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## Assessing spill-over effects of US monetary policy and macroeconomic announcements on financial markets in Argentina

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**No. 23-2008**

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**Assessing Spill-Over Effects of U.S. Monetary Policy and  
Macroeconomic Announcements on Financial Markets in  
Argentina**

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**Assessing Spill-Over Effects of U.S. Monetary Policy and Macroeconomic  
Announcements on Financial Markets in Argentina**

**Abstract**

We study the effects of U.S. monetary policy and macroeconomic announcements on Argentine money, stock and foreign exchange markets' returns and volatility over the period 1998 to 2006 using a GARCH model. Firstly, we show that both types of news have a significant impact on all markets. Secondly, we conclude that the Argentine markets have become less dependent on U.S. news after the abandonment of the currency board. Thirdly, we find that U.S. dollar-denominated assets react less to news which suggests that the currency board was not completely credible. Fourthly, we discover that financial markets react stronger during the financial crisis. Fifthly, in the case of peso-denominated assets, U.S. central bank communication helps to reduce money market volatility during the financial crisis in Argentina.

JEL: E52, F33, G14, G15

Keywords: Argentina, Financial Markets, U.S. Monetary Policy, Federal Reserve Bank, Central Bank Communication, Macroeconomic Announcements

## 1. Introduction

The impact of central bank communication and macroeconomic announcements on financial markets in the United States has been studied extensively. Concentrating on the formal and informal channels of central bank communication many papers find that U.S. financial markets react to this news. However, given that the U.S. is the world's largest economy it is likely that its economic news matters for other countries, too. To our knowledge there are only few studies addressing this issue and these papers assess either the reaction to changes in monetary policy instruments or the impact of macroeconomic announcements. This paper considers both types of influences simultaneously and also applies a newly constructed data set on speeches of FOMC members on monetary policy inclination and economic outlook.

As a case study, investigating financial markets in Argentina over the years 1998-2006 is of particular interest. Until February 2002, the Argentine central bank had no room for national monetary policy discretion due to the existence of a currency board system with the U.S. dollar. Given this fixed exchange rate regime, we expect U.S. developments to have a substantial impact on the Argentine economy. For instance, in the context of the Hong Kong currency board Lo (2005) reports that in response to a U.S. contractionary monetary shock domestic output falls dramatically. Studying this period of recent Argentine economic history also allows an analysis of how news from the anchor country affect financial markets during the phase of the currency board breakdown and the abandonment of the exchange rate peg. Over the course of the crisis in 2001-2002 money market rates reached 127 percentage points amid extremely high volatility. Finally, it is also possible to study how financial markets in Argentina react to U.S. news after entering the new regime of flexible exchange rates with the U.S. dollar.

Within the context of these three phases of the Argentine economy, we want to address six specific research questions: Firstly, do U.S. central bank communication and U.S. macroeconomic announcements exert any influence on Argentine financial market returns? Secondly, does the creation of the currency board affect the strength of this effect? Thirdly, was the currency board credible? Fourthly, is the reaction of financial markets to news stronger during the financial crisis? Fifthly, do spill-over effects (i.e. Argentinean variables mirroring the development in the U.S.) or does diversifying behavior (i.e. investors move from one region to another) dominate financial market reactions in Argentina after observing U.S. news? Sixthly, does U.S. news have an impact on Argentine financial markets' volatility?

The remainder of this paper is organized as follows. In the next section, we summarize the previous work in this area and outline the contributions of this paper. Section 3 describes the construction of the news dummies and explains our data set as well as the econometric methodology. Section 4 reports our empirical results for the money, stock, and foreign exchange markets. Some robustness checks and alternative specifications are shown in section 5. Section 6 concludes.

## **2. Related literature and our contribution**

There are few papers which study spill-over effects of U.S. monetary policy and U.S. macroeconomic announcements on foreign financial markets. Wongswan (2005) analyzes the response of global equity indices to U.S. monetary policy announcements from September 1998 to November 2004. Using intraday data he calculates surprises from expectations derived from federal funds futures and finds that the Argentine Merval Index falls significantly by 6 percentage points after a surprise of 100 bps. However, when excluding inter-meeting target rate moves the coefficient becomes insignificant. He also concludes that the transmission of news across these countries is due to financial integration rather than trade linkages or flexible exchange rates.

Also employing intraday data, Robitaille and Roush (2006) examine the reaction of Brazilian sovereign yield spreads and stock prizes to FOMC announcements and U.S. macroeconomic surprises from February 1999 to April 2005. They find that announcements of a U.S. interest rate hike lead to an increase in bond spreads and a decline in the Bovespa index. Non-farm payroll news as well as CPI surprises tend to raise spreads and cause a fall in share prices.

Andritzky et. al (2007) investigate the reaction of emerging market bonds to U.S. macroeconomic announcements and target rate changes employing daily data from January 1998 to July 2004. Global bond spreads tend to respond more to rating actions and changes in U.S. rates than to the respective domestic news. Concerning volatility they conclude that U.S. macroeconomic data and policy announcements reduce uncertainty and stabilize spreads. Assessing country sub-samples they find that U.S. announcements matter less for countries with more transparent policies and higher credit ratings. They obtain that in times of crises investors tend to focus more on simple and timely indicators than on rating actions.

Wongswan (2006) analyzes the transmission of U.S. and Japanese macroeconomic announcements and interest rate decisions on financial markets in developing countries during the years 1995 to 2000. Using high-frequency data he concludes a large and significant

association between news originating in the U.S. and Japan and volatility, as well as trading volumes, in the Korean and Thai equity indices.

