The Stock Market and Investment

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Abstract

This paper investigates the relation between equity prices and aggregate investment in major European countries including France, Germany, Italy, the Netherlands and the United Kingdom. Increasing integration of European financial markets is likely to result in even stronger correlation between equity prices in different European countries. This process can also lead to convergence in economic development across European countries if developments in stock markets influence real economic components, such as investment and consumption. Indeed, our vector autoregressive models suggest that the positive correlation between changes equity prices and investment is, in general, significant. Hence, monetary authorities should monitor reactions of share prices to monetary policy and their effects on the business cycle.

Key words: stock market, investment
JEL classification: E22, E44

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Contents

1. Introduction

The dramatic increase in stock prices in the 1990s and the following crash beginning in 2000 are evidence of the strong correlation between stock markets across countries. Recent literature documents the link between stock markets in the USA and the rest of the world [Eun and Shim (1989) and Susmel and Engle (1994), among others]. Integration of European financial markets is likely to result in even stronger correlation between equity prices in different European countries. This process can also lead to convergence in economic activities across European countries if developments in stock markets influence real variables, such as investment and consumption. Consequently, shocks originating in one European country are likely to affect other economies through the stock market, in addition to the conventional foreign trade channel. Furthermore, as has been discussed in the literature, because of the potential impact of the stock market on macroeconomic activity, equity price movements may be an important determinant of monetary policy [Rigobon and Sack (2003)].

Correlation between share price and the real economy has been investigated and confirmed in the case of the US [Barrel et al. (1999), Barro (1990), and Morck et al. (1990) among others]. This research empirically analysed the direct and indirect effects of the US stock market movements on real consumption and investment. Less work has been done, however, in examining other countries [Edison and Sløk (2001a), Edison and Sløk (2001b)]. Edison und Sløk pointed out that a ten percent increase in the stock market valuations outside of sectors such as technology, media, and telecommunication leads to a 2.5 percent increase of investment in the United Kingdom and 0.2 percent increase in the Netherlands. For Germany and France, the effect is negative and not significant. Whether these results can be applied using the national accounts data as well as the broader share index remains an open question, which this project seeks to address.

The aim of this paper is to investigate the relation between equity prices and aggregate investment in major European countries. Several econometric approaches are used, including the Granger causality test and impulse-response function calculated from a vector autoregressive model (VAR). The results of our VAR models confirm the significant positive response of investment to changes in equity prices and differing elasticity across countries.

Our empirical estimations are useful for further analyses of the impact of shocks on the economy such as those in the working package number 6 of this project, and are helpful in assessing the implications for monetary policy and monitoring business cycles. Furthermore, they suggest that monetary authorities should monitor the reactions of share prices to monetary policy and the effects of share prices on business cycles.

The paper is organised as follows. In Section 2 we briefly review the theories of investment behaviour and comment on the empirical performance of the q theory. The data and empirical design used in our investigation are described in Section 3. Section 4 presents empirical estimation and testing results. Section 5 concludes. Appendices A and B describe in detail all of the data used in our empirical estimation and their properties. The misspecification tests are described in Appendix C.

2. Theoretical background

The literature on investment is dominated by two theories: the neoclassical theory and the q theory. The neoclassical investment theory is based on the firm's maximisation of the discounted flow of profits [Jorgenson (1963)]. In the presence of a constant elasticity of production function, and absent adjustment costs and a possible substitution between capital and other variable inputs, the desired stock of capital is determined by output and the user cost of capital.

An alternative to the neoclassical investment theory is the q approach The q model relates investment to the q variable, the ratio of the market value of firms to the replacement cost of their assets [Tobin (1969)]. The model assumes that financial market data contain valuable information about changing incentives to invest. Thus, an increase in the prospective returns of firms or a decrease in the market discount rate raise the q ratio and thereby increase investment. Two major drawbacks of the classical version of the q theory are: first, the optimal amount of current investment depends only on the current value of average q, which is not confirmed in empirical analysis. Second, in contrast to the neoclassical theory, the role of the production function is not clearly specified in the original exposition.

Subsequent to the development of the q theory, Abel and Yoshikawa showed that it can be integrated into the neoclassical theory of choice by considering marginal valuations of capital and the optimal rate of investment to be the rate for which q-1 is equal to the marginal cost of installation [Abel (1980) and Yoshikawa (1980)]. Later Hayashi modified the q theory by introduction of marginal q (associated with investment in the new capital) and distinguished it from average q (associated with the existing capital) [Hayashi (1982)]. He showed that sometimes both qs can be very different and the marginal rather than the average q is the central determinant of investment.

The q theory of investment has some theoretical advantages over the Jorgenson neoclassical model. The q theory is robust to the Lucas critique. In fact, the q theory is forward-looking rather than being based on current and past economic developments because the market valuation of firms used to compute q variable contains business expectations in the future and thereby information about changing incentives of the firms to invest. The next advantage of q theory is that it allows output to be endogenously determined and variable. The neoclassical theory, in contrast, assumes that output is given exogenously, which is inconsistent with perfect competition.

