Economics Letters 37 (1991) 151–158
North-Holland

An empirical investigation among real, monetary and financial variables *

A.G. Malliaris and Jorge L. Urrutia
Loyola University of Chicago, Chicago, IL 6011, USA

Received 22 May 1991
Accepted 22 July 1991

This paper attempts to make an empirical contribution to the literature on the relationships among real, monetary and financial variables of the economy. Using the methodology of Granger's causality tests, our results indicate that: (i) Money Supply and S&P 500 exhibit contemporaneous causality; (ii) Money Supply seems to lead the S&P 500 Index and, (iii) the S&P 500 Index seems to lead the Industrial Production Index. Our findings tend to confirm the important role played by Money Supply in the economy and the popular hypothesis that stock return fluctuations are a leading indicator of future real economic activity. However, our results also show that the causal relationships among these three economic variables are not as statistically significant as the economic and financial literature suggests.

1. Introduction

The relationships among real economic variables, monetary variables and financial variables have been topics of active research for economists for a long time. Harberler (1937) has skillfully summarized a wealth of economic theories attempting to explain the nature and causes of economic fluctuations. The great depression of 1930's and the remarkable intellectual impact of the Keynes' *General Theory*, interrupted the rich multidimensional research agenda of the pre-Keynesian economists and during the 1950s to the late 1960s, the Keynesian doctrine of aggregate demand and activist fiscal policy caused intellectual atrophy in the areas of monetary and financial fluctuations. Friedman and Schwartz (1963a, 1982), among other economists, redirected the attention of researchers on the role of money, while financial economists, such as Sharpe (1964), focused on financial assets.

More recently, numerous studies have focused on specialized issues. Rozeff (1974) has studied the relationship between money and stock prices, and Barro (1977) has analyzed the potential relationship between monetary factors and real output. Although Barro's work indicates that money surprises are much more important that actual money, recent work by Mishkin (1982) suggests that actual money is also a factor in explaining departures of actual GNP from potential GNP. Fama (1981) investigates the relationships among stock returns, real economic activity, inflation, and money. Plosser (1989) reviews an extensive literature on real business cycles and

* We are thankful to several colleagues for constructive comments, and to Avinash Bhandari and Wichai Saenghirunwattana for computational assistance.

0165-1765/91/$03.50

emphasizes the significant role of technological shocks on the production function and the economy's real output. Mankiw (1989) criticizes Plosser's ideas and cites the significant role of tight monetary policies.

While a grand theory of the relationships among real, monetary and financial fluctuations is currently unavailable, Kydland and Prescott (1990) offer an in-depth methodological procedure into the measurement of fluctuations for various variables and conclude that M1 moves contemporaneously with the cycle while the much larger M2 leads the cycle, suggesting that credit considerations could play an important role in future business cycle theory.

Furthermore, during the past decade a large number of papers investigate the excessive volatility in stock market returns and question the validity of the efficient financial markets hypothesis. Shiller (1989) summarizes the bulk of these studies and argues that volatilities in speculative asset prices are excessive relative to the volatilities in real or monetary variables. This evidence increases the challenge to business cycle theorists who must now explain, not only potential relations among changes in levels of real, monetary, and financial variables, but also relations among their volatilities. Actually, this is not a new idea; Friedman and Schwartz (1963b) had shown that changes in the volatility of money generated changes in the volatility of output.

The purpose of this paper is to make an empirical contribution to the literature on the relationships among real, monetary and financial dimensions of the economy both in terms of fluctuations in rates of change and in terms of volatilities. We have chosen to study these relationships using monthly data. This is the shortest possible period for which data is available for all three dimensions: real, monetary, and financial. In choosing monthly data we wish to investigate potential relationships that might not be present on an annual basis, say because of data averaging.

On a monthly basis, the most representative variable measuring real economic activity is the Index of Industrial Production. Monetary factors are represented by M1, and the financial activity is appropriately represented by returns on the S&P 500 Index. We investigate lead-lag relationships among these three macroeconomic variables using Granger's causality tests for both rates of change and volatilities. In using this causality methodology, we wish not only to empirically investigate the relationships among these three variables but to also test the popular hypothesis in the financial press which claims that stock market returns are a leading indicator of future real economic activity.

