Expenditure in Durable Goods and Employees on Non-Farm Payrolls. As regards surveys, I take the Purchasing Managers Index (Manufacturing), Consumer Confidence, and the Consumer Sentiment from the University of Michigan. Moreover, given the high importance of the automotive sector in the trade activity between Mexico and US, I include the three pertaining variables that are commented on Bloomberg (Automotive Wholesale sales, Car Imports and Truck Imports).

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[9]Source: www.census.gov.

Date	Country	Series	Average delay	Ref. Period	Bloomberg relevance
01-May	US	ISM Mfg: PMI Composite Index	1	April	94.7
02-May	Mexico	IMEF Index: Mfg	3	April	17.5
02-May	Mexico	IMEF Index: Nonmfg	3	April	12.5
02-May	US	Car Imports	41	March	
02-May	US	Truck Imports	41	March	
03-May	Mexico	Producer Confidence Index	4	April	
03-May	Mexico	Manufacturing Orders	4	April	
03-May	US	Employees on Nonfarm Payrolls	5	April	99.1
06-May	Mexico	Consumer Confidence	4	April	82.5
07-May	Mexico	Total Vehicle Production	10	April	37.5
07-May	Mexico	Total Vehicle Exports	13	April	30
08-May	Mexico	Automobile Sales	37	March	
08-May	Mexico	Truck Sales	37	March	
09-May	US	Automobile Sales	40	March	
10-May	Mexico	Industrial Production	43	March	92.5
13-May	US	Retail Sales	13	April	89.4
15-May	US	Industrial Production	16	April	86.7
15-May	US	Capacity Utilization	16	April	60.71
16-May	US	Housing Starts	18	April	88.5
24-May	Mexico	Unemployment rate	22	March	77.5
22-May	Mexico	Retail Sales	52	March	80
23-May	Mexico	Gross Domestic Product	55	2013 Q1	87.5
26-May	Mexico	Imports	24	April	75*
26-May	Mexico	Exports	24	April	75*
26-May	Mexico	Trade Balance: United States	57	March	
26-May	Mexico	Oil Exports	24	April	
26-May	Mexico	Oil Production	26	April	
28-May	US	Consumer Confidence	-3	May	95.6
31-May	US	Univ. of Michigan: Cons. Sentiment	-3	May	92.9

Table 2.2: Calendar overview.
* Refers to Trade Balance.

In Table 2.2 I report an example of the flow of macroeconomic releases included in the model for May 2013. In the first days of the month three surveys are releases, the Mexican IMEF (manufacturing and non-manufacturing) and the US PMI Manufactuting. On the same day of the IMEF surveys data about Car and Trucks Imports in the United States are released, and they refer to the month of March. This is an example of the ragged edge feature of the dataset, and of the importance of taking all available information into account: using a balanced panel the forecaster would have neglected the information relative to April about US PMI, an indicator which has a very high average impact on the nowcast of Mexican GDP (see section 2.4.2). Data has been downloaded from Haver Analytics on 30th November 2014[10]. All the variables but the surveys have been transformed to have monthly growth rates (or monthly differences when not applicable and in case of Employment variables), and a linear filter has been used to transform non-seasonally adjusted variables.

Regarding the forecasts of the calendar year GDP growth rate (e.g. the growth rate of GDP in 2013 with respect to GDP in 2012), I use some institutional forecasts as benchmarks. In particular, I use the forecasts pub-

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[10]I thank Now-Casting Economics for access to the data.

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lished in the World Economic Outlook by the International Monetary Fund in April and October of the reference year, and the projections published in the OECD Economic Outlook in June and December of the reference year. As a benchmark for the year-on-year growth rate, I use the Surveys of Professional Forecasters conducted monthly by the Bank of Mexico. Capistrán and López-Moctezuma (2014) have analysed the properties of these forecasts, finding that they do not fulfil neither weak nor strong efficiency properties. Forecasters, in particular, do not to efficiently incorporate the available information in updating their assessments. This is indeed a strong motivation to use a model that could update the forecast in real-time, exploiting the relevant information embedded in the data flow of macroeconomic indicators. A comparison of the forecasting ability of the two approaches is presented in the following section.

2.4 Results

2.4.1 Out of sample evaluation

In this section I present the result of the out of sample evaluation of the model, performing a pseudo real-time historical evaluation. It is called "pseudo" because it abstracts from data revisions, but in this framework the

estimates are robust to data revisions if the revision errors are weakly cross-correlated (Giannone, Reichlin and Small, 2008). The estimation sample starts in January 1991, and the sample of the out of sample evaluation goes from the first quarter of 2006 to the fourth quarter of 2013. At any release after 1st January 2006, the forecast (1-period ahead), nowcast (same quarter) and back-cast (last quarter) are updated. It is worth to remark that, since the variables are jointly modelled, the model produces a forecast for each variable in the dataset. If the data release brings new information (i.e. different from the model expectation) the model is updated. I show the performance of the model in which I include all the variables and the one of the model in which I use just Mexican variables. I compare the forecasts of the two models to the benchmark of an AR(1), to the nowcast of the Survey of Professional Forecaster reported monthly by the Bank of Mexico, and to the surveys conducted among Professional Forecasters by Bloomberg[11].

Figure 2.2 shows a comparison between the nowcast of the YoY growth rate of Mexican GDP and the actual values. The nowcast tracks well the large crisis of 2009, the recovery, as well as more tranquil periods. The result performs also very well in comparison to the nowcast resulting from

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[11]The comparison gives an idea of the performance of the model but it should be taken with caution, since the model works with revised data and professional forecasters operate in real time.
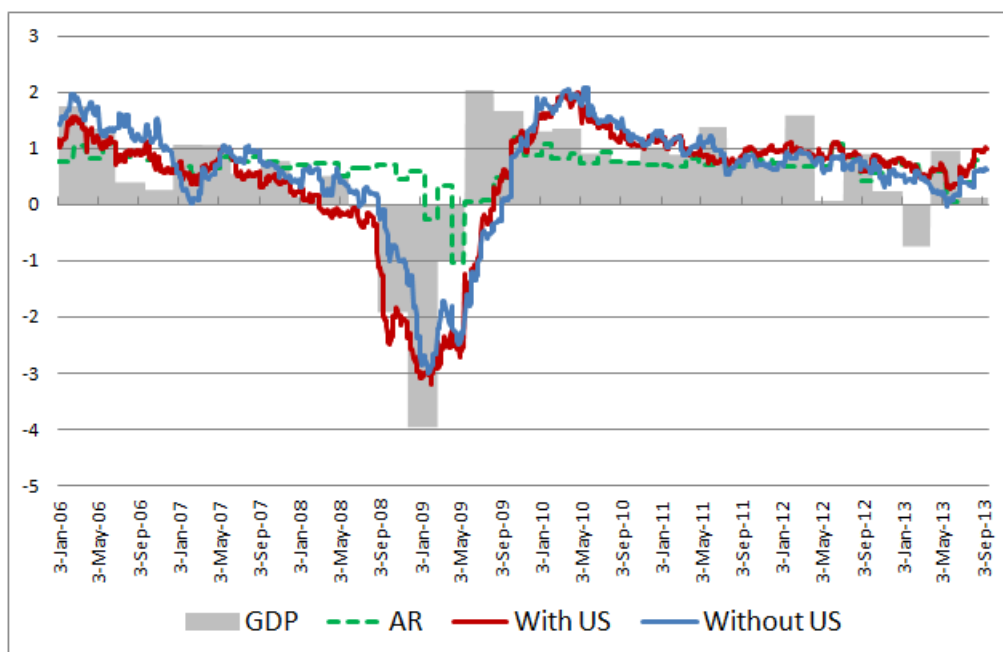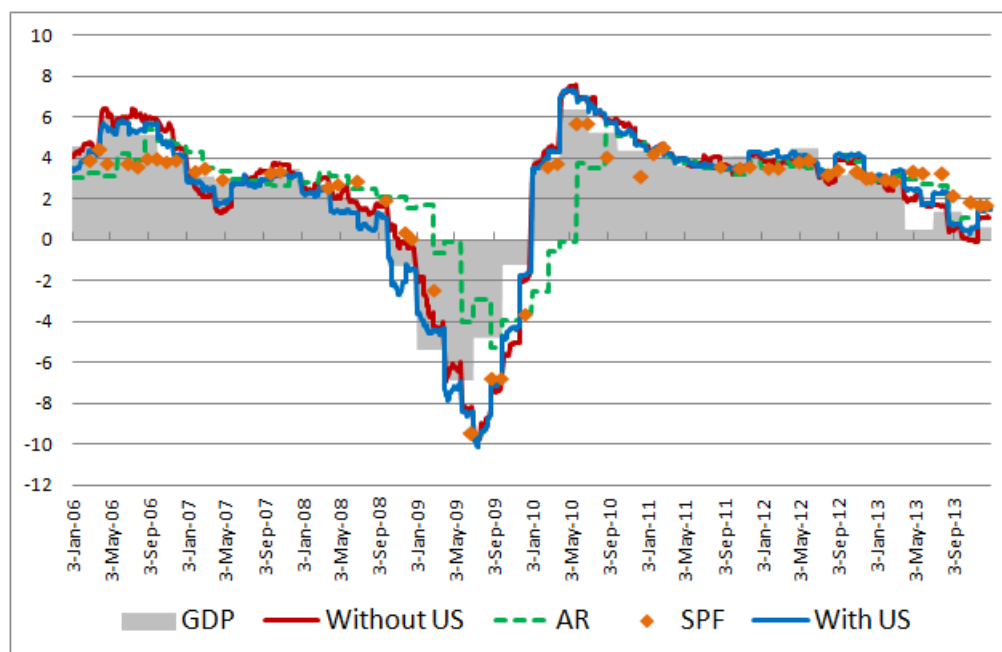
Figure 2.1: Now-cast of the QoQ growth rate of GDP of the model that includes US variables (With US) and the one that includes just Mexican variables (Without US), compared with the actual value and the forecast from an AR(1) model.

the surveys of Professional Forecasters. Same qualitative results hold for the

nowcast of the QoQ growth rate, in Figure 2.1 and for the forecast of the

calendar year growth rate, in Figure 2.3, compared with the performance of

institutional forecasts coming from the IMF World Economic Outlook and

the OECD Economic Outlook. In the QoQ case, it can be noticed that the

model that includes US variables captures the crisis of 2008-2009 and the

recovery more rapidly than the model with just Mexican variables, showing

the importance of taking into account possible shocks from the US.