Despite its theoretical advantages, the q theory of investment behaviour has not performed well in empirical analyses, especially with aggregate data. Although most of the previous studies find that investment is significantly related to q, only a small part of variation in investment is explained by q, and serial correlation of the unexplained part is common. Furthermore, other variables that do not belong to the standard q theory – demand variables and interest rates in particular – appear to affect investment significantly as well. In other words, q itself is not sufficient to explain investment.

To explain the poor empirical performance of the q investment equation, the following four reasons are often cited in literature: the unobservable marginal q, aggregation problems, mismeasurement of capital stock, and mispricing on the stock market. Because the marginal q is unobservable, empirical researchers tend to use the observable average q. Hayashi proved that the average q is equal to the marginal q only under strict assumptions: that the production function is linearly homogeneous in capital and labour, the adjustment cost function is linearly homogeneous in investment and capital, and the real price of investment goods, real wages, and interest rates are exogenous to the firm [Hayashi (1982)].

A possible reason for the poor performance of the q investment equation may lie in inconsistencies between the investment behaviour of individual firms and alternative aggregate representations [Geweke (1985)]. In general, capital markets are not perfect; a firm's investment decisions depend on its financial condition, such as the availability of internal financing, access to new debt, equity finance or credit markets. Behr and Bellgardt document that the larger the firm, the less its investment ratio is influenced by average q [Behr and Bellgardt (2002)].

A measurement error in q can also lead to the poor performance of the investment equation. Capital stock is normally calculated as the cumulated sum of net investment, assuming fixed depreciation rates. These depreciation rates may become highly inaccurate in a situation of structural shifts arising from oil crises and technological progress. Funke agued that a rapid increase in energy prices may render part of the capital stock obsolete: parts of the capital stock are scrapped and replaced by new, more efficient equipment with lower energy expenditures, enabling higher profits [Funke (1990)]. In such a situation, actual depreciation exceeds the one usually calculated, and published capital stock exceeds actual capital stock. Therefore, measured q is systematically downward-biased. The next measurement error of q can arise from excess volatility or other inefficiencies in stock market prices [Shiller, (1987)]. Poterba and Summers and others have argued that stock prices can deviate from their fundamental values for extended periods of time [Poterba and Summers (1988)].

Not only the fundamental part of share prices, but also the non-fundamentals contain information that is relevant for investment in real capital. Galeotti and Schianterelli pointed out in their empirical approach that non-fundamentals are significant explanatory factors for investment [Galeotti and Schianterelli (1994)]. Morck, Shleifer and Vishny also argued that share prices always influence investment, regardless of whether they meet their fundamental value or are just part of a speculative bubble or fad. Share prices are thus more important than the q variable. Aside from the q theory, movements of share price can play other roles that influence investment decision, through active signals, financing costs, or market pressure on managers [Morck et al. (1990)].

The signalling hypothesis assumes that the share index gives managers signals about business expectations in the economy as a whole. If managers' expectations are the same as the stock market signals, the movements in the share price index do not deliver any additional useful information or signal the need to make investment decisions. In this case, the share price index provides only passive information reflecting managers' expectations but not influencing them. It is an active informant and sends signals that influence managers' decisions only if their expectations differ from what they observe on the stock markets.

The financing hypothesis assumes that the stock market is not completely efficient and managers use its swings to finance investments at convenient capital cost. Brainard and Tobin argue "managers react to potentially irrational movements in the market by financing expansion either through new issues, when Q exceeds one, or through mergers and acquisitions, when Q is less than one" [Brainard and Tobin (1968)]. From the finance perspective, rational managers issue equity when equity is overpriced and issue debt or finance internally when equity is not overpriced.

Another external financing option for firms is the take-up loan, which also would depend on the development of their share prices. The share price conveys information about how much a firm is worth. Banks presumably use this information in deciding how much to lend to the firm and on what terms. Morck et al. wrote: “stock price increases would increase debt capacity and reduce the costs of debt, and reverse would be true for stock price decreases” [Morck et al. (1990)]. Furthermore, the development of the firm’s share prices is not the only factor affecting the conditions for loans. The global share index is also an important factor, since increases in share prices lead to increases in the value of shareholding in assets of both the firm and banks. First, increases in net assets improve creditworthiness, which means that it becomes easier for firms to get loans as their potential for credit failure decreases (balance sheet channel).[1] Second, if there is substantial participation in the bank’s portfolio, an increase in share prices also has a positive effect on both their balance sheet and their profitability. As a result, the capital-credit ratio increases, and the banks extend their credit supply (bank loan channel) [Sachverständigenrat (2003)].

