What does high frequency identification tell us about the transmission and synchronization of business cycles?*

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Abstract

We study the effect of U.S. macroeconomic news releases on equity markets, bond markets, and exchange rates of 27 countries from 1997 to 2019. Looking at changes in 60-minute windows around announcements, we document the following findings: First, asset prices respond overwhelmingly symmetric across countries to news. Positive news about real activity lead to an increase in equity prices, a rise in long-term interest rates, and a depreciation of the local currency against the U.S. dollar. Second, some countries respond systematically stronger to U.S. macroeconomic news releases than others. Third, the size of the response co-varies with macroeconomic fundamentals. For instance, stock prices of countries with greater trade and financial linkages respond stronger to news about the real economy and weaker to news on prices. Fourth, U.S. macro news explain a sizable fraction of the quarterly variation in foreign stock and bond markets. Overall, our findings support international business cycle models, in which shocks lead to cross-country co-movement of asset prices and in which linkages affect the transmission of shocks.

JEL Codes: E44, F40, G14, G15

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1 Introduction

How do greater trade and financial linkages affect the synchronization of countries' business cycles? Despite its importance and a large body of work in international macroeconomics, this question has still not been fully answered. Theoretically, the answer is ambiguous and disagreement about the empirical evidence persists.[1] A related literature, which studies the cross-country transmission of shocks, has also found conflicting results.[2] In both cases, identification is notoriously difficult and a likely source for different findings across studies. How countries' business cycles are interlinked thus remains an open and policy-relevant question for research.

In this paper, we use high frequency identification to shed light on this question. We follow a large literature that analyzes asset price changes around U.S. macroeconomic news announcements to inform economic mechanisms.[3] In the context of our question, this methodology is promising for two reasons. First, high frequency identification offers a sharp research design, which causally links asset price movements to news (Gürkaynak and Wright, 2013). Since high frequency identification largely limits outcomes of interest to those traded in liquid asset markets, we think of our approach as complementary to analyses at lower frequencies. Second, earlier work establishes that U.S. macroeconomic news releases lead to asset price movements in selected advanced economies (e.g. Andersen et al., 2007; Faust et al., 2007). Hence, these announcements provide a unique source of variation, which we use to study the expectation formation and decision making process of agents in an international setting.

We begin with developing a framework to interpret international asset price responses to U.S. news releases. Under plausible identification assumptions, systematic changes in foreign asset prices after U.S. news releases reflect either transmission of U.S.-specific shocks to these countries, common global shocks, or both. We further show that heterogeneity in asset price responses across countries is driven by differential transmission of the U.S.-specific shocks or by differential responsiveness to common shocks.

With this framework in hand, we study the responses of stock market indexes, 10-year

[1] For a discussion of the theoretical ambiguity of financial and trade linkages see Kose, Prasad, and Terrones (2003), Imbs (2004), and Kalemli-Ozcan, Papaioannou, and Peydro (2013). Empirically, there is greater consensus of the positive effects of trade integration on synchronization, whereas the role of financial integration is still debated. With respect to the latter, see the discussions in Kalemli-Ozcan, Papaioannou, and Peydro (2013) and Davis (2014).

[2] For instance, Corsetti, Dedola, and Leduc (2014) find a prominent role for U.S. supply shocks while Levchenko and Pandalai-Nayar (2018) argue that most transmission is driven by sentiment shocks.

[3] For example, Andersen et al. (2003) investigate the exchange rate disconnect hypothesis, Gürkaynak, Sack, and Swanson (2005) inform the long-run behavior of macroeconomic models, and Swanson and Williams (2014) study the effect of the zero lower bound on monetary policy.

government bond yields, and U.S. dollar exchange rates of 27 countries from 1997 to 2019. Relative to prior work, our sample contains more countries—including a number of developing countries. We document that asset prices in these countries systematically react to the release of U.S. macroeconomic news within a 60-minute window. Consistent with earlier work, our estimates on a pooled sample confirm that positive news about the U.S. real economy lead international equity markets and interest rates to rise and the U.S. dollar to appreciate.

Our first finding is that stock and bond markets respond overwhelmingly symmetric across countries. All countries' stock markets rise after positive surprises about the U.S. macro economy. Similarly, government bond yields rise systematically. Public information releases therefore generate co-movement in asset markets across countries. Since theory suggests close links between stock prices and interest rates on the one hand, and the real economy on the other, it is thus likely that the co-movement in asset prices ultimately reflects and/or drives shock transmission and business cycle synchronization across countries.

While the direction of responses to U.S. macroeconomic news is essentially identical for all countries, the magnitude of the response is not. For equity markets, we document that a number of countries such as Germany and France systematically respond stronger to surprises about the U.S. economy than countries like Chile or Portugal. As noted above, our empirical framework suggests that this heterogeneity reflects differential transmission of U.S. shocks or differential responsiveness to common global shocks. That is, either the transmission of shocks from the U.S. to Germany and France is greater than to Chile and Portugal, or Germany and France respond more to common global shocks (or both).

We document a similar degree of heterogeneity for exchange rate responses to U.S. macroeconomic news. Developing countries tend to respond strongly to news about U.S. inflation, but not to news about the real economy such as Nonfarm Payrolls. In contrast, developed countries' exchange rates tend to be relatively unresponsive to news about U.S. inflation, but strongly respond to news about the real economy. These findings suggests that shock transmission or responsiveness to common shocks is fundamentally different for these two groups of countries and provide directions for further exploration.

To explain this heterogeneity, we show that country's responsiveness to U.S. macroeconomic news systematically co-varies with its integration into the world economy. Stock markets, bond markets, and exchange rates of countries that are more financially integrated react significantly stronger to news about the U.S. real economy. Further, stock markets and bond markets of more financially integrated economies respond systematically less to news

on prices. Trade integration is associated with greater responsiveness—mostly of exchange rates. Economically, the dependence on economic fundamentals are sizable. Since correlates of financial and trade integration could drive these results, care must be taken when interpreting these findings.

A common concern with high-frequency analyses is that the estimated effects may not be persistent. If the effects of U.S. macroeconomic news dissipated quickly, they would be unlikely to play an important role for the evolution of macroeconomic aggregates at lower frequencies. To address this issue, we follow Altavilla, Giannone, and Modugno (2017) and show that U.S. macroeconomic news explain a sizable fraction of the variation in countries' stock and bond markets at lower frequencies. For many advanced economies, U.S. news explain more than 15 percent of the quarterly variation in these markets. In the case of stock markets, this magnitude is comparable with their explanatory power for the S&P 500. For foreign bond markets it is often between one half and two thirds of their explanatory power for the S&P 500. This finding suggests that correlated asset price responses to shocks are an important mechanism for the cross-country transmission of shocks.

Our paper contributes to the large literature on international business cycle synchronization and transmission, which aims to understand (1) what type of shocks are transmitted across borders and (2) which mechanisms govern the transmission of these shocks. Prominent suggestions for shocks include TFP shocks (Backus, Kehoe, and Kydland, 1992; Corsetti, Dedola, and Leduc, 2014), preference-driven demand shocks (Stockman and Tesar, 1995), monetary policy shocks (Canova, 2005), sentiment shocks (Levchenko and Pandalai-Nayar, 2018), financial shocks (Peek and Rosengren, 1997, 2000), and others. Transmission may occur, for instance, through trade linkages (Frankel and Rose, 1998; di Giovanni and Levchenko, 2009; Boehm, Flaaen, and Pandalai-Nayar, 2019), financial linkages (Peek and Rosengren, 1997, 2000), technology diffusion, and so forth. An additional possibility—as pointed out by Canova and Marrinan (1998) and Imbs (2004)—is that co-movement may arise from correlated country-specific shocks rather than transmission.

Our paper also relates to the literature on high-frequency event studies in macroeconomics.[4] A number of papers study the effect of U.S. news releases on exchange rates and international equity markets. For example, Andersen et al. (2007) and Faust et al. (2007) analyze the transmission to financial markets in Germany and the United Kingdom. Ehrmann, Fratzscher, and Rigobon (2011) identify shocks through heteroscedasticity and study the interdependence of asset markets between the U.S. and the Euro Area for multiple assets.

[4]See Gürkaynak and Wright (2013) for a survey on high-frequency event studies in macroeconomics.

We extend the existing literature in the following dimensions. First, our sample contains a broader set of countries including developing countries while using intraday variation in asset prices. Second, this not only mitigates concerns about external validity but also allows to systematically analyze heterogeneity in countries' in asset price responses. Third, we link the country-specific transmission of the news releases to their trade and financial linkages. Fourth, we show that the explanatory power of U.S. macroeconomic news for foreign stock and bond markets is sizable at lower frequencies.

The rest of the paper is structured as follows. Section 2 lays out the empirical framework for our analysis. Section 3 describes the data on the macroeconomic news releases and financial data. Section 4 presents our empirical evidence on the international transmission to equity, bond, and forex markets. Section 5 describes our integration measures and presents evidence on the link between the measures and the cross-country transmission. We study the explanatory power of U.S. macroeconomic news for foreign asset markets in Section 6. Section 7 concludes.

2 Empirical Framework

The following exposition builds on Faust et al. (2007).

Setup We study asset price changes within a short time window $[t-\Delta^-, t+\Delta^+]$ around the release of news about a U.S. macroeconomic variable y_τ. Here, t is the release time, Δ^- and Δ^+ are short time periods of less than or equal to 45 minutes, and τ is a generic time index. To give a concrete example, the Bureau of Labor Statistics (BLS) publishes U.S. nonfarm payroll employment (Nonfarm Payrolls) at 8:30 am typically on the first Friday of each month. We are interested in how foreign asset prices (e.g. stock prices) respond around the release time. We defer a detailed discussion of the macroeconomic news and asset prices we study to the next section.

Letting $\mathcal{I}_{t-\Delta^-}$ denote agents' (common) information set prior to the news release, the *surprise* about the U.S. macroeconomic variable is

$$s^y_{US,t} = y_{US,t} - E\left[y_{US,t}|\mathcal{I}_{t-\Delta^-}\right], \tag{1}$$

where $E\left[\cdot|\mathcal{I}_{t-\Delta^-}\right]$ denotes the expectation conditional on information set $\mathcal{I}_{t-\Delta^-}$. For expositional clarity, we assume that $y_{US,t}$ is measured without error, but our econometric framework is easily generalized to include measurement error. We denote the set of news that become

available in the time window we study by $\mathcal{N}_{[t-\Delta^-,t+\Delta^+]}$. It includes, in particular, news on the macroeconomic variable $y_{US,t}$, but also other news. Asset prices at time $t+\Delta^+$ are then based on the information set $\mathcal{I}_{t+\Delta^+} = \mathcal{I}_{t-\Delta^-} \cup \mathcal{N}_{[t-\Delta^-,t+\Delta^+]}$.

We assume a log-linear multi-country world with a unique equilibrium. Countries are indexed by i and j and the state variables of the economy are elements of the *vectors* $x_{i,\tau}$ and x^g_τ. State variables specific to country i are included in the vector $x_{i,\tau}$ and global state variables are included in the vector x^g_τ. For instance, a component of total factor productivity (TFP) specific to the U.S. is part of vector $x_{US,\tau}$, while the global TFP component is included in x^g_τ. We are agnostic as to which state variables drive the business cycle and explicitly allow for news shocks in the spirit of Beaudry and Portier (2006). All structural shocks are uncorrelated.

The price of an asset of interest in country i can then be written as

$$q_{i,\tau} = E\left[\sum_j a^q_{i,j} x_{j,\tau} + b^q_i x^g_\tau | \mathcal{I}_\tau\right],$$

where $a^q_{i,j}$ and b^q_i are coefficient vectors that depend on the specification of the model. They capture, respectively, how the asset price $q_{i,\tau}$ is affected by the country-specific state variables in $x_{j,\tau}$ and the global state variables in x^g_τ. Under the assumption that $x_{j,t+\Delta^+} = x_{j,t-\Delta^-}$ for all j and $x^g_{t+\Delta^+} = x^g_{t-\Delta^-}$ for small Δ^-, Δ^+, we can write the change in asset price $q_{i,\tau}$ over the window we study as

$$\begin{aligned}
\Delta q_{i,t} &= q_{i,t+\Delta^+} - q_{i,t-\Delta^-} \\
&= \sum_j a^q_{i,j} \left(E\left[x_{j,t+\Delta^+}|\mathcal{I}_{t+\Delta^+}\right] - E\left[x_{j,t+\Delta^+}|\mathcal{I}_{t-\Delta^-}\right]\right) \\
&\qquad + b^q_i \left(E\left[x^g_{t+\Delta^+}|\mathcal{I}_{t+\Delta^+}\right] - E\left[x^g_{t+\Delta^+}|\mathcal{I}_{t-\Delta^-}\right]\right).
\end{aligned} \tag{2}$$

In words, when new information becomes available, market participants change their expectations about the state of the economy, which in turn, changes asset price $q_{i,t}$.

We next use the fact that $\mathcal{I}_{t+\Delta^+} = I_{t-\Delta^-} \cup \mathcal{N}_{[t-\Delta^-,t+\Delta^+]}$, and parameterize the conditional expectations in equation (2),

$$E\left[x_{j,t+\Delta^+}|\mathcal{I}_{t+\Delta^+}\right] - E\left[x_{j,t+\Delta^+}|I_{t-\Delta^-}\right] = \beta_j s^y_{US,t} + \tilde{\varepsilon}_{i,t}, \tag{3}$$

$$E\left[x^g_{t+\Delta^+}|\mathcal{I}_{t+\Delta^+}\right] - E\left[x^g_{t+\Delta^+}|I_{t-\Delta^-}\right] = \beta^g s^y_{US,t} + \varepsilon^g_t. \tag{4}$$

These expressions make explicit that market participants use the surprise about U.S. macroeconomic news, as well as other information that becomes available within the time window (as captured by $\tilde{\varepsilon}_{i,t}$ and ε_t^g), to update their expectations about the state of the world economy. To the extent that the U.S. macroeconomic news release is informative about the state, the *vectors* β_j and β^g contain nonzero elements. For instance, higher-than-expected U.S. Nonfarm Payrolls may lead market participants to update their expectation of the U.S.-specific component of TFP. In this case, the relevant element in β_{US} is nonzero. If the surprise is not useful for estimating particular state variables, then the relevant entries in β_j and β^g are zero.

Plugging equations (3) and (4) into equation (2) gives

$$\Delta q_{i,t} = \left(\sum_j a_{i,j}^q \beta_j + b_i^q \beta^g \right) s_{US,t}^y + \varepsilon_{i,t}, \tag{5}$$

where $\varepsilon_{i,t} = \tilde{\varepsilon}_{i,t} + \varepsilon_t^g$. This equation is the starting point for our empirical analysis.

Identification assumptions As is common in studies using high frequency identification, we proceed with the assumption that the error $\varepsilon_{i,t}$ is uncorrelated with the surprise $s_{US,t}^y$. As we discuss below, this assumption may require to control for additional news releases that systematically occur within the window $[t - \Delta^-, t + \Delta^+]$. Gürkaynak and Wright (2013) argue that this assumption is plausible for intraday analyses.

We also assume—and this assumption is specific to our empirical framework—that surprises in U.S. macroeconomic variables are not used to update state variables that are specific to countries other than the U.S. That is, $\beta_j = 0$ for $j \neq US$. To give an example, we assume that it is not the case that market participants use U.S. payroll employment to forecast the country-specific component of Belgian TFP. For commonly used state estimation frameworks (Kalman filter), a sufficient condition for this assumption to hold is that countries other than the U.S. are *small*. Continuing with the earlier example, a change in Belgian TFP has no impact on U.S. macroeconomic variables, and hence, the forecaster would find no useful correlation to predict Belgian TFP when new information about the U.S. macroeconomy becomes available.

Under this second identification assumption, equation (5) becomes

$$\Delta q_{i,t} = \left(\underbrace{a^q_{i,US}\beta_{US}}_{\text{transmission from U.S.}} + \underbrace{b^q_i \beta^g}_{\text{common shock}} \right) s^y_{US,t} + \varepsilon_{i,t}. \tag{6}$$

This estimating equation makes clear that a significant coefficient on the U.S. macroeconomic surprise reflects two different components. First, if the surprise leads to an update of market participants' expectations on U.S. state variables (as captured by nonzero elements in the vector β_{US}), and if changes in U.S. state variables impact the foreign asset price (the vector $a^q_{i,US}$ contains nonzero elements), then the inner product $a^q_{i,US}\beta_{US}$ can be different from zero. This component thus reflects *transmission* of macroeconomic shocks from the U.S. to country i. Second, the surprise $s^y_{US,t}$ may be useful to forecast global state variables (β^g contains nonzero elements). In this case, a significant coefficient on the surprise reflects that country i is impacted by a *common shock*.

It also follows from equation (6) that heterogeneity in countries' asset price responses to U.S. macroeconomic news, reflects heterogeneity in how U.S. country-specific shocks affect country i (as captured by $a^q_{i,US}$), or how country i responds to global shocks (as captured by b^q_i). We explore this heterogeneity in our empirical analysis in Section 4. In Section 5, we study whether the heterogeneity in transmission and responsiveness to common shocks correlates with observables such as trade and financial openness.

3 Data

In this section, we describe the main data on macroeconomic news releases and financial assets. In Section 5, we discuss the additional data on cross-country integration measures used in our empirical analysis.