2. Data

The sample data correspond to monthly average figures for the Standard and Poor 500 Index, and M1 (Money Supply, not seasonally adjusted), and to the monthly Industrial Production Index (seasonally adjusted), all three for the time period January 1970 through June 1989. The S&P 500 and Money Supply data were obtained from the *Federal Reserve Bulletin*. The Industrial Production data were collected from the *Business Conditions Digest*.

3. Methodology

The causal tests of Granger (1969) are essentially tests of the predictive ability of time series models and there are several ways of implementing them. A description of several testable forms of Granger's causality can be found in Pierce and Haugh (1977), Geweke, Meese and Dent (1983), and Guilkey and Salemi (1982).

The simple causal model of the Granger test (1969) is

$$X_t = \alpha_0 + \sum_{j=1}^{m} a_j Y_{t-j} + \sum_{j=1}^{m} b_j X_{t-j} + e_t \tag{3.1}$$

$$Y_t = \beta_0 + \sum_{j=1}^{m} c_j X_{t-j} + \sum_{j=1}^{m} d_j Y_{t-j} + \mu_t \tag{3.2}$$

The definition of causality given above implies that Y is causing X provided some a_j is not zero in eq. (3.1). Similarly, X is causing Y if some c_j is not zero in eq. (3.2). If both of these events occur, there is a feedback. The F-statistic, which corresponds to a Wald test, is calculated by estimating the above expression in both unconstrained and constrained forms (full and reduced models) and follows and χ^2/m distribution [see, i.e., Guilkey and Salemi (1982), and Geweke, Meese, and Dent (1983)].

A more general model with contemporaneous causality can be constructed by including the current values of X and Y in eqs. (3.1) and (3.2), respectively. The contemporaneous equations imply that X and Y may affect each other contemporaneously through a_0 and c_0. However, the null hypotheses with contemporaneous causality differ from those that test Granger causality because they allow the coefficient at lag zero to enter the models. The null hypothesis with contemporaneous causality are tested with an F-statistic. Indeed, the possibility of 'instantaneous causality' is ruled out in tests of Granger's causality [see i.e. Granger (1969), Geweke (1978), and Kawaller, P. Koch and I. Koch (1987)].

Engle and Granger (1987) show that if two nonstationary variables are cointegrated a vector autoregression in the first differences is mispecified. For example, if Money Supply and Industrial Production are both nonstationary in levels, but the first differences of each variable are stationary, it is said that the two variables are integrated of order one. Now, if the difference between the Money Supply and the Industrial Production (or any linear combination of the two variables) is stationary, the two variables are said to be cointegrated. Because the presence of cointegration can cause the Granger's causality tests to be mispecified, it is necessary to test for integration before running the causality tests. If cointegration is found, an error-correcting model must be constructed.

We conduct Augmented Dickey and Fuller tests and find that Money Supply, Industrial Production, and The S&P 500 Index are integrated of order one or stationary in the first difference. Following we test for the presence of cointegration using the Durbin–Watson statistic and the Augmented Dickey and Fuller test. We find that the three variables are not cointegrated. Therefore, we conclude that Granger's Causality tests are well-specified and no error-correcting model is needed [1].

4. Granger causality Tests

This section presents and analyzes the empirical findings of the Granger's causality tests. The results of the standard Granger causality tests for the natural logarithm of the variables are presented in table 1. As the χ^2 statistics indicate, the null hypothesis of no-causality cannot be

[1] The empirical results of the tests of integration and cointegration are not presented here for the sake of space but they are available from the authors upon request.

Table 1
Granger causality tests for the first difference of natural logarithm of variables. [a]

Models (I) $X_t = \alpha_0 + \sum_{j=1}^{6} a_j Y_{t-j} + \sum_{j=1}^{6} b_j X_{t-j}$ $(Y \Rightarrow X)$

(II) $Y_t = \beta_0 + \sum_{j=1}^{6} c_j X_{t-j} + \sum_{j=1}^{6} d_j Y_{t-j}$ $(X \Rightarrow Y)$