Besides conveying signals to managers and affecting financing costs, stock markets influence investment by exerting pressure on managers [Morck et al. (1990)]. Morck et al. ague that if market participants make calculations on when to buy and sell stocks based on their own sentiment, and if the hiring and firing of managers is related to the performance of the stock, then these investors will affect investment even if they are uninformed.

Since most empirical analyses basing on q theory perform poorly, the trend that has recently attracted attention is to use share indices to explain investment. In fact, Edison und Sløk find that the share index is positively linked to investment [Edison und Sløk (2001b)]. In our empirical estimation, we follow these models and use the share index directly instead of a constructed q variable to explain investment. This is more appropriate for the purposes a project aiming to investigate the effects of the stock market on investment.

[1] The credit supplies of the banks depend mainly on two factors: the financial situations of these banks (bank loan channel) and the creditworthiness of the firms (balance sheet channel).

3. Empirical design

In our investigations of the dynamics of aggregate equipment investment and total fixed investment, we use the following variables: real share performance index, real gross domestic product as a proxy for output, and real long-term interest rates. We use seasonally adjusted quarterly data between 1980 and 2004. Apart from the long-term interest rates, all the variables are in logs. In order to reduce the effect of aggregation, we use the broad share performance index of MSCI. While in some theoretical models net investment is a dependent variable, the investment variable used in our estimation is gross investment, which consists of expenditures on capital goods. Since the available measures of depreciation are often quite arbitrary, the choice of gross investment in most empirical estimations is dictated by the availability of data. A detailed description of all data is given in Appendix A. The unit-root test results in Appendix B indicate that all of the series are integrated of order one, I(1).

It is difficult to discriminate between the respective effects of share prices on investment, which we discuss in the previous section. Therefore we attempt to uncover the overall link between the share performance index and aggregate investment in each country. We start the empirical analysis with the Granger causality test in order to examine whether share index helps to predict aggregate investment. It is well known that correlation does not necessarily imply causation in the literal sense of the word. If we make *x* and *y* two distinct covariance-stationary stochastic processes, the Granger (1969) approach to the question of whether *x* Granger-causes *y* is to examine whether *y* can be better predicted by using the history of *x* in addition to all the other relevant information available in the universe. In the bivariate case *y* is said to be Granger-caused by *x* if *x* helps in the prediction of y, or if a regression of *y* on its own lags and the lags of *x* produces a lower forecast error variance than the regression of *y* on its own lags – in other words, if and only if the coefficients on the lagged x's are statistically significant. The bivariate regressions can be written as

$$(1) \qquad y_t = \alpha_0 + \alpha_1 y_{t-1} + \ldots + \alpha_l y_{t-l} + \beta_1 x_{t-1} + \ldots + \beta_l x_{t-l} + \varepsilon_t$$

The reported F-statistics are the Wald statistics for the joint hypothesis are:

(2) $$\beta_1 = \beta_2 = \ldots = \beta_l = 0$$

The null hypothesis is that x does not Granger-cause y. Granger-causality from y to x can be defined analogously.

In the empirical section, we test Granger causality using a vector autoregressive model (VAR) model. The procedure for testing Granger causality described above for the bivariate regression can thus also be easily generalized to this case.

Because of the requirement of stationary variables in the original Granger causality test and because all of the series in our study are I(1), we employ the procedure suggested by Toda and Yamamoto (1995). The advantage of using this procedure is that it allows us to conduct the standard statistical inference in the VAR models when the variables are integrated of an arbitrary order and, moreover, when the variables are possibly cointegrated.

This procedure is based on estimating an augmented vector autoregressive model ($k+d_{max}$) model, where k is the lag length in the original system and d_{max} is the maximal order of integration of the variables in question. Toda and Yamamoto suggest employing the usual Wald test for zero restrictions of the first k autoregressive coefficients of a variable in question that under the null hypothesis does not Granger-cause a dependent variable in the respective VAR equation. This test has an asymptotic $\chi^2(k)$ distribution [Toda and Yamamoto (1995)].

The VAR model has some practical advantages over a structural model. Above all, the underlying theoretical framework does not have to be completely specified. This is important since there is no general agreement on how to specify the structure of aggregate investment models precisely, as discussed in the previous section. An additional advantage of the VAR model is that all variables are treated as potentially endogenous, since each is related to its own lags and the lags of all other variables in the system. Of course, in the VAR model, there is no identifying structure; therefore the system itself is inapplicable to causal interpretation of possible links among the variables. For this, we use the results of the Granger causality test. After estimating the model and doing the Granger causality test, we conduct impulse-response analyses to represent the change in investment resulting from the innovation in share index.