3.1 U.S. Macroeconomic News

The data on macroeconomic news come from Bloomberg's U.S. Economic Calendar. For each macroeconomic release, Bloomberg reports, among other things, release date and time, released value, and the median market expectation prior to the release. Table 1 provides an overview on the macroeconomic news we focus on in Sections 4 and 5. This selection is inspired by previous studies in the literature. Following Beechey and Wright (2009), we also distinguish news on real economic activity and news on prices. Appendix Table A2 lists all

available U.S. macroeconomic news series. We will use news series not listed in Table 1 as controls and when studying the explanatory power of U.S. macroeconomic news in Section 6. Following prior work, we treat different releases for the same macroeconomic variable—for instance, the advanced, second, and third release of GDP—as separate news series.

Table 1: U.S. Macroeconomic News

	Frequency	Category	Observations
CB Consumer Confidence	Monthly	Real Activity	268
UM Consumer Sentiment P	Monthly	Real Activity	241
Durable Goods Orders	Monthly	Real Activity	260
GDP A	Quarterly	Real Activity	89
Initial Jobless Claims	Weekly	Real Activity	1140
ISM Mfg Index	Monthly	Real Activity	271
Nonfarm Payrolls	Monthly	Real Activity	268
New Home Sales	Monthly	Real Activity	261
Retail Sales	Monthly	Real Activity	270
Unemployment Rate	Monthly	Real Activity	267
Core CPI	Monthly	Price	269
Core PPI	Monthly	Price	269

Notes: This table displays the 12 macroeconomic series analyzed in the paper. The sample ranges from November 1997 to June 2019. *Frequency* refers to the frequency of the data releases, *Observations* to the number of observations (surprises) of a macroeconomic series in our sample. *Category* specifies if the news release is more concerned about the real or nominal side of the economy. Abbreviations: A — advanced; P — preliminary; Mfg — Manufacturing; CB — Chicago Board.

Based on equation (1), and with slight abuse of notation, we construct surprises by subtracting from a given U.S. macroeconomic series its forecast,

$$s^{y}_{US,t} = \frac{y_{US,t} - E\left[y_{US,t}|\mathcal{I}_{t-\Delta^-}\right]}{\hat{\sigma}^{y}_{US}}, \tag{7}$$

where $y_{US,t}$ is the released value and $E\left[y_{US,t}|\mathcal{I}_{t-\Delta^-}\right]$ is the median market expectation of the release.[5] To make the magnitude of surprises comparable across series, we also divide by the sample standard deviation of $y_{US,t} - E\left[y_{US,t}|\mathcal{I}_{t-\Delta^-}\right]$, denoted by $\hat{\sigma}^{y}_{US}$.

Appendix Figure A1 shows the resulting time series of standardized surprises for each macroeconomic variable. Reassuringly, all series of surprises are centered at zero. Further, there is no discernible pattern of autocorrelation, and there is no systematic trend in the

[5]Since Bloomberg allows forecasters to update their prediction up until the release time, these forecasts should reflect all publicly available information at the time.

standard deviation of surprises. Some series such as Initial Jobless Claims and Retail Sales appear to have somewhat higher volatility during recessions. In contrast, other series such as Core PPI and New Home Sales, appear to have lower volatility during downturns. Overall, there is no indication that using these surprises as our identifying variation is econometrically problematic.

3.2 Financial Data

Intraday data on asset prices are from *Thomson Reuters Tick History* and are obtained from *Refinitiv*. For each country we construct minute-by-minute series of its major stock market index, the 10-year government bond yield, and the exchange rate of its currency. Exchange rates are expressed in U.S. dollars so that an increase reflects a depreciation of the U.S. dollar relative to the foreign currency.[6] Table 2 provides an overview of the countries in the sample, the financial instruments, and the corresponding sample periods.

The composition of our sample reflects two types of constraints. First, our intraday analysis requires that the time window around a particular news release lies within the trading hours of the respective stock market. For instance, Asian and Australian equity markets are closed during typical release times of U.S. macroeconomic variables and are thus not included in our sample. Although this constraint does not apply to currencies and bonds (Forex markets trade 24 hours from Sunday to Friday), we limit ourselves to countries for which we have data on equity markets.

Second, we require that the underlying equities, exchange rates and bonds of our sample are traded in relatively liquid markets. For bond markets, some of our time series experience gaps. Further, we exclude bond market data during sovereign debt crisis, e.g. in Argentina and Greece. Appendix Table A1 summarizes, which equity markets in our sample are open for each announcement.

Lastly, we focus on 10-year government bonds compared to other maturities for two reasons. First, the 10-year rate is a standard measure of long-term interest rates and commonly used in the literature. Second, data for this maturity is available for all countries in our sample.[7]

[6] Within a minute, we use the last quoted index level and exchange rate, where the latter is calculated as the middle rate, i.e. the average of the bid and the ask price. For bond yields, we take the average of a minute.

[7] We are relying on yields calculated by *Thomson Reuters*, which are based on bond prices from external sources. This ensures consistency in the yield calculations across countries. The corresponding identifiers are ending with $=RR$, e.g. $AR10YT = RR$ for the Argentinian 10-year government bond yield.

Table 2: Overview of Cross-Country Financial Data

Country	ISO	Classification	Equity		Forex		Bond	
			Index	Sample	Currency	Sample	10-Year	Sample
Argentina	ARG	Developing	MERVAL	1996–2019	ARS	1996–2019	AR10YT	1999–2017
Brazil	BRA	Developing	IBOVESPA	1996–2019	BRL	1996–2019	BR10YT	1998–2019
Canada	CAN	Developed	TSX	2000–2019	CAD	1996–2019	CA10YT	1996–2019
Switzerland	CHE	Developed	SMI	1996–2019	CHF	1996–2019	CH10YT	1996–2019
Chile	CHL	Developing	IPSA	1996–2019	CLP	1996–2019	CL10YT	2007–2019
Czech Republic	CZE	Developed	PX	1999–2019	CZE	1996–2019	CZ10YT	2000–2019
Denmark	DNK	Developed	OMX C 20	2000–2019			DK10YT	1996–2019
United Kingdom	GBR	Developed	FTSE 100	1996–2019	GBP	1996–2019	GB10YT	1996–2019
Hungary	HUN	Developed	BUX	1997–2019	HUF	1996–2019	HU10YT	1999–2019
Mexico	MEX	Developing	MXX	1996–2019	MXN	1996–2019	MX10YT	2002–2019
Norway	NOR	Developed	OBX	1996–2019	NOK	1996–2019	NO10YT	1996–2019
Poland	POL	Developed	WIG 20	1997–2019	PLN	1996–2019	PL10YT	1999–2019
Russia	RUS	Developing	IMOEX	2001–2019	RUB	1998–2019	RU10YT	2003–2019
Sweden	SWE	Developed	OMX S 30	1996–2019	SEK	1996–2019	SE10YT	1996–2019
Turkey	TUR	Developing	Bist 30	1997–2019	TRY	2004–2019	TR10YT	2010–2019
South Africa	ZAF	Developing	JTOPI	2002–2019	ZAR	1996–2019	ZA10YT	1997–2019
Euro Area	EUR				EUR	1999–2019		
Austria	AUT	Developed	ATX	1996–2019			AT10YT	1996–2019
Belgium	BEL	Developed	BFX	1996–2019			BE10YT	1996–2019
Germany	DEU	Developed	DAX 30	1996–2019			DE10YT	1996–2019
Spain	ESP	Developed	IBEX	1996–2019			ES10YT	1996–2019
Finland	FIN	Developed	OMX H 25	2001–2019			FI10YT	1996–2019
France	FRA	Developed	CAC 40	1996–2019			FR10YT	1996–2019
Greece	GRC	Developed	ATF	1997–2019			GR10YT	1998–2019
Ireland	IRL	Developed	ISEQ	1996–2019			IE10YT	1998–2019
Italy	ITA	Developed	FTSE MIB	1996–2019			IT10YT	1996–2019
Netherlands	NLD	Developed	AEX	1996–2019			NL10YT	1996–2019
Portugal	PRT	Developed	PSI 20	1996–2019			PT10YT	1996–2019

Notes: This table details the list of countries employed throughout the analysis. For a given country, it provides the stock index, U.S. exchange rate, and 10-year government bond yield with the respective data samples. For members of the Euro Area, we do not use country-specific exchange rates prior to the currency union due to the small sample. For exchange rates, we do not use the Danish Krone since its currency is tightly and credibly pegged to the Euro. Abbreviations: ISO — 3 digit ISO country code; Classification — UN classification in 2014.

4 The Effect of Macroeconomic News on International Stocks, Bonds, and Exchange Rates

4.1 Pooled Effects

We begin our empirical analysis with demonstrating that international stock indexes, long-term bond yields and exchange rates respond to the release of news about the U.S. economy. These estimates largely replicate existing work although our sample covers a broader set of countries. We estimate pooled regressions of the form

$$\Delta_h q_{i,t-15} = \alpha + \gamma_h^y s_{US,t}^y + \sum_{k \neq y} \gamma_h^k s_{US,t}^k + \varepsilon_{i,t}, \tag{8}$$

where $\Delta_h q_{i,t-15} = q_{i,t-15+h} - q_{i,t-15}$, $h = 0, 1, ..., 60$ (minutes), and $q_{i,\tau}$ is alternately the log of country i's stock market index, the log of the exchange rate, or the level of the net 10-year government bond yield. In equation (8), $s_{US,t}^y$ is the surprise of interest. We also include other surprises about U.S. macroeconomic variables, $s_{US,t}^k$, which are published within the time window we study. For instance, the BLS publishes the change in Nonfarm Payrolls together with the Unemployment Rate (and other macroeconomic variables) as part of a news release about the Employment Situation. Hence, attributing asset price changes solely to the surprise about the change in payroll employment may be misleading. To account for the fact that surprises on the right hand side are U.S.-specific and thus perfectly correlated across foreign countries, we cluster standard errors by announcement.

Figure 1 shows the evolution of all three dependent variables for a selected set of news. For illustrative purposes, we focus on the releases of Core CPI, Nonfarm Payrolls, CB Consumer Confidence Index, and GDP A. In Appendix B, Figures B1, B2, and B3 show the asset price dynamics for all announcements listed in Table 1.

As the top row demonstrates, equity markets experience a sharp jump around the release time. In all cases, the direction of the response has the anticipated sign. Positive news about the real economy raise equity prices and surprise inflation reduces them. The size of the response varies by announcement. A one standard deviation positive surprise in Nonfarm Payrolls or GDP A raises international stock market indexes by 15 to 20 basis points. The response to the CB Consumer Confidence Index is slightly smaller. Surprises in other variables, notably housing starts, have smaller effects (see Appendix Figure B1).

A number of previous papers have documented that some asset prices drift prior to certain announcements (Lucca and Moench, 2015; Kurov et al., 2019). Such drifts may

reflect information leakage or superior forecasting ability relative to the median forecast and can, in extreme cases, cloud the interpretation of results. As the top row of Figure 1 shows, international equity prices do not drift prior to the four news releases, in line with earlier work studying pre-announcement drifts of U.S. macroeconomic news.

The second row of Figure 1 shows the evolution of exchange rates around U.S. news releases. Consistent with earlier work, the dollar generally appreciates relative to foreign currencies after positive surprises about the U.S. real economy, although surprises in the CB Consumer Confidence Index produce noisy responses. Surprises in the Core CPI also appreciate the U.S. dollar. Again, Nonfarm Payrolls and GDP A have the largest effects and there is no evidence for pre-announcement drifts.

The bottom row of Figure 1 shows that 10-year government bond yields rise after all four announcements. A one standard deviation surprise in Nonfarm Payrolls raises these yields by approximately 1.6 basis points. The responses to the other the news releases are smaller. Echoing the finding by Beechey and Wright's (2009), news about the real economy (Nonfarm Payrolls, CB Consumer Confidence Index, and GDP A) have qualitatively the same effects on foreign asset markets, but differ from news on prices (Core CPI).

4.2 Cross-country Heterogeneity

We next study heterogeneity in countries' asset price responses to U.S. macroeconomic news releases. In particular, we estimate

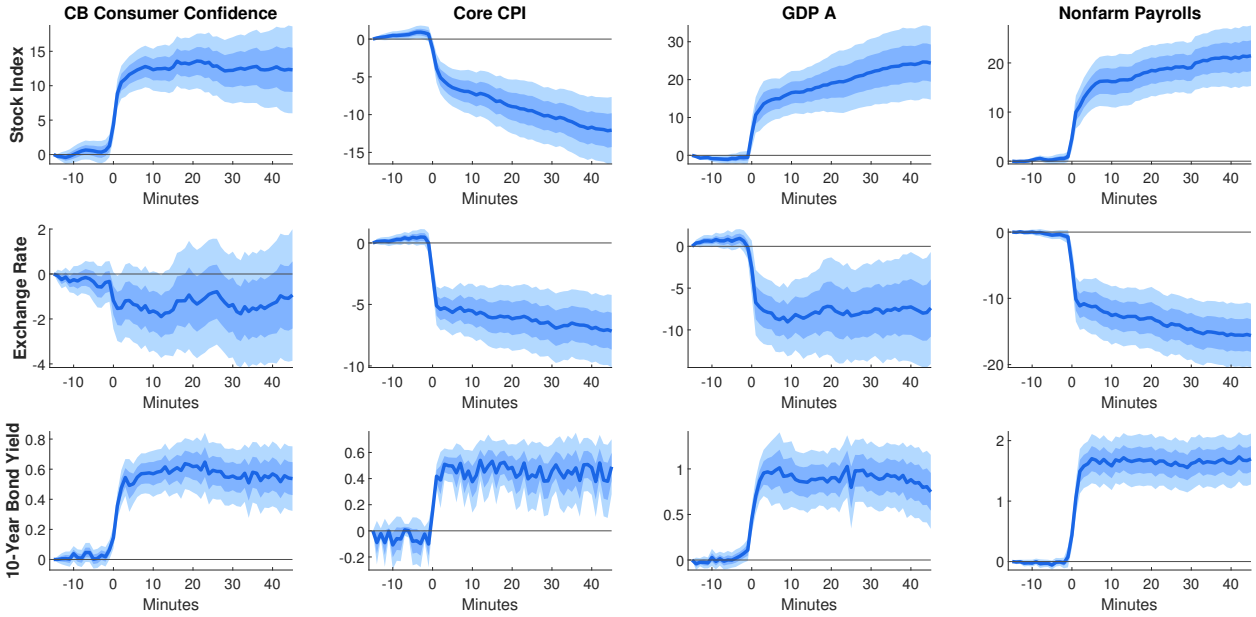
$$\Delta q_{i,t} = \alpha_i + \gamma_i^y s_{US,t}^y + \sum_{k \neq y} \gamma_i^k s_{US,t}^k + \varepsilon_{i,t}, \tag{9}$$

where $\Delta q_{i,t} = \bar{q}_{i,t+20} - \bar{q}_{i,t-10}$ with $\bar{q}_{i,t+20} = (q_{i,t+15} + ... + q_{i,t+25})/11$ and $\bar{q}_{i,t-10} = (q_{i,t-15} + ... + q_{i,t-5})/11$. Different from equation (8), the coefficients γ_i^y are now specific to each country. As discussed in Section 2, estimated differences likely reflect heterogeneity in (1) how U.S. shocks are transmitted to country i and (2) how country i responds to common global shocks (equation 6).