Several other papers deal with spill-over effects within OECD countries. For instance, Gravelle and Moessner (2001) conclude that U.S. news has a significant impact on Canadian interest rates. Two-way interdependencies between Europe and the United States are reported by Ehrmann and Fratzscher (2005). Albuquerque and Vega (2006) find a significant influence of U.S. macroeconomic news on the Portuguese stock market.

In this paper, we study the effects of all types of FOMC communication (including target rate movements) and U.S. macroeconomic announcements on money, stock and foreign exchange markets' returns and volatility in Argentina. The communication events are coded into dummy variables on the basis of their written content. We differentiate between news regarding monetary policy and economic outlook in our examination of post-meeting statements, monetary policy reports, speeches and testimonies. The macroeconomic news dummies are constructed as surprise components of eleven commonly watched business cycle and price indicators. In our view, the sample choice (1998-2006) is particularly useful as it includes several changes in the FOMC communication strategy as well as the switch in the Argentine exchange rate regime and the financial crisis. Econometrically, we employ a rich GARCH specification of daily financial returns to capture the autoregressive conditional heteroscedasticity that characterizes many financial series.

### **3. Data and econometric methodology**

In our analysis we use the data set introduced and extensively described in Hayo et al. (2008). It includes summaries of 1439 speeches and 151 congressional hearings, thereby covering all FOMC members as well as 68 post-meeting statements and 20 monetary policy reports (MPR). Following the literature (see e.g. Ehrmann and Fratzscher, 2007), we categorize the communications' content into a monetary policy and an economic outlook component. The coding for the U.S. economic outlook news is either "positive" (EO+) or "negative" (EO-), while "tightening" (MP+) or "easing" (MP-) are the categories for the monetary policy stance of the Fed. In the analysis, we employ dummy variables that are split into positive and negative news to take into account possible asymmetric reactions of financial markets.<sup>1</sup> In total, there are sixteen communication dummies as all four types

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<sup>1</sup> Evidence of this type of asymmetries can, for instance, be found in the impact of IMF statements on financial returns in emerging markets (Hayo and Kutan, 2005a) or in the effects of FOMC communication on U.S. financial markets' returns (Hayo et al., 2008).

(statements, MPR, testimonies, speeches) can be coded into the four different categories EO+, EO-, MP+, and MP-.

The surprise components of several macroeconomic indicators typically watched by financial market participants are also subject to examination. We choose eleven important news items from the list given by Ielpo and Guégan (2007): Advance GDP, Industrial Production, and Trade Balance to capture the growth expectations; the ISM manufacturing index and the Conference Board Consumer Confidence for producers' and consumers' confidence; Housing Starts for real estate effects, Non-Farm Payroll and the Unemployment Rate to proxy labor market conditions; Retail Sales for actual consumption; and Consumer Price Index and Producer Price Index for inflation. These variables enter the equations separated into positive and negative impulse dummies on the day of their announcement.

Our Argentine financial market indicators comprise daily closing inter-bank lending rates and daily returns on stock and foreign exchange markets over the time period from 2 January 1998 to 28 December 2006.<sup>2</sup> As dependent variables, we employ daily changes of the 3 month, 6 month and 1 year Buenos Aires Inter-bank Offered Rate. Until the abandonment of the currency board in February 2002 we examine both peso- and dollar-denominated inter-bank rates. We also assess the daily growth rates of the Merval Stock Index and the dollar/peso spot rate, respectively.

In a first step, we split the sample into the periods during and after the currency board regime. As it turns out, some of the regressions do not achieve convergence while others did not reveal economically interesting results. A more detailed analysis of the sample indicates that this outcome is probably driven by the extraordinarily high volatility in the months before and after the renouncement of the currency board.<sup>3</sup> Therefore, after an extensive grid-based search, we split the sample into three sub-samples, which then yields stable estimates: the first ends on 16 March 2001 and is called the “pre-crisis” sub-sample or “currency board” period. The second sub-sample closes on 20 November 2002 and is named “crisis” period. The “post-crisis” or “floating exchange rate” period follows thereafter until the end of our sample window.<sup>4</sup>

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<sup>2</sup> Data sources: U.S. bond market and foreign exchange market series: Federal Reserves' statistical releases H10 and H15; stock market series: Yahoo! Finance database; Argentine inter-bank lending rates: Central Bank of Argentina statistical database; Surveys of macroeconomic announcements: Bloomberg newswire. Due to different holidays and non-trading days for the various assets some days had to be excluded. After adjusting the dataset 2075 observations remain. The daily returns are calculated after these adjustments.

<sup>3</sup> Table A2 in the Appendix shows that the means and variances of the estimated conditional historic variances are quite small in the first and third sub-sample, while the ones in the crisis sub-sample are exceptionally high.

<sup>4</sup> The dollar-denominated interest rate series are discontinued on 1 February 2002, so the “dollar crisis” sub-samples ends on this day. The dollar/peso spot rate is only used as an endogenous variable in the third sub-



### Specification for level estimations

Descriptive statistics show that all financial markets series exhibit excess kurtosis (see Table A1 in the Appendix).<sup>5</sup> GARCH models increase estimation efficiency in time series characterized by volatility clustering. We start with a generalized version of the GARCH specification proposed by Bollerslev (1986) and apply a testing-down process to further increase estimation efficiency.