The VARs are identified using the Cholesky recursive scheme. The variables are ordered according to precedence, which corresponds to the theoretical considerations. Variables that are likely to contain information about other variables come first in the sequence. It is assumed that expectations regarding interest rates and future real economic developments are reflected in the share prices. Therefore the share index is ordered first, followed by investments and output. Under this ordering, a change in investment and output will have no contemporaneous impact on the share index. The development of investments in the short and medium run depends more heavily on expectations and reacts more sensitively to interest rates than, for example, consumption. But demand should determine investment on a long-term basis. An investigation of the cross-correlation indicates that the two variables fluctuate simultaneously. Therefore, a predetermined ordering of the two variables is not strict. In our model, we let the output stand before the investments in equipment and allow for a contemporaneous impact of the output on investment. However, the results reported below are not very sensitive to the ordering of the variables.

4. Estimation results

In this section we document the results of the Granger causality tests and the impulse-response analyses for each of five countries: France, Germany, Italy, the Netherlands, and the United Kingdom.

4.1. Granger-Causality Test

Our first step is to estimate two four-variable unrestricted VAR model in levels, including the following variables: share performance index, interest rate, output, and total investment or investment in equipment. The maximal lag length is 4, and the optimal lag length is determined on the basis of several optimal lag length selection criteria including the modified likelihood ratio test [Lütkepohl (1991)], the Akaike, the Schwarz, and the Final Prediction Error criteria. In addition, we have applied the standard misspecification tests, including tests of no residual autocorrelation, residual normality, residual heteroscedasticity, and of no ARCH effects in the regression residuals (Appendix C). For Germany, the optimal lag is three for the both VARs, and two for the remaining countries.

As discussed above, in order to examine whether share index helps to predict aggregate investment, we employ the Toda and Yamamoto (1995) procedure, which is based on the augmented VAR model with the lag length ($k+1$), where k is the optimal lag length in the original system and 1 is the maximal order of integration of the variables in question (see Appendix B). Granger causality tests indicate that the share index provides significant leading information on total investment in France and Germany, and on the investment in equipment in France and the Netherlands, at the five percent level of significance (Table 1).

Comparable results can be found in studies by Funke (1989) and Andersen and Subbaraman (1996). Funke found that in Germany, real share index Granger-causes both equipment investment and structural investment for the time period between 1962 and 1984. There is also evidence of Granger causality from the real share index to total investment for the time period between 1962 and 1996 in Australia [Andersen and Subbaraman (1996)]. One possible explanation for the heterogeneity, according to these studies, is the unstable behaviour of the stock markets in our estimation time period. During this time, two specific events took place: the boom at the beginning 1990s and the crash at the beginning of 2000.

Table 1. Testing Granger causality from share performance index to investment

	Null hypothesis: share performance index do not Granger-cause total investment	Null hypothesis: share performance index do not Granger-cause equipment investment
France	0.006	0.028
Germany	0.049	0.264
Italy	0.329	0.344
Netherlands	0.260	0.020
United Kingdom	0.309	0.312

Table 1 reports p-value from testing the null hypothesis that the lags of the coefficients of share performance index are jointly equal to zero.

4.2. Impulse-Response Analyses

In order to assess the response of investment to changes in the share performance index, we carry out impulse-response analyses. The VARs were identified using the Choleski recursive scheme. In the ordering, as discussed in the previous section, the share index is placed first, then the interest rate, output, and finally investment. We quantify the response, in the next fifteen quarters, to a one-percent increase in stock market values on total investment and on equipment investment in the five countries. The results of this analysis are shown in Table 2 and the following figures. The left panels display the response of the total investment to changes in share performance index and the right-hand panels give the responses of the equipment investment.

Table 2. The maximal response of total investment and of equipment investment to one-percent Cholesky innovation in share performance index (in percent)

	The response of total investment	The response of equipment investment
France	0.18	0.24
Germany	0.16	0.23
Italy	0.17	0.19
Netherlands	0.23	0.30
United Kingdom	0.18	0.22

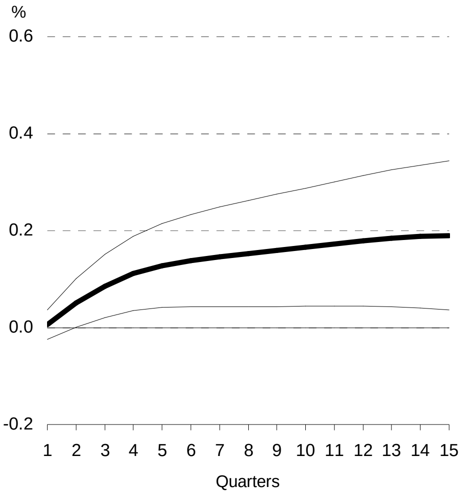
Figure 1.