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Figure 2.2: Now-cast of the YoY growth rate of GDP of the model that includes US variables (With US) and the one that includes just Mexican variables (Without US), compared with the actual value and forecast from an AR(1) model and of the surveys of Professional Forecasters conducted by the Bank of Mexico.
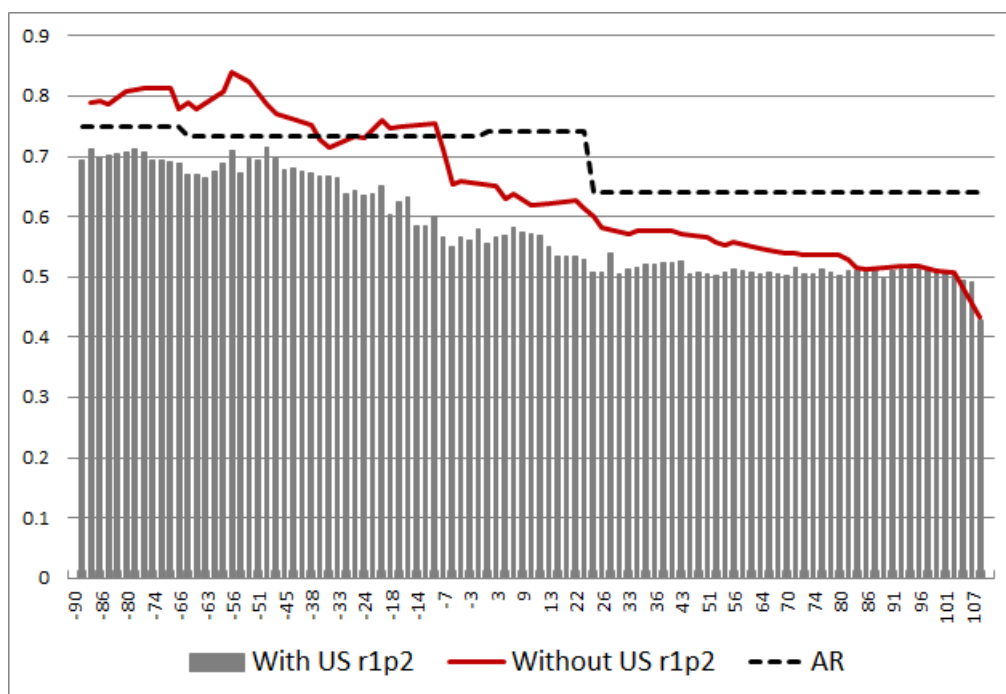
In Figure 2.4 and 2.5 I present the reduction in the Root Mean Squared Forecast Errors of the nowcast of the QoQ and the YoY growth rate during the forecast period (from -90 to 0 days to the start of the reference quarter), the nowcast period (from day 0 to day 90) and the back-cast period (from day 90 onwards). The figure shows the result of the model that includes the US variables, as well as the result of the model with just Mexican ones. I also compare the performance of these models to the same benchmarks: the forecast from an AR(1), from surveys of Professional Forecasters interviewed

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by the Bank of Mexico, and from the surveys of Professional Forecasters interviewed by Bloomberg.
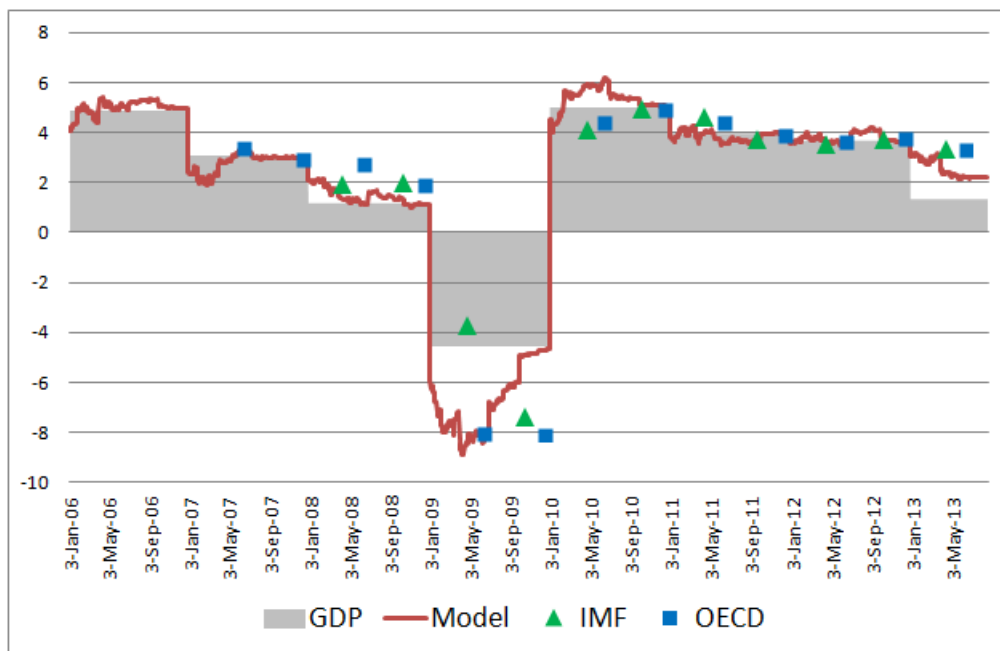
Figure 2.3: Now-cast of the calendar year growth rate of GDP using the model that includes US and Mexican variables, compared with the actual value of GDP growth rate and forecast produced by IMF and OECD.

The chart shows three main results. First, the reduction in RMSFE shows how the information coming from macroeconomic releases is effectively incorporated into the estimates of the GDP growth rate. Second, it shows how the model that includes the US indicators performs uniformly better than the model that excludes them in the QoQ case, in the forecast period and in the nowcast period up to the 80th day after the start of the
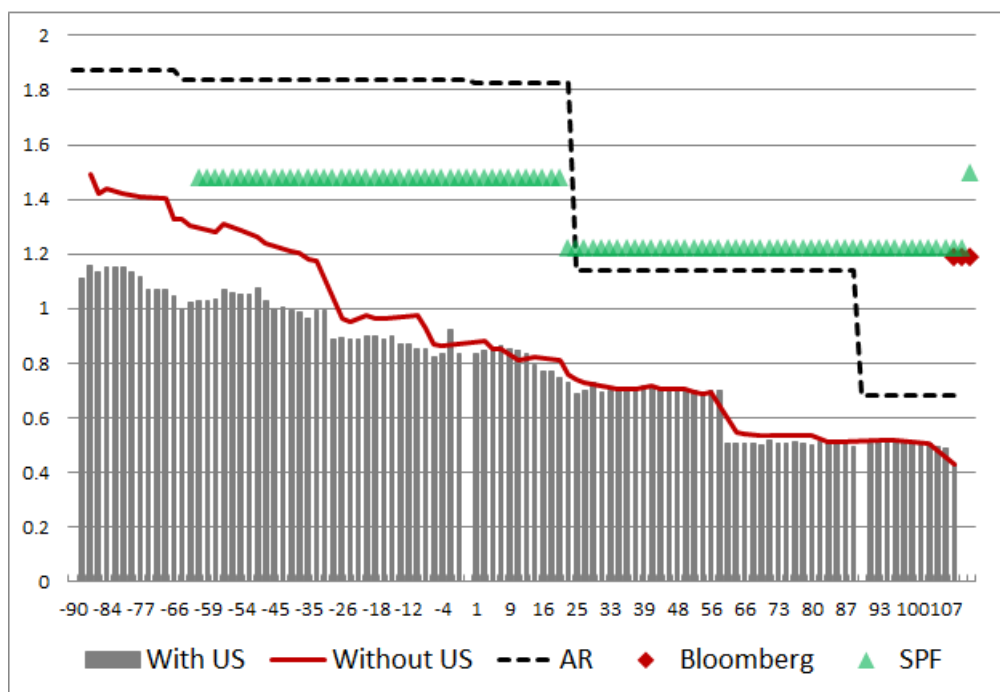
60

Figure 2.4: Root Mean Squared Forecast Errors of the two nowcast models of the QoQ growth rate of GDP during the forecast period (from -90 to 0 days to the start of the reference quarter), the nowcast period (from day 0 to day 90) and the back-cast period (from day 90 onwards). The days are on the horizontal axis.

reference quarter; in the YoY case the RMSFE is lower only in the forecast period, and very similar in the nowcast and backcast period. Third, it shows that the forecast coming from such a mechanical model are comparable to the one of Professional forecasters, with the advantages that the model can be updated in real time at any release and it is totally free of judgemental possible biases.

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Figure 2.5: Root Mean Squared Forecast Errors of the two nowcast models of the YoY growth rate of GDP during the forecast period (from -90 to 0 days to the start of the reference quarter), the nowcast period (from day 0 to day 90) and the back-cast period (from day 90 onwards). The days are on the horizontal axis. The chart shows also the comparison with the RMSFE of the forecast of SPF from Bank of Mexico and of Bloomberg surveys.

To test the performance of the models I perform a Diebold and Mariano (1995) test of equal predictive accuracy. Define "small" the model that includes just Mexican variables, and "large" the model that includes Mexican and US variables. I test the equal accuracy of the forecasts (i) from the small model with the ones from the large, (ii) from the large model with respect to the ones from the AR(1), (iii) from the small model with respect

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to the ones from the AR(1). The models are nested, but the higher estimation uncertainty of the parameters in finite samples, in the case of the large model, makes the test of Diebold-Mariano even more conservative if the test is designed to evaluate the greater forecasting accuracy of its forecasts with respect to the ones from the small model. I consider as the loss function the average squared differential of the forecast errors of the two competing model, taken in correspondence of the last release of each month. The null hypothesis is that the forecast from the two models have the same predictive accuracy, the alternative is that the forecast from the latter models in the couples specified above have higher predictive accuracy.

I first analyse the results relative to the target of the YoY GDP growth rate. Regarding the comparison of nowcast and forecast of the nowcasting models with respect to the AR(1), the test rejects the null hypothesis at the 99% confidence level, and at 95% in the case of the backcast. When comparing the small and the large models, the null is the rejected at the 90% level in the case if the nowcast and at the 95% level in the case of the forecast. In comparison with the Surveys of Professional Forecasters, the null of equal forecasting ability is rejected for both nowcasting models at the 99% confidence level.

Considering the results relative to the target of the QoQ growth, there is

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no advantage of the nowcasting models with respect to the AR in forecasting one step ahead. However, in the backcast case there is evidence in favour of the small model at the 90% level and in favour of the large at 95%level, and for the nowcast the null is rejected at 90% level for the small and at 95% level form the large. Comparing the two nowcasting models, the null is rejected in favour of the large one at 95% for nowcast and forecast, and it is not rejected for the backcast.

To sum up, the test indicates a statistically significant advantage[12] of the nowcasting models with respect to the AR(1), and an advantage of the large model with respect to the small one in nowcasting and forecasting. More-over, the analysis shows that the nowcasting models produce nowcasts and forecasts that are more accurate than the ones of professional forecasters. The general worse performance in backcasting, also with respect to the AR, is a feature of a model that is designed to take advantage of the timeliness of some indicators that are referred to the reference quarter. It disregards indicators that might forecast some components included in the GDP accounting (e.g. investment), and that might be useful only in the backcasting period. The inclusion of such indicators, and an improvement of the model in that direction, are left for future research.

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[12]I express as an advantage the fact that H_0 is rejected at least at 90% confidence level.