$$\begin{aligned}
 \text{returns}_t &= \gamma + \sum_{r=1}^5 \delta_r \cdot \text{returns}_{t-r} + \sum_{r=1}^5 \zeta_r \cdot \text{other markets' and U.S. returns}_{t-r} \\
 &+ \eta \cdot \text{ID} + \theta \cdot \text{US Macroeconomic Announcements}_t + \iota \cdot \text{FFTR movements}_t \\
 &+ \lambda \cdot \text{U.S. Communication Dummies}_t + \nu \cdot h_t + \mu_t, \\
 (1) \quad \mu_t &= \varepsilon_t h_t^{1/2}, \\
 h_t &= \alpha_0 + \alpha_1 (\mu_{t-1} - \kappa_1)^2 + \kappa_2 \tau (\mu_{t-1} - \kappa_1)^2 + \beta_1 h_{t-1}, \\
 \tau &= 1 \text{ if } \mu_{t-1} < \kappa_1 \text{ and zero otherwise.}
 \end{aligned}$$

where  $\alpha_0, \alpha_1, \beta_1, \mu, \kappa_1, \kappa_2, \gamma, \delta, \zeta, \eta, \theta, \iota, \lambda,$  and  $\nu$  are parameters or vectors of parameters,  $h$  is the conditional variance,  $\tau$  is an indicator function as defined in the last line above, and  $\varepsilon_t | \Gamma_{t-1} = t(\nu)$ ; with  $\Gamma_{t-1}$  capturing all information up to  $t-1$ , and  $t(\nu)$  a  $t$ -distribution with  $\nu$  degrees of freedom.

The general specification (1) is an autoregressive-distributed lag model with five lags.<sup>6</sup> Contemporaneous other markets' and U.S. returns are excluded to avoid potential simultaneity problems. We also control for movements in the Federal Funds Target Rate by including separate dummies for rate hikes and cuts. Rate movements after unscheduled FOMC meetings are captured by an additional dummy. To avoid spurious correlations, we include a number of impulse dummies (ID) in the crisis sample to take into account exceptional events not captured by our types of news dummies.<sup>7</sup>

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sample as it was pegged until February 2002 and still heavily influenced by monetary policy actions in the first months after the breakdown of the currency board.

<sup>5</sup> In the case of the three stock market series there is only mild evidence of excess kurtosis.

<sup>6</sup> The lag structure is shortened to three in the regressions concerning dollar-denominated interest rates in the crisis sub-sample.

<sup>7</sup> These impulse dummy variables correspond to the first trading day in our sample after the respective event: 12 July 2001: worse credit rating; 17 September 2001: 9/11; 1 November 2001: public debt swap; 30 November 2001: bank run; 4 December 2001 (dollar series only): capital restrictions to contain bank run; 5 December 2001 (dollar series only): International Monetary Fund denies release of financial aid; 22 January 2002 (dollar series only): first exchange rate devaluation; 25 January 2002 (peso series only): sample break; 15 February 2002 (peso series only): abandonment of currency board.

Model (1) allows for several special features: First, student-t distributed errors (Bollerslev (1987)) are assumed; these provide a better approximation to residuals that are not normally distributed. Second, the variance enters the main equation (Engle et al. (1987)) to test whether volatility as a measure of risk is priced in the markets. Asymmetric effects of shocks (Engle and Ng (1993)), defined as last periods forecast errors, are included in the model if  $\kappa_1$  is significantly different from zero. In addition, asymmetry thresholds (Glosten et al. (1993)) are captured when  $\kappa_2$  is not equal to zero.

After estimating these rich GARCH(1,1) models we exclude all insignificant variables in a general-to-specific approach. In case that we cannot rule out an integrated GARCH process (Nelson (1990)) we ensure stationarity by imposing appropriate a priori restrictions. Serial correlation is left in two of the regressions (pre-crisis 6 month dollar, crisis 1 year dollar) as the Portmanteau statistics are significant at the five percent level. Diagnostic testing shows that non-normality appears to be present in all but two series (crisis 3 and 6 month dollar) and we consequently use robust standard errors as suggested by Bollerslev and Wooldridge (1992).

### **Specification for volatility estimations**

The specification put forward in (1) turns out to be too demanding for the analysis of an impact of news variables on the conditional variance. The large number of dummy variables in the models prevents convergence in the estimation procedures (see Doornik and Ooms, 2008). Therefore, we simplify the specifications as given in equation (2):

$$\begin{aligned}
 & returns_t = \delta \cdot returns_{t-1} + \eta \cdot ID + \theta \cdot Aggregated\ Macroeconomic\ Announcements_t \\
 & + \iota \cdot FFTR\ movements_t + \lambda \cdot Aggregated\ Communication\ Dummies_t + \nu \cdot h_t + \mu_t, \\
 (2) \quad & \mu_t = \varepsilon_t h_t^{1/2}, \\
 & h_t = \alpha_0 + \alpha_1 (\mu_{t-1} - \kappa_1)^2 + \kappa_2 \tau (\mu_{t-1} - \kappa_1)^2 + \beta_1 h_{t-1} + \lambda \cdot Event\ Dummies_t, \\
 & \tau = 1 \text{ if } \mu_{t-1} < \kappa_1 \text{ and zero otherwise,}
 \end{aligned}$$

where the parameters are defined as above.

Some of the control variables used in (1) are omitted and the macroeconomic announcements are condensed into real and price indicator announcements with codings +1, 0, and -1. All Communication Dummies are aggregated into economic outlook and monetary policy dummy variables with +1, 0, and -1 codings and the target rate movements are merged in the same way.

We run three sets of regressions for all series. Firstly, we test whether a dummy variable capturing all events (EO+, EO-, MP+, MP-, 11 types of macroeconomic shocks) affects the conditional volatility of financial market returns. Secondly, we distinguish between the occurrence of communication (EO+, EO-, MP+, MP-) and macroeconomic news (11 types of macroeconomic shocks) by creating two separate variables. Thirdly, we differentiate between good and bad news independent of the type of announcements or shocks. After estimating these models we exclude all insignificant variables using a general-to-specific approach.

#### 4. Analyzing the effects on returns and volatility

We first discuss the effects of news on financial market returns for each of our three sample periods.<sup>8</sup>

##### **Pre-crisis sub-sample: Effects on returns**

Table 1a shows the impact of news before the financial crisis on peso-denominated money market returns as well as on the equity market.