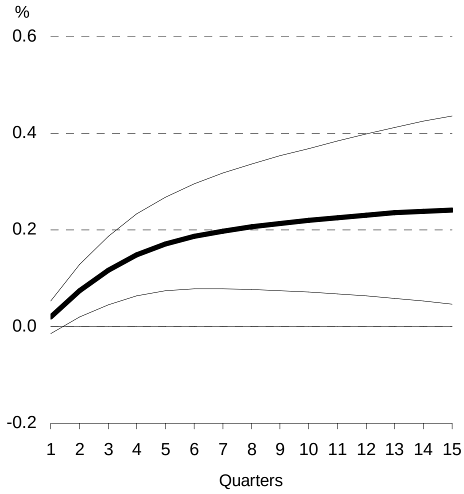
The response of total investment to a one-percent Cholesky innovation in performance performance index (in percent)

Figure 2.

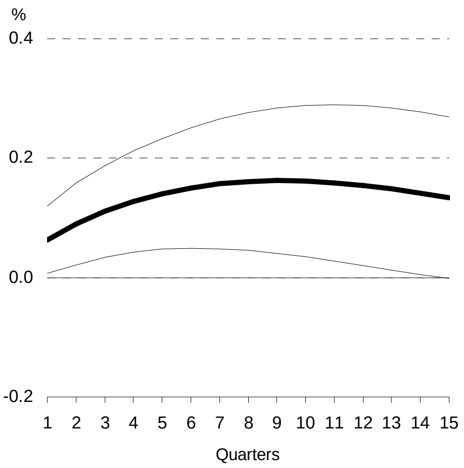
The response of equipment investment to a one-percent Cholesky innovation in performance performance index (in percent)

France





Germany



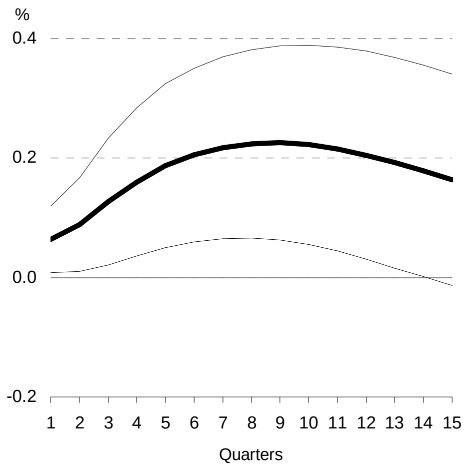


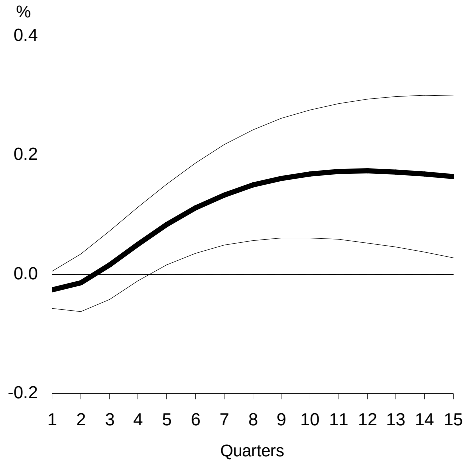
Figure 1 contd.

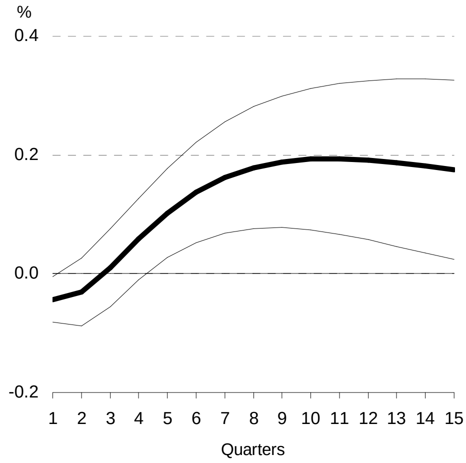
The response of total investment to a one-percent Cholesky innovation in performance performance index (in percent)

Figure 2 contd.

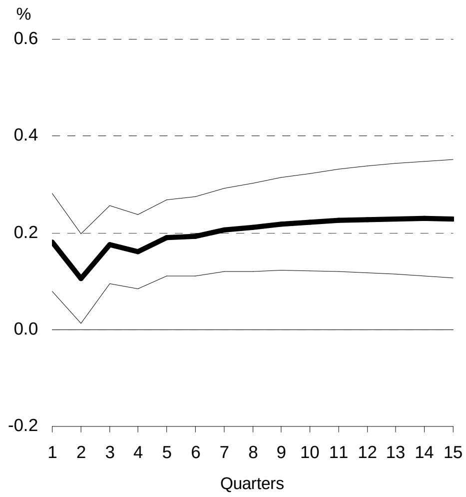
The response of equipment investment to a one-percent Cholesky innovation in performance performance index (in percent)

Italy





Netherlands



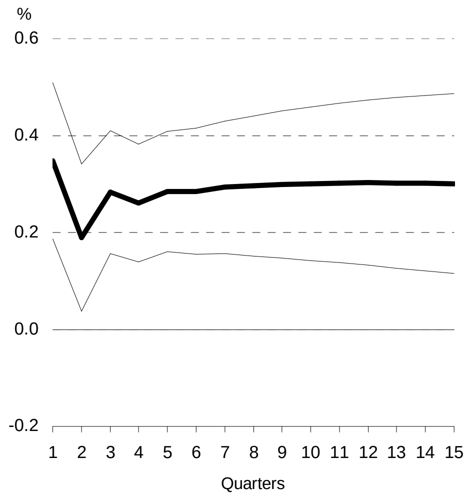


Figure 1 contd.