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	DM stat	Backcast	Nowcast	Forecast
QoQ	Mex vs (Mex+US)	0.479	2.048	1.693
	AR vs (Mex+US)	1.262	1.783	0.912
	AR vs Mex	1.299	1.541	0.256
YoY	Mex vs (Mex+US)	0.479	1.496	1.971
	AR vs (Mex+US)	2.271	3.403	3.379
	AR vs Mex	2.267	3.354	3.231
	SPF vs Mex		3.497	2.490
	SPF vs (Mex+US)		4.212	2.630

Table 2.3: In the table the results of a Diebold-Mariano (1995) test of equal predictive accuracy. The model written as the second is the one whose forecast are tested to be more accurate in the alternative hypothesis (e.g.: A vs B, H_1 is that forecasts from B are more accurate than forecasts from A). "Mex" refers to the model with just Mexican variables; "Mex+US" to the model with all the variables; "AR" to the AR(1); "SPF" to the survey of professional forecasters (Bank of Mexico).

2.4.2 News analysis

Bańbura and Modugno (2014) explain how to extract model-based news in the nowcasting framework. In our case, let y_t^Q be the GDP at time t, and Ω_ν the information set at time ν, where ν is a vintage of data. The nowcast is the projection of y_t^Q using the available data, $\mathbb{E}[y_t^Q|\Omega_\nu]$. At any release, the information set expands : $\Omega_\nu \subset \Omega_{\nu+1}$, and it is possible to decompose the new forecast in:

$$\underbrace{\mathbb{E}[y_t^Q|\Omega_{\nu+1}]}_{\text{new forecast}} = \underbrace{\mathbb{E}[y_t^Q|\Omega_\nu]}_{\text{old forecast}} + \underbrace{\mathbb{E}[y_t^Q|I_{\nu+1}]}_{revision} \qquad (2.8)$$

Where $I_{\nu+1}$ is the information in $\Omega_{\nu+1}$ orthogonal to Ω_ν. Therefore, it is

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possible to express the revision as a weighted sum of news from the released variables, where $b_{j,t,\nu+1}$ are the weights:

$$\underbrace{\mathbb{E}[y_t^Q|\Omega_{\nu+1}] - \mathbb{E}[y_t^Q|\Omega_\nu]}_{revision} = \sum_{j\in J_{\nu+1}} b_{j,t,\nu+1} \underbrace{(x_{i_j,t_j} - \mathbb{E}[(x_{i_j,t_j}|\Omega_\nu)])}_{news} \qquad (2.9)$$

This methodology permits to evaluate the marginal contribution of every release in the updating of the nowcast. In Figure 2.6 I report the average impact of the variables on the update of the nowcast, calculated as the average weight multiplied by the standard deviation of the model-based news. I have ordered the variables by the average distance of the releases from their reference period, expressed in days, to appreciate the effect of the timeliness (if any) on the variables impacts. The main result of this analysis is that the now-casting model attribute a very high importance to the variables relative to the US economy. The release of the US PMI in the first month of the quarter has the second highest impact after Mexican GDP, followed by Mexican Producer Confidence, US Industrial Production and US Non Farm Payrolls. I find a high impact of both US soft and hard variables. As expected, the highest impacts are of the variables that are releases on average in the first half of the first month, and this confirm that the timeliness is indeed important. The ranking of the impacts is

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very similar if we look at the second month in the quarter, other than Mexican GDP. In the third month, the US Industrial Production seems to be the most important variable according to the model. However, the also the informational content of the variables is important, not just their timeliness: the high impact of US Car and Truck imports, that are released with a significant delay, confirms the relevance of looking at the trade with the US, especially in the automotive sector, to gauge the state of the Mexican economy. Among Mexican variables, it is worth noticing the predominant role of the Producer Confidence Index, of Vehicle Production and Vehicle Exports, and of Imports and Exports. The analysis confirms the high importance of US variables in assessing the current state of the Mexican economy.
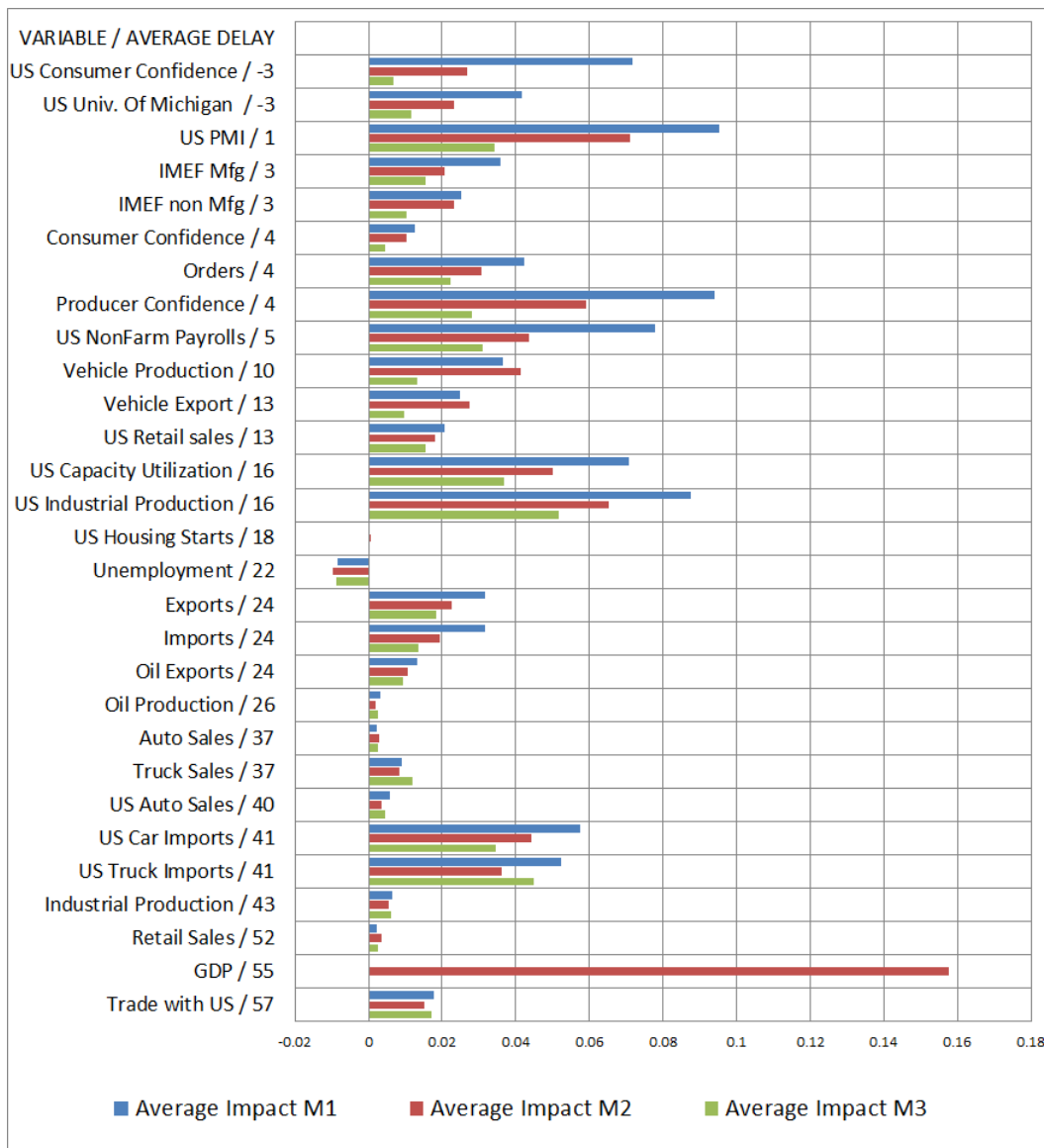
Figure 2.6: The chart shows the average impact of the variables in the 3 months of the nowcast (m1, m2, m3), where the impact is the product of the average model-based standardized news and the weight of the variable in the updating process. The variables are ordered by average release delay from the reference period, expressed in days after the name of the variable.

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2.5 Conclusions

In this chapter I have presented a model to interpret the Mexican data flow of macroeconomic releases. In particular, I exploited the information embedded in macroeconomic news from Mexico and from the United States, in a model constructed to nowcast Mexican real GDP. I have used the nowcasting technique based on dynamic factor models and Kalman filters that has its grounds in Giannone, Reichlin and Small (2008), which permits to evaluate the relevance of any single indicator used in the nowcast. The results confirm the good quality of the model if compared to institutional forecasts from the International Monetary Fund and the OECD, with the advantage that it is possible to update the nowcast at any macroeconomic release. Moreover, the model outperforms the judgemental forecast of professional forecasters of Bank of Mexico, either in nowcasting and in forecasting the GDP growth rate in the following quarter. Among the results, I have documented the importance of the variables related to the automotive sector and trade, and I have found an important role of indicators about the US economy. In particular, the model indicates the usefulness of a group of "core" US variables, given their high average impact in the nowcast updates, like the Manufacturing Purchasing Managers Index, Non-Farm Payrolls,

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Capacity Utilization and Industrial production. These results confirm the findings of a literature on the important linkages between US and Mexican economy in the post-NAFTA period (e.g. Sosa, 2008; Miles and Vijverberg, 2011). Therefore, they encourage a more frequent use of external indicators in short-term GDP forecasting of countries whose business cycles are highly synchronized with other economies.

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Appendix A

The impact of macroeconomic news on the euro-dollar exchange rate

A.1   The USD/EUR exchange rate

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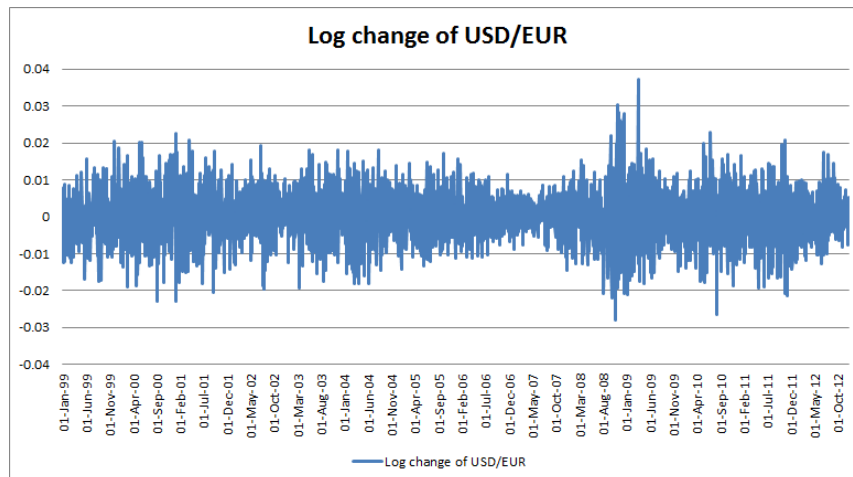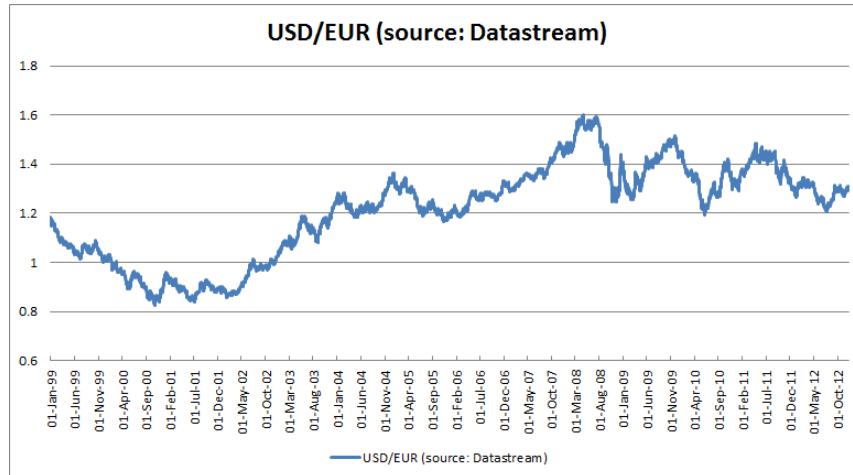
A.1.1 Data description: announcements