4.2.1 Stock Price Indexes

Figure 2 illustrates heterogeneity in countries' stock index responses for the selected set of announcements. Two striking features emerge from the figure. First, the sign of the response is the same for all countries whenever statistically significant. That is, news about

Figure 1: Average Paths within 60-minute Window for Selected Announcements

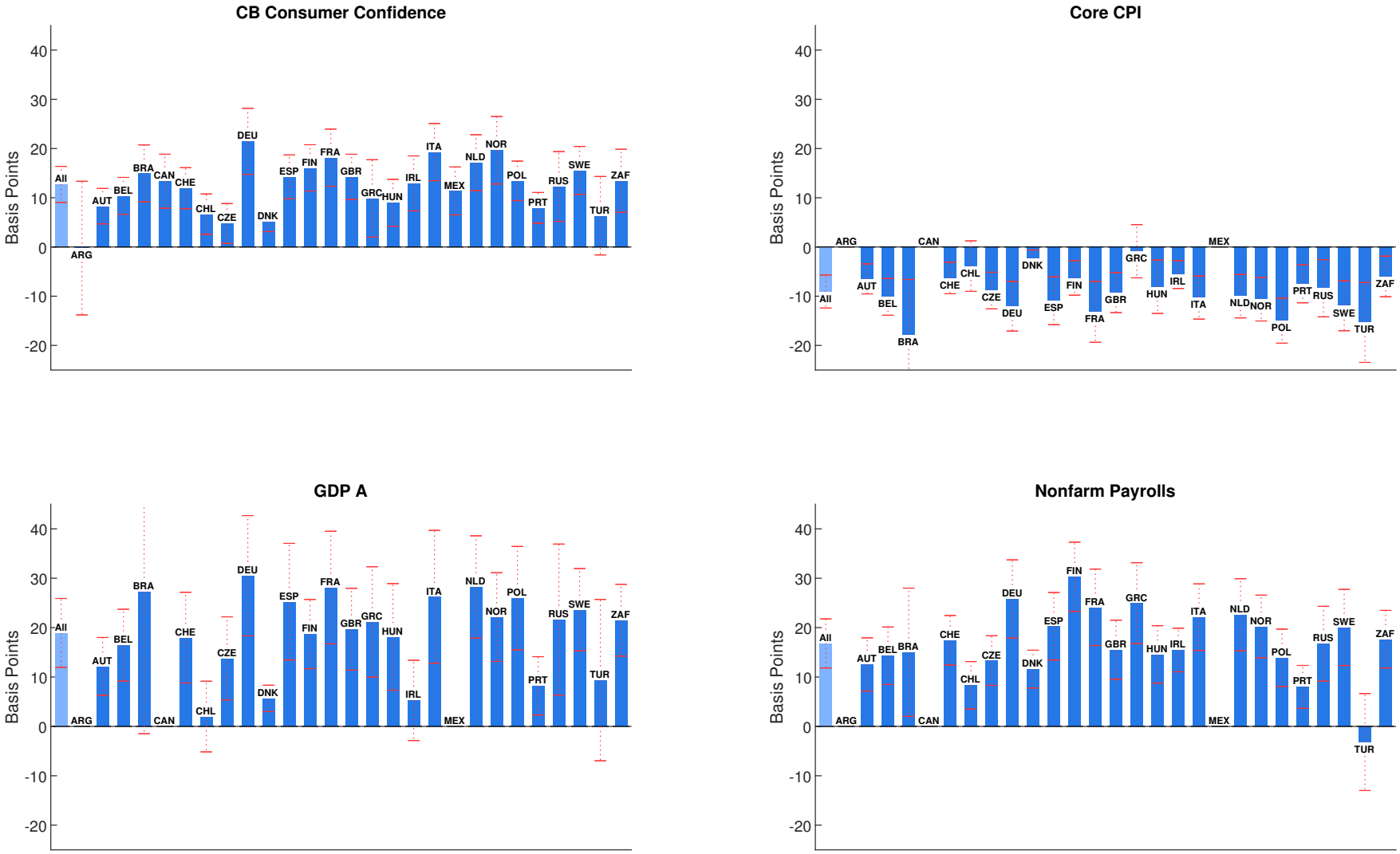


Notes: This figure displays the average path for equity, forex, and bond markets within a 60 minute window for a given news release. The units are expressed in basis points. The changes are relative to the level 15 minutes prior to each release obtained by estimating equation (8). The dark and light blue bands display the 68 percent and 95 percent confidence bands, respectively. Standard errors are clustered at event-level. Figures B1, B2, and B3 show the paths for all announcements.

the U.S. economy leads market participants to update their view about U.S. and global state variables, as defined in Section 2, in such a way, that stock price indexes in essentially all countries move in the same direction. Our evidence therefore does not support mechanisms that imply that changes in certain state variables raise equity price in some countries but reduce them in others. Changes in U.S. and global state variables drive synchronization of asset prices and potentially the business cycles of the countries in our sample. Appendix Figure B4 shows analogous plots for the remaining announcements.

Second, Figure 2 hints at a systematic component in countries' responses *across* U.S. macroeconomic news. For news about all four variables, equity prices in countries such as Germany and France consistently respond stronger than the average while equity prices in countries such as Denmark and Portugal consistently respond less than the average. Depending on the announcement, the Danish response is approximately a quarter to a half of the German response. Both responses are reasonably precisely estimated.

Figure 2: Response of Equity Markets for Selected Announcements

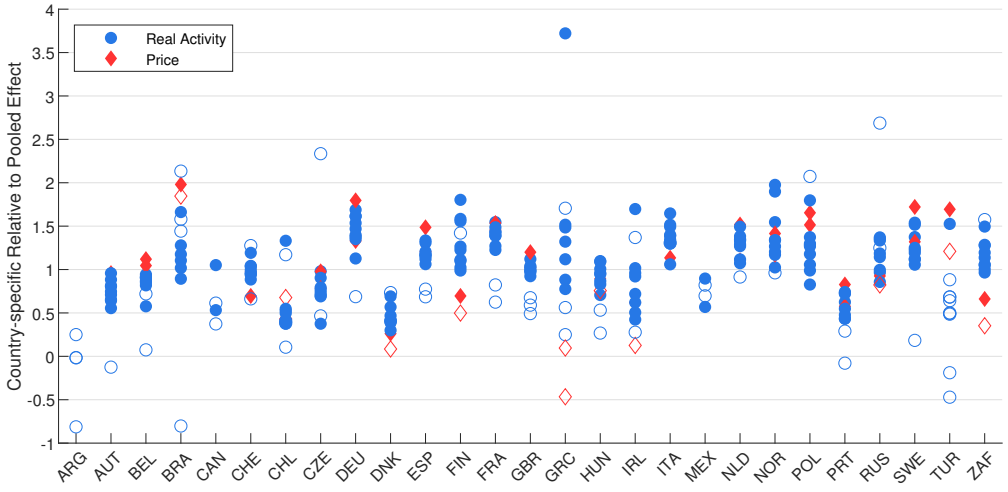


Notes: This figure shows the equity market responses for the four releases with the largest cross-country average effects. The light blue bar shows the pooled effect (Equation (9) with common coefficient γ^y instead of γ_i^y) while the dark blue bars show the country-specific effect, obtained from estimating equation (9). Missing country bars depict cases in which the country is dropped because it had less than 24 observations for a given announcement. The red error bands depict 95 percent confidence intervals, where standard errors are clustered at the event-level. The bar charts for all news releases are shown in Appendix Figure B4.

We continue with exploring the country-specific component in responsiveness in greater detail. Figure 3 plots the country-specific effect $\hat{\gamma}_i^y$ relative to the pooled effect $\hat{\gamma}^y$ (obtained by estimating equation (9) with common coefficients) for all 12 announcements. The figure shows that Germany, Spain, France, Italy, Netherlands, Norway, and Sweden tend to respond systematically stronger than countries such as Chile, Denmark, Ireland, Mexico, and Portugal. When interpreted through the lens of our empirical framework (Section 2), this finding suggests that the former set of countries responds systematically stronger to U.S. and/or common shocks than the latter set of countries.

Note that there is a sizable degree of heterogeneity in stock price responses between Euro Area countries. The observed cross-country differences are therefore not exclusively driven by monetary policy or the exchange rate response.

Figure 3: Equity Market Responses by Country

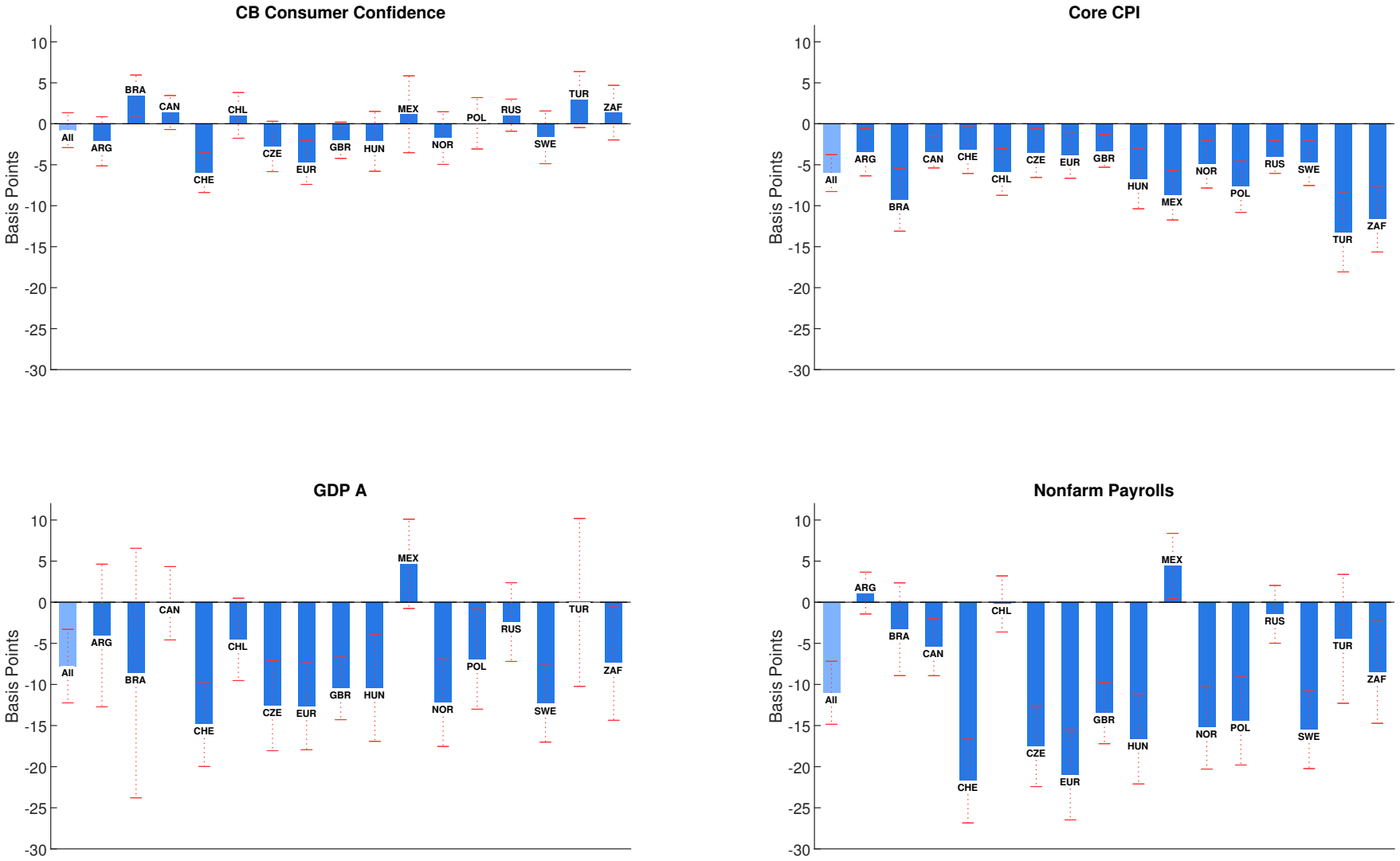


Notes: This figure plots the country-specific equity market response relative to the pooled response, i.e. $\hat{\gamma}_i^y/\hat{\gamma}^y$. A filled circle indicates significance at the 5 percent level while an empty circle indicates an insignificant effect.

4.2.2 Exchange rates

We next turn to the heterogeneity of exchange rate responses. Figure 4 shows the currency-specific estimates for each announcement. The full set of announcements is shown in Appendix Figure B5. As the top right panel demonstrates, higher-than-expected inflation leads all currencies to depreciate against the dollar. Surprises in the Core CPI have relatively small effects for currencies of most developed countries. This contrasts to exchange rates of developing countries such as Brazil, Mexico, Turkey, and South Africa, which respond strongly and significantly.

Figure 4: Response of U.S. Dollar Exchange Rates for Selected Announcements

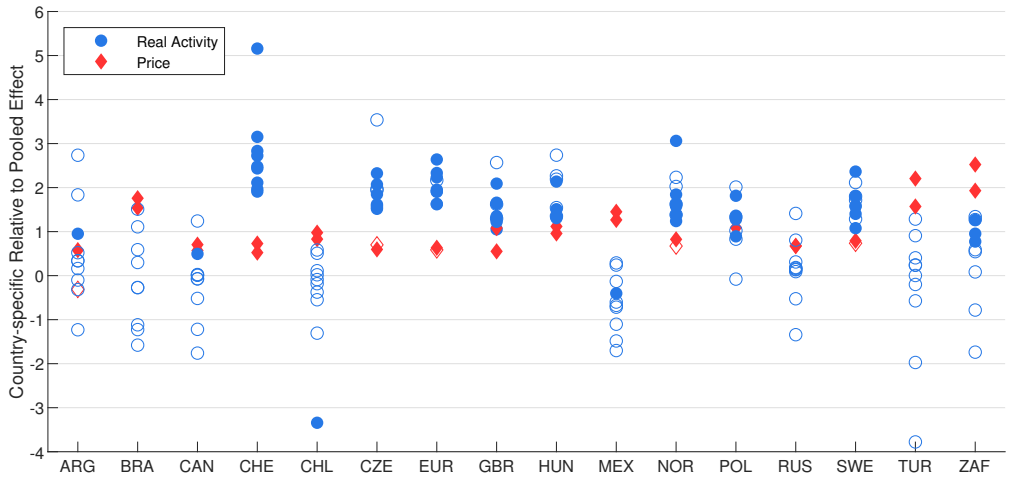


Notes: This figure shows the U.S. dollar exchange rate responses for the four releases with the largest cross-country average effects. The light blue bar shows the pooled effect (Equation (9) with common coefficient γ^y instead of γ_i^y) while the dark blue bars show the country-specific effect, obtained from estimating equation (9). Missing country bars depict cases in which the country is dropped because it had less than 24 observations for a given announcement. The red error bands depict 95 percent confidence intervals, where standard errors are clustered at the event-level. The bar charts for all news releases are shown in Appendix Figure B5.

This pattern reverses for news about the real economy. After positive surprises in Nonfarm Payrolls and GDP A exchange rates of developing countries respond weakly and often insignificantly. Currencies of developed countries, however, experience sizable depreciations against the dollar. Responses to news on the CB Consumer Confidence index are small and often insignificant.

Figure 5 visualizes the earlier point more systematically by considering all 12 announcements. U.S. news about the real economy have sizable effects mostly on developed countries, while news on prices have relatively small effects on these countries. For developing countries, news about the real economy are relatively unimportant, but news on prices have relatively large effects. Consistent with previous work, this finding suggests that shock transmission differs between developed and from developed to developing countries. It also suggests a special role for shockswhich generate surprises in prices.

Figure 5: U.S. Dollar Exchange Rate Responses by Country

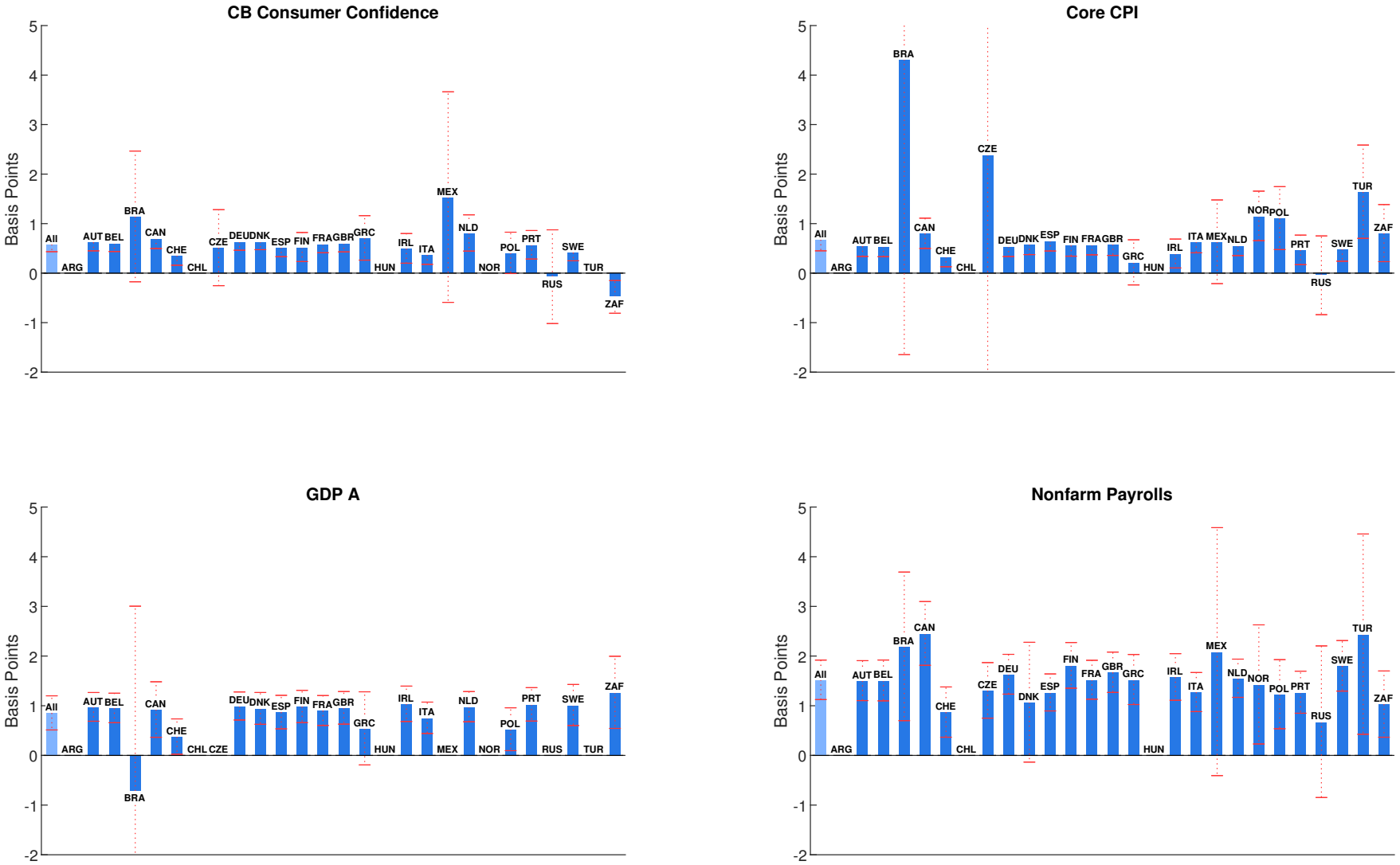


Notes: This figure plots the country-specific U.S. dollar exchange rate response relative to the pooled response, i.e. $\hat{\gamma}_i^y / \hat{\gamma}^y$. A filled circle indicates significance at the 5 percent level while an empty circle indicates an insignificant effect.

