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Abstract

We study the correlation between pairs of bond and stock markets in Canada and the United States between January 1998 and December 2006 in the framework of Diagonal-BEKK models. Our research question is whether monetary policy action and communication by the Bank of Canada and the Federal Reserve significantly affect the co-movement of financial markets. We find that target rate changes and various forms of communication by both central banks increase correlations within Canadian bond and stock markets as well as between Canadian and US financial markets.

Keywords: Bank of Canada, Central Bank Communication, Diagonal-BEKK Models, Dynamic Correlations, Federal Reserve, Financial Markets

JEL: E52, F30, G12, G15

1. Introduction

Central bank communication has become a lively topic of research during the last decade (for a survey of the relevant literature, see Blinder et al. 2008). Many central banks communicate with the public as a way of providing information about the future course of monetary policy as well as their views of the economic outlook. This information helps guide the expectation formation process in the private sector and improves transparency of monetary policy decisions. A large part of the relevant literature focuses on how monetary policy actions, particularly interest rate changes, affect financial markets; only a relatively few studies investigate the impact of communication, either formal or informal, on financial markets.

Studies on the influence of central bank communication on financial markets can be broadly classified into four categories. (i) The impact of central bank communication on financial market returns within one country. For instance, Ehrmann and Fratzscher (2007), based on newswire communication, examine how markets in the euro area, the United Kingdom, and the United States react to domestic central bank communication. (ii) The effect of central bank communication on the volatility of financial markets. Kohn and Sack (2004), for example, report that congressional hearings by members of the US Federal Reserve (Fed) have a significantly positive effect on asset volatility in various financial markets. (iii) The spillover effects of communication by members of an important central bank on financial market returns in other countries. For instance, Hayo et al. (2010) show that US monetary communications have significant effects on European and Pacific equity market returns. (iv) The possible impact of spillover effects not only occurs in the context of financial market returns but also with regard to volatility. As one part of their analysis, Hayo and Neuenkirch (2011) study the impact of US monetary policy communications on Canadian financial markets. They find that US interest rate changes increase volatility on 3-month treasury markets, but that US communication does not significantly affect volatility on Canadian financial markets.

An important issue not yet covered in the literature is whether central bank communication brings about a higher degree of co-movement in financial markets. We address this gap in this literature by focussing on the impact of central bank communication on the correlation between different financial series. Financial market integration has generally increased over time, as has interdependence. Ayuso and Blanco (2001) provide evidence on this general trend, Bessler and Yang (2003) investigate world stock markets, Chen et al. (2002) focus on Latin America, and Kim et al. (2005) look at the euro area. Knowledge about the correlation of financial markets is important both from a monetary policy point of view, as it entails the possibility of contagion and systemic shocks, and to individual investors trying to reduce the risk of their portfolio by diversification.

There are at least two ways of studying the question of whether monetary policy communication affects financial market correlations: first, by comparing the correlation between different markets *within one country* and, second, by comparing the correlation of the same type of markets *across different countries*. We study this research question in the context of the United States and Canada. Since we allow for the impact of cross-country monetary policy communication spillovers in the sense of (iii) and (iv) above, we focus on Canada, as Canadian financial markets are affected by US macroeconomic shocks and Fed actions and communications (Hayo and Neuenkirch 2011). In terms of monetary policy communication, we rely on formal and informal communication by the Fed and the Bank of Canada (BoC). To provide robust empirical evidence, we study four combinations of potentially increasing financial market correlations in the aftermath of central bank communication:

Canadian bonds markets with 6 and 10 years' maturity, equity and bonds markets in Canada, equity markets in the United States and Canada, and 10-year bonds in the United States and Canada.

2. Data and Empirical Methodology

Our financial market variables for the two countries comprise daily closing interest rates on 6-month treasury bills and 10-year government bonds, as well as daily rates of change of the Toronto Stock Exchange Index and the S&P 500 Index for the period 2 January 1998 to 29 December 2006.