The response of total investment to a one-percent Cholesky innovation in performance performance index (in percent)

United Kingdom

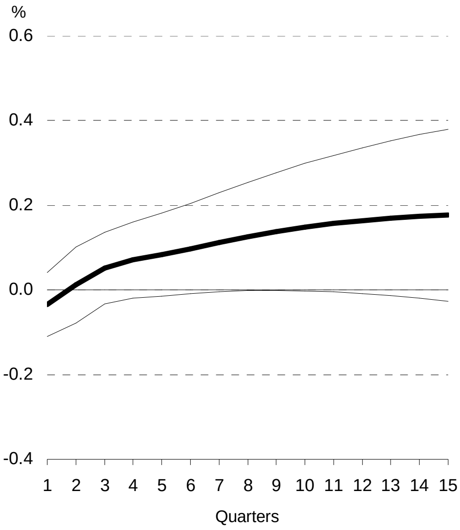
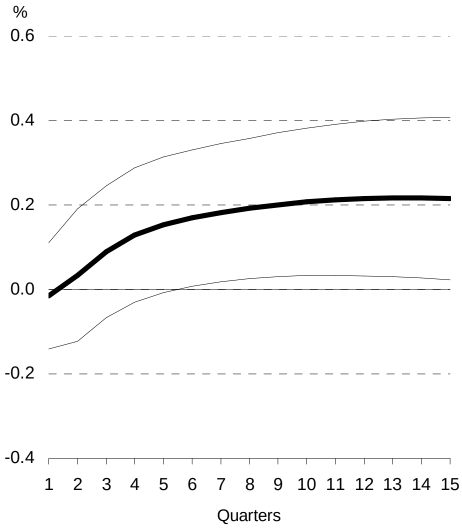


Figure 2 contd.

The response of equipment investment to a one-percent Cholesky innovation in performance performance index (in percent)



The figures display the response of total investment and of equipment investment to the shocks to the share performance index for each of the five countries. For the United Kingdom, only the response of equipment investment to the changes in the share performance index is significant, but not that of total investment. One possible explanation for the heterogeneity is the boom of the investment in non-residential construction in the last five years in the United Kingdom, which is totally different from the general development on the stock market. For the four countries France, Germany, Italy and the Netherlands, the increase in the share performance index appears to cause a significant positive response of total investment. In contrast to the path of the response, its magnitude does not vary widely across countries. The maximum response of total investment to a one-percent change in share index varies from 0.16 percent for Germany to 0.23 percent for the Netherlands. The path of Germany suggests that the response is no longer significant after about three years, whereas for France, Italy and the Netherlands, the time period of significant response is much longer. The maximum response of equipment investment to a one-percent change in performance index varies from 0.19 percent for Italy to 0.30 percent for the Netherlands. The response of equipment investment is generally slightly greater than that of total investment for all these countries.

Comparable results can be seen in a study by Edison and Sløk [Edison and Sløk (2001b)]. In this study, they found that for the continental European countries, the elasticity of total investment to a change in stock market valuation is not always significant, and is smaller than in the United Kingdom. The explanation for this heterogeneity suggested by Edison and Sløk is "the difference in corporate laws and traditions, as witnessed by less frequent takeovers, the greater importance accorded to employees in decision making, and the higher gearing ratios" [Edison and Sløk (2001b)]. In our study, the response of total investment in all of the European countries is significant, and the difference in investment elasticity caused by changes in the share index between the European countries and the United Kingdom is insignificant.

5. Conclusion

The empirical results in our study lead to three conclusions. First, based on the Granger causality tests, we produce mixed evidence on whether share performance index Granger-causes investment. In our data sample, we find empirical support for the Granger causality from the share performance index to total investment for Germany and France, and from the share performance index to equipment investment for France and the Netherlands. For all other countries, we uncover no evidence of Granger causality. Second, based on the impulse-response analysis, we establish that the share performance index is a good predictor for equipment investment in all five countries, France, Germany, Italy, the Netherlands, and the United Kingdom, and for total investment in four of these countries: France, Germany, Italy, and the Netherlands. Third, we find that equipment investment tends to respond more strongly than total investment in all of these countries.

