Macroeconomic Surprises and International Financial Market Returns

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Abstract

This paper investigates the simultaneous effect of macroeconomic developments on stock and foreign exchange (FX) market returns in a system that is characterized by dynamic interaction among asset returns. Using US and UK data, we find that US stock market returns are significantly responsive to domestic macroeconomic developments in output growth, interest rates, and unemployment rate. US stock market returns are also responsive to UK surprises in money growth and inflation and the surprises in FX markets such as the ones in interest rates and trade balance. We also find that the dollar/pound exchange rate is asymmetrically responsive to the money growth surprise in US and UK and in the FX market as well.

Keywords: Macroeconomic Surprise; Stock Market; Foreign Exchange Market

1. Introduction

Macroeconomic surprises that originate from a country impact both stock and foreign exchange (FX) markets of that country and then can be transmitted to the corresponding markets of other countries. As documented by Anderson, Bollerslev, Diebold, and Vega (2007), stock return and exchange rate dynamics are jointly linked to macroeconomic fundamentals and the linkage is significantly contemporaneous between stock and FX markets. Thus, it is important to recognize that the market response to macroeconomic developments should be modeled within a simultaneous framework linking stock and FX markets. Extant research on the relation between macroeconomic surprises and subsequent market responses have focused on the effect of the surprises either on the stock market or on the FX market in a separate framework without linking the two markets. For example, one class of the studies focuses on the connection between macroeconomic surprises and subsequent movements in stock prices (see, for example, Jones and Kaul (1996), Errunza and Hogan (1998), Flannery and Protopapadakis (2002), Boyd et al. (2005), Basistha and Kurov (2008), and Gilbert (2011)), while the other class of the studies examines the influence of macroeconomic surprises on the exchange rate movement (see, for example, Good hart et al. (1993), Tanner (1997), Almeida et al. (1998), Anderson, Bollerslev, Diebold, and Vega (2003), Evans and Lyons (2003), Simpson et al. (2005), Bergin (2006), Chen and Gau (2010)). This isolated analysis of only a particular market response ignores cross-market information effects of macroeconomic surprises and the results may not simultaneously hold true.

In contrast to the separate approach, the simultaneous response of stock and FX markets to macroeconomic surprises has been largely ignored. Notable exceptions are thepapers by Anderson, Bollerslev, Diebold, and Vega (ABD&V, 2007) and Mun (2012), for which FX markets as well as the domestic and foreign stock markets are characterized by the joint response to US macroeconomic surprises. ABD&V (2007) measures the magnitude of response coefficients using two-step weighted least squares (WLS) procedure with error terms following ARCH process and find that bad news has a negative impact on stock markets during economic contractions, but a positive impact during expansions. Mun (2012) investigates the joint response of stock and FX markets to macroeconomic surprises using US and Japanese data. Yet, these studies neglect the possibility that macroeconomic surprises can affect the volatility of stock returns and exchange rates, which in turn feeds through to changes in stock returns and exchange rates via increased risk premia. The purpose of our paper is to investigates the simultaneous response of stock and FX market returns to macroeconomic surprises in a system that is characterized by dynamic interaction among asset returns.

