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Essays in applied finance

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ABSTRACT

FACULTY OF SOCIAL SCIENCES
DEPARTMENT OF ECONOMICS

Doctor of Philosophy

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In this thesis we explore three issues in financial economics. We address each of the topics using the VAR methodology of Sims (1980). We begin by asking ourselves to what extent movements in the financial markets can be attributed to the arrival of new information. The research presented here provides an innovative approach by considering not only information coming from outside the market, *i.e.* information about fundamentals, but also information from inside the market, more in line with the game theoretic approach to financial markets. We find information generated inside the market to be the most relevant in explaining trading. We also test the assumption of one-way-influence from information to volume. This hypothesis is not justified according to our results. Part 2 proceeds to assess if the new structure of security markets, diminished importance of banks and increased importance of investment vehicles such as unit trusts and direct trading, could inject instability into the market. The hypothesis is tested in two European countries, providing in this way a test of American studies. We find little evidence of a positive feedback mechanism between unit trust net acquisitions and aggregate bond and stock returns. We do find however a positive relationship running from aggregate bond and stock returns to unit trust bond and stock net acquisitions respectively. Our results are similar to previous American research. Part 3 investigates the relationship between inflation and stock returns. The relationship was previously extensively tested in periods of high inflation. More recent years have seen lower inflation. We use a more recent, lower inflation data set and conclude that the Fisher hypothesis holds also in more recent periods.

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PREFACE

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This thesis is the result of work done wholly while in registered postgraduate candidature.

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Introduction

This thesis consists of three parts. The common thread between each of the three Parts of the thesis is the use of Sims' (1980) VAR methodology. Below we outline briefly the contributions of this thesis.

In Part 1 of the thesis we investigate the foundations for game theoretic approaches to frame trading. Various criticisms have been levelled against these theories, among which the absence of conclusive evidence to prove the main implications deriving from these models is one of the most important. Chapter two tries to provide this evidence by testing the implication of a trading model presented in Morris and Shin (1998).

Morris and Shin (1994) present a paper that emphasises the strategic nature of trade. They show how the arrival of apparently uninformative news can propagate large fluctuations in the volume of trade. Indeed, they claim that the public announcement of a fact that is already known by all traders can cause large changes in trading volume. Even if these announcements may seem at first sight to be uninformative, they convey information about the belief of others that is crucial in the context of the game. Chapter two shows that internally generated information is the aggregate to be most influential on trading volume. All the other information variables, if any, prove to have a very small direct influence on trading. It is found that the influence of information on trading activity has a longer influence than market efficiency related theories normally would imply.

The test is developed using data on the Italian stock exchange as data on other markets where not available. However various considerations exposed in the chapter support the extension of the results to other EU markets.

In Part 2 of the thesis Chapters three and four address the issue of whether the growth of a new investment vehicle, mutual funds, injects instability into the market. The

argument is widely debated in both the theoretical and practitioners literature. We show that there is no ground in the data to support fears about increased instability.

Data availability allows us to develop the test in two different markets, UK and Italy. The difference is significant given the different roles that stock markets have traditionally developed in the two economies. The UK financial system is market centred as firms' finances mainly come from shares and bonds. Institutional investors have been active players in the market for at least the last 40 years. Italy is a intermediary based financial system where the stock market has traditionally played a marginal role. Investors have traditionally been families.

In Part three of the thesis we address the relationship between inflation and the stock market. The theme was widely debated during the mid-eighties following years of high inflation and is now again debated to assess the impact of low inflation on share prices. Various explanations have been proposed most of which are presented in the paper. The paper shows that the Fisher equation providing for the growth of nominal returns in parallel with inflation holds in the UK, in contrast to the US. The fall in inflation in the recent years cannot as a consequence be assumed as one of the reasons of the growth of financial markets.

Finally, a further contribution of the thesis is the development of a new database. Databases such as those built across the thesis are not available in the EU, while they are in the US (CRSP, Stern school etc).

PART 1

Chapter 1

The relationship between information and trading.

1.1 Introduction

This paper is a review of research into the relation between trading and information in financial markets. Our approach will be to follow the development of the research in its historical context. Theoretical and empirical papers will be considered together. Two concepts will drive our survey. The first is the progressive acknowledgement of market participants' strategic behaviour. The second is the growing attention given to the definition of the information used by traders.

We will consider both empirical and theoretical research trying to identify the issues left unresolved and the opportunities for further research.