(Weak) market efficiency is violated on all money markets as past interest rates help to predict today's. Note the difference to the stock market, which appears to be efficient. There are portfolio diversification effects in the case of interest rates, as a bullish stock market will depress money market rates. The negative sign of the conditional variance suggests that volatility is particularly high during phases of falling interest rates. Note that U.S. stocks and interest rates have no influence on Argentine yields (i.e. they did not survive the testing-down process).<sup>9</sup>

Assessing central bank news we find mixed signs across the maturity spectrum as a sound (poor) U.S. economic outlook can cause some rates to rise and others to decline. For instance, this can be seen in the impact of negative post-meeting statements: the three and twelve month rates fall, while the six month rate rises on such days. Because of these mixed signs in the pre-crisis period we cannot decisively conclude whether Argentinean financial markets mirror the U.S. reactions to central bank communications or whether diversification effects across the two countries dominate.

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<sup>8</sup> Note in the following interpretations of the estimation results that our variables of interest are transformed into daily returns (stock prices/foreign exchange rates) or differences (interest rates). Moreover, the comparisons of coefficients within or across models are generally based on point estimates and the statistical significance of these effects is noted separately.

<sup>9</sup> For instance, Hayo and Kutan (2005b) obtain an impact of past S&P 500 values on Russian bond and stock markets.

Table 1a: Results for the pre-crisis sub-sample (peso-denominated Baibor and Merval index)

	3 month peso	6 month peso	1 year peso	Merval
Conditional Variance in Mean	-0.09*	-0.11**	-0.09**	
Baibor <sub>t-1</sub>	0.32**	0.30**	0.13**	
Baibor <sub>t-2</sub>	0.12**	0.22**		
Baibor <sub>t-3</sub>	0.09*			
Baibor <sub>t-4</sub>			0.08**	
Baibor <sub>t-5</sub>			0.05*	
Merval <sub>t-1</sub>	-0.40**			
Merval <sub>t-2</sub>			-0.45*	
FFTR Cut			0.16**	
FFTR Inter Meeting Cut				0.04**
Statements EO Negative	-0.07**	0.07*	-0.31**	
MPR EO Negative	0.03**			-0.02**
Testimonies EO Positive	0.02**	-0.05**		-0.06**
Speeches MP Tightening	-0.02*			-0.01*
GDP Negative	-0.09**			0.02**
Industrial Production Positive				-0.01*
Trade Balance Positive		-0.04*		
Retail Sales Positive		0.05**		
Housing Starts Negative	0.03*	0.03*		
Non-farm Payroll Negative				0.01*
CPI Positive	0.05*			-0.03**
CPI Negative	-0.04**			

Notes: \* (\*\*) indicates significance at a 5% (1%) level. Standard errors are heteroscedasticity-consistent. Only the variables of interest of the reduced model resulting from the testing-down process are listed. Full tables are available upon request.

News concerning the economic outlook is generally characterized by showing relatively more significant effects compared to those news directly referring to the future course of monetary policy. Since in a currency board there is no room for Argentine monetary policy discretion we expect U.S. monetary policy to exert a relatively larger impact. It could be the case that the forward looking character of monetary policy is better captured by the economic outlook variables than by the monetary policy announcements. Finally, as in Hayo et al. (2008), the impact of central bank talk is ascending with the asset's maturity.

Considering the impact of U.S. macroeconomic shocks on financial markets, we find that a higher than expected CPI announcement significantly moves 3 months rates up, an indication of the Fisher-relationship, and the stock market down. A greater than expected CPI announcement raises 3 months interest rates by more (5 bps) than a negative CPI shock reduces rates (4 bps). We also observe falling money market rates after negative U.S. GDP shocks and rising rates in the case of positive U.S. retail sale news. Negative U.S. housing news is associated with rising rates in Argentina. The reaction of 6 month rates to positive

U.S. trade balance news is negative, which could be due to the fact that a stronger trade position requires less capital inflow into the U.S. based on higher interest rates. Examining the equity market we find unambiguous evidence for diversification effects as negative U.S. GDP and employment news generate higher daily returns and better than expected U.S. industrial production news depresses the Argentinean stock market.

In Table 1b the results of the dollar-denominated counterparts are listed. Again, (weak) efficiency is violated in all markets as lagged values turn out to be significantly different from zero. U.S. markets in turn have no impact on Argentine returns. We do not find evidence for risk being priced as the conditional variance is insignificant in the mean equations.

Table 1b: Results in the pre-crisis sub-sample (dollar-denominated Baibor)

	3 month dollar	6 month dollar	1 year dollar
Baibor <sub>t-1</sub>	0.23**	0.20**	0.08**
Baibor <sub>t-2</sub>	0.14**	0.10**	
Baibor <sub>t-3</sub>		0.07**	
Baibor <sub>t-4</sub>		0.06*	
FFTR Inter Meeting Cut	-0.09**		
Statements EO Negative	-0.14**	-0.07**	-0.24**
MPR EO Negative		0.03**	
Testimonies EO Positive		-0.08**	

Notes: \* (\*\*) indicates significance at a 5% (1%) level. Standard errors are heteroscedasticity-consistent. Only the variables of interest of the reduced model resulting from the testing-down process are listed. Full tables are available upon request.

We do not find significant financial market reactions in Argentina to U.S. monetary and price indicator announcements. Negative U.S. post-meeting economic outlook statements bring down all rates, with a maximum at a one year maturity (24 bps). The three month interest rate falls after a Fed inter-meeting rate cut (9 bps), too. In the case of the six months rate, changes occur after a negative economic outlook in the Monetary Policy Reports and a positive economic outlook given in the testimonies. Once again, the economic outlook produces more significant coefficients than the monetary policy inclination.