We use data on Fed and BoC communications taken from Hayo and Neuenkirch (2011). In the case of the Fed, the dataset covers 663 speeches, 151 congressional hearings, 68 post-meeting statements, and 20 monetary policy reports; in the case of the BoC, there is information from 115 speeches, 5 testimonies, 61 post-meeting statements, and 32 monetary policy reports. The communication content is coded as either 'monetary policy' or 'economic outlook'. Coding for the economic outlook news is either 'positive' (EO+) or 'negative' (EO–); 'tightening' (MP+) or 'easing' (MP–) are the categories for monetary policy. In the analysis, we employ separate dummy variables for positive and negative news to take into account possible asymmetric reactions of financial markets. In total, there are 16 informal communication dummies as all four types of communication (statements, MPR, testimony, speeches) can be coded into four different categories (EO+, EO–, MP+, or MP–).

Target rate changes by the BoC and the Fed are captured by including indicator variables, separating rate hikes and cuts for each central bank. The coding is 1 for a 25 bps move, 2 for 50 bps move, and so on. Target rate change surprises, which occur either after an unscheduled meeting or as an unexpected outcome of a meeting, are captured by separate indicators.[1]

As control variables, we include several important US and Canadian macroeconomic variables that are regularly observed by financial market actors. In our analysis, these take the form of dummies for positive and negative news, which allows for an asymmetric adjustment on financial markets depending on the sign of the shocks. In the case of the United States, we use the variables put forward by Ielpo and Guégan (2009). In the case of Canada, we rely on the list of variables compiled by Gravelle and Moessner (2001) and Doukas and Switzer (2004). Finally, we include a dummy variable for 11 September 2001.

We use MGARCH models to analyse the question of how target rate changes and central bank communication affect the correlation of financial market returns in two markets. One reason why this class of models is used rather sparingly in practical applications is their complexity, which often leads to severe convergence problems (for a survey, see Bauwens et al. 2006). For our dataset, we find that bivariate Diagonal-BEKK(1,1) models, proposed by Engle and Kroner (1995), provide a good compromise between conducting a multivariate analysis and still achieving robust convergence.[2] Moreover, information criteria indicate the superiority of Diagonal-BEKK models compared to other linear or non-linear combinations of univariate GARCH models, particularly O-GARCH, GO-GARCH

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[1] Bloomberg surveys are used to identify surprises that occur during scheduled meetings. Intermeeting moves are naturally classified as surprises. For instance, a 'surprise hike' can be (i) an unexpected rise in the target rate or (ii) an unchanged target rate when a rate cut was expected.

[2] All our estimated models are stationary, as the following condition is always fulfilled: $a^2_{11} + b^2_{11} < 1$. We use t-distributed errors, as they provide a better empirical approximation.

(van der Weide 2002), CCC (Bollerslev 1990), DCC (Engle 2002), generalised DCC (Tse and Tsui 2002), and Scalar-BEKK.[3]

Diagonal-BEKK models simultaneously consider factors that have an influence on the variances of the time series as well as on their correlation. However, within our framework, these models are still too demanding to allow inclusion of all control variables, i.e., macroeconomic news, monetary policy actions, and central bank communication, at the same time. Therefore, in a conservative procedure, we first eliminate the influence of macroeconomic news from the financial series and then study the impact of central bank variables on these filtered variables. We then estimate the Diagonal-BEKK models and reduce the number of included communication variables in a consistent general-to-specific modelling approach. The Diagonal-BEKK model takes the general form:

(1) $y_t = \mu + cH_t + \varepsilon_t$

(2) $H_t = C'C + \sum_{i=1}^{q} A'_{i\,t-i}{}'_{t-i} A_i + \sum_{j=1}^{p} B'_j H_{t-j} B_j$

y_t is a vector of N time series, μ is the mean of this process, ε is a white-noise error, H is the conditional variance covariance matrix of y, c is a parameter, and C is an NxN matrix, the elements of which are zero below the main diagonal. A_i and B_j are NxN matrices.