1.2 Origins of the debate

Bagehot (1971) is the origin of research relating information to trading in financial markets. In an informal paper the author draws a distinction between market and trading gains. The distinction between market and trading gains is the starting point and the fundamental insight of the paper. Market gains correspond to the popular notion of gain in asset markets. Most investors gain when market prices go up; when prices go down most investors lose. The traditional theory before Bagehot (1971) was that investors play a fair game and receive the economy wide rate of return since prices fall and rise over time. The concept of trading gain is more subtle and is connected to the presence in the market of traders endowed with superior information. As a consequence the average investor will actually lose money with respect to the market return in the long run.

The focus of attention in Bagehot's paper is the market maker or middleman. The market maker is the intermediary between the supply of and demand for assets and is aware that some traders could have better, i.e. finer, information. Informed traders can use their information to understand and trade when the price of the asset is too low (high) with respect to the present and future state of the world. When informed traders do not have any better information they do not trade, unlike the market maker who must always be in the market and quote buy and sell prices. As a consequence the market maker knows that she may lose when trading with an informed investor. Yet she is not able to differentiate

between traders. As a consequence, to remain solvent she must balance the losses to the informed with the gains from the uninformed through the bid ask spread.

Before Bagehot's insight that the bid ask spread could be related to informational asymmetries, bid ask spreads were related only to temporal mismatching between supply and demand making costly inventories necessary, Garman (1976).

Bagehot (1971) provided the first way of explaining bid ask spread without recourse to exogenous factors such as inventory technology.

Bagehot's ideas were formalised by Copeland and Galai (1983). The model proposed in the paper captures the information idea suggested by Bagehot and makes it possible to calculate the gains and losses that the market maker has in trading. The model clarifies that to calculate gains and losses we need to know the trading probabilities of the informed and uninformed traders , their demand elasticities and the stochastic process driving the stocks. The model is interesting in providing the first formulation for prices based on asymmetric information. Yet it does so in a static context. The order flow is not exogenous to the dealer's problem and, as a consequence, the fact that the dealer is trading is informative.

Glosten and Milgrom (1985) elaborate on this concept that trades are signals. Market makers do not learn about traders' information in Copeland and Galai (1983). They do in Glosten and Milgrom (1985). The authors focus on a competitive market where informed traders buy when aware of a good state and sell when aware of a bad one, making the inference content of information-trade possible. An obstacle which makes learning difficult is represented by the presence of uninformed liquidity traders. Since the market maker cannot differentiate uninformed from informed traders, she is compelled to set a bid-ask spread. As trade unfolds Glosten and Milgrom demonstrate that the preponderance of informed trades on one side of the market results in the market maker learning the state of the world and the spread to shrink to zero. The focus of the Glosten and Milgrom (1985) paper is on the learning process undertaken by the market maker. The learning mechanism adopted in this paper, and in all the most important following contributions, is based on Bayes' theorem.

The uncertainty present in the Glosten and Milgrom (1985) paper relates to the direction of the information owned by the sophisticated traders, not to its existence. Easley and O'Hara (1987) also take into account this "existence" uncertainty. The main conclusion of the paper is that prices are martingales, but do not have the Markov property. In a market

where trade is sequential, the price effect of the trade depends not only on the going price and the trade, but also on the sequence of past trades.

The main advantage of both the Glosten and Milgrom (1985) and the Easley and O'Hara (1987) papers is that at the limit prices converge to their full information values. Two main difficulties are present. First, while market makers are assumed to be strategic players, informed and uninformed/liquidity traders are not. This issue is obviously difficult to reconcile with reality where traders seek information and try to gain from it. Furthermore we note that the inability to compute the return on information is a further problem of these models. Second, modelling trade as sequential is equally rather unrealistic. In both papers traders are in a queue from which they come to trade according to the percentage of that kind of trader in the population. If we suppose that there are x informed traders in a population of N traders, then the chance that an informed trader is transacting is x/N. Each trader transacts only once and then rejoins the queue at the end.

Both approximations are credible in some particular markets, but it is not clear that they hold generally. The next step of research had necessarily to incorporate both batch auctions and strategic submission of orders by informed traders.