4.2.3 Bond markets

Figure 6 shows the responses of 10-year government bond yields. Again, these yields almost always rise after positive news about the U.S. real economy. The responses are largest for Nonfarm Payrolls, of intermediate size for GDP A, and smallest for the CB Consumer Confidence Index. Responses to news about the Core CPI are typically insignificant and small for developed countries, and larger but noisy for developing countries. Euro Area countries respond very similar to U.S. macro news, consistent with the idea that yield curves converged in the Euro Area (Ehrmann et al., 2011).

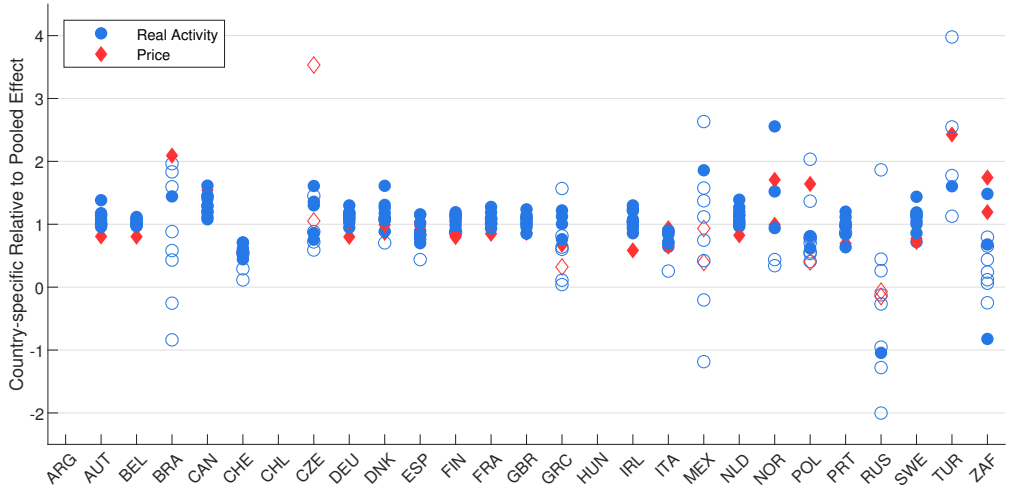
Figure 6: Response of 10-Year Bond Yield for Selected Announcements



Notes: This figure shows the 10-year government bond yield responses for the four releases with the largest cross-country average effects. The light blue bar shows the pooled effect (Equation (9) with common coefficient γ^y instead of γ_i^y) while the dark blue bars show the country-specific effect, obtained from estimating equation (9). Missing country bars depict cases in which the country is dropped because it had less than 24 observations for a given announcement. The red error bands depict 95 percent confidence intervals, where standard errors are clustered at the event-level. The bar charts for all news releases are shown in Appendix Figure B6.

Among developing countries, there is less systematic heterogeneity in countries' interest rate responses than in their stock price and exchange rate responses. As Figure 7 shows, Canada responds slightly more than the average, and Italy slightly less. Most countries are close to the average. For developing countries, the estimates are often too noisy for some news releases to clearly document systematic heterogeneity, perhaps because bond markets are more volatile in these countries.

Figure 7: 10-Year Bond Yield Responses by Country



Notes: This figure plots the country-specific 10-year government bond yield response relative to the pooled response, i.e. $\hat{\gamma}_i^y/\hat{\gamma}^y$. A filled circle indicates significance at the 5 percent level while an empty circle indicates an insignificant effect.

5 International Integration and Responsiveness to U.S. News

In this section we explore whether countries' asset price responsiveness to U.S. news correlates with measures of globalization. In particular, we explore the role of financial integration and openness to trade. The evidence in this section relates to a large literature studying whether greater integration is associated with more correlated business cycles (e.g. Kose, Prasad, and Terrones, 2003).

We estimate specifications of the form

$$\Delta q_{i,t} = \alpha_i + \gamma^y s^y_{US,t} + \delta^y \left(s^y_{US,t} \times \text{Int}_{i,t-}\right) + \sum_{k \neq y} \gamma^k s^k_{US,t} + \sum_{k \neq y} \delta^k \left(s^k_{US,t} \times \text{Int}_{i,t-}\right) + \zeta \text{Int}_{i,t-} + \varepsilon_{i,t}, \tag{10}$$

where $\text{Int}_{i,t-}$ is a measure of integration and the subscript $t-$ indicates that the measure is

predetermined. We use the calendar year prior to the announcement.

For ease of interpretation, we standardize the measures of integration by first subtracting the sample mean and then by dividing by the sample standard deviation. Hence, the main effect γ^y in equation (10) captures the average response and δ^y captures the differential response of a country with a one standard deviation greater-than-average degree of integration.

5.1 Measures of integration

As is common in the literature, we measure financial integration of country i in year τ as

$$\text{finInt}_{i,\tau} = \frac{\text{FA}_{i,\tau} + \text{FL}_{i,\tau}}{\text{GDP}_{i,\tau}}, \tag{11}$$

where $\text{FA}_{i,\tau}$ and $\text{FL}_{i,\tau}$ denote the stock of foreign assets and liabilities, respectively. All series are measured in current U.S. dollars, and the data are taken from Lane and Milesi-Ferretti (2007, 2017).[8]

As we document in Appendix Figure B7, a handful of countries experience an enormous growth in financial integration, most notably Ireland (IRL). While we report results for all countries in Appendix B, we prefer a set of baseline results that excludes these countries (Ireland (IRL), Switzerland (CHE), the Netherlands (NLD), the United Kingdom (GBR), and Belgium (BEL)), since they may unduely drive the results.

Again following previous work, we measure trade integration (or openness) for country i and year τ as

$$\text{tradeInt}_{i,\tau} = \frac{\text{Imports}_{i,\tau} + \text{Exports}_{i,\tau}}{\text{GDP}_{i,\tau}}. \tag{12}$$

The time series of this measure are shown Appendix Figure B8. Relative to the financial integration measure, there is no clear outlier among this set of countries. For our baseline estimates we only exclude Ireland (IRL), since it is well-known that profit-shifting motives of multinational firms may artificially inflate Ireland's degree of trade openness. Again, results for a sample that includes Ireland are reported in Appendix B. We note that both the between-country and the within-country variation of integration measures are sizable (Appendix Figures B7 and B8).

[8] Theory does not make clear predictions as to whether these measures should be constructed at the bilateral level, i.e. between country i and the U.S., or at the multilateral level as equation (11). In our baseline analysis we use multilateral measures.

5.2 Results

5.2.1 Financial Integration

The top panel of Table 3 shows the estimates of equation (10) for stock market indexes on the left hand side, and using financial openness as the measure of integration. For 6 out of 12 news releases, the interaction term has a significant coefficient. For news about the real economy the interaction term has the same sign as the main effect, indicating that countries with greater financial integration are more affected by news about the U.S. economy. For news on prices, the interaction term has the opposite sign as the main effect, implying that countries with greater financial integration are less affected.

The size of the interaction term is often large. For instance, in response to surprises about Nonfarm Payrolls, a country with 1.5 standard deviations of greater-than-average financial openness responds twice as much as the average country.

When interpreting these results, it is important to note that the following. While we argue that asset prices *causally* respond to U.S. news releases, a significant interaction term does *not* necessarily imply that greater financial integration *causes* these responses to be greater. It is likely, for instance, that other measures of integration correlate with financial openness and ultimately drive the estimate on the interaction term. Nonetheless, our finding is important since it implies that financial integration itself or correlates of financial integration lead to greater asset price responsiveness to U.S. news.

The middle panel of Table 3 shows estimates for exchange rates on the left hand side. For 3 out of 12 announcements—all on real activity—the interaction term with financial integration is statistically significant. Exchange rates of countries with greater financial integration respond systematically stronger to these 3 U.S. news releases. Again, the magnitudes of the interaction terms are often large. For Nonfarm Payrolls, increasing the financial integration measure by two standard deviations doubles the effect. Note that in 2 out of 3 cases, a significant interaction term with the exchange rate on the left hand side is also significant with stock price indexes on the left hand side.

The bottom panel of Table 3 shows that 10-year bond yields respond stronger to Nonfarm Payrolls, Retail Sales, and Initial Jobless Claims in countries that are more financially integrated. For Nonfarm Payrolls, a one standard deviation increase of financial integration increases the response by approximately one quarter of the average response. As was the case for stock indexes, greater financial integration attenuates the effect of price news: For bond yields on the left hand side, the interaction term is negative for the Core CPI and

Core PPI.

For all three outcomes of interest, the general impression from Table 3 is that financial integration is associated with larger effects for announcements on the real economy and with smaller effects for news on prices. To check the robustness of this finding, we re-estimate equation (10) but control additionally for country fixed effects interacted with the surprise of interest and with all other surprises. These controls remove time-invariant differences in responsiveness from the interaction term, and identify it from within-country variation of financial integration. As Appendix Table B3 shows, the attenuating effect of financial integration on stock indexes and bond yields survives this check. This implies, for instance, that this effect is not driven by the fact that news on prices impact developed and developing countries with different magnitudes (see Section 4.2).

5.2.2 Trade Integration

The results for trade integration are shown in Table 4. With stock market indexes on the left hand side, the interaction with trade openness is significant for 4 out of 12 announcements. As for financial integration, trade integration increases the effect of news about the real economy and reduces the effect of prices. In all 4 cases is the size of the interaction term small relative to the main effect. That trade integration increases the effect of news about the real economy and reduces the effect of prices survives the robustness check of additionally controlling for country fixed effects interacted with the surprise of interest and with all other surprises (see Appendix Table B4).

Exchange rates respond systematically stronger to news about the real economy for countries with greater trade integration. For 5 out of 12 announcements the interaction term is significant. Further, the coefficient estimates of the interaction terms are often large. For surprises about Nonfarm Payrolls, a one standard deviation increase in trade openness raises the size of the exchange rate response by half. The the size of the responses of bond yields is not strongly correlated with our measure of trade integration.

Table 3: Financial Integration

	CB Consumer Confidence	UM Consumer Sentiment P	Core CPI	Durable Goods Orders	Core PPI	GDP A	Initial Jobless Claims	ISM Mfg Index	Nonfarm Payrolls	New Home Sales	Retail Sales	Unemployment Rate
Stock Index (bp)												
News	13.70***	6.14***	-9.32***	6.80***	-4.42***	20.13***	-5.42***	12.32***	21.06***	4.36***	10.84***	-3.06
	(1.99)	(1.71)	(1.87)	(1.75)	(1.36)	(3.65)	(0.80)	(2.19)	(2.48)	(1.45)	(2.17)	(3.13)
Fin. Integration × News	1.13	0.49	2.55***	0.13	2.49***	-1.24	-1.20***	4.44***	14.00***	0.81	3.23***	0.41
	(0.78)	(0.71)	(0.95)	(0.89)	(0.75)	(1.92)	(0.41)	(1.29)	(1.61)	(0.89)	(0.74)	(1.22)
R^2	0.13	0.05	0.10	0.06	0.04	0.17	0.03	0.12	0.17	0.03	0.11	0.01
Observations	3998	3788	3757	3667	3812	1251	15905	3675	3719	3886	3836	3709
Exchange Rate (bp)												
News	0.15	-0.67	-4.86***	-1.79**	-2.90***	-7.73***	0.27	-2.68**	-11.72***	-1.42*	-1.87	1.69
	(1.20)	(0.89)	(1.16)	(0.84)	(0.91)	(2.58)	(0.44)	(1.10)	(2.26)	(0.73)	(1.35)	(1.61)
Fin. Integration × News	0.20	-0.57	0.09	-0.37	0.08	-1.62	-0.20	-1.07*	-6.08***	-1.26**	-1.09	0.02
	(0.49)	(0.43)	(0.57)	(0.38)	(0.54)	(1.03)	(0.26)	(0.63)	(1.44)	(0.53)	(0.69)	(0.90)
R^2	0.00	0.02	0.07	0.02	0.04	0.08	0.03	0.03	0.12	0.02	0.08	0.03
Observations	2944	2701	2799	2786	2866	947	12123	2932	2843	2887	2859	2835
10-Year Bond Yield (bp)												
News	0.65***	0.30***	0.65***	0.33***	0.44***	0.88***	-0.33***	0.91***	1.78***	0.36***	0.55***	-0.49***
	(0.08)	(0.07)	(0.12)	(0.11)	(0.09)	(0.18)	(0.04)	(0.09)	(0.22)	(0.07)	(0.10)	(0.16)
Fin. Integration × News	-0.08	-0.00	-0.42***	-0.06	-0.09*	0.13	-0.07*	0.10	0.41***	-0.01	0.13**	0.18*
	(0.08)	(0.06)	(0.16)	(0.09)	(0.05)	(0.17)	(0.04)	(0.07)	(0.13)	(0.06)	(0.06)	(0.09)
R^2	0.10	0.04	0.05	0.01	0.07	0.12	0.01	0.13	0.17	0.03	0.07	0.04
Observations	2707	2541	2840	2788	2918	893	12199	2560	2853	2649	2905	2848

Notes: This table presents the regression results of equation (10) using the financial integration measure for all announcements. Each of the four panels shows the results for a different dependent variable. Standard errors are clustered at event-level and reported in parentheses. ***, **, and * refer to significance at the 1, 5, and 10 percent level. Appendix Tables B1 and B3 show the regression results including the outliers and including country-news interactions terms, respectively.

Table 4: Trade Integration

	CB Consumer Confidence	UM Consumer Sentiment P	Core CPI	Durable Goods Orders	Core PPI	GDP A	Initial Jobless Claims	ISM Mfg Index	Nonfarm Payrolls	New Home Sales	Retail Sales	Unemployment Rate
Stock Index (bp)												
News	13.11***	6.17***	-9.23***	6.29***	-4.38***	20.28***	-5.09***	11.67***	17.97***	3.93***	10.35***	-2.38
	(1.93)	(1.63)	(1.78)	(1.72)	(1.36)	(3.64)	(0.76)	(2.18)	(2.64)	(1.38)	(2.34)	(2.96)
Trade Integration × News	-0.62	-0.03	1.29**	-0.04	1.26***	-1.59	0.23	1.36*	3.57***	-0.38	0.36	-0.11
	(0.55)	(0.45)	(0.51)	(0.45)	(0.41)	(1.26)	(0.21)	(0.75)	(0.79)	(0.52)	(0.41)	(0.60)
R^2	0.13	0.05	0.10	0.05	0.04	0.19	0.03	0.10	0.13	0.03	0.11	0.01
Observations	5504	5186	5177	5083	5274	1732	22049	5041	5158	5328	5270	5144
Exchange Rate (bp)												
News	-0.70	-0.98	-5.98***	-2.14**	-3.02***	-8.26***	0.54	-3.48***	-11.78***	-1.61**	-2.34*	2.14
	(1.13)	(0.82)	(1.17)	(0.82)	(0.84)	(2.41)	(0.42)	(0.99)	(2.09)	(0.68)	(1.22)	(1.54)
Trade Integration × News	-0.79	-1.03***	0.08	-0.33	-0.02	-1.23	0.30	-2.34***	-6.30***	-1.24***	-1.35**	0.95
	(0.48)	(0.35)	(0.42)	(0.31)	(0.35)	(1.33)	(0.22)	(0.50)	(0.93)	(0.42)	(0.55)	(0.74)
R^2	0.01	0.02	0.08	0.02	0.04	0.10	0.02	0.06	0.13	0.02	0.08	0.03
Observations	3798	3495	3629	3608	3711	1225	15707	3783	3684	3712	3696	3674
10-Year Bond Yield (bp)												
News	0.61***	0.30***	0.69***	0.33***	0.45***	0.89***	-0.31***	0.90***	1.59***	0.31***	0.52***	-0.44***
	(0.08)	(0.06)	(0.12)	(0.11)	(0.08)	(0.18)	(0.04)	(0.08)	(0.21)	(0.07)	(0.10)	(0.15)
Trade Integration × News	-0.01	0.02	-0.16	-0.05	-0.06**	0.09	-0.02	0.07*	0.01	-0.03	0.01	0.02
	(0.04)	(0.03)	(0.12)	(0.07)	(0.02)	(0.11)	(0.02)	(0.04)	(0.05)	(0.03)	(0.03)	(0.05)
R^2	0.09	0.04	0.04	0.02	0.07	0.13	0.01	0.15	0.17	0.02	0.07	0.03
Observations	3903	3671	4031	3952	4135	1282	17362	3664	4061	3796	4099	4054

Notes: This table presents the regression results of equation (10) using the trade integration measure for all announcements. Each of the four panels shows the results for a different dependent variable. Standard errors are clustered at event-level and reported in parentheses. ***, **, and * refer to significance at the 1, 5, and 10 percent level. Appendix Tables B2 and B4 show the regression results including the outliers and including country-news interactions terms, respectively.

6 Low Frequency Effects and Explanatory Power of U.S. Macro News

In this section, we study how persistent the effects of U.S. macroeconomic news on international asset markets are. If their effects dissipated quickly and if their explanatory power was low, U.S. news would be unlikely to play an important role for the evolution of macroeconomic aggregates at lower frequencies. Following the method by Altavilla, Giannone, and Modugno (2017), we demonstrate that the effect of U.S. macro news on foreign stock and bond markets is persistent and their explanatory power sizable.