Direction of causality	a_j, c_j Regression coefficients, std. errors and t-statistics in parentheses $j=1$	$j=2$	$j=3$	$j=4$	$j=5$	$j=6$	χ^2 $H_0: \sum_{j=1}^{6} \alpha_j = 0$, $\sum_{j=1}^{6} c_j = 0$
Money supply ⇒	−0.0716	0.2524	−0.0563	0.2784	−0.1022	0.1748	
S&P 500	(0.1613)	(0.1649)	(0.1813)	(0.1825)	(0.1653)	(0.1641)	0.69
	(−0.44)	(1.53)	(−0.31)	(1.53)	(0.62)	(1.07)	
S&P 500 ⇒	−0.0037	0.0155	0.0308	−0.0161	0.0334	−0.0001	
Money supply	(0.0018)	(0.0290)	(0.0306)	(0.0301)	(0.0302)	(0.0297)	0.49
	(−0.13)	(0.51)	(1.02)	(−0.53)	(1.12)	(−0.01)	
Money supply ⇒	0.0661	0.0291	0.0641	0.0061	0.0189	0.0072	
Industrial production	(0.0363)	(0.0374)	(0.0408)	(0.0414)	(0.0375)	(0.0370)	0.71
	(1.82)	(0.78)	(1.57)	(0.15)	(0.51)	(0.20)	
Industrial production ⇒	0.0614	0.0417	−0.0546	0.0314	−0.0787	−0.0757	
money supply	(0.0018)	(0.1272)	(0.1374)	(0.1379)	(0.1373)	(0.1372)	0.29
	(0.48)	(0.30)	(−0.40)	(0.23)	(−0.57)	(−0.60)	
S&P 500 ⇒	0.0055	0.0305	0.0157	0.0505	−0.0240	0.0360	
industrial production	(0.0149)	(0.0156)	(0.0154)	(0.0154)	(0.0156)	(0.0149)	4.28
	(0.37)	(1.96) *	(1.02)	(3.27) *	(−1.54)	(2.40) *	
Industrial production ⇒	−0.0827	−0.2711	0.0201	−0.2773	−0.1720	−0.1771	
S&P 500	(0.3081)	(0.3288)	(0.3237)	(0.3232)	(0.3231)	(0.3005)	1.01
	(−0.27)	(−0.83)	(0.06)	(−0.86)	(−0.53)	(−0.59)	

[a] χ^2_{crit} at 5% = 12.59, at 10% = 10.64.
* Significantly different from zero at the 5% significance level.

rejected. Practically no lead-lag relationship is detected, except for some individual coefficients that are statistically significant implying that the S&P 500 Index may lead Industrial Production. We have repeated the standard Granger's causality test using as input data in eqs. (3.1) and (3.2) the standard deviation of the first difference of the natural logarithm of the variables [2]. The results shown in table 2 are not different from those presented in table 1. That is the null hypothesis of no-causality cannot be rejected.

The results of the tests of contemporaneous causality are presented in Table 3 for the first differences of the natural logarithm of the variables, and in table 4 for the standard deviations. As it was indicated earlier, the tests generated in tables 3 and 4 are not exactly Granger's tests, because the regressions include also the current values of the variables. An F-statistic is used to

[2] The standard deviation is computed using a moving window procedure: First we take twelve monthly data and estimate the standard deviation. Then we reestimate the standard deviation by deleting the three oldest monthly data and by adding three most recent monthly data (always keeping twelve monthly observations in our sample).

Table 2
Granger causality tests for the standard deviation of the first difference of natural logarithm of variables

Models (I) $X_t = \alpha_0 + \sum_{j=1}^{6} a_j Y_{t-j} + \sum_{j=1}^{6} b_j X_{t-j}$ $(Y \Rightarrow X)$

(II) $Y_t = \beta_0 + \sum_{j=1}^{6} c_j X_{t-j} + \sum_{j=1}^{6} d_j Y_{t-j}$ $(X \Rightarrow Y)$