On the one hand, one could expect dollar-denominated assets to react stronger to U.S. news than peso-denominated assets because of movements in the external value of the U.S. dollar. On the other hand, dollar assets are considered as much safer investments than peso-denominated assets and thus markets react less nervously to any U.S. news. The latter interpretation receives indirect support by the sharp increase in the spread between peso and dollar assets at the beginning of the crisis. In addition, our finding of fewer significant

coefficients can be interpreted as evidence that even during its heyday the currency board was not completely credible.<sup>10</sup> Finally, the “safe harbor” interpretation is at least indirectly supported by two tests: Compared to their respective dollar-denominated counterparts, negative post-meeting statements exert a significantly larger influence on 3 month peso rates and positive testimonies by BOG members on 6 month peso rates.<sup>11</sup>

### Crisis sub-sample: Effects on returns

Table 2a summarizes the reaction of dollar-denominated rates during the financial crisis. These series were discontinued in February 2002 and therefore our estimates are based on 186 observations only.

Table 2a: Results in the crisis sub-sample (dollar-denominated Baibor)

	3 month dollar	6 month dollar	1 year dollar
Baibor <sub>t-1</sub>	0.55**	0.42**	
Baibor <sub>t-2</sub>	-0.19*		
Baibor <sub>t-3</sub>			-0.14*
Merval <sub>t-1</sub>		2.54**	
U.S. Bond Return <sub>t-1</sub>	-6.25**	-5.67**	-6.04**
U.S. Bond Return <sub>t-2</sub>		-4.93**	-3.95*
FFTR Inter Meeting Cut	-0.86*	-0.47**	
Testimonies EO Positive	3.20**	2.24**	
Testimonies EO Negative			-1.05**
Speeches EO Negative	-0.41*	-0.25*	
Speeches MP Easing	0.54*		
GDP Positive			0.54*
Industrial Production Positive		-0.91*	
Trade Balance Negative		-0.35*	
Consumer Confidence Positive	0.25*		
Retail Sales Positive	0.81*	0.59*	
Housing Starts Positive		0.79*	0.45*
Housing Starts Negative			0.57*
Non-farm Payroll Positive	1.97*	2.20*	3.17**
Unemployment Rate Positive		1.04**	
Unemployment Rate Negative		0.52*	

Notes: \* (\*\*) indicates significance at a 5% (1%) level. Standard errors are heteroscedasticity-consistent. Only the variables of interest of the reduced model resulting from the testing-down process are listed. Full tables are available upon request.

A major difference to the results obtained for the earlier period is that now the U.S. money market matters. If U.S. interest rates go down Argentinean rates move up sharply

<sup>10</sup> This receives further evidence as one can observe a large (and during the crisis increasing) spread between peso and dollar assets.

<sup>11</sup> The outcome of these tests of differences in means under the assumption of independent samples is  $t(1498) = -3.1**$  and  $-6.3**$ , respectively.

which implies that U.S. assets are the safe harbor. In the case of the two interest rate series with shorter maturity we observe persistence while in the case of the one year series we obtain some evidence of reversion. For the six month series we find signs of capital market interdependencies, with stock market hikes pushing up interest rates. As the optimization algorithm does not achieve convergence with the conditional variance term added to the mean equation we are not able to test whether risk is priced in the markets.

In spite of the general upward trend in interest rates during the crisis period U.S. inter-meeting rate cuts have a negative effect on three and six month rates. Testimonies and speeches with a positive (negative) economic outlook bring rates up (down), with positive speeches having a larger economic impact. Speeches announcing Fed easing inclinations lead to an increase in 3 months Argentine interest rates. In spite of this last result we conclude that overall in the case of central bank talk spill-over effects dominate diversifying behavior. To compare these results with the ones before the crisis a substantial increase in the standard deviation has to be taken into account. For instance, a 25 bps inter-meeting cut brings down 3 month rates by 86 bps compared to 8.9 bps in the pre-crisis period, which is both a statistically and economically significant difference.<sup>12</sup>

Examining the macroeconomic announcements we find throughout all maturities that U.S. price indicators do not matter. Housing and unemployment news bring up interest rates, with negative news having relatively larger absolute effects.<sup>13</sup> A positive non-farm payroll shock in the U.S. has the largest economic impact on Argentina's financial markets of all macroeconomic surprises, driving up interest rates by 2 to 3 percentage points. Examining business-cycle indicators, we find significant coefficients for positive U.S. GDP news, negative U.S. trade balance news and for positive U.S. industrial production shocks. Finally, a better than expected U.S. consumer confidence index and sound retail sales affect interest rates positively.

Beside the consistently positive reaction of money markets in Argentina to U.S. unemployment and housing indicators we find spill-over effects for both U.S. central bank talk and macroeconomic announcements.<sup>14</sup> On the other hand we discover more statistically significant influences of U.S. variables on Argentinean financial markets than in the currency board era.

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<sup>12</sup> The corresponding t-test value is  $t(934) = 2.26^*$ .

<sup>13</sup> There is a significantly stronger reaction to bad news in the case of the unemployment rate:  $\text{Chi}^2(1) = 4.58^*$ .

<sup>14</sup> Due to a much higher standard deviation in the crisis period we can conclude at the five percent level and based on one test only that U.S. news has a significantly larger absolute impact on dollar-denominated assets during Argentina's financial crisis.

In Table 2b the results of peso-denominated assets and the Merval equity index are listed. The sample period includes also the months after the abandonment of the currency board that can still be described under the heading of “crisis”. (Weak) efficiency is violated in the equity market as past U.S. money and stock market figures help to predict daily returns of the Merval. Investors diversify between U.S. and Argentine markets as equity indices move in different directions. All money market series show a persistent behavior and parallel investments between U.S. and Argentinean assets at the one year maturity. We do not find any significant pricing of risk.