In particular, we develop a unified framework by integrating two strands of the literature on market response to macroeconomic surprises: studies on the stock market response to macroeconomic surprises and studies on the FX market response to macroeconomic surprises. Our empirical strategy is based on the vector-autoregressive model with error terms following GARCH-M process that allows for asymmetries of market responses. We extend previous research by estimating the model for stock market returns and exchange rate changes in which the endogenous variables are allowed to be simultaneously affected by macroeconomic developments not only at home but also abroad. The investigation of the impact of foreign macroeconomic surprises on US stock and FX markets can provide important evidence on several hypotheses about the cross-country and cross-market transmission of macroeconomic surprises. In our model, stock market returns and exchange rate movements are simultaneously influenced by surprises of macroeconomic variables common in both US and foreign economy. We use US and UK data for six macroeconomic variables common in both countries: (i) money growth, (ii) output growth, (iii) inflation, (iv) interest rates, (v) unemployment rate, and (vi) trade balance. Estimation results indicate that to the extent that revelation of the surprises are directly impounded in returns, US stock market returns are significantly responsive to domestic macroeconomic developments in output growth, interest rates, and unemployment rate. Also, US stock market returns are responsive to UK surprises in money growth and inflation and the surprises in FX markets such as the ones in interest rates and trade balance. This indicates that some of macroeconomic developments in UK and in FX markets feed through to US stock markets. We find that the dollar/pound exchange rate is directly and asymmetrically responsive to the money growth surprise in US and UK and in the FX market as well. The results indicate that a higher-than-expected money growth in US leads to weaker dollar (or stronger pound) than a lower-than-expected money growth of the same magnitude. The paper is organized as follows. Section 2 provides data and empirical models to be estimated. Section 3 presents empirical results for effects of macroeconomic surprises. Finally, conclusions are given in section 4.

2. Data and Methodology

2.1 Data

To investigate the simultaneous impact of a macroeconomic surprise on the stock and FX market, it is necessary to choose a set of factors that are common in both stock and FX markets. By examining factors previously identified in the literature, we select the following set of macroeconomic factors as a fair and parsimonious representation of the macroeconomic fundamentals that can influence both stock and FX markets commonly: (i) money growth; (ii) output growth; (iii) inflation; (iv) interest rates; (v) unemployment rate; and (vi) trade balance. For our analysis, we use the seasonally-adjusted M1, the Consumer Price Index (CPI), the seasonally-adjusted Industrial Production Index (IPI), and 3-month T-bill rates as proxies for the money supply, price level, output, and interest rates, respectively.[1]The stock market indices used are the S&P 500 Index and the FTSE 100 Index of UK. We obtain these data from *International Financial Statistics* and *Global Financial Database* (GFD). The data set we analyze is the monthly series (except for trade balance for which it is the quarterly series) for the period from December 1988 to December 2006. This sample period is consistent with the so-called "Great Moderation", during which period output, inflation, investment, and other macroeconomic variables were sharply less volatile across G7 countries than they were during the prior 20-year period (see, for instance, Justiniano and Primiceri (2008)).[2]This shift in the volatility of macroeconomic variables towards stability during the Great Moderation reduces possible abrupt breaks in the statistical estimation of macroeconomic shocks and contributes to an increase in the precision of forecasts of the macroeconomic variables (Stock and Watson (2002 and 2003) and Justiniano and Primiceri (2008)).Stock market returns are computed as the difference of the logarithm of the stock market index. Exchange rates are expressed as US dollar per unit of foreign currency. Money growth, inflation, and output growth are measured as the difference of the logarithm of the M1 (M4 for UK), the consumer price index, and the output growth index, respectively. Other economic series such as interest rates and unemployment rate are logged. The trade balance is scaled as a ratio to the gross domestic product (GDP).

[1]We use the seasonally-adjusted M4 running from June 1989 to December 2006, defined by the International Financial Statistics,for UK money supply.

[2]Although there is no consensus on its exact duration, the beginning of the Great Moderation is often suggested to be the mid 1980s (Stock and Watson (2002)). Economists generally agree that the Great Moderation ended with the collapse of sub-prime mortgages in 2007.

2.2 Empirical Model

Developments in stock markets are known to influence foreign exchange markets and vice versa, and interrelationships exist among international stock markets. This implies that a macroeconomic surprise in one country can simultaneously affect both stock and FX markets at home, and can be transmitted to other countries. To statistically capture the cross-country transmission and simultaneous response of stock and FX markets to a macroeconomic development, one should employ a system method of estimation. Also, given that risk-averse agents require compensation for holding a risky asset, asset returns should depend on the risk premium which is an increasing function of the conditional variance of returns. One model that can effectively incorporate these phenomena is the vector autoregressive model with error terms following GARCH in-mean process. Following Mun (2012), the specification we use for the means of stock market (both US and UK) returns and exchange rate changes is given by:

$$Y_t = \mu + \sum_{i=1}^{p} \mathrm{A}_i Y_{t-i} + \Psi\sqrt{h_t} + \Pi Z_t + \Phi(D_t Z_t) + \varepsilon_t \quad (1)$$

$$\varepsilon_t \,|\, \Omega_t \sim N(0,\ H_t)$$

$$H_t = C'C + K'\varepsilon_{t-1}\varepsilon'_{t-1}K + F'H_{t-1}F \quad (2)$$

Where

$$Y_t = \begin{bmatrix} \Delta r_t \\ \Delta r_t^* \\ \Delta s_t \end{bmatrix};\ \mu = \begin{bmatrix} \mu_r \\ \mu_{r^*} \\ \mu_s \end{bmatrix};\ \mathrm{A}_i = \begin{bmatrix} a_{11}^{(i)} & a_{12}^{(i)} & a_{13}^{(i)} \\ a_{21}^{(i)} & a_{22}^{(i)} & a_{23}^{(i)} \\ a_{31}^{(i)} & a_{32}^{(i)} & a_{33}^{(i)} \end{bmatrix};\ \Psi = \begin{bmatrix} \psi_{11} & \psi_{12} & \psi_{13} \\ \psi_{21} & \psi_{22} & \psi_{23} \\ \psi_{31} & \psi_{32} & \psi_{33} \end{bmatrix}$$

$$\Pi = \begin{bmatrix} \pi_{11} & \pi_{12} & \pi_{13} \\ \pi_{21} & \pi_{22} & \pi_{23} \\ \pi_{31} & \pi_{32} & \pi_{33} \end{bmatrix};\ \Phi = \begin{bmatrix} \phi_{11} & \phi_{12} & \phi_{13} \\ \phi_{21} & \phi_{22} & \phi_{23} \\ \phi_{31} & \phi_{32} & \phi_{33} \end{bmatrix};\quad Z_t = \begin{bmatrix} z_t \\ z_t^* \\ z_t - z_t^* \end{bmatrix};$$

$$D_t = \begin{cases} I_3 & \text{if the surprise is negative} \\ 0_3 & \text{otherwise} \end{cases} \qquad \varepsilon_t = \begin{bmatrix} \varepsilon_{rr,t} \\ \varepsilon_{r^*r^*,t} \\ \varepsilon_{ss,t} \end{bmatrix}$$

$$H_t = \begin{bmatrix} h_{rr,t} & h_{rr^*,t} & h_{rs,t} \\ h_{r^*r,t} & h_{r^*r^*,t} & h_{r^*s,t} \\ h_{sr,t} & h_{sr^*,t} & h_{ss,t} \end{bmatrix};\qquad \sqrt{h_t} = \begin{bmatrix} \sqrt{h_{rr,t}} \\ \sqrt{h_{r^*r^*,t}} \\ \sqrt{h_{ss,t}} \end{bmatrix};$$

$$C = \begin{bmatrix} c_{11} & c_{12} & c_{13} \\ 0 & c_{22} & c_{23} \\ 0 & 0 & c_{33} \end{bmatrix};\ K = \begin{bmatrix} k_{11} & k_{12} & k_{13} \\ k_{21} & k_{22} & k_{23} \\ k_{31} & k_{32} & k_{33} \end{bmatrix};\ F = \begin{bmatrix} f_{11} & f_{12} & f_{13} \\ f_{21} & f_{22} & f_{23} \\ f_{31} & f_{32} & f_{33} \end{bmatrix};$$

where $\Delta r_t \equiv r_t - r_{t-1}$; r_t is the logarithmic return on the US stock market.

$\Delta r_t^* \equiv r_t^* - r_{t-1}^*$, r_t^* is the logarithmic return on the UK stock market.