Altavilla, Giannone, and Modugno (2017) develop a method to measure the explanatory power of news on asset prices at lower frequencies. Focusing on the U.S., their key finding is that macroeconomic news explain a larger share of variation in Treasury bond yields at the quarterly than at the daily frequency, because residual variation averages out at longer horizons. We extend this result in an international setting and show that the explanatory power of U.S. news also increases at lower frequencies for foreign stock price indexes and for foreign government bond yields. Such persistent effects imply that U.S. news are an important driver of foreign asset prices and thus potentially a driver of foreign business cycles. Considering that our surprises only partially capture the information of a given release as argued by Gürkaynak, Kısacıkoğlu, and Wright (2018), our measures of explanatory power of U.S. macroeconomic news should be interpreted as lower bounds.[9]

6.1 Method

Following Altavilla, Giannone, and Modugno's (2017) method, we switch from our earlier intraday event study approach in previous sections to a daily time series analysis. In a first step, we estimate the specification

$$\Delta q_{i,d} = \alpha_i + \sum_k \beta_i^k s_{US,d}^k + \varepsilon_{i,d}. \tag{13}$$

Here, d indexes time in days, $\Delta q_{i,d}$ is the change in the log asset price or return q of country i as measured by the difference from market closing to market closing, and the sum on the right hand side now includes *all* available announcements as listed in Appendix Table A2.[10]

[9] Gürkaynak, Kısacıkoğlu, and Wright (2018) show that additionally accounting for non-headline news, which are unobservable to the econometrician, further increases explanatory power.

[10] By focusing on daily changes, we circumvent the problem that some foreign markets are closed for some announcements. Hence, the set of U.S. news that drive foreign asset prices in specification (13) are identical for all countries.

Note that all coefficients are country-specific. A surprise $s^k_{US,d}$ takes the value 0 if no news are released on a given day. Since the coverage of news releases is incomplete in the late 90's, the sample period now ranges from January 1, 2000 to June 28, 2019.

Next, we define the daily news index as the fitted value $nix^q_{i,d} := \widehat{\Delta q_{i,d}}$ from equation (13), and aggregate this predicted value to the desired time horizon h (in days), $nix^q_{i,d,h} = \sum_{j=0}^{h-1} nix^q_{i,d-j}$. Letting $\Delta_h q_{i,d} = q_{i,d} - q_{i,d-h} = \sum_{j=0}^{h-1} \Delta q_{i,d}$ be the h-day difference in asset price q, we estimate in a second step the specification

$$\Delta_h q_{i,d} = \alpha_{i,h} + \beta_i^{q,h} nix^q_{i,d,h} + \varepsilon_{i,d,h}. \tag{14}$$

The coefficient of interest is $\beta_i^{q,h}$. This coefficient exceeds one, if the effect of macroeconomic news increases at lower frequencies. If it is smaller than one, the effect of macroeconomic news averages out over time. The R-squared of regression (14) measures the explanatory power of macroeconomic news releases at horizon h. As do Altavilla, Giannone, and Modugno (2017), we consider aggregation to the monthly and quarterly frequency.

6.2 Results

Tables 5, 6, and 7 show our results for stock markets, exchange rates, and bond markets, respectively.

As Table 5 shows, the explanatory power of U.S. news for foreign stock price indexes increases at lower frequencies. In an overwhelming number of cases, the R-squared at the quarterly frequency exceeds the R-squared at the monthly frequency, which in turn, exceeds the R-squared at the daily frequency. Relative to other driving forces of foreign stock market indexes, the effect of U.S. news is persistent.

At the quarterly frequency, the explanatory power of U.S. news is sizable, often explaining between 15 and 22 percent of the variation. For comparison, we repeat the analysis for the S&P 500, and report the R-squared in the first column of the table. For a number of countries, U.S. macroeconomic news explain an even larger fraction of stock price movements as they do in the U.S. For a number of countries we reject the null hypothesis that $\hat{\beta}_i^{q,h} = 1$, implying that the effect of U.S. macro news on foreign bond markets is more persistent than the residual driving forces.

We extend this analysis to exchange rates and report results in Table 6. For the majority

Relative to Altavilla, Giannone, and Modugno (2017), our set of announcements do includes more macroeconomic news releases. However, we exclude news about monetary policy.

of currencies, the explanatory power of U.S. news falls at lower frequencies. These include the Euro (EUR), the British Pound (GBR), the Canadian Dollar (CAN), and others. Note that this result is consistent with the finding in Altavilla, Giannone, and Modugno (2017). For a handful of emerging market countries such as Argentina, Chile, Mexico, and Russia the explanatory power rises at lower frequencies.

The explanatory power of U.S. macro news for foreign bond yields is heterogeneous across countries. As Table 7 demonstrates, U.S. macro news explain a sizable fraction of quarterly variation for countries such as Canada, Switzerland, Germany, Denmark, the Netherlands, and Sweden. In these cases, U.S. news explain between 20 and 25 percent of the quarterly variation, which is approximately two thirds of their explanatory power for U.S. treasury yields. For other countries such as Chile, Hungary, or Russia, U.S. news explain very little variation in government bond prices at all horizons.

Overall, the explanatory power on international stock and bond markets at lower frequencies is striking. Reassuringly, our estimates for the U.S. are in line with the ones by Altavilla, Giannone, and Modugno (2017).[11]

[11] Our R-squares are slightly higher since we are using a larger set of macroeconomic news announcements than Altavilla, Giannone, and Modugno (2017).

Table 5: Low Frequency Analysis — Stock Indexes

	USA	ARG	AUT	BEL	BRA	CAN	CHE	CHL	CZE	DEU	DNK	ESP	FIN	FRA
R-squared														
1-day	0.02	0.02	0.03	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.03	0.02
1-month	0.04	0.09	0.05	0.04	0.01	0.04	0.05	0.02	0.04	0.04	0.08	0.03	0.04	0.05
1-quarter	0.18	0.20	0.13	0.10	0.13	0.16	0.19	0.04	0.15	0.14	0.21	0.18	0.22	0.18
Coefficient														
1-month	1.05	2.57	1.31	1.15	0.66	1.22	0.95	0.81	1.61	1.11	2.18	1.14	0.93	1.11
	(0.39)	(0.43)	(0.67)	(0.83)	(0.38)	(0.46)	(0.38)	(0.45)	(0.63)	(0.37)	(1.04)	(0.57)	(0.35)	(0.44)
1-quarter	2.20	3.63	2.40	1.83	2.79	2.37	1.58	0.97	2.91	2.04	4.01	2.47	2.05	2.08
	(0.64)	(0.55)	(0.96)	(1.05)	(0.69)	(0.82)	(0.47)	(0.52)	(0.95)	(0.72)	(1.70)	(0.82)	(0.51)	(0.65)
	GBR	GRC	HUN	IRL	ITA	MEX	NLD	NOR	POL	PRT	RUS	SWE	TUR	ZAF
R-squared														
1-day	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.01	0.02	0.02	0.02	0.02	0.01	0.03
1-month	0.02	0.04	0.06	0.07	0.03	0.03	0.07	0.01	0.05	0.02	0.01	0.03	0.03	0.01
1-quarter	0.16	0.12	0.12	0.18	0.17	0.14	0.22	0.06	0.13	0.07	0.09	0.19	0.03	0.06
Coefficient														
1-month	0.74	1.37	1.52	1.44	0.96	1.13	1.30	0.64	1.65	0.99	0.61	0.96	1.41	0.56
	(0.47)	(0.54)	(0.62)	(0.79)	(0.55)	(0.44)	(0.50)	(0.58)	(0.47)	(0.74)	(0.35)	(0.42)	(0.64)	(0.37)
1-quarter	1.93	2.48	2.04	2.64	2.05	2.57	2.21	1.94	2.50	2.39	1.55	2.39	1.27	1.00
	(0.56)	(0.62)	(1.03)	(1.05)	(0.72)	(0.90)	(0.60)	(0.57)	(0.68)	(1.36)	(0.46)	(0.78)	(0.83)	(0.51)

Notes: This table reports, country-by-country, the R-squared values of equation (13) (1-day) and, R-squared and coefficient values of equation (14) (1-month and 1-quarter) for stock indexes. The sample is from January 1, 2000 to June 28, 2019 and Newey-West standard errors are used. For the US, we use the S&P 500 where we obtain daily data from the Center of Research in Security Prices (CRSP).

Table 6: Low Frequency Analysis — U.S. Dollar Exchange Rates

	ARG	BRA	CAN	CHE	CHL	CZE	EUR	GBR	HUN	MEX	NOR	POL	RUS	SWE	TUR	ZAF
R-squared																
1-day	0.14	0.02	0.01	0.03	0.02	0.03	0.03	0.02	0.03	0.02	0.02	0.02	0.01	0.02	0.02	0.02
1-month	0.20	0.00	0.00	0.02	0.06	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.02	0.00	0.00	0.00
1-quarter	0.18	0.00	0.00	0.02	0.08	0.00	0.00	0.01	0.00	0.05	0.00	0.02	0.07	0.01	0.03	0.00
Coefficient																
1-month	1.45	0.32	0.59	0.69	2.39	0.70	0.55	0.62	0.59	0.87	0.46	0.39	1.32	0.10	0.55	-0.06
	(0.72)	(0.57)	(0.52)	(0.27)	(0.64)	(0.36)	(0.30)	(0.56)	(0.41)	(0.46)	(0.47)	(0.53)	(0.75)	(0.51)	(0.45)	(0.68)
1-quarter	1.86	-0.01	0.26	0.43	3.23	0.30	0.00	-0.59	0.25	1.89	-0.28	-1.02	2.90	-0.45	1.35	-0.49
	(1.24)	(0.73)	(1.00)	(0.26)	(0.79)	(0.35)	(0.32)	(0.87)	(0.59)	(0.50)	(0.88)	(0.77)	(1.64)	(0.77)	(0.56)	(0.99)

Notes: This table reports, country-by-country, the R-squared values of equation (13) (1-day) and, R-squared and coefficient values of equation (14) (1-month and 1-quarter) for U.S. Dollar exchange rates. The sample is from January 1, 2000 to June 28, 2019 and Newey-West standard errors are used.

Table 7: Low Frequency Analysis — 10-Year Government Bond Yield

	USA	ARG	AUT	BEL	BRA	CAN	CHE	CHL	CZE	DEU	DNK	ESP	FIN	FRA
R-squared														
1-day	0.08	0.14	0.04	0.04	0.00	0.06	0.03	0.04	0.04	0.05	0.05	0.02	0.05	0.05
1-month	0.16	0.02	0.09	0.07	0.00	0.10	0.10	0.02	0.08	0.08	0.08	0.06	0.05	0.10
1-quarter	0.34	0.07	0.17	0.15	0.00	0.24	0.21	0.01	0.08	0.25	0.22	0.04	0.16	0.19
Coefficient														
1-month	1.18	0.17	1.26	1.20	0.50	1.03	1.26	0.81	1.39	1.15	1.12	1.31	0.89	1.24
	(0.15)	(0.13)	(0.25)	(0.21)	(0.54)	(0.14)	(0.22)	(0.62)	(0.49)	(0.28)	(0.20)	(0.41)	(0.27)	(0.20)
1-quarter	1.57	0.44	1.48	1.42	-0.29	1.36	1.64	0.55	1.93	1.79	1.57	0.90	1.32	1.48
	(0.36)	(0.29)	(0.32)	(0.47)	(0.72)	(0.34)	(0.29)	(0.96)	(0.90)	(0.41)	(0.28)	(0.64)	(0.39)	(0.40)
	GBR	GRC	HUN	IRL	ITA	MEX	NLD	NOR	POL	PRT	RUS	SWE	TUR	ZAF
R-squared														
1-day	0.06	0.01	0.03	0.03	0.02	0.02	0.05	0.07	0.01	0.02	0.02	0.05	0.02	0.02
1-month	0.03	0.00	0.01	0.05	0.05	0.06	0.08	0.04	0.05	0.02	0.00	0.09	0.04	0.10
1-quarter	0.03	0.02	0.00	0.01	0.05	0.05	0.21	0.07	0.02	0.01	0.00	0.22	0.00	0.19
Coefficient														
1-month	0.62	0.08	0.77	1.18	1.30	1.39	1.13	0.80	1.82	0.88	0.15	1.34	1.31	2.15
	(0.31)	(0.44)	(0.42)	(0.40)	(0.45)	(0.32)	(0.21)	(0.28)	(0.59)	(0.37)	(0.18)	(0.35)	(0.48)	(0.43)
1-quarter	0.68	-1.55	-0.13	0.54	1.23	1.27	1.56	1.00	1.45	0.37	-0.12	2.03	-0.07	2.70
	(0.42)	(1.07)	(0.85)	(0.55)	(0.54)	(0.53)	(0.26)	(0.29)	(0.87)	(0.42)	(0.24)	(0.65)	(0.50)	(0.64)

Notes:This table reports, country-by-country, the R-squared values of equation (13) (1-day) and, R-squared and coefficient values of equation (14) (1-month and 1-quarter) for 10-year government bond yields. The sample is from January 1, 2000 to June 28, 2019 and Newey-West standard errors are used. For the US, we obtain the daily data from the Federal Reserve Board (H.15).

7 Conclusion

Using a high-frequency design, this paper establishes new facts on the response of asset prices to the release of macroeconomic news. We summarize the key findings. First, asset prices respond overwhelmingly symmetric across countries to macroeconomic news about the U.S. economy. Positive news on real activity lead to an increase in equity prices, a rise in long-term interest rates, and a depreciation of the local currency against the U.S. dollar. Second, some countries respond systematically stronger to U.S. macroeconomic news releases than others. Third, the size of the response is correlated with macroeconomic fundamentals such as trade and financial integration into the world economy. Fourth, U.S. macro news explain a sizable fraction of the quarterly variation in foreign stock and bond markets.

Our findings provide a useful benchmark for international business cycle models and their driving forces of international co-movement. They suggest, for instance, that shocks which generate asymmetric responses of stock or bond prices across countries are unlikely to play an important role. They also suggest that trade and financial linkages amplify the transmission of shocks which manifest in surprises on real activity, while they attenuate responses to shocks which manifest in surprises on prices. Finally, transmission to developed countries differs in important ways from transmission to developing countries.

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A Appendix: Data

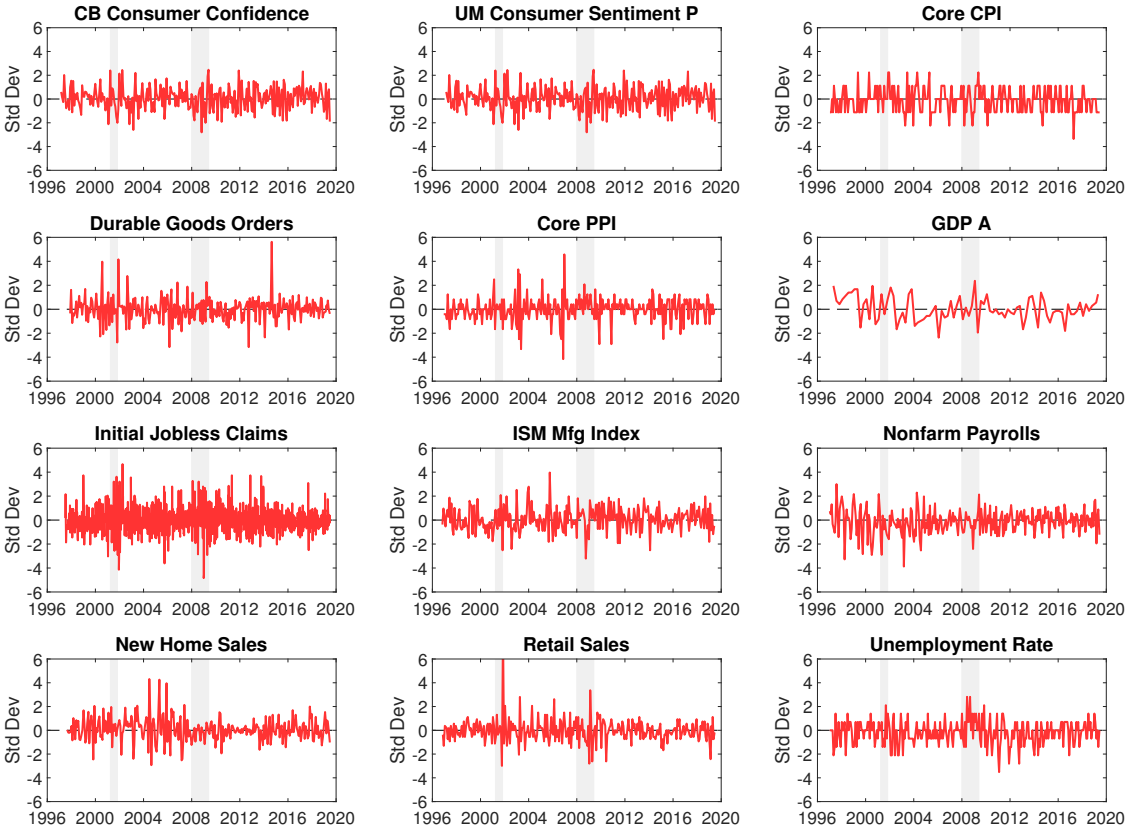
Table A1: Overview of Open/Closed Equity Markets during U.S. Macroeconomic News Announcements

Event	ARG	AUT	BEL	BRA	CAN	CHE	CHL	CZE	DEU	DNK	ESP	FIN	FRA	GBR
CPI MoM	Closed	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open	Open
Change in Nonfarm Payrolls	Closed	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open	Open
Conf. Board Consumer Confidence	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open
Durable Goods Orders	Closed	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open	Open
GDP Annualized QoQ A	Closed	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open	Open
GDP Annualized QoQ S	Closed	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open	Open
GDP Annualized QoQ T	Closed	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open	Open
Housing Starts	Closed	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open	Open
ISM Manufacturing	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open
Initial Jobless Claims	Closed	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open	Open
New Home Sales	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open
Retail Sales Advance MoM	Closed	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open	Open
U. of Mich. Sentiment P	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open
U. of Mich. Sentiment F	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open

	GRC	HUN	IRL	ITA	MEX	NLD	NOR	POL	PRT	RUS	SWE	TUR	ZAF
CPI MoM	Open	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open
Change in Nonfarm Payrolls	Open	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open
Conf. Board Consumer Confidence	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open
Durable Goods Orders	Open	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open
GDP Annualized QoQ A	Open	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open
GDP Annualized QoQ S	Open	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open
GDP Annualized QoQ T	Open	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open
Housing Starts	Open	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open
ISM Manufacturing	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open
Initial Jobless Claims	Open	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open
New Home Sales	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open
Retail Sales Advance MoM	Open	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open
U. of Mich. Sentiment P	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open
U. of Mich. Sentiment F	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open

Notes: *Green* indicates that the corresponding equity market is usually open at the time of the news release. *Orange* indicates that the equity market is usually open but that the news release is around market opening or closing. In the case of Brazil, it indicates that the news release moves outside the trading hours during the U.S. daylight saving time since Sao Paulo, the location of the Brazilian stock market, does not observe daylight saving time. *Red* indicates indicates that the equity market is usually closed at the release time.