Models where informed traders behave strategically were initiated by Kyle (1985). The main similarity in the Kyle related papers is that informed traders have an incentive to maximise their profits by acting strategically. The two dimensions of the strategy are size and timing of the trade. Since at least two of the market participants are strategic the theoretical literature is strictly connected with game theory. The necessity for both strategic traders, market makers and informed traders, to foretell each other's strategy makes them focus on the price as a statistic which is informative about other's information and strategy. This framework links this literature to the rational expectation literature where part of an agent's decision problem is to infer from market statistics others' information, see Grossman and Stiglitz (1980).

1.3 The Kyle model and its developments

The Kyle (1985) model expressly takes into account the fact that the informed trader is in fact a monopolist. The principle of the model is that as market monopolists act to exploit their advantage, so should information ones. The strategy of an information monopolist has two dimensions, order size and trading intensity.

The model proposed by Kyle (1985) is a one-time batch auction. Three types of agents participate in the auction. First there is the market maker. Next, there is a single risk neutral informed trader who seeks to maximise return from information and set her market behaviour/strategy to this end. Finally, there is a group of uninformed traders. Uninformed traders do not act strategically. The trading of the uninformed traders is exogenous. Uninformed traders' orders are normally distributed with an expected value not connected to the value of the asset being traded. Since uninformed trading is continuous and stochastic the actual trading differs from the expected value. Neither the market maker nor the informed trader get to know the actual value of the trading. Uninformed trading creates noise in the system making a single fully revealing equilibrium, where price is fully informative, impossible. The impossibility for the speculator/informed trader to condition her strategy on the noise trader quantity is a significant departure from the rational expectations framework. By not allowing the informed trader to condition on equilibrium price before submitting the order Kyle makes his model substantially more credible.

The market maker aggregates the orders and clears the market at a single price. The bid ask spread as well as a characterisation of prices for individual trades do not appear in Kyle's batch trading, unlike the sequential trading models. Since focus of the paper is on the informed trader's behaviour it is in this field that the model represents a substantial step forward.

The first substantial result is the characterisation of the informed trader strategy aimed at maximising the revenue from the information seeking activity. The first variable in the speculator's strategy is the variance of the informed trader's order flow. Since the speculator does not know the actual uninformed order quantity, she uses the variance to hide her trade from the market maker. The larger the noise induced by the variance of the noise traders' orders the easier it is for the speculator to hide, gaining larger profits. The second variable considered in the informed trader's strategy is the effect that her trade has on the equilibrium price set by the market maker. The equilibrium presented in the model is a Nash-like equilibrium where the expected profit of the informed from following the equilibrium strategy are greater than those following any other strategy. The strategy of the market maker consists in setting the price equal to the expected value conditional on the aggregate order quantity.

The problem of this equilibrium is that it is not clear that it will still be valid if multiple rounds of trading are held. The decision problem in a sequential trading environment has to

take into account the idea that the speculator has to consider not only the effect of the order on the same period price, but also the effect on following period prices.

The issue of multiperiod prices is confronted by Kyle in the same 1985 paper we mentioned before and by Back (1992).

The Kyle paper frames the multiperiod decision problem into a sequential auction model; Back (1992) into a continuous trading one.

Kyle (1985) designs a market where N rounds of trading are supposed to take place in one trading period. The informed trader in a multiperiod world faces the problem that some information could be revealed to the market through the history of her trading decisions. If, trying to exploit his information at best, the informed trades large quantities at the beginning, the market maker could infer more information and set less profitable, for the informed, prices. The optimal strategy must then include current and future trading profit opportunities. The role of noise is as crucial here as it was in the single time frame. Noise agent trades follow a Brownian motion, making the quantity traded in each period independent of what was previously traded. As trade unfolds the market maker updates her beliefs using Bayes' Rule and fixes the prices equal to the mean of her posterior beliefs. The informed trader's best strategy becomes the submission of orders resulting in prices with constant volatility. The price path follows a martingale, so prices follow a martingale, and therefore prices are efficient in the sense that an uninformed trader's expectation of the future price is today's price. Kyle demonstrates that at the limit prices reflect all new information obtained by speculators.

Back (1992) presents the continuous time, limiting version of the Kyle model. Back's main result is to show that the equilibrium pricing rule will have the property that price changes are proportional to order sizes. The Kyle pricing rule holds also in a dynamic environment if asset prices are normally distributed.

The obvious specification of Kyle's and Back's models is that a single informed trader is envisaged. If information is not held by a single trader, the possibility arises that the Grossman and Stiglitz (1980) result applies. In this seminal paper Grossman and Stiglitz (1980) show that the competition among informed traders results in prices reflecting all information and then in a fully revealing equilibrium. If information seeking provides no returns there is no incentive for it and the link between information and prices becomes unclear. The explicit consideration of the framework in which trades take place and the strategic action of traders makes the Grossman and Stiglitz (1980) result not applicable.