	N	AVERAGE	STD	MIN	MAX
US - ADP Employment Change	77	2.909	65.081	-198.000	197.000
US - Building Permits	124	4.710	55.383	-95.000	170.000
US - Capacity Utilization	165	0.000	0.003	-0.015	0.008
US - Change in Nonfarm Payrolls	168	-21.649	85.378	-318.000	188.000
US - Chicago Purchasing Manager	166	0.675	4.116	-11.800	12.400
US - Consumer Confidence	167	-0.032	5.054	-14.000	12.300
US - CPI	166	0.000	0.001	-0.004	0.004
US - CPI Core	121	0.000	0.001	-0.002	0.003
US - Current Account Balance	55	0.611	6.015	-16.500	13.300
US - Durable Goods Orders	167	-0.001	0.027	-0.082	0.108
US - FOMC rate decision	100	0.000	0.001	-0.003	0.003
US - GDP (Advance)	48	-0.001	0.007	-0.017	0.017
US - GDP (Final)	47	0.000	0.002	-0.006	0.005
US - GDP (Preliminary)	48	0.000	0.003	-0.008	0.006
US - Housing Starts	167	8.108	81.886	-253.000	256.000
US - Import Price Index	164	0.000	0.006	-0.022	0.013
US - Industrial Production	167	-0.001	0.004	-0.020	0.011
US - Initial Jobless Claims	696	1.303	22.259	-83.000	80
US - ISM Manufacturing PMI	168	0.129	2.033	-6.000	7.400
US - New Home Sales	166	5.735	63.835	-166.000	244.000
US - Phil. Fed. Mfg. Index	167	-1.088	9.284	-32.700	18.100
US - PPI	167	0.000	0.005	-0.012	0.017
US - PPI Core	121	0.000	0.002	-0.010	0.009
US - Retail Sales	167	0.000	0.006	-0.016	0.046
US - Retail Sales Less Autos	167	0.000	0.005	-0.017	0.014
US - Trade Balance	168	0.008	3.102	-8.800	10.600
US - U. of Michigan Conf.	163	0.288	1.380	-4.000	4.800
US - Unemployment rate	168	0.000	0.002	-0.005	0.004
EUR - CPI	167	0.001	0.003	-0.001	0.017
EUR - CPI Core	94	0.000	0.001	-0.004	0.002
EUR - ECB interest rate	190	0.002	0.007	-0.005	0.048
Continued on Next Page. . .					

	N	AVERAGE	STD	MIN	MAX
EUR - GDP	46	0.000	0.001	-0.005	0.004
EUR - Industrial Production	140	0.000	0.006	-0.018	0.020
EUR - M3	132	0.001	0.004	-0.010	0.011
EUR - PPI	141	0.000	0.002	-0.011	0.005
EUR - Retail Sales	141	-0.001	0.006	-0.017	0.024
EUR - Trade Balance	90	0.293	2.513	-4.600	6.800
EUR - Unemployment rate	134	0.000	0.001	-0.003	0.004
FRA - CPI	165	0.000	0.001	-0.004	0.004
FRA - GDP	57	0.000	0.003	-0.007	0.006
FRA - Industrial Production	165	-0.002	0.011	-0.032	0.033
FRA - PMI Mfg.	81	0.046	0.655	-2.300	2.100
FRA - PPI	142	0.001	0.012	-0.057	0.094
FRA - Unemployment rate	124	0.000	0.001	-0.004	0.005
GER - CPI	164	0.000	0.003	-0.019	0.024
GER - GDP	56	0.000	0.003	-0.008	0.009
GER - IFO Business Climate	82	0.201	1.315	-2.600	4.700
GER - IFO Current Assessment	106	0.376	1.574	-3.800	5.000
GER - IFO Expectations	106	0.215	1.449	-3.600	3.900
GER - Industrial Production	159	-0.002	0.015	-0.045	0.037
GER - PMI Mgf.	93	-0.012	0.578	-1.800	1.600
GER - PPI	128	0.000	0.004	-0.014	0.014
GER - Retail Sales	168	-0.006	0.021	-0.072	0.078
GER - Unemployment rate	167	0.002	0.015	-0.004	0.003
GER - ZEW Survey	108	0.109	8.972	-21.600	27.800
ITA - Business Confidence	152	-0.043	2.336	-8.000	10.400
ITA - Consumer Confidence	139	-0.074	2.356	-7.200	5.400
ITA - CPI	141	0.000	0.002	-0.007	0.009
ITA - GDP	52	0.000	0.002	-0.006	0.009
ITA - Industrial Production	165	-0.002	0.010	-0.026	0.055
ITA - PMI Mfg.	102	-0.111	1.915	-6.600	4.400
ITA - Retail Sales	116	-0.001	0.004	-0.010	0.009
SPA - CPI	251	0.007	0.014	-0.004	0.042
SPA - GDP	75	0.000	0.001	-0.003	0.005
Continued on Next Page. . .					

	N	AVERAGE	STD	MIN	MAX
SPA - Industrial Output	163	-0.001	0.021	-0.050	0.070
SPA - Unemployment	157	3.241	20.986	-86.300	82.700

Table A.1: The table shows some descriptive statistics of the macroeconomic announcements.
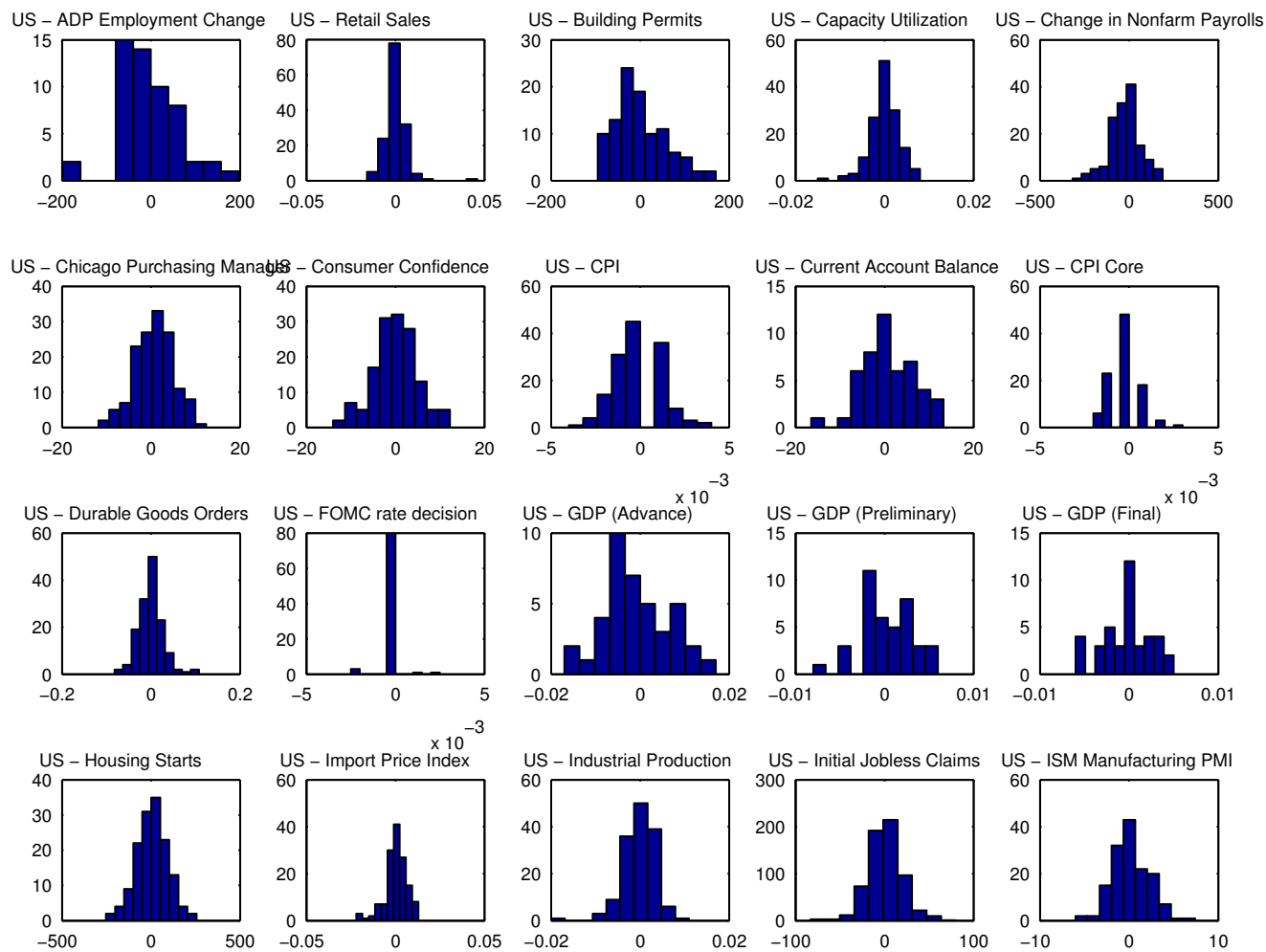
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Tesi di dottorato di Alberto Caruso discussa presso la LUISS Guido Carli il 15 Giugno 2015 - soggetta a copyright