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Appendix A: Data

Real Investment

For all countries, our data on real investment were taken from the Eurostat Database. We define total investment as the total fixed investment without housing investment. We adopt Eurostat's definition of investment in equipment as the sum of investment in metal products and machinery and in transport equipment.

Real gross domestic product and gross domestic product price deflator

For all countries, real GDP and the GDP price index were taken from the Eurostat Database.

Stock market variable

For all countries, the share performance index was taken from Morgan Stanley Capital International, Inc. This variable, MSCI Total Return Indices, measures market performance, including price performance and income from dividend payments. Quarterly data are averages of monthly data reported on the last business day of the month. The real size of share performance index is computed using a GDP price deflator.

Long-term interest rate

For all countries, the long-term government bond yield was used as the long-term interest rate and was taken from International Financial Statistics, IMF. The real interest rate is defined as long-term government bond yield minus the one-year percentage change in the GDP price deflator.

Appendix B: Unit-Root Test

For the unit root test, we use the Augmented Dickey-Fuller (ADF) test described in Said and Dickey (1984). The tests are conducted over the estimation period 1980:Q1-2004:Q4. The tests share the same MacKinnon (1991) critical values. The null hypothesis is that the variables are integrated of order one. Apart from the real long-term interest rates, all the variables are in logs. The results for the level of each series are presented in Table 3. The results suggest that for all the variables, we can accept the null hypothesis of non-stationarity.

Table 3. Augmented Dickey-Fuller (ADF) test

		lag	t-Statistic	p-value	Result
France	Share index	1	-1.16	0.69	I(1)
	Interest rate	4	-1.38	0.59	I(1)
	Gross domestic product	2	-0.47	0.89	I(1)
	Total investment	3	-1.23	0.66	I(1)
	Equipment investment	3	-0.95	0.77	I(1)
Germany	Share index	1	-1.49	0.54	I(1)
	Interest rate	8	-2.41	0.14	I(1)
	Gross domestic product	0	-0.68	0.85	I(1)
	Total investment	4	-1.63	0.46	I(1)
	Equipment investment	1	-0.86	0.80	I(1)
Italy	Share index	8	-1.79	0.39	I(1)
	Interest rate	4	-1.74	0.41	I(1)
	Gross domestic product	0	-1.26	0.64	I(1)
	Total investment	1	-0.65	0.85	I(1)
	Equipment investment	1	-0.64	0.85	I(1)
Netherlands	Share index	0	-2.14	0.23	I(1)
	Interest rate	5	-0.87	0.79	I(1)
	Gross domestic product	0	0.23	0.97	I(1)
	Total investment	7	-2.13	0.24	I(1)
	Equipment investment	1	-1.18	0.68	I(1)
United Kingdom	Share index	0	-2.04	0.27	I(1)
	Interest rate	8	-1.48	0.54	I(1)
	Gross domestic product	3	-0.80	0.81	I(1)
	Total investment	0	-0.21	0.93	I(1)
	Equipment investment	0	-0.72	0.84	I(1)

Table 3 reports the p-values of the ADF test of the null hypothesis that the variables are integrated of order one, i.e. I(1). The lags are automatic chosen by Akaike criteria, the maximal lag is 8.

Appendix C: VAR Misspecification Tests

We have applied the standard misspecification tests, including tests of no residual autocorrelation (AR), residual normality, residual heteroscedasticity, and of no ARCH effects in the regression residuals.

	FR_SPERI	FR_r	FR_Y	FR_I	Vector
AR(1)	[0.5011]	[0.4294]	[0.6323]	[0.7165]	[0.4704]
AR(4)	[0.1516]	[0.4448]	[0.1969]	[0.0717]	[0.3881]
Normality	[0.3183]	[0.0460]*	[0.9878]	[0.8319]	[0.3325]
Heteroscedasticity	[0.9929]	[0.5264]	[0.9132]	[0.5921]	[0.9625]
ARCH(4)	[0.8135]	[0.0164]*	[0.8075]	[0.7362]	-

	FR_SPERI	FR_r	FR_Y	FR_IMEQ	Vector
AR(1)	[0.5705]	[0.4276]	[0.9391]	[0.6036]	[0.4711]
AR(4)	[0.1676]	[0.5273]	[0.3888]	[0.1603]	[0.6394]
Normality	[0.3194]	[0.0460]*	[0.7079]	[0.2994]	[0.2055]
Heteroscedasticity	[0.9940]	[0.5224]	[0.9144]	[0.9924]	[0.9994]
ARCH(4)	[0.8043]	[0.0163]*	[0.4791]	[0.9832]	-

For Germany
Optimal lag length: k = 3

	DE_SPERI	DE_r	DE_Y	DE_I	Vector
AR(1)	[0.4643]	[0.1145]	[0.4350]	[0.7737]	[0.7726]
AR(4)	[0.9190]	[0.1817]	[0.2602]	[0.9890]	[0.5432]
Normality	[0.5652]	[0.0536]	[0.3738]	[0.7355]	[0.2437]
Heteroscedasticity	[0.9794]	[0.7121]	[0.2882]	[0.9478]	[1.0000]
ARCH(4)	[0.9094]	[0.9379]	[0.1354]	[0.7585]	-