Figure A1: Time Series of Standardized Surprises



Notes: This figure shows the standardized surprises for each macroeconomic series over the sample period. The construction follows equation (7) in the text. Gray bars indicate NBER recession periods.

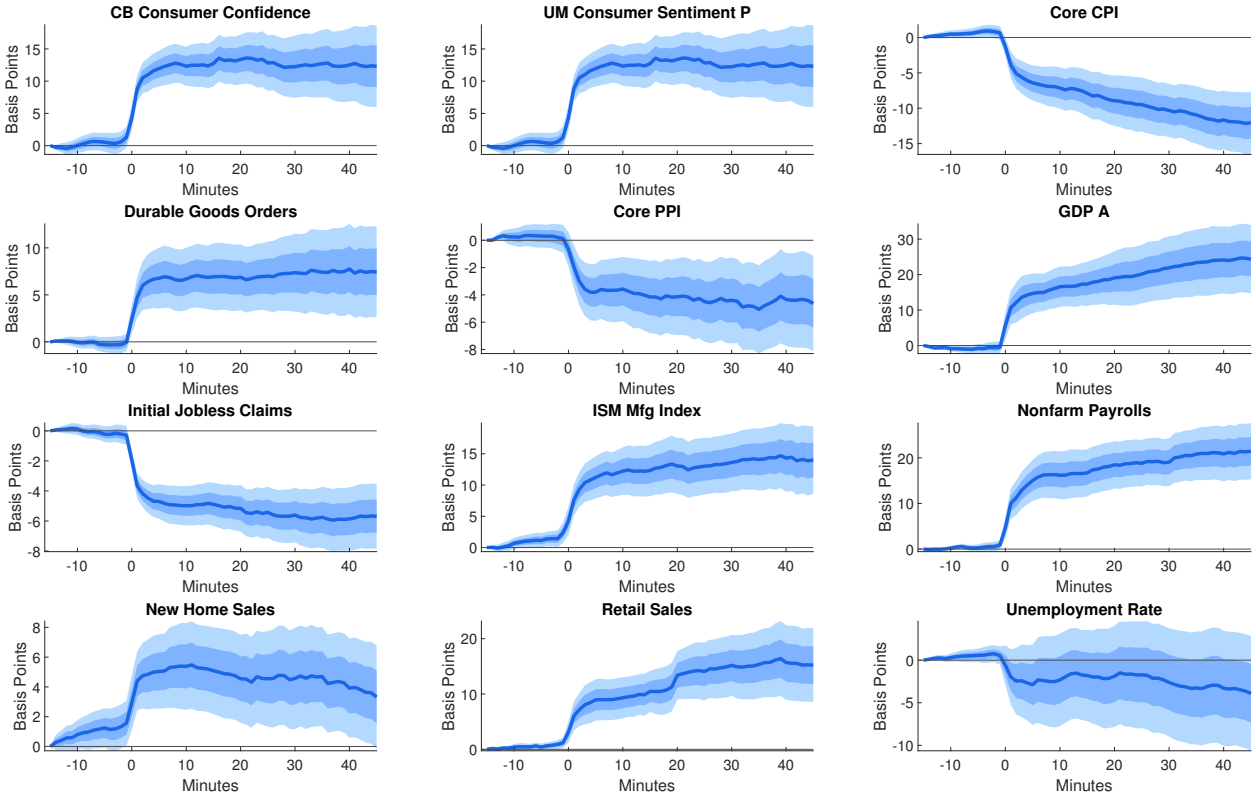
Table A2: U.S. Macroeconomic News

	Relevance	Frequency	Observations
ADP Employment	87	Monthly	154
Average Hourly Earnings	31	Monthly	252
Chicago Fed Nat Activity Index	63	Monthly	101
Capital Goods Orders	60	Monthly	106
Capital Goods Shipments	59	Monthly	89
ISM Chicago Index	82	Monthly	269
Consumer Credit	39	Monthly	271
Construction Spending	80	Monthly	246
CB Consumer Confidence	94	Monthly	268
UM Consumer Sentiment F	94	Monthly	242
UM Consumer Sentiment P	94	Monthly	241
Unit Labor Costs F	38	Quarterly	79
Unit Labor Costs P	38	Quarterly	79
CPI	96	Monthly	271
Capacity Utilization	62	Monthly	268
Core CPI	77	Monthly	269
Dallas Fed Mfg Index	64	Monthly	125
Durable Goods Orders	93	Monthly	260
Durables Ex Transportation	74	Monthly	211
Employment Cost Index	75	Quarterly	89
NY Fed Mfg Index	83	Monthly	200
Existing Home Sales	88	Monthly	172
Government Budget Balance	76	Monthly	270
PPI	87	Monthly	257
Core PPI	67	Monthly	269
Net Long-term TIC Flows	74	Monthly	117
GDP A	97	Quarterly	89
GDP S	97	Quarterly	88
GDP T	97	Quarterly	89
GDP Price Index A	77	Quarterly	85
GDP Price Index S	77	Quarterly	85
GDP Price Index T	77	Quarterly	84
FHFA House Price Index	69	Monthly	133
Import Price Index	79	Monthly	247
Initial Jobless Claims	98	Weekly	1140
Continuing Claims	69	Weekly	839
Industrial Production	89	Monthly	271
CB Leading Economic Index	83	Monthly	266
Business Inventories	39	Monthly	263
Wholesale Inventories	81	Monthly	264
ISM Non-Mfg Index	78	Monthly	245
ISM Mfg Index	95	Monthly	271
ISM Prices Paid	73	Monthly	228
Private Payrolls	31	Monthly	110
Nonfarm Payrolls	99	Monthly	268
New Home Sales	91	Monthly	261
Building Permits	63	Monthly	202
Housing Starts	90	Monthly	254
Philly Fed Business Outlook	80	Monthly	267
Core PCE Price Index	60	Monthly	168
Personal Consumption Expenditure	85	Monthly	267
Personal Income	85	Monthly	271
Nonfarm Productivity F	43	Quarterly	84
Nonfarm Productivity P	43	Quarterly	85
Richmond Fed Mfg Index	72	Monthly	164
Retail Sales	92	Monthly	270
Retail Sales Ex Auto	64	Monthly	264
Total Vehicle Sales	44	Monthly	82
NFIB Small Business Optimism	62	Monthly	112
Factory Orders	86	Monthly	271
Current Account Balance	72	Quarterly	85
NAHB Housing Market Index	45	Monthly	195
Mfg Payrolls	69	Monthly	246
Pending Home Sales	77	Monthly	170
Trade Balance	84	Monthly	271
Unemployment Rate	89	Monthly	267

Notes: This table displays the entirety of macroeconomic series analyzed in the paper. The sample ranges from November 1997 to June 2019. *Relevance* indicates the percentage of alerts set for the particular release to total alerts. *Observations* refers to number of observations (surprises) of a macroeconomic series in the sample, *Frequency* to the frequency of the data releases. Abbreviations: A — advanced; S — second; T — third; P — preliminary; F — final; MFG — Manufacturing; ADP — Automatic Data Processing Inc; CB — Chicago Board; ISM — Institute for Supply Management; UM — University of Michigan; NFIB — National Federation of Independent Business; NAHB — National Association of Home Builders.

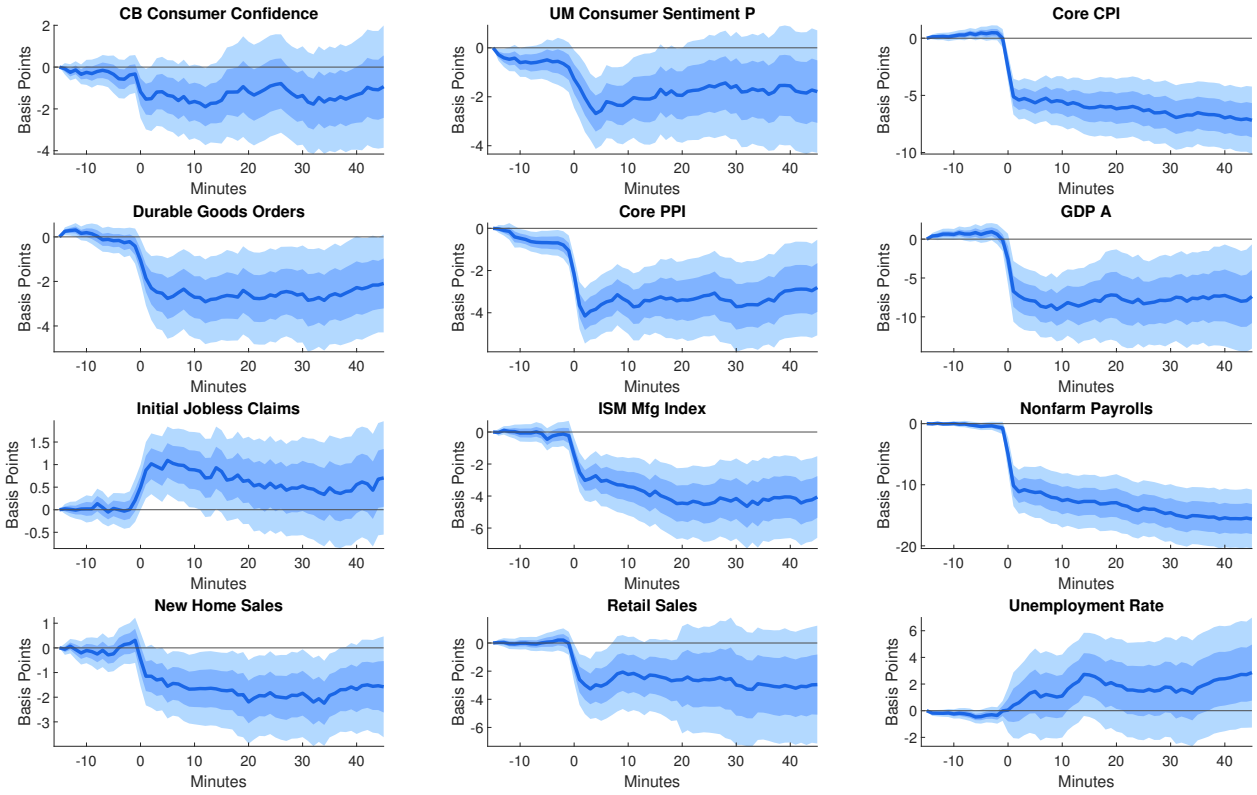
B Appendix: Additional Results

Figure B1: Average Equity Market Path within 60-minute Window



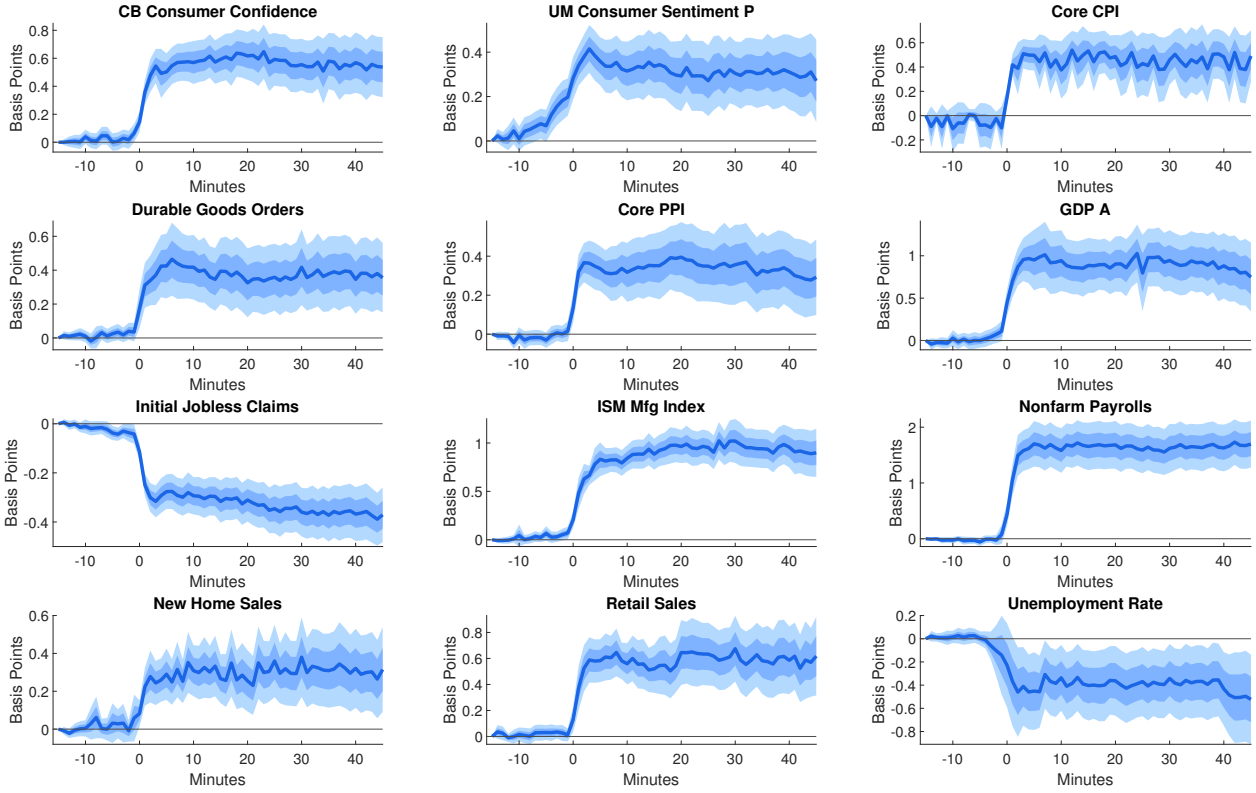
Notes: This figure displays the average equity market path within a 60 minute window for a given news release. The changes are relative to the level 15 minutes prior to each release obtained by estimating equation 8. The dark and light blue bands display the 68 percent and 95 percent confidence bands, respectively. Standard errors are clustered at event-level.

Figure B2: Average U.S. Dollar Exchange Rate Path within 60-minute Window



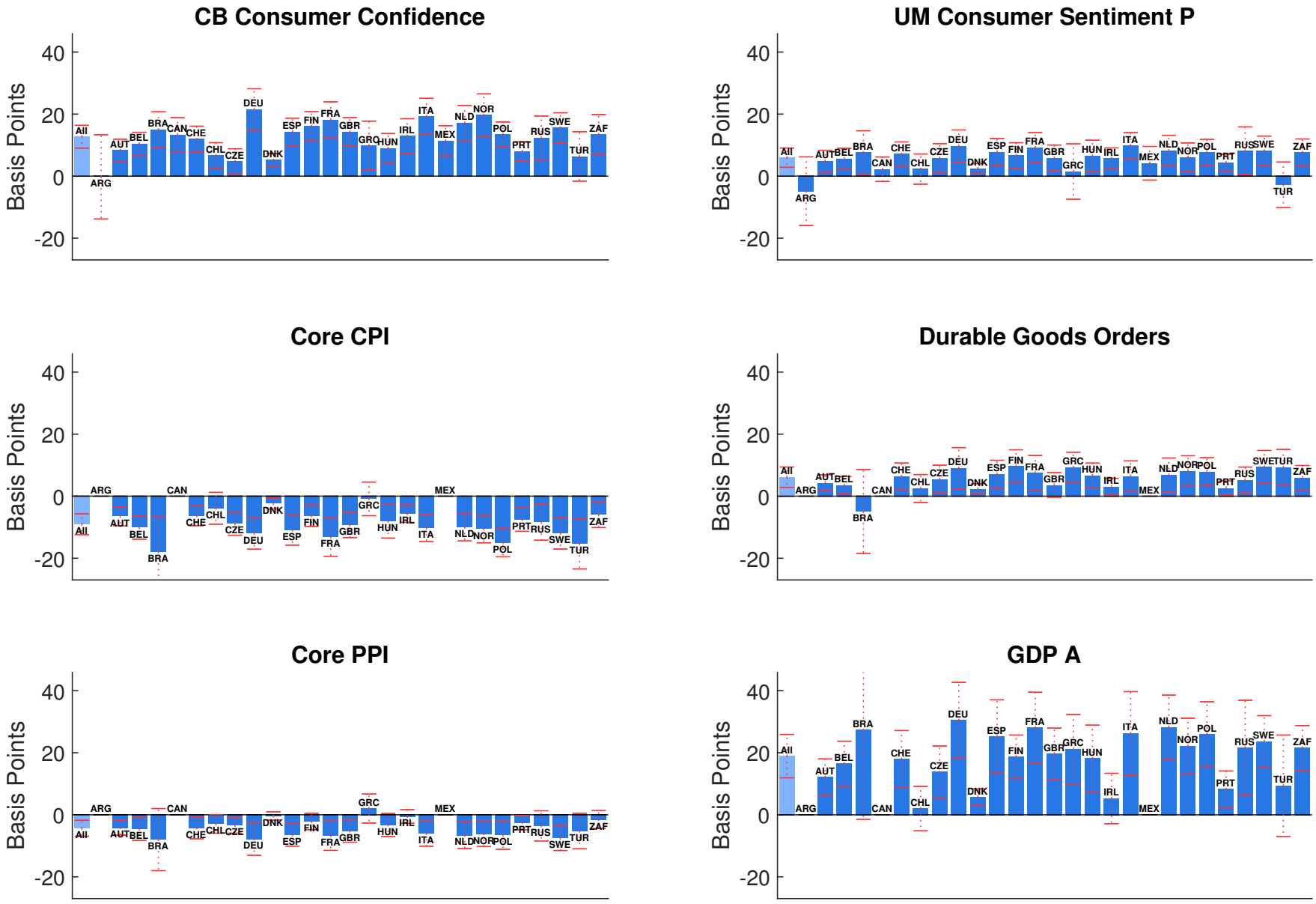
Notes: This figure displays the U.S. dollar exchange rate path within a 60 minute window for a given news release. The changes are relative to the level 15 minutes prior to each release obtained by estimating equation 8. The dark and light blue bands display the 68 percent and 95 percent confidence bands, respectively. Standard errors are clustered at event-level.