Direction of causality	a_j, c_j Regression coefficients, std. errors and t-statistics in parentheses $j=1$	$j=2$	$j=3$	$j=4$	$j=5$	$j=6$	χ^2 $H_0: \sum_{j=1}^{6} \alpha_j = 0$, $\sum_{j=1}^{6} c_j = 0$
Money supply ⇒	−0.3957	0.6229	0.2647	1.7793	−2.5100	0.2283	
S&P 500	(0.7424)	(1.0163)	(0.9618)	(0.9564)	(1.0215)	(0.7557)	2.10
	(−0.53)	(0.61)	(0.28)	(1.86) [b]	(−2.46) [a]	(0.30)	
S&P 500 ⇒	−0.0184	0.0207	−0.0076	−0.0156	0.0317	−0.0320	
Money Supply	(0.0230)	(0.0284)	(0.0285)	(0.0286)	(0.0294)	(0.0224)	0.72
	(−0.80)	(0.73)	(−0.27)	(−0.54)	(1.08)	(−1.43)	
Money supply ⇒	−0.2087	0.3941	0.1373	0.0244	−0.0199	0.0201	
Industrial production	(0.2170)	(0.2888)	(0.2706)	(0.2719)	(0.2873)	(0.2001)	0.43
	(−0.96)	(1.37)	(−0.51)	(0.09)	(−0.07)	(0.10)	
Industrial production	−0.0621)	0.1028	−0.0477	0.1644	−0.2155	0.0298	
⇒ Money supply	(0.0791)	(0.1090)	(0.1037)	(0.1030)	(0.1056)	(0.0799)	1.21
	(−0.79)	(0.94)	(−0.46)	(1.60)	(−2.04) [a]	(0.37)	
S&P 500 ⇒	0.0711	−0.0158	−0.0619	−0.0159	0.0516	0.0082	
Industrial production	(0.0336)	(0.0458)	(0.0464)	(0.0448)	(0.0457)	(0.0390)	1.45
	(2.12) [a]	(−0.35)	(−1.33)	(−0.36)	(1.13)	(0.21)	
Industrial Production	−0.0194	1.0131	−1.5008	1.1324	−0.5339	0.2903	
⇒ S&P 500	(0.5071)	(0.6794)	0.6576)	(0.6589)	(0.6694)	(0.4897)	1.13
	(−0.04)	(1.49)	(−2.28) [a]	(1.72) [b]	(−0.80)	(0.59)	

χ^2_{crit} at 5% = 12.59, at 10% = 10.64.
[a] Significantly different from zero at the 5% significance level.
[b] Significantly different from zero at the 10% significance level.

test the null hypothesis of no-causality. Results in table 3 indicate that the S&P 500 and Money Supply exhibit contemporaneous causality and that the S&P 500 Index leads Industrial Production. Also, several statistically significant individual regression coefficients seem to indicate that Money Supply tends to lead the S&P 500 Index. This later result is confirmed in table 4 where we can observe that the null hypothesis of no-causality is rejected at the 5% significance level.

5. Summary and conclusion

This paper attempts to make an empirical contribution to the literature on the relationships among real, monetary and financial sectors. The three sectors are represented by the Industrial Production Index, Money Supply, and S&P 500 Index, respectively. We use Granger's causality tests to investigate lead-lag relationships among the three indicators and have found that: (i) S&P

Table 3
Tests of contemporaneous causality for the first difference of natural logarithm of variables.

Models (I) $X_t = \alpha_0 + \sum_{j=0}^{6} a_j Y_{t-j} + \sum_{j=1}^{6} b_j X_{t-j} \quad (Y \Rightarrow X)$

(II) $Y_t = \beta_0 + \sum_{j=1}^{6} c_j X_{t-j} + \sum_{j=1}^{6} d_j Y_{t-j} \quad (X \Rightarrow Y)$