	DE_SPERI	DE_r	DE_Y	DE_IMEQ95	Vector
AR(1)	[0.6695]	[0.6287]	[0.8558]	[0.4276]	[0.3574]
AR(4)	[0.9240]	[0.2752]	[0.7335]	[0.1120]	[0.2461]
Normality	[0.3907]	[0.0632]	[0.1892]	[0.2095]	[0.1806]
Heteroscedasticity	[0.9860]	[0.5863]	[0.3888]	[0.9718]	[0.9992]
ARCH(4)	[0.5332]	[0.8315]	[0.2346]	[0.5020]	-

For Italy
Optimal lag length: k = 2

	IT_SPERI	IT_r	IT_Y	IT_I	Vector
AR(1)	[0.8396]	[0.3450]	[0.2381]	[0.1603]	[0.1925]
AR(4)	[0.0950]	[0.1174]	[0.5930]	[0.5326]	[0.1938]
Normality	[0.7750]	[0.6720]	[0.6818]	[0.2571]	[0.7252]
Heteroscedasticity	[0.8581]	[0.2709]	[0.2888]	[0.3512]	[0.4639]
ARCH(4)	[0.7697]	[0.8972]	[0.2020]	[0.8240]	-

	IT_SPERI	IT_r	IT_Y	IT_IMEQ	Vector
AR(1)	[0.8767]	[0.3619]	[0.3117]	[0.2411]	[0.5490]
AR(4)	[0.0547]	[0.1688]	[0.5190]	[0.2291]	[0.1383]
Normality	[0.7522]	[0.7440]	[0.6795]	[0.2169]	[0.4604]
Heteroscedasticity	[0.8577]	[0.3475]	[0.1506]	[0.2714]	[0.5426]
ARCH(4)	[0.8079]	[0.9067]	[0.1499]	[0.9685]	-

For the Netherlands
Optimal lag length: k = 2

	NL_SPERI	NL_r	NL_Y	NL_I	Vector
AR(1)	[0.4389]	[0.7479]	[0.2236]	[0.0550]	[0.1640]
AR(4)	[0.5857]	[0.0317]*	[0.2991]	[0.3296]	[0.0533]
Normality	[0.3252]	[0.1772]	[0.3734]	[0.4631]	[0.0824]
Heteroscedasticity	[0.7345]	[0.3998]	[0.1693]	[0.8089]	[0.9614]
ARCH(4)	[0.5056]	[0.2303]	[0.0238]*	[0.2677]	-

	NL_SPERI	NL_r	NL_Y	NL_IMEQ	Vector
AR(1)	[0.4318]	[0.8351]	[0.1652]	[0.8391]	[0.3701]
AR(4)	[0.3279]	[0.0259]*	[0.1922]	[0.2440]	[0.1624]
Normality	[0.4882]	[0.3456]	[0.4609]	[0.3725]	[0.2513]
Heteroscedasticity	[0.8382]	[0.3424]	[0.1232]	[0.9320]	[0.6501]
ARCH(4)	[0.3587]	[0.2793]	[0.0354]*	[0.0595]	-

For the United Kingdom
Optimal lag length: k = 2

	UK_SPERI	UK_r	UK_Y	UK_I	Vector
AR(1)	[0.6989]	[0.6677]	[0.1919]	[0.5110]	[0.4397]
AR(4)	[0.4465]	[0.2933]	[0.1669]	[0.4883]	[0.0677]
Normality	[0.9914]	[0.5542]	[0.6425]	[0.3692]	[0.8757]
Heteroscedasticity	[0.8701]	[0.5582]	[0.7298]	[0.8766]	[0.9993]
ARCH(4)	[0.3827]	[0.8633]	[0.3975]	[0.3695]	-

	UK_SPERI	UK_r	UK_Y	UK_IMEQ	Vector
AR(1)	[0.2020]	[0.9885]	[0.1853]	[0.6592]	[0.2016]
AR(4)	[0.9336]	[0.2987]	[0.4146]	[0.4400]	[0.1271]
Normality	[0.9655]	[0.7147]	[0.9111]	[0.6108]	[0.9714]
Heteroscedasticity	[0.9797]	[0.7241]	[0.2345]	[0.9965]	[0.9959]
ARCH(4)	[0.4859]	[0.6289]	[0.0859]	[0.2432]	

FR: France

GE: Germany

IT: Italy

NL: The Netherlands

UK: The United Kingdom

I: Total Investment

IMEQ: Investment in Equipment

Y: Gross Domestic Product

r: long-term interest rate

SPERI: Share Performance index