$\Delta s_t \equiv s_t - s_{t-1}$, the appreciation rate of the UK pound relative to the US dollar at time *t*. s_t is the exchange rate expressed in US dollars per unit of the UK pound at time *t*. z_t (z_t^*) = the US (UK) macroeconomic surprise at time *t*. ($z_t - z_t^*$) = the surprise of the differential in macroeconomic developments between US and UK at time *t*. This represents the surprise in FX markets associated with macroeconomic developments.

D_t = the dummy variable matrix that takes on the (3×3) identity matrix, I_3, if the surprise is negative or the (3×3) null matrix, 0_3, otherwise. In equation (1), the conditional mean of US stock market returns is described as a function of the past history of stock returns for both domestic & foreign markets and exchange rate changes, the past history of error terms given by $\varepsilon_{rr,t}$, $\varepsilon_{r^*r^*,t}$, and $\varepsilon_{ss,t}$, and their conditional variances given by $h_{rr,t}$, $h_{r^*r^*,t}$, and $h_{ss,t}$, respectively. Thus, this model explicitly considers possible return and volatility transmissions among the three endogenous variables. The conditional means of UK stock market returns and exchange rate changes are also represented by the past history of the three variables and their error terms, and their conditional standard deviations. Equations (1) and (2) present that surprises emanating from multiple countries (the US and UK in this study) as well as the FX market are allowed to simultaneously influence the stock market at home and abroad and the FX market. Specifically, the off-diagonal parameters of the (3×3) matrix Π in equation (1) effectively capture possible cross-country and cross-market transmission of the macroeconomic surprise. For example, the statistically significant value of π_{31} implies that a US macroeconomic surprise influences exchange rate movements, while the significant value of π_{13} indicates that a macroeconomic surprise in the FX market influences US stock market returns. The model can be estimated using maximum likelihood methods given $\varepsilon_t|\Omega_t \sim N(0, H_t)$, where Ω_t is the information set available at time *t*. The BEKK (Engle and Kroner (1995)) parameterization of equation (2) guarantees the conditional covariance matrix, H_t, positive definite for all values of ε_t. The off-diagonal parameters of matrices of A_i and *K* in equations (1) and (2) allow for tests for various hypotheses concerning cross-market spillovers. For example, jointly significant values of $a_{31}^{(i)}$ and $a_{32}^{(i)}$ in matrix A_i imply that there are return spillovers from stock to FX markets. Tests for volatility spillovers from one market to another can be performed employing the off-diagonal parameters of matrix *K* in equation (2). For example, the joint hypothesis of $k_{31}=k_{32}=0$ implies that there is no volatility spillover from stock to FX markets.The (3×1) vector of z_t in equation (1) captures surprises induced by macroeconomic developments. Since asset returns/exchange rates are affected only by an unanticipated change in the level of economic variables, the value of the surprise in equation (1) is measured as follows:

$$z_t = \frac{\text{Actual}_t - \text{Expected}_t}{\sigma_t} \tag{3}$$

Where σ_t = the standard deviation of the macroeconomic surprise at time *t*.

The values of z_t for macroeconomic surprises are statistically estimated using the VAR model with the following format:

$$y_t = a + \sum_{i=1}^{p} b_i y_{t-i} + e_t \tag{4}$$

Where y_t = the 3×1 vector for macroeconomic variables for each country and the FX market; a = the 3×1 vector of constants; b_i = the 3×3 parameter matrices; and e_t = the 3×1 vector of errors. The time path of residuals and their standard deviation are obtained from equation (4).We take the surprise to be positive (negative) if the actual value of a macroeconomic variable is greater (less) than its expected value. For the FX market, we postulate the surprise to be positive (negative) if the actual value of the terms of trade ratio between the US and UK is larger (smaller) than expected. To capture possible asymmetric responses of stock and FX markets to macroeconomic surprises, a dummy variable is added to the equation (1) as an additional exogenous variable. Specifically, the diagonal parameters of the (3×3) matrix Φ in equation (1) capture potential asymmetric responses of stock and FX markets to macroeconomic surprises. For example, significantly negative values of ϕ_{11} for output growth imply that lower-than-expected US output growth leads to lower domestic stock market returns by more than equivalent positive surprises increase the returns. The off-diagonal parameters of the Φ matrix capture possible transmission of negative surprises from one market or country to the other market or country.