Figure A.1: The figure shows the histograms of the macroeconomic news.
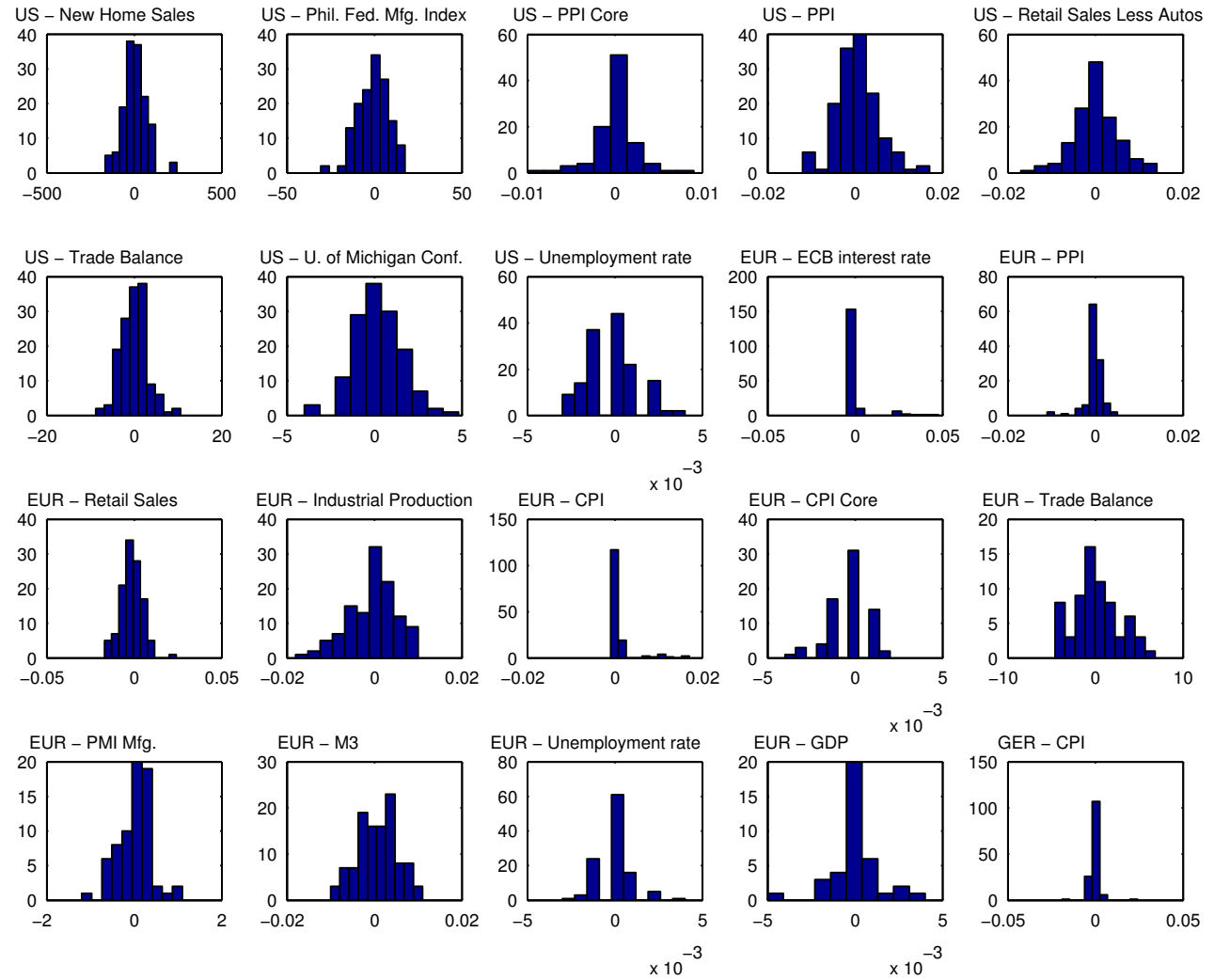
Figure A.2: The figure shows the histograms of the macroeconomic news.
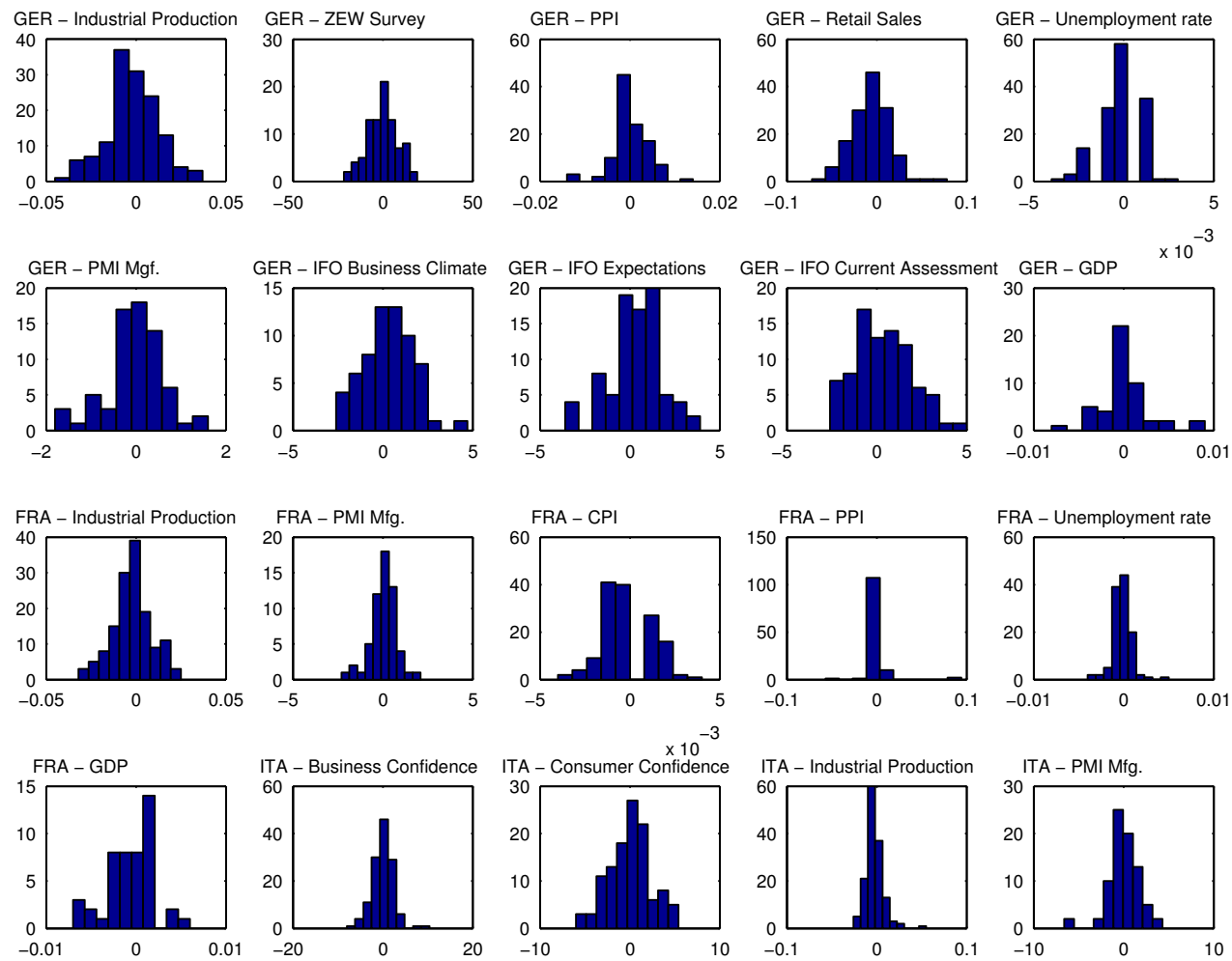
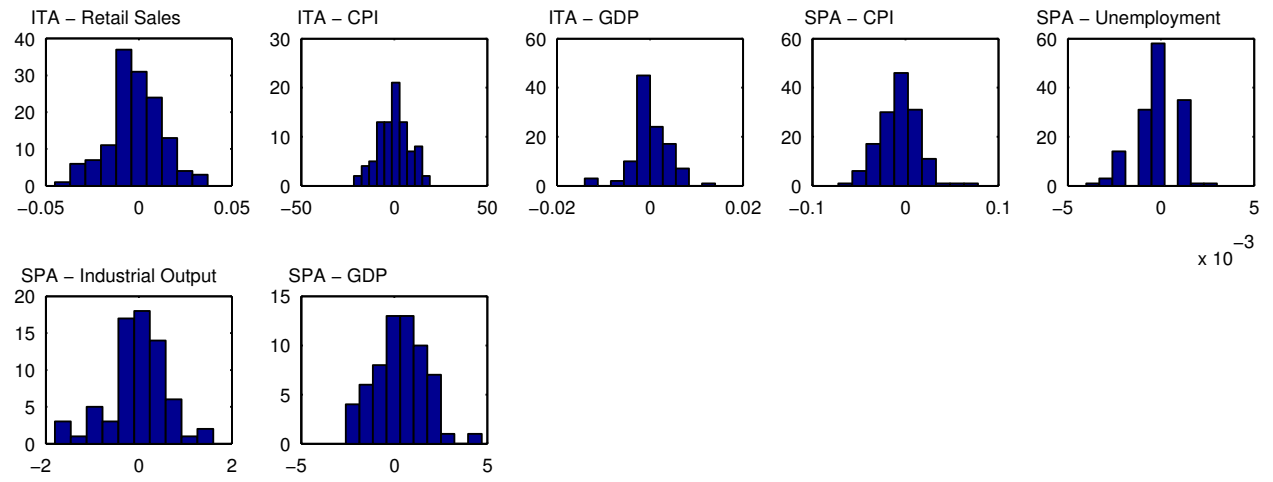Figure A.3: The figure shows the histograms of the macroeconomic news.

Figure A.4: The figure shows the histograms of the macroeconomic news.

A.1.2 German GDP: additional regressions

As explained in the main text, European GDP and German GDP are systematically released on the same day since February 2005, and they are considerably correlated. In order to better identify the effect of news about German GDP, I try to isolate their effect using a two-step procedure. In the first step, I run a regression of news about German GDP on news about the European GDP, from February 2005 to December 2012:

$$GDP_{ger,t} = \alpha + \beta \, GDP_{eur,t} + u_t \tag{A.1}$$

Then I regress the change in the Euro-Dollar exchange rate on the residual of regression A.1, that is the part of German GDP that is not explained by the European GDP:

$$\Delta(\ln e_t) = \gamma + \delta\Delta(\ln e_{t-1})\eta u_t + \epsilon_t \tag{A.2}$$

The result of regression A.1 is:

	Beta	p-value	s.e.
α	0.0017	0.393	0.002
GDP_{EUR}	0.8375	0.0000	0.1042

Table A.2: The table shows the result of regression A.1.

The result of regression A.2 is:

	Beta	**p-value**	**s.e.**
γ	-0.0002	0.9887	0.0143
ER_{t-1}	0.0167	0.5494	0.0279
GDP_{GER}	-0.5591	0.0008	0.1667

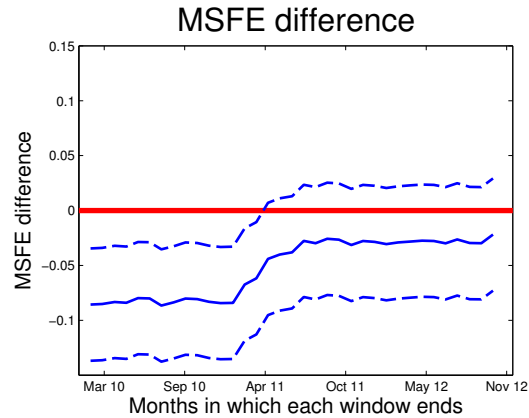Table A.3: The table shows the result of regression A.2.

Figure A.5: Results with both US and euro area news used as predictors. Initial window W_1: December 2001 - December 2008, out of sample window approximately equal to 20 months. On the x-axes, the month in which the windows end. On the y-axes, the difference of the MSFE of the model with the MSFE obtained using a random walk without drift.
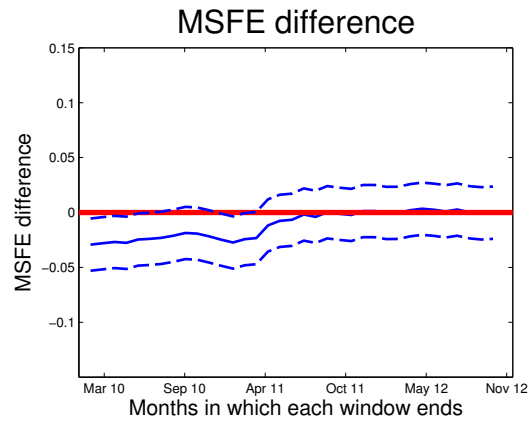
A.1.3 Forecasting evaluation

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Figure A.6: Results with both US news used as predictors. Initial window W_1: December 2001 - December 2008, out of sample window approximately equal to 20 months. On the x-axes, the month in which the windows end. On the y-axes, the difference of the MSFE of the model with the MSFE obtained using a random walk without drift.