The reason for non-applicability is that the market mechanism determines how trades affect prices, which in turn affects speculators' strategies and finally prices.

Kyle's (1985) assumption of a single informed trader is strong , in the sense that in actual financial markets, it is reasonable to expect that at least a few players will have access to private information and will trade in the knowledge that they will face competition with other informed traders in the market. The presence of multiple informed traders has been investigated in an empirical literature. Brennan and Hughes (1990) approximate the number of informed traders per security as the number of analysts that generate private information on each security for sale to brokers and traders. They report that in 1987 the average number of analysts per security were 12.4 in the NYSE, 4 in the AMEX and 4.8 in the NASDAQ.

Kyle's model has been developed in various directions. Holden and Subrahmanyan (1992) provide the insights about price adjustment to information with multiple informed traders. Foster and Viswanathan (1993) deal with a single trader whose information has a declining value as trading unfolds.

Holden and Subrahmanyan (1992) develop a multi period auction model in which multiple, strategic informed traders optimally exploit their long-lived informational advantage. In this way they can explore the restrictiveness of Kyle's assumption of a single trader and also how quickly the system approaches the perfect competition outcome characterised by the price fully reflecting the information of all privately informed agents. Their finding is that there exists a unique linear equilibrium where sophisticated traders trend very aggressively. Just two informed traders cause nearly all of their common private information to be incorporated into prices almost immediately, provided the number of auctions is reasonably large. As a consequence a market with multiple informed traders approximates a strong form efficient market quite accurately at almost all times. In the case of only two sophisticated agents the amount of information revealed increases at any cut-off point in calendar time as the number of auctions is increased by shortening each time interval into smaller ones. At the limit as the number of auctions goes to infinity all information is revealed in an arbitrarily small amount of calendar time, i.e. immediately. As a consequence market depth, defined as how much order flow affects price adjustment, is small in the earlier periods when adverse selection is severe and large in later periods when almost all information has been released. At the opposite extreme, as the number of traders goes to infinity all their private information is revealed in their first trade. As a consequence

the perfectly competitive outcome is strong from the market efficiency point of view, irrespective of the total number of auctions in the game.

This contrasts with Kyle's (1985) model of monopolistic informed traders driven by what Holden and Subrahmanyan (1992) call aggressive trading between traders. In the game where private information lasts only one period, with a linear pricing rule the unique Nash equilibrium is an equilibrium where imperfect competitors acting non co-operatively choose larger quantities than a monopolist would choose. In the multi-period equilibrium with linear pricing rule, the linear equilibrium is unique and consists of imperfect competitors trading aggressively in each single period as in the single period equilibrium. The noise trading that preserved the returns to information with a single informed trader is not enough to keep the flows of informed traders from dominating the order flow.

Foster and Viswanathan (1993) study the implication of considering a single informed trader who has more information on Monday than on other days. Foster and Viswanathan (1993) argue that since price is an important source of information for uninformed liquidity traders, the informed trader has the greatest advantage when the market first opens. The longer the market is closed, the more significant is the advantage of the informed trader at the opening. A real counterpart to this theoretical fiction is the weekend closing of markets that causes information advantages to be higher on Mondays.

The paper shows that in a model with monopolistic access to information, it is optimal to trade to make market depth or market maker's price response to new orders the same every day. As a consequence prices are equally informative each day. If private information can be publicly revealed at some later stage, the informed trader must transact more intensely, causing the private information to be released more quickly. If private information is received throughout the week, while public information only in market days, the market maker's sensitivity to changes in order flows decreases throughout the week, as a result the variance of prices decreases throughout the week. The determinants of inter day variances of prices and market makers auctions, and their dependence on the quality of public information received, are the key results of the article.

1.4 Strategic liquidity traders

The papers reviewed so far show a progressive sophistication of traders. In Bagehot (1971) and related papers, the only strategic player was the market maker. Kyle (1985) considers a world where both the market maker and the informed trader act strategically. The models rely on uninformed traders as passive/non strategic players to reach their

conclusions. Yet the view of uninformed traders as non-strategic is difficult to apply to the real world. Another difficulty in the previous models is to understand the level of the losses of the uninformed. Liquidity traders can reasonably trade for reasons exogenous to the model; it is however less reasonable to assume that exogenous reasons constrain also the timing of the trading. If it is profitable for an informed trader to time his trades, it must be profitable for the uninformed trader as well.