Table1. Hypothesized Effects of Macroeconomic Surprises on Stock and FX Markets

Macroeconomic factor surprise	US stock market	Stock market of foreign counterpart	FX market
Money supply			
a. US	–		
b. Foreign counterpart		–	
c. Differential between US and foreign counterpart			–
Industrial Production			
a. US	+		
b. Foreign counterpart		+	
c. Differential between US and foreign counterpart			+
Inflation			
a. US	–		
b. Foreign counterpart		–	
c. Differential between US and foreign counterpart			–
Interest rates			
a. US	–		
b. Foreign counterpart		–	
c. Differential between US and foreign counterpart			+
Unemployment rate			
a. US	–		
b. Foreign counterpart		–	
c. Differential between US and foreign counterpart			–
Trade balance			
a. US	+		
b. Foreign counterpart		+	
c. Differential between US and foreign counterpart			+

As described in Table 1, we next hypothesize for our own purposes that the surprise is positive if output growth is higher than expected and negative if it is lower than expected. Similarly, the surprise is negative if money growth, inflation, interest rates, unemployment rate, or trade deficit is higher than expected. Earlier studies have documented that if US inflation is unexpectedly higher than UK inflation, the dollar/pound exchange rate rises or equivalently US dollar depreciates relative to the UKpound. If US interest rates are unexpectedly higher than UK interest rates, US dollar appreciates. This is because existing models (except for the flexible-price monetary model) for exchange rate determination predict that higher domestic interest rates relative to foreign interest rates imply an appreciation of domestic currency.

3. Empirical Results

3.1 Summary Statistics

Table 2 reports summary statistics for various economic variables. Panel A of Table 2 shows that over the sample period. US stock market returns were higher than UK stock returns and the dollar/pound exchange rate increased by 0.19% monthly, implying depreciation of the dollar relative to the pound. Panel B presents that US had higher levels in output growth, inflation, and trade deficit relative to UK. During the sample period US had an interest rate of 4.72% while UK had 7.42%. Panel C reports the magnitude of macroeconomic surprises and the direction of surprises over the sample period. US had higher-than-expected levels in money growth, inflation, and unemployment while having lower-than-expected levels in output growth, interest rates, and trade balance. On the other hand, UK had higher-than-expected levels in money growth, output growth, unemployment, and trade balance while having lower-than-expected levels in inflation and interest rates. In particular, positive money growth surprise was the largest in magnitude in US while negative interest rate surprise was in UK.

Table2. Summary Statistics

A. Mean of Stock Index Returns and Exchange Rate Changes (12/1988-12/2013)

	US	UK
Stock index returns (%)	0.8156 (3.3885)	0.6472 (3.8765)
Exchange rate changes (%)	-	0.1909 (2.4950)

Note: Figures in parentheses are standard deviations

B. Mean of Macroeconomic Factors (12/1988-12/2013)

Country	Money growth (%)	Output growth (%)	Inflation (%)	Interest rates (%)	Unemploy-ment rate (%)	Trade balance (%)
US	0.3388 (0.7977)	1.5670 (0.3109)	0.2464 (0.2654)	4.7211 (0.9672)	5.6638 (0.9914)	-0.8295 (0.3789)
UK	1.2825 (7.8145)	1.2620 (0.1020)	0.2450 (0.4427)	7.4248 (3.1366)	7.4411 (2.2007)	-0.7859 (0.4156)

Note: Money growth, output growth, and inflation are monthly data. Interest rates and unemployment rates are annualized. Trade balance is scaled as a ratio to the gross domestic product (GDP) and is a quarterly data. Figures in parentheses are standard deviations.