For bivariate Diagonal-BEKK models, Equation (2) simplifies to:

(3) $$H_t = \begin{pmatrix} c_{11} & c_{12} \\ 0 & c_{22} \end{pmatrix}' \begin{pmatrix} c_{11} & c_{12} \\ 0 & c_{22} \end{pmatrix} + \begin{pmatrix} a_{11} & 0 \\ 0 & a_{22} \end{pmatrix}' \begin{pmatrix} \varepsilon_{1,t-1}^2 & \varepsilon_{1,t-1}\varepsilon_{2,t-1} \\ \varepsilon_{2,t-1}\varepsilon_{1,t-1} & \varepsilon_{2,t-1}^2 \end{pmatrix} \begin{pmatrix} a_{11} & 0 \\ 0 & a_{22} \end{pmatrix} + \begin{pmatrix} b_{11} & 0 \\ 0 & b_{22} \end{pmatrix}' H_{t-1} \begin{pmatrix} b_{11} & 0 \\ 0 & b_{22} \end{pmatrix}$$

The financial market correlations are then described by:

(4) $h_{12,t} = c_{11}c_{12} + a_{11}a_{22}\varepsilon_{1,t-1}\varepsilon_{2,t-1} + b_{11}b_{22}h_{12,t-1}$

Our communication indicators and target rate changes are then included as additional exogenous regressors in the volatility Equation (2) by adding:

$$F\ \mathrm{diag}(|Z_t|)F'$$

F is a 2xf matrix, where f is the number of explanatory variables and Z is the matrix itself (diag implies that there are non-zero elements only on the main diagonal).

As the impact of target rate changes and communication on mean and variance is studied elsewhere (Hayo and Neuenkirch 2011), and to economise on space, we focus our attention on the effects relevant for the correlations between two financial markets. If our explanatory variables have the same sign and are jointly significant across both volatility equations, monetary policy actions and/or central bank communication increase the correlation between the time series.[4]

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[3] The hypothesis of constant conditional correlations can be rejected (Engle and Sheppard 2001).

[4] Omitted results are available on request.

3. Empirical Results

Table 1 shows the outcome of estimating Diagonal-BEKK(1,1) models for four pairs of financial markets.

Table 1: Estimating Bivariate Financial Market Correlations

	Canada: 10-year and 6-month	**Canada: Stock and 10-year**	**Stock: Canada and US**	**10-year: Canada vs. US**
Model	1	2	3	4
Target rate change BoC	2 indicators (joint test: **)	2 indicators (joint test: **)	1 indicator (**)	2 indicators (joint test: **)
Target rate change Fed			1 indicator (**)	
Communication BoC	2 indicators (joint test: **)	5 indicators (joint test: **)	4 indicators (joint test: **)	4 indicators (joint test: **)
Communication Fed	4 indicators (joint test: **)	4 indicators (joint test: **)	3 indicators (joint test: **)	5 indicators (joint test: **)
$\mathbf{c_{11}}$	0.0031*	0.0009**	0.088**	0.0058**
$\mathbf{c_{12}}$	0.0010	-0.0002	0.0066**	0.0063**
$\mathbf{b_{11}}$	0.9844**	0.9658**	0.0000	0.9750**
$\mathbf{b_{22}}$	0.9793**	0.9778**	-0.7042**	0.9680**
$\mathbf{a_{11}}$	0.1502**	0.2230**	0.4110**	0.1522**
$\mathbf{a_{22}}$	0.1508**	0.1630**	0.3432**	0.1847**
Log-likelihood	8614	11006	14700	8192
Parameters	24	34	36	32

Note: * and ** indicate significance at a 5% and 1% level, respectively. Number of observations: 2204.

Model (1) gives the estimated parameters relevant for the dynamic correlation between 10-year and 6-month bond markets. The non-significant value of parameter c_{12} indicates that the long-run unconditional correlation between both series, estimated by $c_{11}c_{12}$, is zero. However, as parameters $b_{1,11}$ to $a_{1,22}$ are highly significant, correlations are time variant over the short run. Given the significant impact of target rate changes and communication by the Fed and the BoC on bond markets, we conclude that formal and informal monetary policy communications affect the short-term correlation between both Canadian markets. Model (2) contains the estimates for the dynamic correlations between Canadian stock and bond markets. Again, we find no evidence of a significant long-run unconditional correlation between both series, but there are significant short-run effects. The cross-country analysis of stock markets in Canada and the United States presented in Model (3) shows that this time there is a significant positive long-run correlation. In addition, there are common short-run movements between both series, although there is a zero impact of lagged correlations. Thus, given that we again observe a significant impact of central bank communication indicators, the correlation between stock markets in both countries is affected in the short as well as in the long term by communication. Finally, when studying bond markets in both countries in Model (4), we now find the strongest evidence of target rate changes and formal and informal central bank communication strengthening the correlation both in the short and long run.