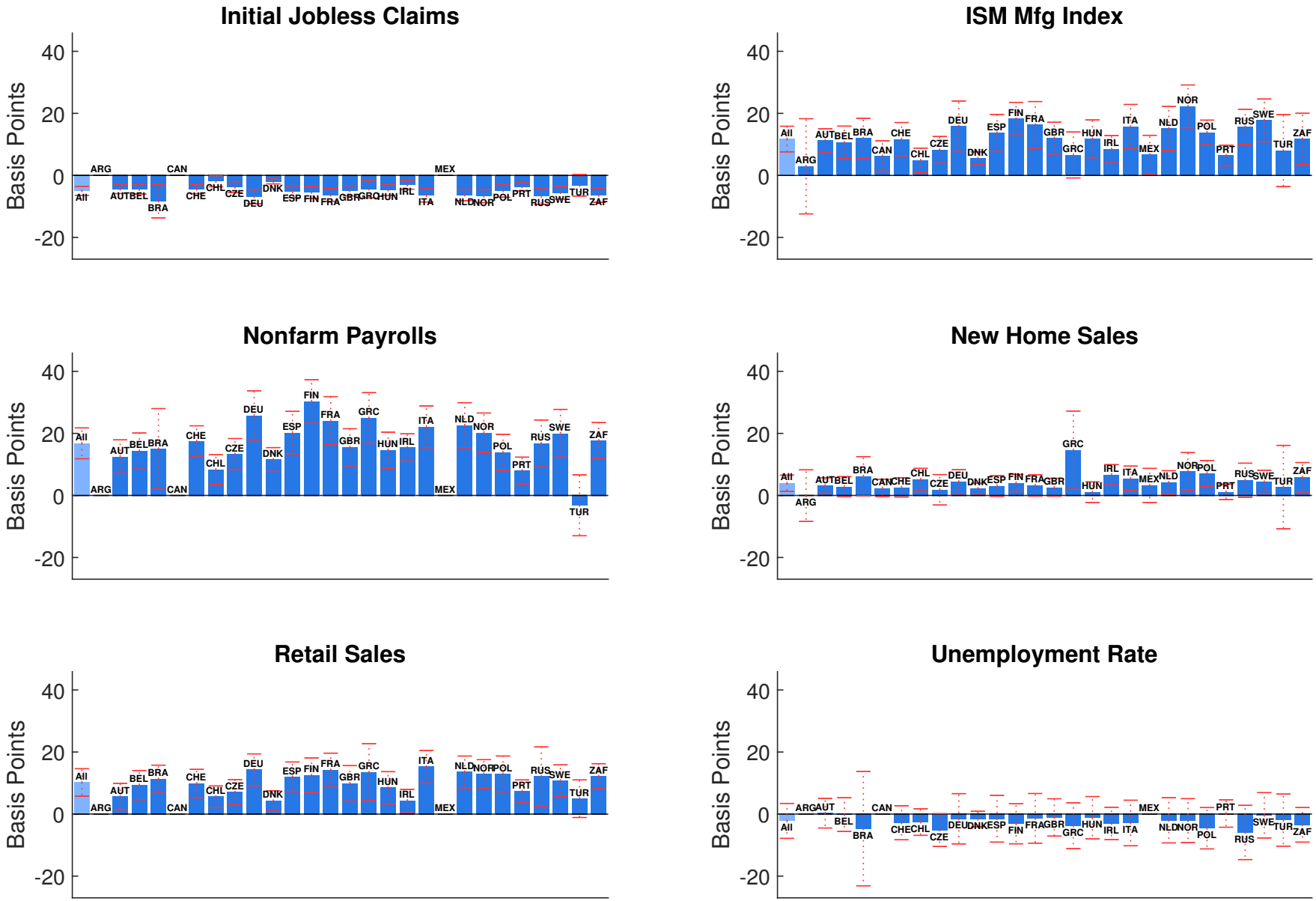
Figure B3: Average 10-Year Bond Yield Path within 60-minute Window



Notes: This figure displays the 10-year government bond yield path within a 60 minute window for a given news release. The changes are relative to the level 15 minutes prior to each release obtained by estimating equation 8. The dark and light blue bands display the 68 percent and 95 percent confidence bands, respectively. Standard errors are clustered at event-level.

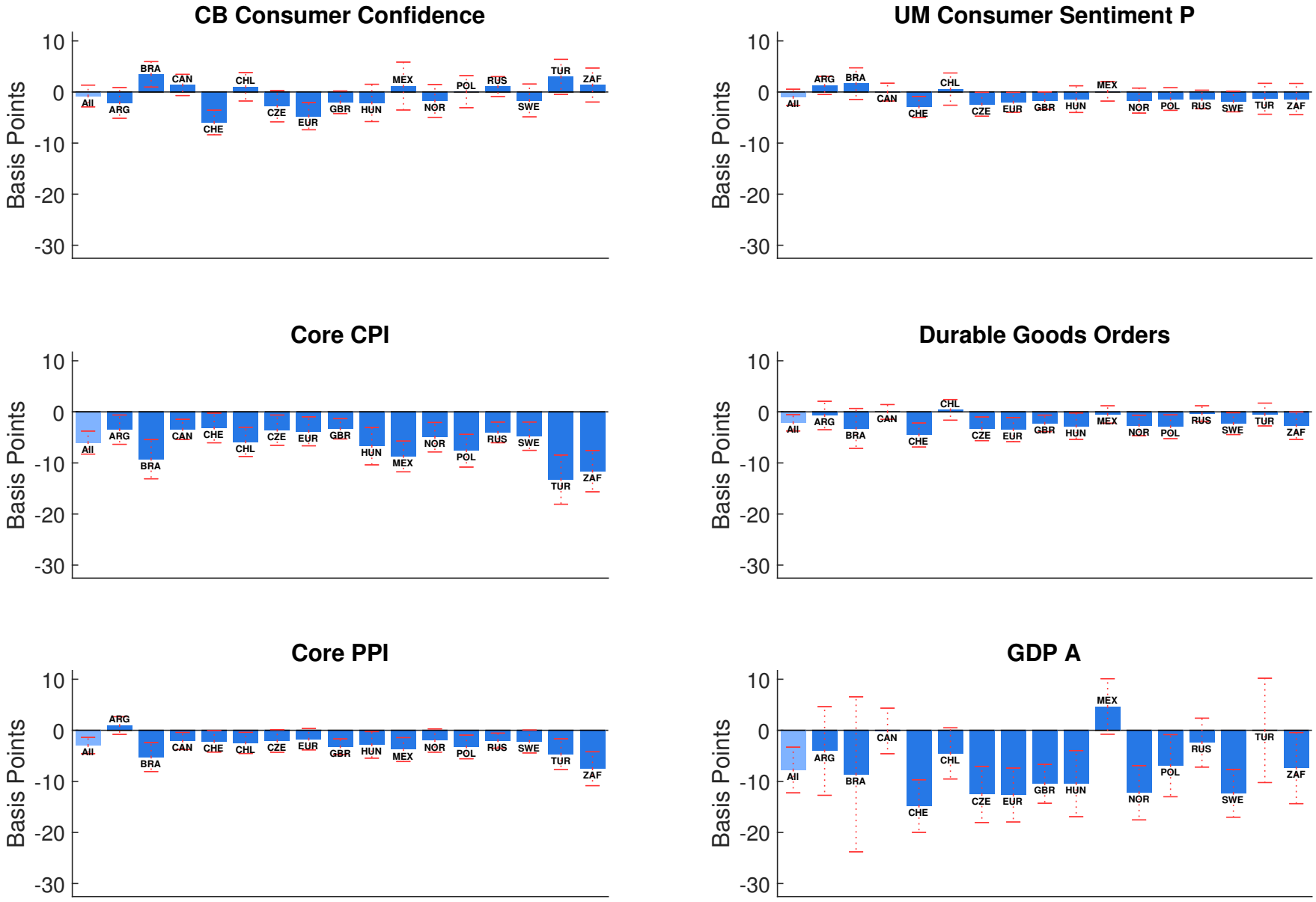
Figure B4: Response of Equity Markets for All Announcements

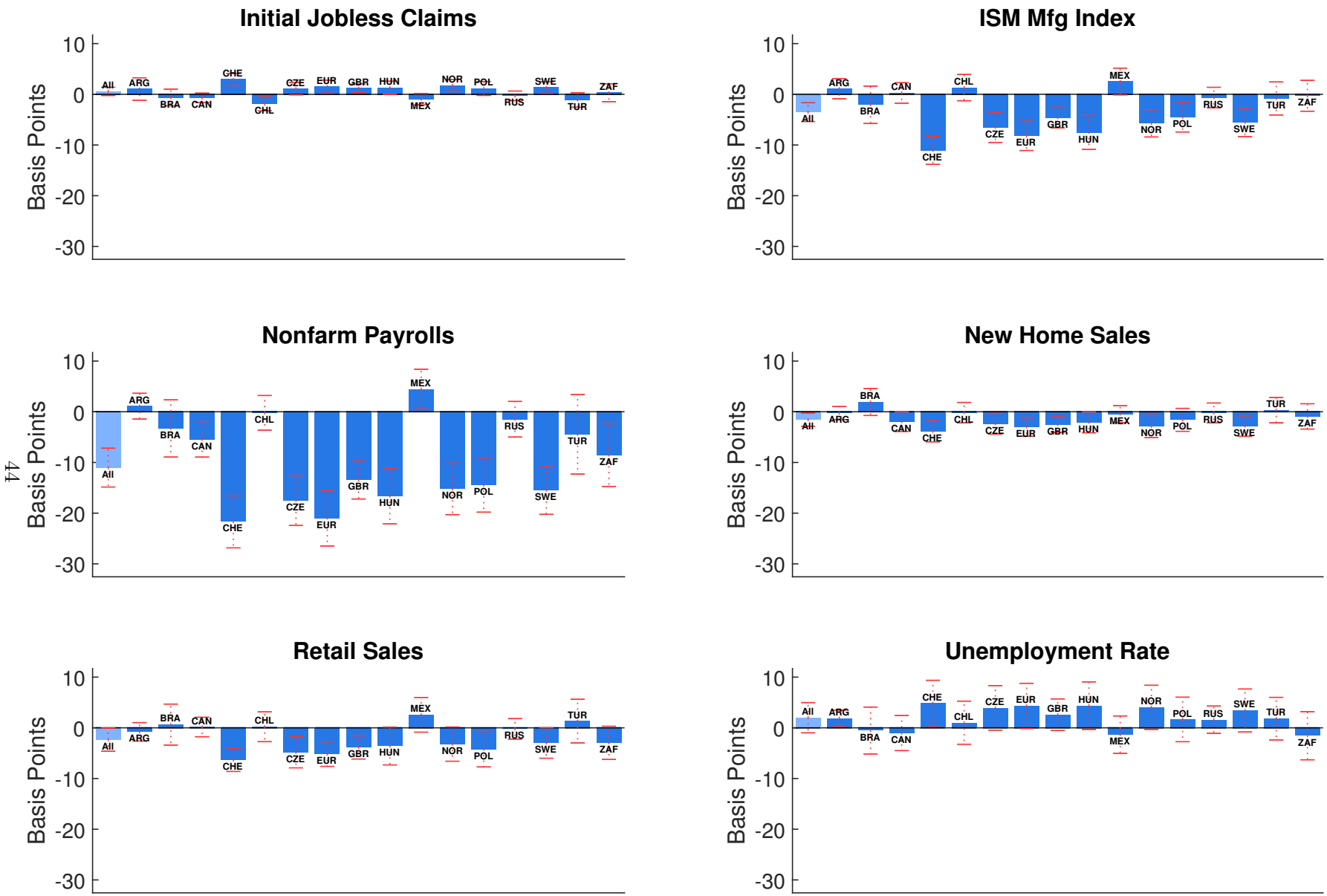




This figure shows the equity market responses for all releases. The light blue bar shows the pooled effect (Equation (9) with common coefficient γ^y instead of γ_i^y) while the dark blue bars show the country-specific effect, obtained from estimating equation (9). Missing country bars depict cases in which the country is dropped because it had less than 24 observations for a given announcement. The red error bands depict 95 percent confidence intervals, where standard errors are clustered at the event-level.

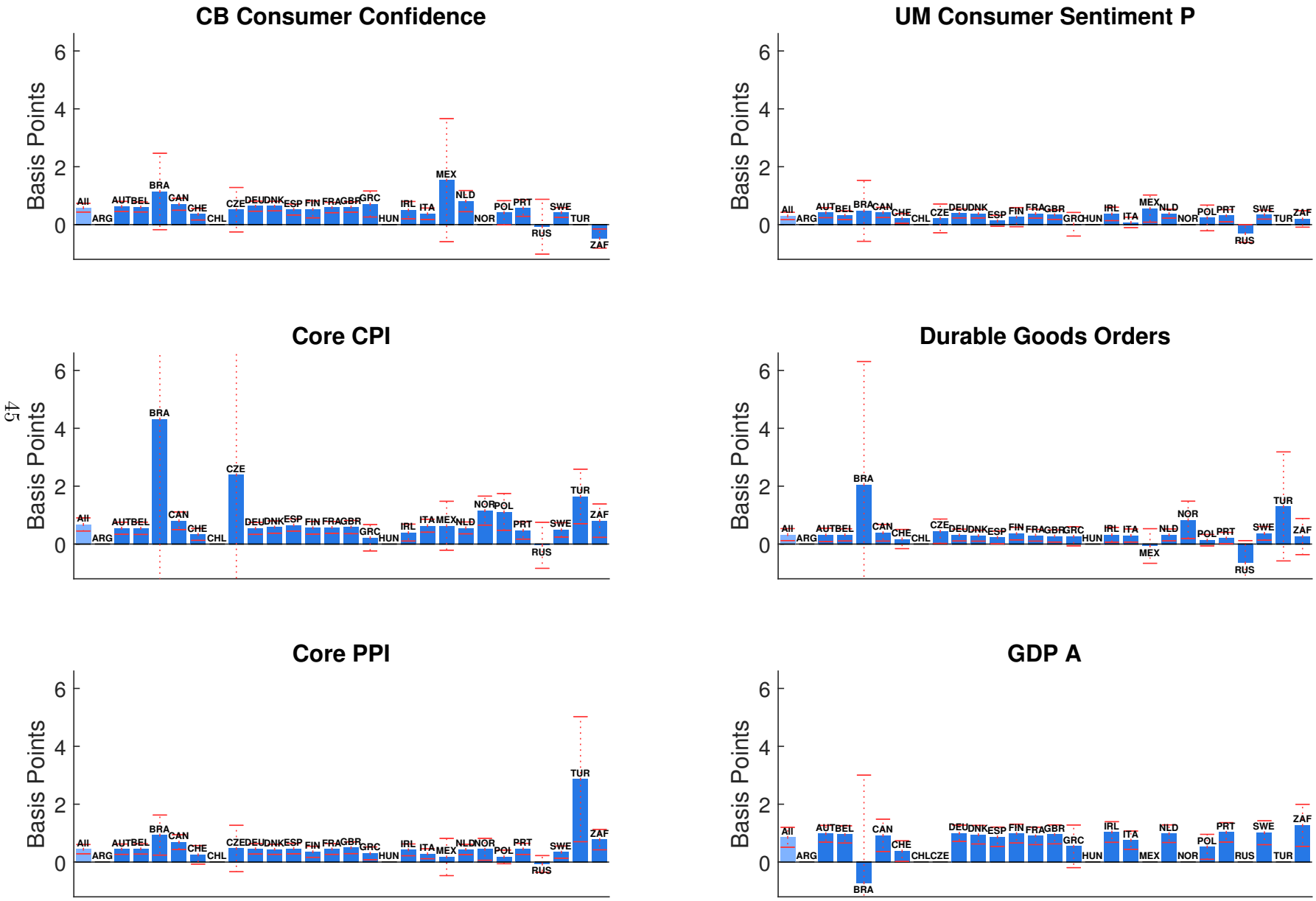
Figure B5: Response of U.S. Dollar Exchange Rates for All Announcements