C. Mean of Macroeconomic Surprises (1 2/1988-12/2013)

Country	Money growth	Output growth	Inflation	Interest rates	Unemployment rate	Trade balance
US	0.0610 (0.9998)	-0.0035 (1.0018)	0.0219 (0.9990)	-0.0407 (1.0019)	0.0059 (1.0019)	-0.0273 (1.0049)
UK	0.0052 (1.0020)	0.0288 (1.0017)	-0.0085 (1.0088)	-0.0516 (1.0338)	0.0025 (1.0005)	0.0118 (1.0126)
* Differential surprises for US/UK						
US/UK	-0.0311 (1.0025)	-0.0231 (1.0014)	0.0534 (1.0447)	-0.0078 (1.0428)	-0.0017 (1.0020)	-0.0377 (1.0101)

Note: Figures in parentheses are standard deviations.

3.2Effects of Macroeconomic Surprises on Stock and FX Markets

In this section, we examine the effects of US and UK macroeconomic surprises on US and UK stock markets as well as FX markets to the extent that these surprises are impounded in returns. Table 3 presents the results of estimating equation (1) for various macroeconomic surprises. Because the model in equations (1) and (2) contains so many variables, it would be counterproductive to report all the parameter estimates. Instead, we present key parameter estimates that are of importance for investigating the market response in returns directly to macroeconomic surprises.

$$Y_t = \mu + \sum_{i=1}^{p} \mathrm{A}_i Y_{t-i} + \Psi\sqrt{h_t} + \Pi Z_t + \Phi(D_t Z_t) + \varepsilon_t$$

$$H_t = C'C + K'\varepsilon_{t-1}\varepsilon'_{t-1}K + F'H_{t-1}F$$

Table3. Estimation Results of Direct Effects

Parameter	Money growth	Output growth	Inflation	Interest rates	Unemp-loyment	Trade balance
π_{11}	-0.0007 (-1.308)	0.0016 (2.142)**	-0.0042 (-1.934)	-0.0029 (-2.477)*	-0.0021 (-2.018)*	0.0020 (1.357)
π_{12}	0.0031 (2.229)*	0.0094 (1.666)	0.0012 (2.065)*	-0.0001 (-0.149)	0.0019 (0.668)	-0.0050 (-0.701)
π_{13}	0.0032 (1.643)	0.0077 (1.553)	0.0009 (0.303)	0.0016 (0.471)	0.0085 (1.882)	0.0050 (-0.231)
π_{21}	-0.0038 (-1.180)	-0.0007 (-0.552)	-0.0061 (-2.117)*	-0.0004 (-0.174)	-0.0093 (-2.030)*	0.0047 (2.227)*
π_{22}	-0.0090 (-2.144)*	0.0042 (0.537)	-0.0097 (-2.250)*	0.0002 (0.173)	-0.0041 (-1.068)	0.0036 (0.352)
π_{23}	0.0032 (1.231)	0.0033 (0.488)	-0.0009 (-0.211)	0.0040 (0.865)	0.0101 (1.690)	-0.00045 (-1.430)
π_{31}	0.0148 (4.220)**	-0.0005 (-0.741)	-0.0006 (-0.362)	0.0017 (1.481)	-0.0020 (-0.818)	-0.0053 (-0.425)
π_{32}	-0.0077 (-3.361)**	-0.0043 (-1.047)	-0.0009 (-0.291)	0.0008 (1.196)	-0.0027 (-1.335)	0.0011 (1.827)
π_{33}	0.0139 (5.114)**	0.0035 (0.967)	0.0008 (0.384)	0.0022 (0.913)	0.0065 (2.060)*	-0.0080 (-0.432)
ϕ_{11}	-0.0016 (-0.629)	-0.0185 (-4.565)**	-0.0056 (-1.771)	-0.0110 (-2.253)*	-0.0123 (-2.240)*	-0.0477 (-1.752)
ϕ_{12}	-0.0015 (-0.531)	0.0010 (0.410)	-0.0028 (-0.511)	0.0006 (0.438)	-0.0010 (-2.207)*	0.0038 (0.402)
ϕ_{13}	-0.0058 (-1.745)	-0.0164 (-1.944)	-0.0011 (-0.209)	0.0015 (0.390)	-0.0147 (-1.103)	0.0235 (0.694)
ϕ_{21}	0.0026 (0.775)	0.016 (2.272)*	-0.0114 (-2.721)**	-0.0012 (-0.217)	0.0117 (1.603)	-0.0493 (-1.254)
ϕ_{22}	-0.0059 (-1.525)	-0.0003 (-0.031)	0.0121 (2.139)*	-0.0006 (-0.334)	-0.0033 (-0.554)	0.0085 (0.624)
ϕ_{23}	-0.0060 (-1.351)	0.0048 (0.414)	0.0082 (1.192)	-0.0040 (-0.777)	-0.0091 (-0.987)	0.0497 (1.019)
ϕ_{31}	0.0055 (4.689)**	-0.0004 (-0.293)	0.0002 (0.100)	-0.0020 (-0.701)	0.0031 (0.813)	-0.0153 (-0.670)
ϕ_{32}	-0.0149 (-10.84)**	-0.0013 (-0.218)	0.0008 (0.206)	-0.0005 (-0.530)	-0.0029 (-0.918)	-0.0120 (-1.499)
ϕ_{33}	0.0264 (16.73)**	0.0032 (0.514)	-0.0021 (-0.575)	-0.0019 (-0.686)	-0.0056 (-1.144)	0.0307 (1.077)