Table 2b: Results in the crisis sub-sample (peso-denominated Baibor and Merval index)

	3 month peso	6 month peso	1 year peso	Merval
ARG Bond Return <sub>t-1</sub>	0.38**	0.41**	0.14**	
U.S. Bond Return <sub>t-1</sub>			1.30*	
U.S. Bond Return <sub>t-5</sub>			1.89*	-0.09**
S&P 500 <sub>t-4</sub>				-0.15*
FFTR Inter Meeting Cut	-1.33**		-0.74**	0.02**
MPR EO Positive	0.97**	1.45**		
Testimonies EO Negative	-1.48**		-1.80**	
Speeches MP Easing				-0.04**
GDP Positive			1.60**	
GDP Negative			1.04*	-0.02**
Industrial Production Positive			-1.01*	
Trade Balance Positive		-0.71**		
Retail Sales Positive			0.83*	-0.02**
Non-farm Payroll Positive			-6.19**	0.03**
Non-farm Payroll Negative		-1.26*		
Unemployment Rate Positive		1.99*		
Unemployment Rate Negative		1.32*	1.16**	
CPI Positive				-0.02**
CPI Negative				0.03**

Notes: \* (\*\*) indicates significance at a 5% (1%) level. Standard errors are heteroscedasticity-consistent. Only the variables of interest of the reduced model resulting from the testing-down process are listed. Full tables are available upon request.

Leaving aside the violation of market efficiency, the behavior of the Merval index is quite normal as no signs of an extraordinarily high volatility can be seen in Tables A1 and A2. We find that a negative (lower than expected) U.S. CPI affects the Argentina’s stock market index more than a positive shock. A 25 bps inter-meeting cut raises the Merval by about 2.3 percentage points while Fed speeches indicating looser U.S. monetary policy lower the index. Negative U.S. GDP news and positive employment news matter significantly with an impact of -2.3 percent points and 3.3 percent points respectively as well as positive U.S. retail sales



with an unexpected sign. While we find both spill-over and diversification effects in our analysis of the earlier sub-sample, during the crisis the former are dominant. The impact of inter-meeting cuts before the financial crisis is statistically larger.<sup>15</sup> Given that the Merval performed quite normal during the crisis, the larger impact before the crisis could be driven by the currency board.

Turning to the money market one can see a Fed 25 bps inter-meeting rate cut moving 3 month and 1 year interest rates in Argentina down by 133 bps and 74 bps, respectively. Positive economic news communicated in U.S. monetary policy reports and negative ones originating from congressional hearings raises (lowers) 3 month rates with negative news having a statistically larger economic impact.<sup>16</sup>

U.S. price indicator shocks have no significant impact on Argentina's money markets. Assessing our real indicators we find a puzzling set of coefficients as both, positive and negative GDP news, raise the 1 year rate by 160 and 104 bps, respectively. U.S. unemployment shocks always push up interest rates, with bad news exerting a larger economic influence. Argentine money market rates fall after U.S. non-farm payroll news independently of its direction. Positive U.S. industrial production news and positive trade balance shocks also exert significant reactions, while better than expected U.S. retail sales move 1 year interest rates up by 83 bps.

While we find in the case of U.S. central bank news that spill-over effects dominate the impact of U.S. variables on Argentina's financial markets, the evidence is more mixed in the case of macroeconomic shocks. Testing the size of the effects across the samples, we find positive U.S. trade balance shocks exerting a significantly larger influence during the crisis.<sup>17</sup> However, we find many more significant coefficients of U.S. news variables during the crisis period compared to the pre-crisis sub-sample.

### **Post-crisis sub-sample: Effects on returns**

The results for the post-crisis sub-sample, characterized by a floating exchange rate and less volatility, are given in Table 3. Results for the 1 year interest rates are not reported because there are neither significant financial control variables nor U.S. news variables. In general, we find that there are fewer significant variables in the money market equations after the crisis than during the other sample periods. We interpret this as evidence that the Argentine economy has become less dependent on events in the United States due to the abandonment of the currency board. In addition, the share of foreign trade with the U.S. is

<sup>15</sup> The resulting t-test value is  $t(1087) = 4.5^{**}$ .

<sup>16</sup> The test statistics is  $\text{Chi}^2(1) = 4.3^*$ .

<sup>17</sup> The resulting t-test value is  $t(1087) = 2.6^{**}$ .

declining during this period. We find no evidence for an Argentinean inter-market reallocation of funds. As there is persistence in the money and equity markets and reversion in the foreign exchange market, (weak) efficiency is still violated. Finally, risk appears not to be priced directly in the market as the conditional variance term does not enter the mean equation significantly.

U.S. central bank talk or rate movements have no significant impact on money market rates. The Merval index goes down by 2.6 percentage points if the possibility of a federal funds rate hike is mentioned in Fed testimonies. The exchange rate appreciates by 0.6 percentage points after an actual U.S. rate cut or when a cut is considered in a speech. A relatively higher Argentine rate then triggers additional capital imports, which lead to an appreciation of the exchange rate.

Table 3: Results in the post-crisis sub-sample

	3 month peso	6 month peso	Merval	USD/ARS
Baibor <sub>t-1</sub>	0.19**	0.13*		
Merval <sub>t-3</sub>			0.08*	
USD/ARS Spot Rate <sub>t-2</sub>				-0.14**
FFTR Cut				0.006**
Testimonies MP Tightening			-0.03**	
Speeches MP Easing				0.006**
Trade Balance Positive	0.05*			
Consumer Confidence Positive		0.06**		
ISM Positive			0.01**	0.002*
ISM Negative				0.001*
Retail Sales Positive				
Retail Sales Negative			0.005*	
Housing Starts Negative		0.04*		-0.002**

Notes: \* (\*\*) indicates significance at a 5% (1%) level. Standard errors are heteroscedasticity-consistent. Only the variables of interest of the reduced model resulting from the testing-down process are listed. Full tables are available upon request.