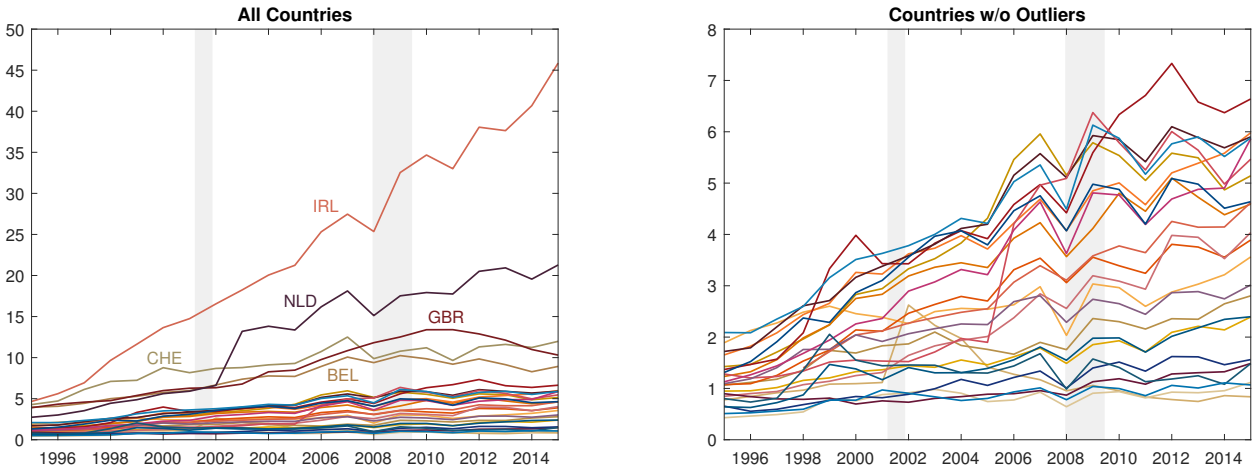
Notes: This figure shows the U.S. dollar exchange rate responses for all releases. The light blue bar shows the pooled effect (Equation (9) with common coefficient γ^y instead of γ_i^y) while the dark blue bars show the country-specific effect, obtained from estimating equation (9). Missing country bars depict cases in which the country is dropped because it had less than 24 observations for a given announcement. The red error bands depict 95 percent confidence intervals, where standard errors are clustered at the event-level.

Figure B6: Response of 10-Year Bond Yield for All Announcements



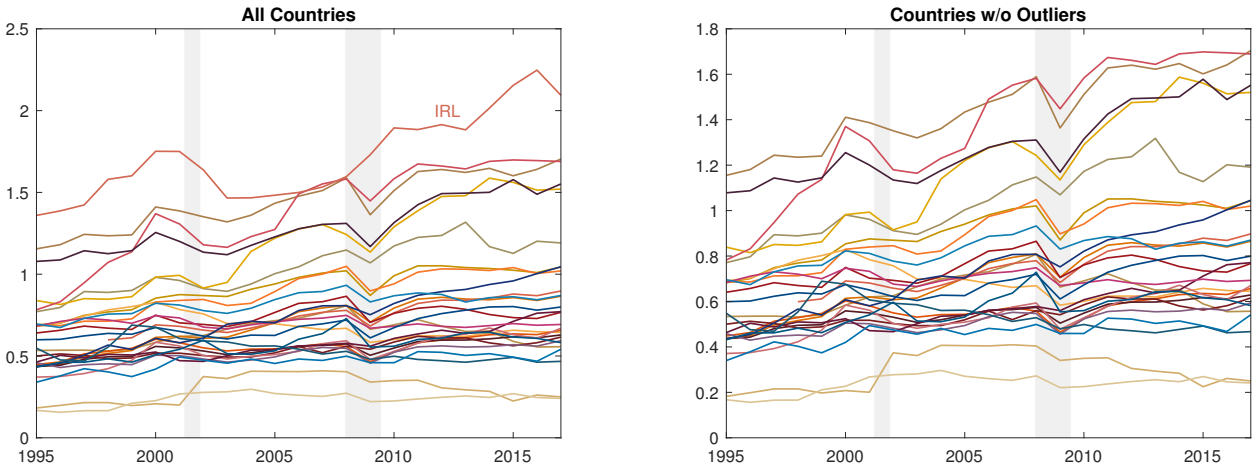
Notes: This figure shows the 10-year government bond yield responses for all releases. The light blue bar shows the pooled effect (Equation (9) with common coefficient γ^y instead of γ_i^y) while the dark blue bars show the country-specific effect, obtained from estimating equation (9). Missing country bars depict cases in which the country is dropped because it had less than 24 observations for a given announcement. The red error bands depict 95 percent confidence intervals, where standard errors are clustered at the event-level.

Figure B7: Time Series of Financial Integration by Country



Notes: This figure shows the time series of financial integration from 1995 to 2015. The construction of the measure follows equation (11). The left hand side graph depicts the time series for all countries in the sample. The right hand side excludes the time series for the five outliers, i.e. Belgian, Ireland, Netherlands, Switzerland, and the United Kingdom. Note that the Euro Area is a separate line in both graphs.

Figure B8: Time Series of Trade Integration by Country



Notes: This figure shows the time series of trade integration from 1995 to 2017. The construction of the measure follows equation (12). The left hand side graph depicts the time series for all countries in the sample. The right hand side excludes the time series for the five outliers, i.e. Ireland. Note that the Euro Area is a separate line in both graphs.

Table B1: Financial Integration — All Countries

	CB Consumer Confidence	UM Consumer Sentiment P	Core CPI	Durable Goods Orders	Core PPI	GDP A	Initial Jobless Claims	ISM Mfg Index	Nonfarm Payrolls	New Home Sales	Retail Sales	Unemployment Rate
Stock Index (bp)												
News	13.83***	6.22***	-9.13***	6.30***	-4.63***	19.58***	-5.26***	12.13***	18.64***	4.27***	10.04***	-2.90
	(2.03)	(1.70)	(1.80)	(1.74)	(1.38)	(3.68)	(0.78)	(2.29)	(2.65)	(1.44)	(2.29)	(3.09)
Fin. Integration × News	0.95	0.31	1.30**	-0.63	1.52***	-1.48	-0.38	2.15***	8.14***	0.99*	1.09**	0.28
	(0.59)	(0.42)	(0.57)	(0.44)	(0.46)	(1.39)	(0.25)	(0.73)	(1.11)	(0.54)	(0.46)	(0.72)
R^2	0.14	0.05	0.10	0.06	0.04	0.18	0.03	0.10	0.14	0.03	0.10	0.01
Observations	5149	4819	4919	4785	4998	1638	20799	4740	4881	4990	5020	4866
Exchange Rate (bp)												
News	-0.43	-0.86	-4.46***	-2.02**	-2.86***	-8.57***	0.56	-3.41***	-12.66***	-1.66**	-2.34*	2.00
	(1.20)	(0.86)	(1.14)	(0.84)	(0.88)	(2.46)	(0.43)	(1.05)	(2.14)	(0.71)	(1.21)	(1.60)
Fin. Integration × News	-0.89***	-0.65**	0.67	-0.62**	0.01	-2.26***	0.46**	-2.04***	-6.25***	-1.24***	-1.52***	0.43
	(0.30)	(0.28)	(0.42)	(0.30)	(0.31)	(0.69)	(0.19)	(0.39)	(0.83)	(0.36)	(0.40)	(0.70)
R^2	0.01	0.02	0.07	0.02	0.04	0.11	0.03	0.05	0.15	0.02	0.08	0.03
Observations	3416	3115	3265	3244	3344	1103	14125	3410	3319	3345	3335	3309
10-Year Bond Yield (bp)												
News	0.65***	0.32***	0.61***	0.32***	0.45***	0.89***	-0.33***	0.94***	1.70***	0.35***	0.54***	-0.48***
	(0.08)	(0.07)	(0.12)	(0.11)	(0.09)	(0.18)	(0.04)	(0.09)	(0.22)	(0.07)	(0.10)	(0.16)
Fin. Integration × News	-0.07	0.02	-0.22***	-0.03	-0.05	0.03	-0.02	0.04	0.21**	-0.02	0.06	0.08
	(0.04)	(0.04)	(0.07)	(0.04)	(0.03)	(0.08)	(0.02)	(0.04)	(0.08)	(0.03)	(0.04)	(0.05)
R^2	0.09	0.04	0.04	0.02	0.07	0.14	0.01	0.16	0.18	0.03	0.08	0.03
Observations	3646	3420	3784	3694	3876	1211	16210	3463	3787	3559	3859	3780

Notes: This table presents the regression results of equation (10) using the financial integration measure for all announcements and all countries. Each of the four panels shows the results for a different dependent variable. Standard errors are clustered at event-level and reported in parentheses. ***, **, and * refer to significance at the 1, 5, and 10 percent level.

Table B2: Trade Integration — All Countries

	CB Consumer Confidence	UM Consumer Sentiment P	Core CPI	Durable Goods Orders	Core PPI	GDP A	Initial Jobless Claims	ISM Mfg Index	Nonfarm Payrolls	New Home Sales	Retail Sales	Unemployment Rate
Stock Index (bp)												
News	13.11***	6.16***	-9.05***	6.14***	-4.19***	19.44***	-5.00***	11.48***	17.70***	4.07***	10.03***	-2.43
	(1.92)	(1.60)	(1.73)	(1.68)	(1.31)	(3.56)	(0.75)	(2.14)	(2.62)	(1.37)	(2.32)	(2.93)
Trade Integration × News	-0.58	-0.09	1.56***	-0.37	1.56***	-2.92**	0.42*	0.78	2.85***	0.02	-0.42	-0.08
	(0.53)	(0.45)	(0.54)	(0.41)	(0.45)	(1.37)	(0.22)	(0.73)	(0.76)	(0.51)	(0.40)	(0.62)
R^2	0.13	0.05	0.10	0.05	0.04	0.19	0.03	0.10	0.12	0.03	0.11	0.01
Observations	5756	5417	5432	5326	5537	1818	23135	5271	5415	5571	5531	5400
Exchange Rate (bp)												
News	-0.70	-0.98	-5.98***	-2.14**	-3.02***	-8.26***	0.54	-3.48***	-11.78***	-1.61**	-2.34*	2.14
	(1.13)	(0.82)	(1.17)	(0.82)	(0.84)	(2.41)	(0.42)	(0.99)	(2.09)	(0.68)	(1.22)	(1.54)
Trade Integration × News	-0.79	-1.03***	0.08	-0.33	-0.02	-1.23	0.30	-2.34***	-6.30***	-1.24***	-1.35**	0.95
	(0.48)	(0.35)	(0.42)	(0.31)	(0.35)	(1.33)	(0.22)	(0.50)	(0.93)	(0.42)	(0.55)	(0.74)
R^2	0.01	0.02	0.08	0.02	0.04	0.10	0.02	0.06	0.13	0.02	0.08	0.03
Observations	3798	3495	3629	3608	3711	1225	15707	3783	3684	3712	3696	3674
10-Year Bond Yield (bp)												
News	0.61***	0.31***	0.67***	0.33***	0.45***	0.89***	-0.31***	0.90***	1.59***	0.31***	0.52***	-0.45***
	(0.08)	(0.07)	(0.11)	(0.11)	(0.08)	(0.18)	(0.04)	(0.08)	(0.21)	(0.07)	(0.10)	(0.15)
Trade Integration × News	-0.03	0.03	-0.17*	-0.04	-0.05**	0.08	-0.01	0.06	-0.00	-0.03	0.00	0.01
	(0.04)	(0.03)	(0.10)	(0.06)	(0.02)	(0.10)	(0.02)	(0.04)	(0.05)	(0.03)	(0.03)	(0.05)
R^2	0.08	0.04	0.04	0.02	0.07	0.14	0.01	0.15	0.17	0.02	0.08	0.03
Observations	4108	3873	4240	4158	4348	1352	18261	3860	4266	4000	4310	4259

Notes: This table presents the regression results of equation (10) using the trade integration measure for all announcements and all countries. Each of the four panels shows the results for a different dependent variable. Standard errors are clustered at event-level and reported in parentheses. ***, **, and * refer to significance at the 1, 5, and 10 percent level.

Table B3: Financial Integration — with Country FE × news controls

	CB Consumer Confidence	UM Consumer Sentiment P	Core CPI	Durable Goods Orders	Core PPI	GDP A	Initial Jobless Claims	ISM Mfg Index	Nonfarm Payrolls	New Home Sales	Retail Sales	Unemployment Rate
Stock Index (bp)												
Fin. Integration × News	1.66	-0.79	4.10	-0.02	7.30***	-1.46	-3.52***	10.24***	23.11***	5.25**	10.08***	-1.70
	(2.85)	(2.51)	(2.72)	(2.56)	(2.43)	(5.34)	(1.11)	(3.56)	(3.01)	(2.66)	(2.42)	(3.42)
R^2	0.16	0.07	0.12	0.07	0.07	0.20	0.04	0.14	0.22	0.06	0.14	0.01
Observations	3998	3788	3757	3667	3812	1251	15905	3675	3719	3886	3836	3709
Exchange Rate (bp)												
Fin. Integration × News	4.40***	0.22	-3.18**	-0.02	-1.55	1.70	-2.36***	2.21	-5.59*	-0.80	-0.56	-3.66
	(1.23)	(1.33)	(1.54)	(1.22)	(1.65)	(3.17)	(0.62)	(1.56)	(3.16)	(1.21)	(1.91)	(2.30)
R^2	0.04	0.03	0.11	0.03	0.07	0.13	0.07	0.08	0.16	0.04	0.10	0.04
Observations	2944	2701	2799	2786	2866	947	12123	2932	2843	2887	2859	2835
10-Year Bond Yield (bp)												
Fin. Integration × News	-0.10	-0.15	-0.48***	-0.05	-0.26**	-0.00	-0.08	-0.14	0.81***	-0.04	0.24*	0.60***
	(0.12)	(0.12)	(0.17)	(0.13)	(0.13)	(0.17)	(0.06)	(0.12)	(0.24)	(0.13)	(0.14)	(0.20)
R^2	0.16	0.05	0.07	0.02	0.10	0.14	0.02	0.14	0.20	0.03	0.09	0.06
Observations	2707	2541	2840	2788	2918	893	12199	2560	2853	2649	2905	2848

Notes: This table presents the regression results of equation (10) but control additionally for country fixed effects interacted with the surprise of interest and with all other surprises. Each of the four panels shows the results for a different dependent variable. Standard errors are clustered at event-level and reported in parentheses. ***, **, and * refer to significance at the 1, 5, and 10 percent level.

Table B4: Trade Integration — with Country FE × news controls

	CB Consumer Confidence	UM Consumer Sentiment P	Core CPI	Durable Goods Orders	Core PPI	GDP A	Initial Jobless Claims	ISM Mfg Index	Nonfarm Payrolls	New Home Sales	Retail Sales	Unemployment Rate
Stock Index (bp)												
Trade Integration × News	3.74	-3.29	6.04	1.83	9.82***	-1.40	-1.08	15.88**	28.92***	4.27	15.87***	-5.01
	(4.78)	(3.20)	(3.81)	(3.54)	(3.68)	(8.45)	(1.69)	(6.16)	(4.98)	(4.05)	(4.33)	(5.94)
R^2	0.15	0.07	0.12	0.07	0.06	0.22	0.03	0.12	0.18	0.05	0.14	0.01
Observations	5504	5186	5177	5083	5274	1732	22049	5041	5158	5328	5270	5144
Exchange Rate (bp)												
Trade Integration × News	5.21***	-1.77	-5.73**	1.68	-3.76**	8.01*	-2.97***	0.89	-6.00	-2.10	0.85	-3.26
	(1.87)	(1.72)	(2.21)	(1.49)	(1.49)	(4.76)	(0.87)	(1.92)	(3.97)	(1.58)	(3.34)	(3.05)
R^2	0.04	0.04	0.12	0.03	0.07	0.15	0.06	0.09	0.16	0.03	0.10	0.04
Observations	3798	3495	3629	3608	3711	1225	15707	3783	3684	3712	3696	3674
10-Year Bond Yield (bp)												
Trade Integration × News	-0.15	-0.22	-0.26	-0.09	-0.38*	-0.29	0.09	-0.18	0.44	-0.33	-0.07	0.83**
	(0.22)	(0.17)	(0.26)	(0.17)	(0.21)	(0.33)	(0.11)	(0.19)	(0.41)	(0.21)	(0.26)	(0.38)
R^2	0.12	0.05	0.06	0.03	0.11	0.15	0.02	0.16	0.19	0.03	0.08	0.05
Observations	3903	3671	4031	3952	4135	1282	17362	3664	4061	3796	4099	4054

Notes: This table presents the regression results of equation (10) but control additionally for country fixed effects interacted with the surprise of interest and with all other surprises. Each of the four panels shows the results for a different dependent variable. Standard errors are clustered at event-level and reported in parentheses. ***, **, and * refer to significance at the 1, 5, and 10 percent level.