Note: Figures in parentheses are *t*-statistics.

3.2.1 Response to Money Growth Surprises

The parameter estimates from π_{11} down to π_{13} for money growth in Table 3 indicate that US stock market returns are affected by monetary surprises in UK but not by domestic and FX market developments. This implies that while the monetary surprise in UK feeds through to US stock markets, it is not directly impounded in domestic stock returns and has limited information value for stock market participants about the future course of the economy or economic policies. In contrast, UK stock returns appear to be directly affected by domestic monetary surprise. The dollar/pound exchange rate is significantly affected by both US and UK money surprises. For example, the parameter estimates of π_{31} and π_{32} for monetary growth indicate that the US monetary surprise has a significantly positive direct impact on the dollar/pound exchange rate, while the UK monetary surprise is significantly negatively related to the exchange rate, implying a US dollar depreciation and a pound appreciation. This is, of course, consistent with basic theoretical predictions. It is noteworthy that the dollar/pound exchange rate is positively affected by the monetary surprise in FX markets, implying that the US monetary surprise is dominantly affecting the dollar/pound exchange rate relative to the UK surprise.

Also, the significance of ϕ_{31}, ϕ_{32}, and ϕ_{33} for money growth indicates that exchange rates are asymmetrically responsive to US and UK monetary surprises. For example, the significantly positive value of ϕ_{31} indicates that a higher-than-expected US money growth leads to higher dollar/pound exchange rates than a lower-than-expected US money growth of the same magnitude. Note that a positive coefficient in the regressions implies that negative surprise is associated with a depreciation of the dollar (or an appreciation of the pound). Similarly, the values of ϕ_{32} (significantly negative) and ϕ_{33} (significantly positive) for money growth suggest that the dollar/pound exchange rate also displays an asymmetric response to the UK monetary surprise and the monetary surprise in the FX market.

3.2.2 Response to Output Growth Surprises

As suggested by the parameter estimate of π_{11} for output growth, US stock market returns are significantly positively related to domestic output growth surprises. This estimated response is consistent with market participants' assessments of a stronger economy with higher-than-expected output growth. All of the off-diagonal parameter estimates of matrix Π for inflation are statistically insignificant, implying that there is no direct cross-market and cross-country feedback relation in response to an output surprise. It is also shown in Table 4 for output growth that both US and UK stock market returns appear to be asymmetrically responsive to US output surprises but in the opposite direction. That is, a lower-than-expected US output growth is followed by lower stock market returns in US but higher returns in UK than a higher-than-expected US output growth of the same magnitude. Thus, it appears that the good (bad) surprise in US output growth is received in UK stock markets as a bad (good) surprise. In the FX market, the output growth surprise either in US or in UK does not seem to directly affect exchange rates.