4. Conclusion

The extant literature shows that central bank communication can affect financial market returns and volatility within one country and cause spillover effects on financial market returns and volatility in other countries. Our results show that it can also affect the dynamic correlation between two financial markets, both within and across countries, thereby increasing their co-movements. Thus, monetary policy communication can influence the likelihood of contagion across financial markets, a finding that emphasises the importance of careful deliberation before communicating with the public.

References

Ayuso, J. and Blanco, R. (2001), Has Financial Market Integration Increased During the Nineties? *Journal of International Financial Markets, Institutions and Money* 11, 265–287.

Bauwens, L., Laurent, S., and Rombouts, J. V. K. (2006), Multivariate GARCH-Models: A Survey, *Journal of Applied Econometrics* 21, 79–109.

Bessler, D. A. and Yang, J. (2003), The Structure of Interdependence in International Stock Markets, *Journal of International Money and Finance* 22, 261–287.

Blinder, A., Ehrmann, M., Fratzscher, M., de Haan, J., and Jansen, D.-J. (2008), Central Bank Communication and Monetary Policy: A Survey of Theory and Evidence, *Journal of Economic Literature* 46, 910–945.

Bollerslev, T. (1990), Modelling the Coherence in Short-Run Nominal Exchange Rates: A Multivariate Generalized ARCH Model, *Review of Economics and Statistics* 72, 498–505.

Chen, G.-M., Firth, M., and Rui, O. M. (2002), Stock Market Linkages: Evidence from Latin America, *Journal of Banking and Finance* 26, 1113–1141.

Doukas, J. and Switzer, L. (2004), Bi-National News Effects and Exchange Rate Futures: The Case of Canadian Dollar Futures Contracts, *EFMA 2004 Basel Meetings Paper*.

Ehrmann, M., and Fratzscher, M. (2007), Communication by Central Bank Committee Members: Different Strategies, Same Effectiveness? *Journal of Money, Credit and Banking* 39, 509–541.

Engle, R. F. (2002), Dynamic Conditional Correlations—A Simple Class of Multivariate GARCH Models, *Journal of Business and Economics Statistics* 20, 339−350.

Engle, R. F. and Kroner, K. F. (1995), Multivariate Simultaneous Generalized ARCH, *Econometric Theory* 11, 122–150.

Engle, R. F. and Sheppard, K. (2001), Theoretical and Empirical Properties of Dynamic Conditional Correlation Multivariate GARCH, *NBER Working Paper* 8554, October.

Gravelle, T. and Moessner, R. (2001), Reactions of Canadian Interest Rates to Macroeconomic Announcements: Implications for Monetary Policy Transparency, *Bank of Canada Working Paper* 2001-5.

Hayo, B., Kutan, A. M., and Neuenkirch, M. (2010), The Impact of U.S. Central Bank Communication on European and Pacific Equity Markets, *Economics Letters* 108, 172–174.

Hayo, B. and Neuenkirch, M. (2011), Domestic or U.S. News: What Drives Canadian Financial Markets? *Economic Inquiry* forthcoming.

Ielpo, F. and Guégan, D. (2009), Further Evidence on the Impact of Economic News on Interest Rates, *Frontiers in Finance and Economics* 6, 1–45.

Kim, S. J., Moshirian, F., and Wu, E. (2005), Dynamic Stock Market Integration Driven by the European Monetary Union: An Empirical Analysis, *Journal of Banking & Finance* 29, 2475–2502.

Kohn, D. L. and Sack, B. P. (2004), Central Bank Talk: Does it Matter and Why? in: *Macroeconomics, Monetary Policy, and Financial Stability*, Bank of Canada: Ottawa, 175–206.

Tse, Y. K. and Tsui, A. K. C. (2002), A Multivariate Generalized Autoregressive Conditional Heteroscedasticity Model with Time-Varying Correlations, *Journal of Business and Economics Statistics* 20, 351−362.

Van der Weide, R. (2002), GO-GARCH: Multivariate Generalized Orthogonal GARCH Model, *Journal of Applied Econometrics* 17, 549–564.