Direction of causality	a_j, c_j Regression coefficients, std.errors and t-statistics in parentheses $j=0$	$j=1$	$j=2$	$j=3$	$j=4$	$j=5$	$j=6$	F H$_0$: $\sum_{j=0}^{6} a_j = 0$, $\sum_{j=0}^{6} c_j = 0$
Money supply ⇒ S&P 500								
	0.2846	−0.0337	0.3916	0.0616	0.3259	−0.0893	0.1358	
	(0.1607)	(0.1619)	(0.1820)	(0.1804)	(0.1836)	(0.1647)	(0.1648)	1.04
	(1.77) [b]	(−0.21)	(2.15) [a]	(−0.34)	(1.78) [b]	(−0.54)	(0.82)	
S&P 500 ⇒ Money supply								
	0.0510	−0.0213	0.0232	0.0284	−0.0149	0.0296	0.0043	
	(0.0288)	(0.0305)	(0.0308)	(0.0300)	(0.0300)	(0.0296)	(0.0282)	0.87
	(1.77) [b]	(−0.70)	(0.75)	(0.95)	(−0.50)	(1.00)	(0.15)	
Money supply ⇒ Industrial production								
	0.0298	0.0701	0.0436	0.0633	0.0109	0.0199	0.0029	
	(0.0368)	(0.0367)	(0.0415)	(0.0409)	(0.0419)	(0.0376)	(0.0374)	0.70
	(0.81)	(1.91) [b]	(1.05)	(1.55)	(0.26)	(0.53)	(0.08)	
Industrial production ⇒ Money supply								
	0.1028	0.0192	0.0351	−0.0615	0.0277	−0.0757	−0.0756	
	(0.1272)	(0.1376)	(0.1378)	(0.1383)	(0.1375)	(0.1373)	(0.1266)	0.34
	(0.81)	(0.14)	(0.26)	(−0.45)	(0.20)	(−0.55)	(−0.60)	
S&P 500 ⇒ Industrial production								
	0.0093	0.0026	0.0318	0.0155	0.0504	−0.0247	0.0364	
	(0.0149)	(0.0157)	(0.0157)	(0.0154)	(0.0155)	(0.0156)	(0.0150)	3.70 *
	(0.62)	(0.17)	(2.02) [a]	(1.01)	(3.26) [a]	(−1.58)	(2.43) [a]	
Industrial production ⇒ S&P 500								
	0.1941	−0.1580	−0.2754	0.0071	−0.2844	−0.1710	−0.1845	
	(0.3129)	(0.3316)	(0.3294)	(0.3248)	(0.3239)	(0.3235)	(0.3012)	0.92
	(0.62)	(−0.48)	(−0.84)	(0.02)	(−0.88)	−0.53)	(−0.61)	

$F^{crit}_{7,213}$ at 5% = 2.01, at10% = 1.72.
[a] Significantly different from zero to the 5% significance level.
[b] Significantly different from zero to the 10% significance level.
* Null is rejected at the 5% significance level.

500 and Money Supply exhibit contemporaneous causality; (ii) Money Supply tends to lead the S&P 500 Index; and, (iii) the S&P Index tends to lead the Industrial Production Index.

Our results agree with Barro (1977), Friedman and Schwartz (1963a, 1963b, 1982), Mishkin (1982) and Kydland and Prescott (1990) about the important role played by Money Supply in the economy. Our findings also seem to confirm the popular hypothesis that fluctuations in stock market returns are a leading indicator of future real economic activity. However, our empirical results also indicate that the causal relationships among the rates of change and their volatilities for the three variables are not as statistically significant as the economic and financial literature suggests.

Table 4
Tests of contemporaneous causality for the standard deviation of the first difference of natural logarithm of variables.

Models (I) $X_t = \alpha_0 + \sum_{j=0}^{6} a_j Y_{t-j} + \sum_{j=1}^{6} b_j X_{t-j} \quad (Y \Rightarrow X)$

(II) $Y_t = \beta_0 + \sum_{j=0}^{6} c_j X_{t-j} + \sum_{j=1}^{6} d_j Y_{t-j} \quad (X \Rightarrow Y)$

Direction of causality	a_j, c_j Regression coefficients, std. errors and t-statistics in parentheses $j=0$	$j=1$	$j=2$	$j=3$	$j=4$	$j=5$	$j=6$	F H$_0$: $\sum_{j=0}^{6} a_j = 0$, $\sum_{j=0}^{6} c_j = 0$
Money supply ⇒ S&P 500								
	−1.07979	0.6863	0.4556	0.4518	1.2850	−2.1832	0.1740	
	(0.7483)	(1.0503)	(1.0132)	(0.9614)	(1.0073)	(1.0368)	(0.7494)	2.13 *
	(−1.44)	(0.65)	(0.45)	(0.47)	(1.28)	(−2.11) [a]	(0.23)	
S&P 500 ⇒ Money supply								
	−0.0338	0.0115	0.0193	−0.0065	−0.0284	0.0441	−0.0402	
	(0.0234)	(0.0308)	(0.0282)	(0.0282)	(0.0297)	(0.0304)	(0.0229)	0.92
	(−1.44)	(0.37)	(0.69)	(−0.23)	(−0.96)	(1.46)	(−1.76) [b]	
Money Supply ⇒ Industrial production								
	−0.0437	−0.1656	0.3890	−0.1287	0.0032	−0.0083	0.0192	
	(0.2222)	(0.3097)	(0.2925)	(0.2765)	(0.2946)	(0.2958)	(0.2019)	0.36
	(−0.20)	(−0.54)	(1.33)	(−0.47)	(0.01)	(−0.03)	(0.10)	
Industrial production ⇒ Money supply								
	−0.0161	−0.0452	0.0978	−0.0448	0.1585	−0.2093	0.0265	
	(0.0818)	(0.1176)	(0.1129)	(0.1057)	(0.1083)	(0.1111)	(0.0823)	1.03
	(−0.20)	(−0.38)	(0.87)	(−0.42)	(1.46)	(−1.88) [b]	(0.32)	
S&P 500 ⇒ Industrial production								
	0.0246	0.0465	−0.0115	−0.0605	−0.0070	0.0403	0.0152	
	(0.0348)	(0.0485)	(0.0465)	(0.0467)	(0.0467)	(0.0486)	(0.0405)	1.30
	(0.71)	(0.96)	(−0.25)	(−1.30)	(0.15)	(0.83)	(0.38)	
Industrial production ⇒ S&P 500								
	0.3658	−0.3794	1.0855	−1.5439	1.2583	−0.6531	0.3583	
	(0.5180)	(0.7208)	(0.6902)	(0.6634)	(0.6855)	(0.6933)	(0.5012)	1.03
	(0.71)	(−0.53)	(1.57)	(−2.33) [a]	(1.84) [b]	(−0.84)	(0.72)	