3.2.3 Response to Inflation Surprises

The parameter estimates of π_{12}, π_{21}, and ϕ_{21} for inflation reveal that UK stock market returns are affecting US stock markets positively but negatively responsive to domestic and US inflation surprises and the response is asymmetric. The US inflation surprise appears to be transmitted to the UK stock market and a higher-than-expected US inflation surprise leads to lower UK stock market returns than a lower-than-expected US inflation of the same magnitude. This indicates that there is a direct cross-market and cross-country feedback relation in response to an inflation surprise.

3.2.4 Response to Output Growth Surprises

The parameter estimates of π_{11} and ϕ_{11} for interest rates suggest that the US interest rate surprise has a negative and direct impact on US stock market returns and the market response displays own asymmetry. That is, a higher-than-expected US interest rate is followed by lower US stock market returns than a lower-than-expected US interest rate of the same magnitude. It appears that there is no direct cross-market and cross-country feedback relation in response to an interest rate surprise. In the FX market, the inflation surprise either in US or in UK does not seem to directly affect exchange rates.

3.2.5 Response to Unemployment and Trade Balance Surprises

As evidenced by the parameter estimates of π_{11} and π_{21} for unemployment, the US unemployment surprise has a negative effect on US stock market returns and is transmitted directly to UK stock market returns. In the FX market, the unemployment surprise either in US or in UK does not seem to directly affect exchange rates, while the unemployment surprise in the FX market is significantly positively related to the dollar/pound exchange rate. The significantly positive value of π_{33} for unemployment indicates that the exchange rate is dominantly affected by the US unemployment surprise relative to UK surprise. Also, the significance of ϕ_{11} and ϕ_{12} for unemployment indicates that US stock market returns are negatively and directly responsive to unemployment surprises both in US and UK. For example, the significantly negative value of ϕ_{11} indicates that a higher-than-expected US unemployment leads to lower US stock market returns than a lower-than-expected unemployment of the same magnitude.

It appears that UK stock market returns are positively responsive to theUS trade balance surprise, although not responsive directly to the domestic trade balance surprise. In the FX market, the trade balance surprise either in US or in UK does not seem to directly affect exchange rates.

4. Conclusions

In this study we investigate the simultaneous effect of macroeconomic developments on stock and foreign exchange (FX) market returns in a system that is characterized by dynamic interaction among asset returns. Unlike extant research on the market response to macroeconomic surprises. we estimate the model for stock market returns and exchange rate movements in which the endogenous variables are allowed to be simultaneously affected by macroeconomic developments not only at home but also abroad. We use US and UK data for six series of macroeconomic variables common in both countries: money growth, output growth, inflation, interest rates, unemployment and trade balance. Evidence presented in this paper indicates that US stock market returns are significantly responsive to domestic macroeconomic developments in output growth, interest rates, and unemployment rates to the extent that revelation of those surprises is impounded in returns. In particular, as measured by the magnitude of the parameter estimates, the US interest rate development appears to be the surprise causing the largest direct response to US stock market returns, followed by the surprise in unemployment and output growth. US domestic macroeconomic developments such as money growth, inflation, and trade balance are not significantly related to US stock market returns. We find that US stock returns are responsive to UK macroeconomic developments in money growth and inflation surprises and UK stock returns are significantly and directly responsive to US macroeconomic developments in inflation, unemployment, and trade balance. This indicates that some of US and UK macroeconomic surprises feed through to counterparty's stock markets. UK stock market returns are significantly responsive to domestic developments in money growth and inflation, with inflation surprise causing the largest response. The dollar/pound exchange rate is significantly responsive to the money growth surprise in US and UK and in the FX market as well. The response of exchange rates to monetary surprises is significantly asymmetric.

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