Figure A.7: Results with euro area news used as predictors. Initial window W_1: December 2001 - December 2008, out of sample window approximately equal to 20 months. On the x-axes, the month in which the windows end. On the y-axes, the difference of the MSFE of the model with the MSFE obtained using a random walk without drift.
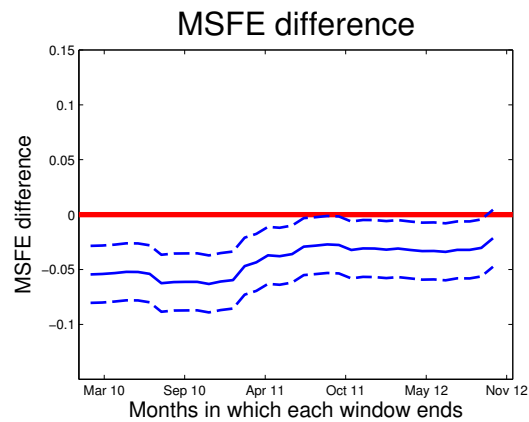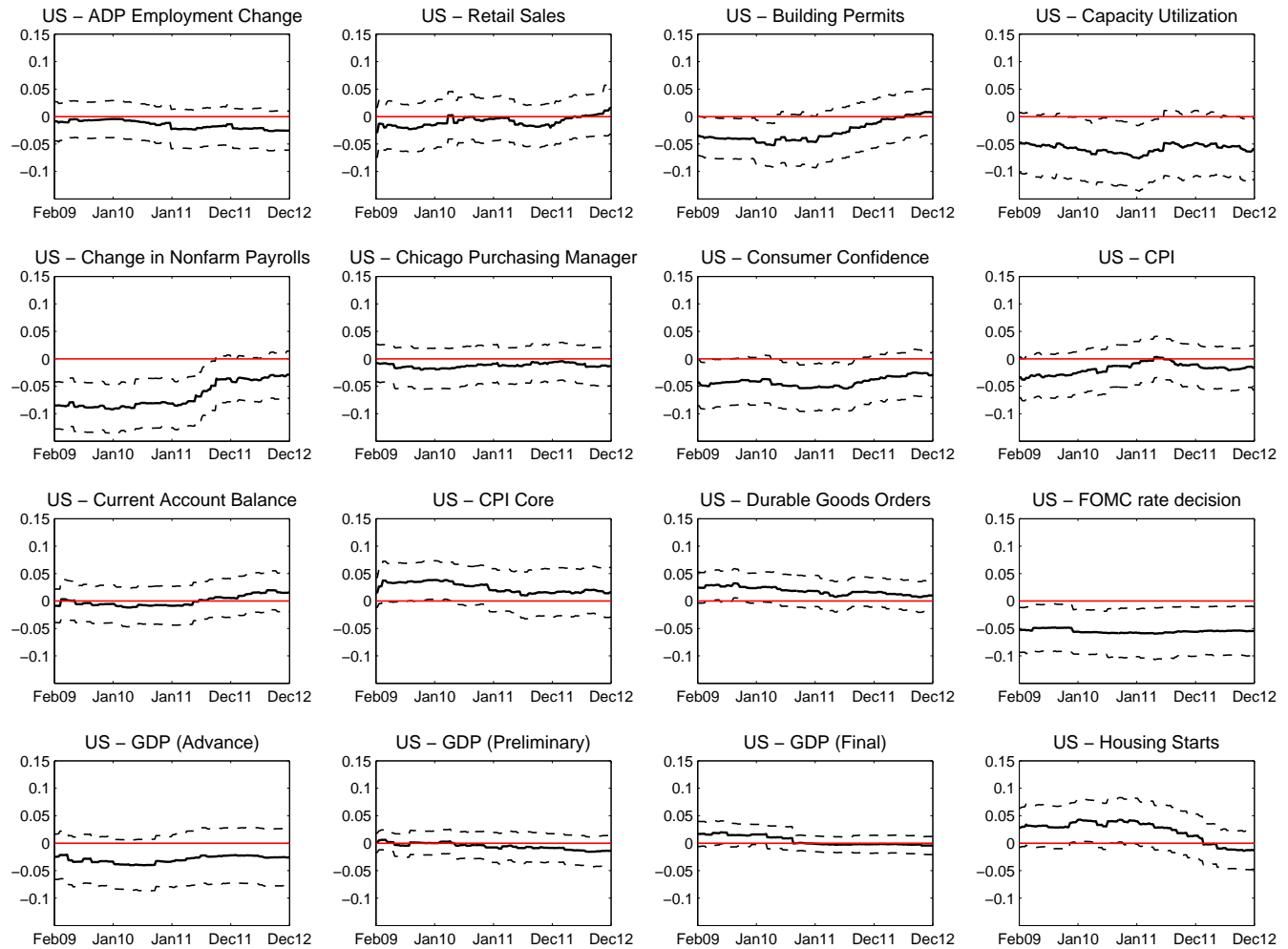
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Figure A.8: The figure shows the coefficients relative to US announcements and the 90% confidence bands, from rolling OLS estimations of equation 1.2 (Newey West stardard errors). The estimation is performed using US and euro area news and 5-year rolling windows starting from April 2002.
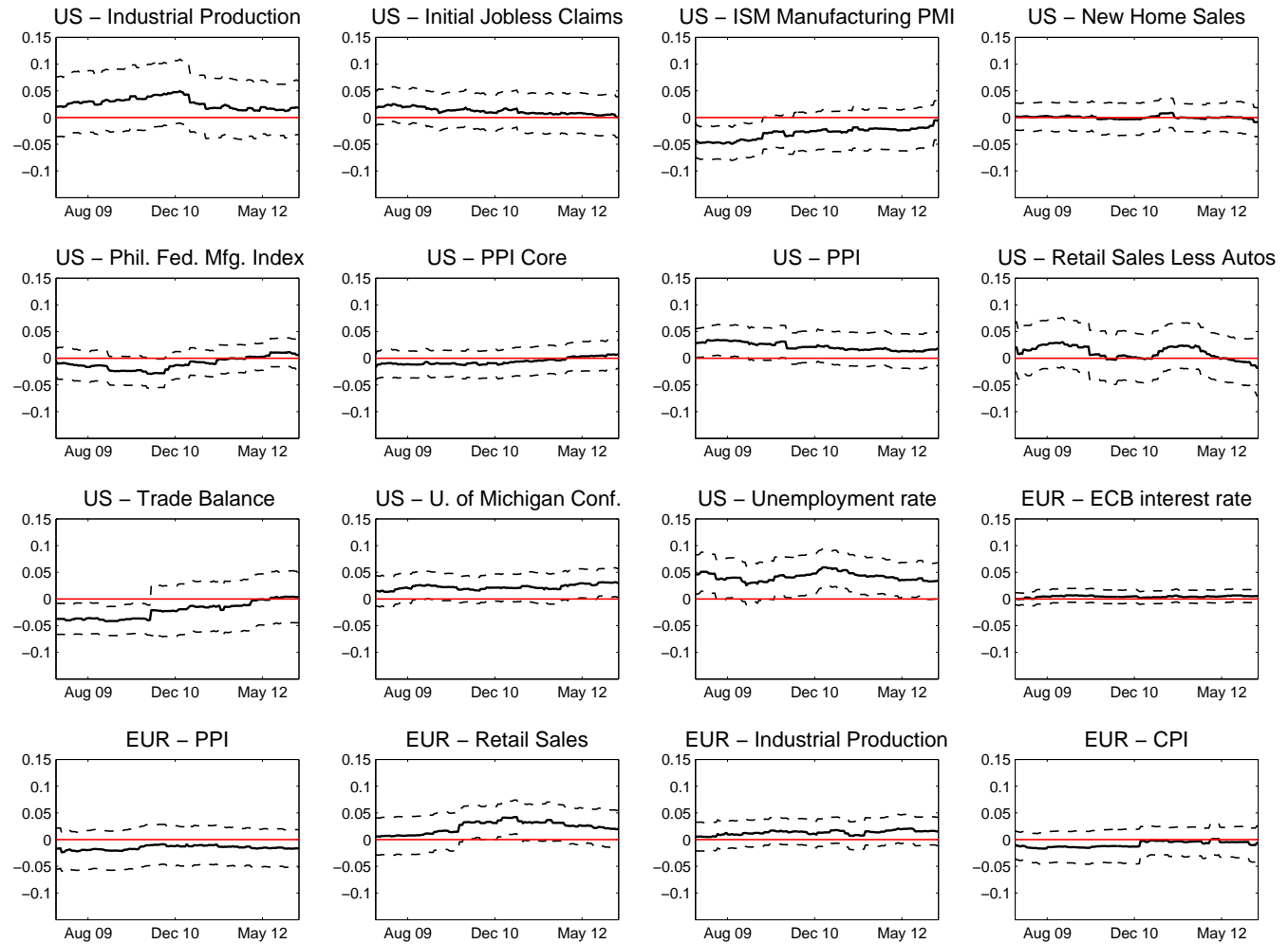
Figure A.9: The figure shows the coefficients relative to US and euro area announcements and the 90% confidence bands, from rolling OLS estimations of equation 1.2 (Newey West stardard errors). The estimation is performed using US and euro area news and 5-year rolling windows starting from April 2002.

Figure A.10: The figure shows the coefficients relative to euro area announcements and the 90% confidence bands, from rolling OLS estimations of equation 1.2 (Newey West stardard errors). The estimation is performed using US and euro area news and 5-year rolling windows starting from April 2002.