While Fed monetary policy news matters for Argentina's equity and foreign exchange markets, the only relevant U.S. macroeconomic shocks for the money markets are positive trade balance news on the three months interest rate (4.7 bps) as well as positive consumer confidence news (6.1 bps) and negative housing news (3.8 bps) on the six month rate. Negative U.S. retail news has an unexpected effect on the equity market while positive ISM news drives equity returns up by 1.1 percentage points. Any announcement of the ISM index causes an appreciation of the spot rate, with positive news having a larger absolute impact. Finally, negative U.S. housing news, perhaps reflecting expectations of high interest rates, depreciates the exchange rate.

Again, we obtain mainly spill-over effects on the money and equity markets from the U.S. to Argentina with only one outlier in the Merval equation. In the case of the exchange rate there are some diversification effects, which is not surprising as good (bad) news for the U.S. dollar is bad (good) news for the dollar/peso exchange rate. Few of the variables are significant in both models, before and after the crisis, but if they are, statistical testing indicates similar economic effects.<sup>18</sup>

### Effects on volatility

Equation (2) is used to detect the impact of central bank talk and macroeconomic announcements on Argentine financial market volatility. Due to convergence failures in the GARCH models brought about by including too many dummy variables we do not obtain results for some markets and sub-samples, while in many other cases we do not find significant variables in the volatility equations. Table 4 summarizes all models, in this case only two, that are characterized by robust convergence and which contain significant explanatory dummy variables in the volatility equation.

Table 4: Volatility Results in the crisis sub-sample (peso-denominated Baibor)

	<b>3 month peso</b>	<b>1 year peso</b>
Communication Event (Volatility)	-1.24*	-1.36**

Notes: \* (\*\*) indicates significance at a 5% (1%) level. Standard errors are heteroscedasticity-consistent. Only the variables of interest of the reduced model resulting from the testing-down process are listed. Full tables are available upon request.

Neither in the first nor the last sample period we achieve convergence or obtain significant coefficients. This implies that none of the events has a significant impact on the conditional volatility of returns, nor does the differentiation in good and bad news reveal significant coefficients. Only for peso-denominated money market rates during the crisis period we find that U.S. communication events independent from their source or contents have a negative impact on price volatility. The largest and most significant effect is on 1 year interest rates although the average size of the conditional variance for this market is the smallest among both maturities listed in Table 4. Hayo et al. (2008) show a similar impact of FOMC communications on U.S. markets and conclude that central bankers appear to perform a role on financial markets that is comparable to that of psychologists. At least during the severe crisis associated with the breakdown of the currency board system Fed central bankers appear to be able to calm down financial market participants in Argentina, too.

<sup>18</sup> For instance, one cannot reject the null that negative housing news has the same impact before and after the financial crisis ( $t(1719) = 0.32$ ).

## 5. Further specifications and robustness checks

We now explore extensively the robustness of our findings. Firstly, we systematically split the sample at different dates. However, only in the case of the presented periods do we achieve convergence in all level regressions. Instead of splitting the data set into three sub-samples, we also apply impulse and step dummies to the pooled data set to capture the periods of different market activities. It turns out to be impossible to robustly estimate equations (1) and (2) within such an encompassing framework.

Secondly, we control for regional business cycle effects in South America by including the corresponding Brazilian assets and the real/peso spot rate into the equation. Only few assets from Brazil are significant and, moreover, they do not affect our main variables of interest in a noteworthy way. Since we lose observations, encounter some problems related to a distorted timing of news, and to avoid convergence problems, we decide to keep the simpler specifications.

Thirdly, regarding our U.S. macroeconomic news dummies we use several specifications. In a first step, we test whether the actual values, the standardized shocks or both have an impact on our financial market indicators. The shocks turn out to be significant while the actual values remain insignificant. The same outcome occurs when including actual values and news dummies instead of shocks. In a second step we discover that the results using news dummies weakly dominate the ones using standardized shocks and, therefore, we employ news dummies in the analysis presented above.

Fourthly, concerning the Fed central bank communication dummies we try different types of aggregation. We split the speeches into those given by Board of Governors' members and those by regional presidents. This richer specification as well as a further disaggregation according to formal importance is dominated by our more parsimonious approach as we have to include many more dummy variables, causing instability of the GARCH models, while we do not discover additional significant coefficients.

Finally, we explore anticipation and persistence or reversion effects by also including one-period lead and lagged U.S. central bank variables and macroeconomic announcements. As it turns out, this overburdens the models as we rarely achieve convergence.

## 6. Conclusions

We study the effects of many types of FOMC communications and U.S. macroeconomic shocks on Argentina's financial markets' returns and volatility. Using a GARCH model we explore the impact on money, stock and foreign exchange markets over

the period 1998 to 2006 after splitting the sample into three sub-samples (pre-crisis/currency board; financial crisis; post-crisis/floating exchange rate). We concentrate our analysis on six research questions:

Firstly, do Fed central bank communications and U.S. macroeconomic announcements have an effect on financial market returns in Argentina? We show that both types of news have a significant impact on money, equity and foreign exchange markets. The impact is statistically significant and economically relevant but not particularly large.<sup>19</sup>

Secondly, we explore whether the existence of the currency board with the U.S. dollar matters for the extent of the impact. We conclude that Argentina's financial markets have become less dependent on U.S. events in the aftermath of the breakdown. There are fewer significant central bank and macroeconomic news variables (especially no monetary indicators) in the post-crisis sub-sample compared with the currency board sub-sample. In addition, we do not discover any influence of the corresponding U.S. assets on money or stock markets after abandoning the currency board.