$F^{crit}_{7,55}$ at 5% = 2.17, at 10% = 1.82.
[a] Significantly different from zero to the 5% significance level.
[b] Significantly different from zero to the 10% significance level.
* Null is rejected at te 10% significance level.

References

Barro, Robert J., 1977, Unanticipated money, output and the price level in the United States, Journal of Political Economy 86, 549–580.

Engle, R. and C.W.J. Granger, 1987, Co-integration and error-correction: Representation, estimation, and testing, Econometrica 55, 251–276.
Fama, Eugene, 1981, Stock returns, real activity, inflation and money, American Economic Review 71, 545–564.
Friedman, Milton and Anna Schwartz, 1963a, A monetary history of the United States, 1867–1960 (Princeton University Press, Princeton, NJ).
Friedman, Milton and Anna J. Schwartz, 1963b, Money and business cycles, Review of Economics and Statistics 45, 32–64.
Friedman, Milton and Anna Schwartz, 1982, Monetary trends in the United States and the United Kingdom (University of Chicago Press, Chicago, IL).
Geweke, John, 1978, Testing the exogeneity specification in the complete dynamic simultaneous equations model, Journal of Econometrics 6, 163–185.
geweke, John, Richard Meese and Warren Dent, 1983, Comparing alternative tests of causality in temporal systems, Journal of Econometrics 21, 161–194.
Granger, C.W.J., 1969, Investigating causal relations by econometric models and cross spectral methods, Econometrica 37, 428–438.
Guilkey, David K., and Michael K. Salemi, 1982, Small sample properties of three tests for Granger causal ordering in a bivariate stochastic system, The Review of Economics and Statistics 64, 668–680.
Haberler, Gottfried, 1937, Prosperity and depression: A theoretical Analysis of cyclical movements (George Allen and Unwin Ltd., London).
Kawaller, Ira, Paul Koch and Timothy Koch 1987, The temporal price relationship between S&P 500 futures and the S&P 500 index, *The Journal of Finance* 42, 1309–1329.
Kydland, Finn E., and Edward C. Prescott, 1990, Business cycles: Real facts and a monetary myth, Quarterly Review of the Federal Reserve Bank of Minneapolis 14, 3–18.
Mankiw, Gregory N., 1989, Real business cycles: A new Keynesian perspective, The Journal of Economic Perspectives 3, 79–90.
Mishkin, Frederick, 1982, Does unanticipated money matter? An econometric investigation, Journal of Political Economy 91, 22–51.
Pierce, David A., and Larry D. Haugh 1977, Causality in temporal systems: Characterizations and a survey, Journal of Econometrics 5, 265–293.
Plosser, Charles I., 1989, Understanding real business cycles, The Journal of Economic Perspectives 3, 51–71.
Rozeff, Michael, 1974, Money and stock prices; Market efficiency and the lag in effect of monetary policy, Journal of Financial Economics 2, 245–302.
Sharpe, William 1964, Capital asset prices: A theory of capital market equilibrium under conditions of risk, Journal of Finance 19, 425–442.
Shiller, Robert, 1989, Market volatility (MIT Press, Cambridge, MA).