Figure A.11: The figure shows the coefficients relative to euro area announcements and the 90% confidence bands, from rolling OLS estimations of equation 1.2 (Newey West stardard errors). The estimation is performed using US and euro area news and 5-year rolling windows starting from April 2002.
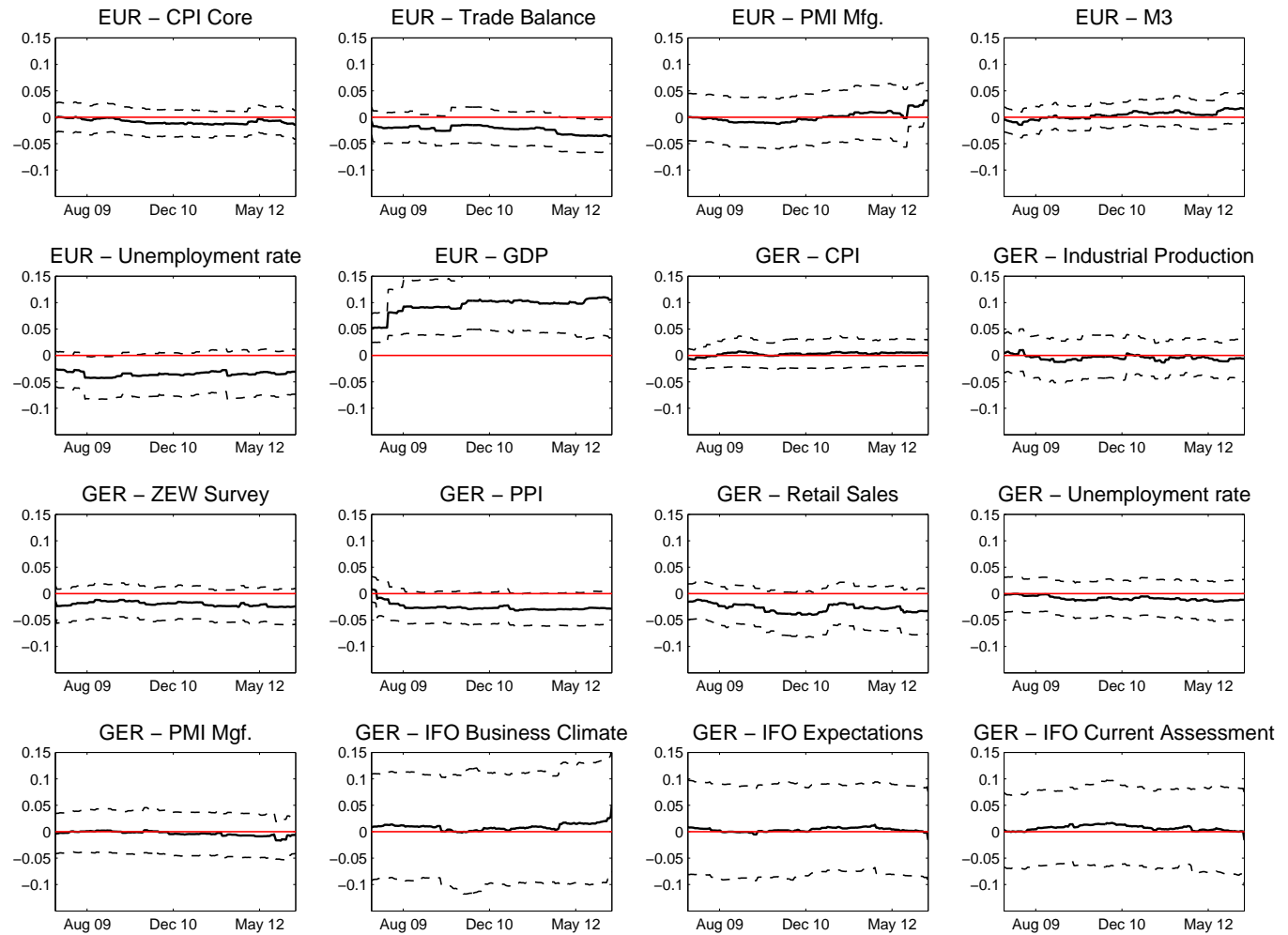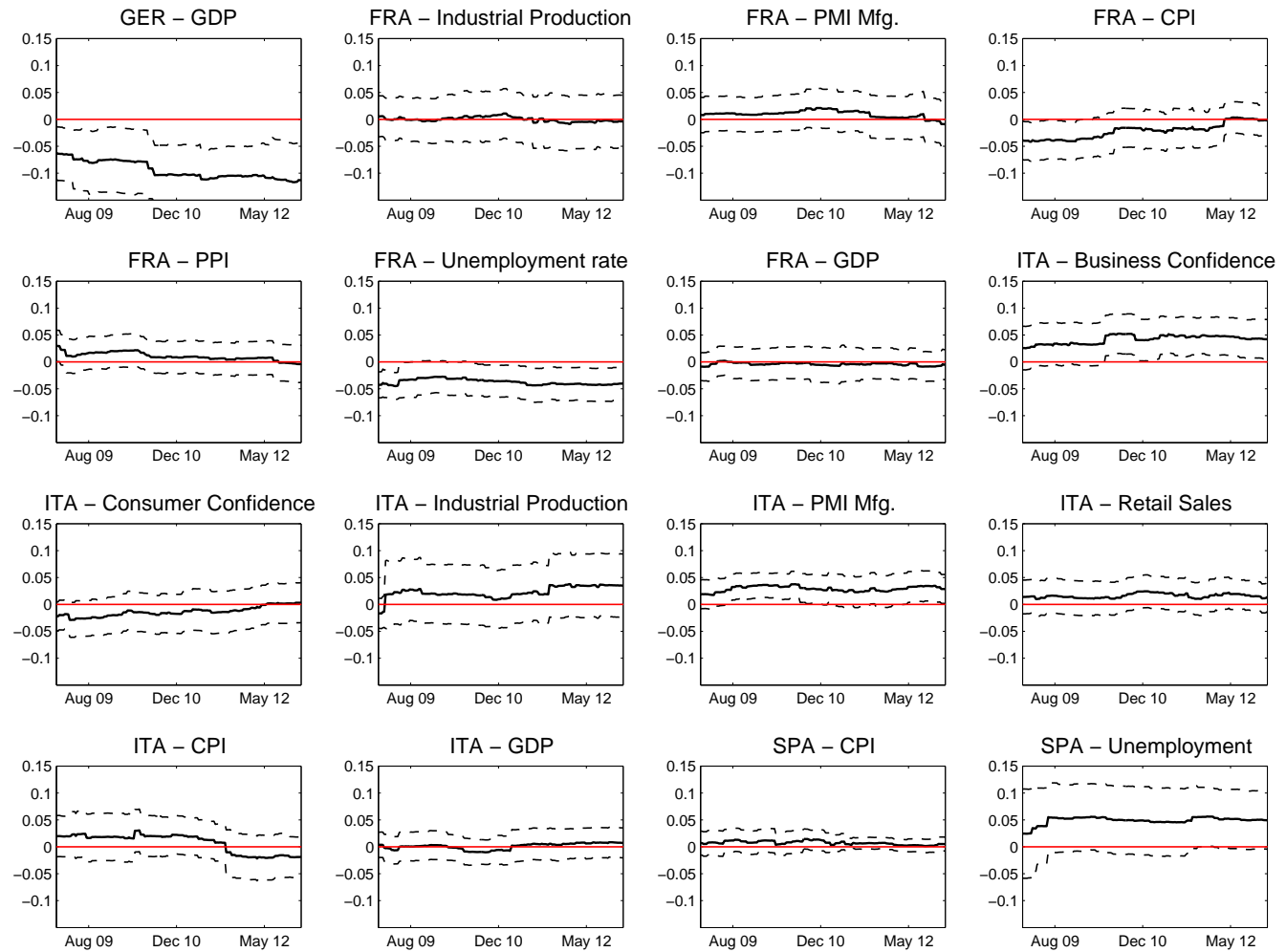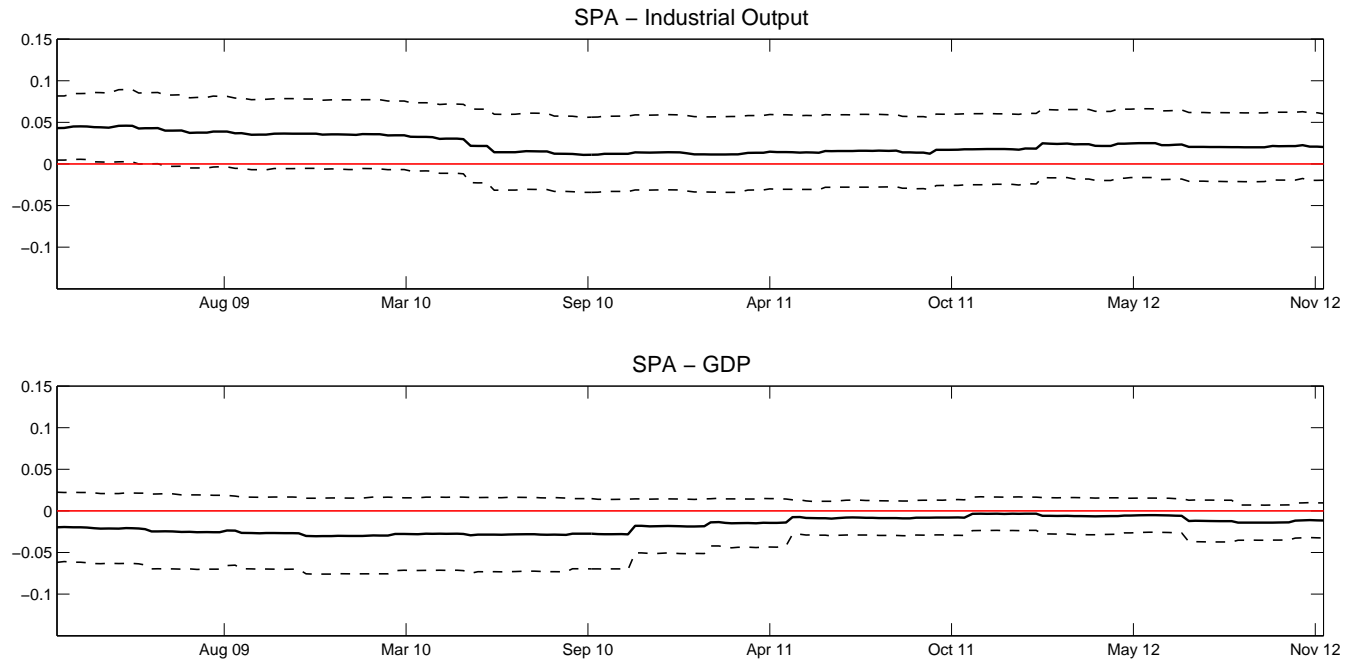
Figure A.12: The figure shows the coefficients relative to euro area announcements and the 90% confidence bands, from rolling OLS estimations of equation 1.2 (Newey West stardard errors). The estimation is performed using US and euro area news and 5-year rolling windows starting from April 2002.

A.1.4 Single regressions

Since some announcements take place in the same days, and some identification problem may arise, I tested the robustness of the results performing N different regressions[1] using the day-of-the-week dummies, the autocorrelation term and one single news variable on the right hand side. The main significant change is that news about euro area GDP and German GDP are not significant if taken on their own, and this may be due to the fact that they are always released on the same day after February 2005 - see the relative section in the appendix. All the other results are robust.