Thirdly, concerning the credibility of the currency board we find that our pre-crisis equations for assets denominated in dollar reveal less significant and smaller coefficients than the corresponding equations for peso-denominated assets. One would expect dollar-denominated assets to react more sensitively to U.S. news because this news should affect the dollar exchange rate and via this channel the dollar-denominated assets too. One interpretation of these results is that dollar-denominated assets are seen as safer than peso-denominated assets, which implies that the currency board was not regarded as completely credible by market participants.

Fourthly, we obtain a significantly larger economic reaction to U.S. news during Argentina's financial crisis on both dollar- and peso-denominated assets. Moreover, additional types of U.S. news have a significant impact on Argentine financial markets compared to those found in the pre- and post-crisis sub-samples.

Fifthly, we assess whether spill-over effects (i.e. Argentinean variables mirroring the development in the U.S.) or diversifying behavior (i.e. investors move from one region to another) are more common. Clear diversification effects can only be found in the reaction of the equity market to real macroeconomic announcements prior to the financial crisis as bad (good) U.S. news brings higher (lower) Argentine returns. In all other markets and sub-samples we find spill-over effects dominating, as the markets react the same way as we would expect it for the United States.

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<sup>19</sup> Analysing three-day windows suggests that there are no obvious persistence effects on daily returns.

Sixthly, Fed monetary policy news affects financial market volatility of peso-denominated assets during the financial crisis. During these turbulent times U.S. central bankers seem to be “psychologists” as on days of Fed communications (Monetary Policy Report, post-meeting statement, speech or testimony) the conditional volatility in the peso-denominated money market goes down.

Finally, comparing the impact of U.S. monetary policy and macroeconomic news on Argentina’s money and stock markets with the ones on U.S. financial markets discussed in Hayo et al. (2008) we find that there are more significant types of events in the former case – at least during the financial crisis. Thus, an analysis of the interdependency between news in the U.S. and reactions in emerging market countries is an interesting topic for further research. In particular, it is important to find out whether these linkages between the U.S. and Argentina are the direct outcome of the currency board regime or whether they can be found in other financial markets as well, for instance in countries with strong U.S. trade linkages (e.g. Canada) or other emerging markets.

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## Appendix

Table A1: Descriptive statistics of Argentine financial market returns

Currency Board (Pre-Crisis): 1 January 1998 – 16 March 2001							
	3 month peso	6 month peso	1 year peso	3 month dollar	6 month dollar	1 year dollar	Merval
Mean	-0.0027	-0.0015	0.001	-0.0007	-0.0004	0.0002	-0.0006
Minimum	-3	-2.5	-2.25	-1.375	-1.25	-1.5	-0.143
Maximum	4.38	4.69	6.63	2.25	2.63	4.88	0.1157
Std.Dev.	0.3167	0.3077	0.4004	0.1787	0.1826	0.262	0.0242
Skewness	3.76	5.2	7.1	2.97	4.76	8.72	-0.2031
Excess Kurtosis	67.47	83.28	106.61	45.22	69.93	161	4.66

  

Crisis: 19 March 2001 - 1 February 2002				Crisis: 19 March 2001 – 20 November 2002			
	3 month dollar	6 month dollar	1 year dollar	3 month peso	6 month peso	1 year peso	Merval
Mean	0.1171	0.1141	0.1194	0.1868	0.1583	-0.0064	-0.002
Minimum	-24.13	-20.75	-9.75	-40.44	-27	-14.94	-0.1679
Maximum	9.19	7.56	20.75	39.5	30.31	29.13	0.0827
Std.Dev.	2.61	2.31	2.25	5.74	4.6	3.59	0.0301
Skewness	-3.51	-3.31	3.47	1.35	1.48	1.76	-0.5135
Excess Kurtosis	39.4	35.32	39.9	24.63	19.51	16.87	2.63

  

Floating Exchange Rate (Post-Crisis): 21 November 2002 - 2006					
	3 month peso	6 month peso	1 year peso	Merval	USD/ARS
Mean	-0.01	-0.01	-0.03	0.002	0.0001
Minimum	-1.19	-1.88	-6.25	-0.09	-0.04
Maximum	2.25	2.38	3.19	0.07	0.04
Std.Dev.	0.19	0.20	0.43	0.02	0.006
Skewness	0.69	-0.39	-5.47	-0.36	-0.46
Excess Kurtosis	32.4	38.4	89.2	2.14	10.2

Table A2: Means and variances of the estimated conditional variances

Currency Board (Pre-Crisis)							
	3 month peso	6 month peso	1 year peso	3 month dollar	6 month dollar	1 year dollar	Merval
Mean ( $h_t$ )	0.08	0.08	0.16	0.03	0.03	0.07	0.0006
Variance ( $h_t$ )	0.23	0.19	0.52	0.01	0.02	0.12	0.0000002

  

Crisis							
	3 month dollar	6 month dollar	1 year dollar	3 month peso	6 month peso	1 year peso	Merval
Mean ( $h_t$ )	1.84	2.68	2.31	16.31	11.3	15.18	0.0008
Variance ( $h_t$ )	10.2	66.6	30.4	1048	398	305	0.0000002

  

Floating Exchange Rate (Post-Crisis)					
	3 month peso	6 month peso	1 year peso	Merval	USD/ARS
Mean ( $h_t$ )	0.04	0.04	0.25	0.0003	0.00004
Variance ( $h_t$ )	0.004	0.007	0.49	0.00000003	0.000000005