	All variables			Single variables		
	Beta		s.e.	Beta		s.e.
US - ADP Employment Change	-0.122		[0.08]	-0.147	*	[0.08]
US - Retail Sales	-0.030		[0.05]	-0.024		[0.05]
US - Building Permits	-0.081		[0.07]	-0.055		[0.07]
US - Capacity Utilization	-0.131	*	[0.08]	-0.115	**	[0.05]
US - Change in Nonfarm Payrolls	-0.250	***	[0.06]	-0.234	***	[0.06]
US - Chicago Purchasing Manager	-0.084		[0.06]	-0.102	*	[0.06]
US - Consumer Confidence	-0.108	*	[0.06]	-0.116	**	[0.06]
US - CPI	-0.026		[0.07]	-0.048		[0.08]
US - Current Account Balance	-0.059		[0.09]	-0.056		[0.09]
US - CPI Core	0.040		[0.07]	-0.001		[0.07]
US - Durable Goods Orders	-0.017		[0.06]	-0.014		[0.06]
US - FOMC rate decision	-0.193	**	[0.09]	-0.183	*	[0.11]
US - GDP (Advance)	-0.242	**	[0.1]	-0.229	**	[0.11]
US - GDP (Preliminary)	-0.043		[0.08]	-0.058		[0.08]
US - GDP (Final)	0.049		[0.06]	0.066		[0.06]
US - Housing Starts	0.069		[0.06]	0.029		[0.05]
US - Import Price Index	-0.014		[0.06]	-0.022		[0.06]
US - Industrial Production	0.004		[0.07]	-0.083	*	[0.04]
US - Initial Jobless Claims	0.011		[0.03]	0.025		[0.03]
US - ISM Manufacturing PMI	-0.149	***	[0.06]	-0.121	**	[0.06]
US - New Home Sales	-0.048		[0.04]	-0.051		[0.04]
US - Phil. Fed. Mfg. Index	-0.022		[0.05]	-0.032		[0.05]
US - PPI Core	0.016		[0.05]	0.050		[0.04]
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[1]where N is the number of macroeconomic news

	All variables			Single variables		
	Beta		s.e.	Beta		s.e.
US - PPI	0.061		[0.05]	0.041		[0.05]
US - Retail Sales Less Autos	-0.001		[0.07]	-0.020		[0.05]
US - Trade Balance	-0.074		[0.07]	-0.080		[0.07]
US - U. of Michigan Conf.	0.018		[0.05]	0.021		[0.05]
US - Unemployment rate	0.139	**	[0.05]	0.148	**	[0.06]
EUR - ECB interest rate	0.128	**	[0.06]	0.106		[0.07]
EUR - PPI	-0.042		[0.06]	-0.035		[0.06]
EUR - Retail Sales	0.058		[0.07]	0.078		[0.07]
EUR - Industrial Production	0.062		[0.04]	0.062		[0.05]
EUR - CPI	-0.019		[0.06]	-0.008		[0.06]
EUR - CPI Core	-0.050		[0.05]	-0.052		[0.06]
EUR - Trade Balance	-0.122	*	[0.07]	-0.106		[0.07]
EUR - PMI Mfg.	0.036		[0.1]	0.077		[0.07]
EUR - M3	0.032		[0.05]	0.032		[0.05]
EUR - Unemployment rate	-0.126	*	[0.07]	-0.136	**	[0.06]
EUR - GDP	0.319	*	[0.2]	0.092		[0.08]
GER - CPI	0.028		[0.03]	0.024		[0.03]
GER - Industrial Production	-0.008		[0.05]	0.011		[0.05]
GER - ZEW Survey	-0.087		[0.06]	-0.087		[0.06]
GER - PPI	-0.081		[0.06]	-0.074		[0.06]
GER - Retail Sales	-0.114	**	[0.05]	-0.116	**	[0.05]
GER - Unemployment rate	-0.166	***	[0.06]	-0.112	**	[0.05]
GER - PMI Mgf.	-0.016		[0.09]	0.030		[0.07]
GER - IFO Business Climate	0.108		[0.3]	0.093		[0.06]
GER - IFO Expectations	0.015		[0.2]	0.074		[0.09]
GER - IFO Current Assessment	-0.030		[0.2]	0.053		[0.07]
GER - GDP	-0.322	*	[0.2]	-0.062		[0.11]
FRA - Industrial Production	0.008		[0.07]	0.024		[0.06]
FRA - PMI Mfg.	0.017		[0.09]	0.083		[0.07]
FRA - CPI	-0.076		[0.06]	-0.071		[0.06]
FRA - PPI	-0.004		[0.06]	0.001		[0.06]
FRA - Unemployment rate	-0.119	**	[0.05]	-0.108	**	[0.05]
FRA - GDP	0.000		[0.08]	0.032		[0.08]
ITA - Business Confidence	0.068		[0.07]	0.079		[0.07]
ITA - Consumer Confidence	-0.059		[0.06]	-0.060		[0.06]
ITA - Industrial Production	0.073		[0.09]	0.070		[0.09]
ITA - PMI Mfg.	0.136	**	[0.06]	0.136	***	[0.05]
ITA - Retail Sales	0.062		[0.05]	0.058		[0.05]
ITA - CPI	-0.051		[0.06]	-0.075		[0.07]
ITA - GDP	0.114	*	[0.06]	0.090		[0.07]
SPA - CPI	0.053		[0.04]	0.036		[0.04]
SPA - Unemployment	0.144	*	[0.08]	0.130		[0.08]
SPA - Industrial Output	0.087		[0.06]	0.080		[0.06]

Continued on Next Page. . .

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	All variables		Single variables	
	Beta	s.e.	Beta	s.e.
SPA - GDP	-0.104	[0.08]	-0.098	[0.08]

Table A.4: Comparison of the results using just one variable for each regression (left column), with the results using all the variables together (right column). Dependent variable: % change in daily spot exchange rate (ER_t). OLS with Newey West s.e., 1999-2012. The model includes days of the week dummies and $ER_t - 1$

Appendix B

Nowcasting Mexican GDP

B.1   News - descriptive statistics

In Table B.1 I present some descriptive statistics of the model-based news, from the out of sample evaluation presented in section 2.4.2.

Variable	Average News	News Standard Deviation
Auto Sales	0.249	4.404
Consumer Confidence	-0.320	1.840
Exports	0.139	3.286
GDP	0.094	0.648
IMEF Manufacturing	0.055	1.665
IMEF non Manufacturing	-0.630	2.350
Imports	0.045	3.164
Industrial Production	0.000	0.763
Oil Exports	-0.380	8.170
Oil Production	-0.251	1.966
Orders	0.076	1.119
Producer Confidence	0.069	2.292
Retail Sales	0.067	1.208
Trade with US	56829	807908
Truck Sales	-1.873	8.117
Unemployment	-0.017	0.200
Vehicle Export	1.093	17.598
Vehicle Production	1.864	15.790
US Auto Sales	0.005	12.071
US Capacity Utilization	0.111	0.557
US Car Imports	-0.104	4.666
US Consumer Confidence	-21.471	86.793
US Housing Starts	0.045	3.976
US Industrial Production	-0.022	0.730
US Change in NonFarm Payrolls	-24.559	117.208
US PMI Mfg.	0.188	1.633
US Retail sales	-0.082	1.104
US Truck Imports	-0.379	10.436
US Univ. Of Michigan	0.198	6.060

Table B.1: The table shows the average and the standard deviation of the news, extracted as described in Section 2.4.2.

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B.2   Robustness

In this section I present some results of the out of sample performance of the model with different specifications. In particular, in Figure B.1 I present some results of the estimation performed using different lags and factors, for the model with Mexican and US variables, and in Figure B.2 the results relative to the model with just Mexican variables.
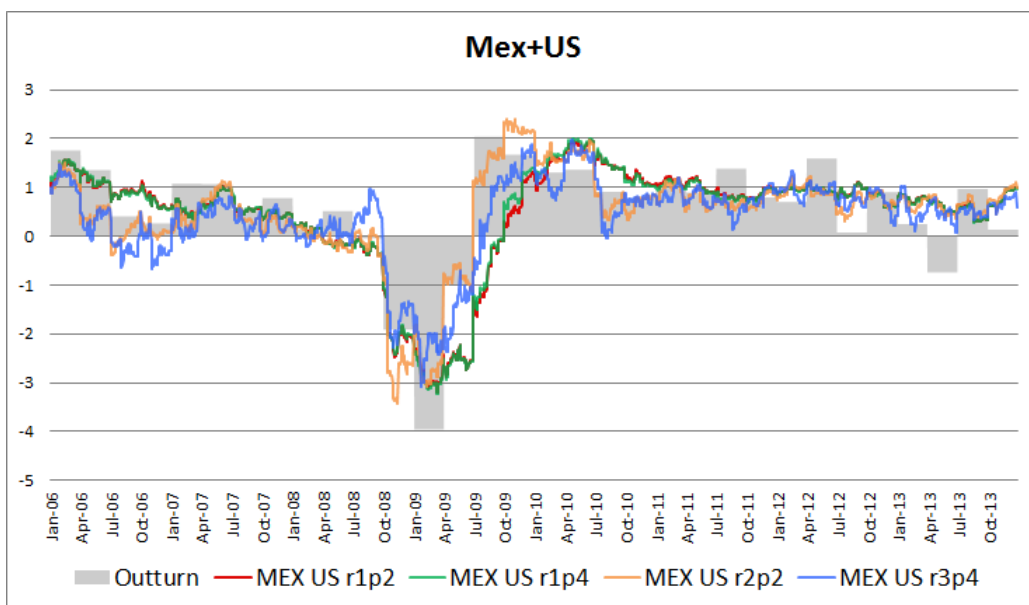

Figure B.1: The figure shows the historical out of sample evaluation (QoQ) of different specifications of the model including Mexican and US variables. I indicate with r the number of factors, and with p the number of lags.
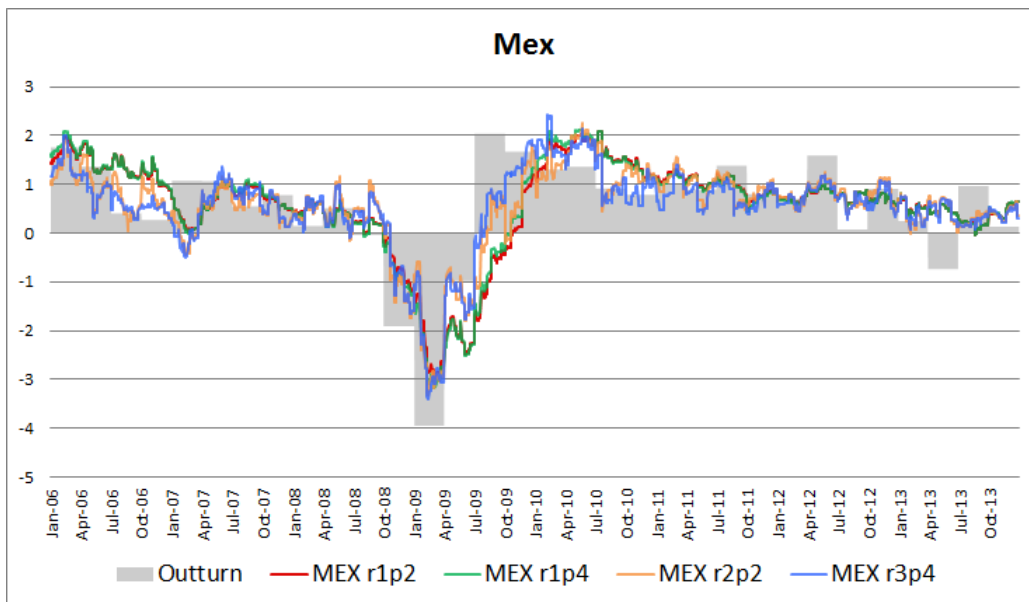
Figure B.2: The figure shows the historical out of sample evaluation (QoQ) of different specifications of the model including just Mexican variables. I indicate with r the number of factors, and with p the number of lags.