Introducing strategic, uninformed traders alters the form of the game substantially as the game is not between market maker and informed traders any more. If the uninformed traders act strategically it is not possible to generate from their losses the gains made by the informed. The structure of the models must change completely. The change of the structure of the models has deep implications for the equilibria being reached. Equilibria in models with strategic uninformed traders will depend crucially on the strategy sets from which traders are allowed to select. In some cases the equilibrium might not even exist. Admati and Pfleiderer (1988) is the first paper to address these issues.

The trading model used is in the spirit of Glosten and Milgrom (1985) and Kyle (1985) Informed traders submit market orders to a market maker who sets prices so that her expected profits are zero given the total order flow. Order are not of fixed size. Information is useful only for one period.

The third set of agents are liquidity traders. Liquidity traders are assumed to be of two types. The first comprises non discretionary liquidity traders who must transact a given amount at a specific time for exogenous reasons. These traders are identical to the noise traders of the previous research. The second group of liquidity traders must trade a given amount as well. Yet they have a certain discretion with respect to the timing of the fulfilment of the orders. It is intuitive that, to the extent of the discretion in their possess, liquidity traders prefer to trade when the market is thick, that is when their orders have the least impact on prices. This creates strong incentives for liquidity traders to trade together and for trading to be concentrated. Informed traders also want to trade when the market is thick. Yet if strategic liquidity traders and informed traders all want to trade at the same point in time then the terms of trade will reflect the increased level of informed trading as well, and this may drive out liquidity traders. The selection of the equilibrium is then uncertain. Admati and Pfleiderer (1988) show that informed traders compete with each other and this typically improves the welfare of liquidity traders. In fact they show that (as long as there is one informed trader) introducing more informed traders intensifies the

forces leading to the concentration of trading by discretionary noise traders. However if information differs across traders this may not be true. As more diversely informed traders enter the market, the amount of available information increases with the possible outcome that the terms of trade worsen for everyone. Despite this possibility, the authors show that an equilibrium where trade is concentrated is generally achieved.

The paper by Admati and Pfleiderer (1988) clearly shows the limits of modelling, with game theory, a situation where much of the structure is exogenously imposed. The rate of arrival of public information, the amount of non discretionary liquidity trading and other less important parameters must all be imposed to reach an equilibrium. A proper game theoretical model would require more endogeneity than the settings allow. The authors acknowledge this in the conclusions of the paper. Yet they notice that, once these limits are acknowledged, the model performs well in explaining trading patterns.

The criticism connected with the difficulty in identifying an equilibrium is not the only one levelled against the game theoretic theories. Ross (1989) laments that the lack of any convincing theory explaining volume behaviour remains a serious gap in our understanding. In particular Ross (1989) notes that any theory of trading volume will be difficult to reconcile with existing theories of intertemporal asset pricing since these theories are based on price taking behaviour aimed at incremental and gradual portfolio re-balancing in the face of news. Events such as the crash of 1987, as well as the magnitude of day to day fluctuations in trading volume, sit uncomfortably with the theories of asset pricing reviewed so far.

Morris and Shin (1994) present a paper responding to both criticisms. In this paper the authors emphasise the strategic nature of trade. They show how the arrival of apparently uninformative news can propagate large fluctuations in the volume of trade. Indeed, they claim that the public announcement of a fact that is already known by all traders can cause large changes in trading volume. Even if these announcements may seem at first sight to be uninformative, they convey information about the belief of others that is crucial in the context of the game.

Morris and Shin (1994) is the last paper in a stream of literature connecting volume to information. This literature presents only a limited number of contributions. Verrecchia (1981) and Kim and Verrechia (1991) represent attempts to model the link between volume and (public) information in a non-strategic environment.

Verrecchia (1981) represents the influence of information on trading in a non-strategic environment. The paper shows that the absence of volume reaction to the release of a piece of information implies that there is total consensus among investors. Any increase or decrease in relative demand for a security is perfectly offset by a corresponding shift in its relative price. Thus there is no incentive to trade. However, if there is some volume reaction, unambiguous inferences about consensus or lack of consensus are impossible since volume reaction may be induced solely by the underlying structure of risk tolerances. Market clearing prices result from geometric averaging of each investor's expectations weighted by that investor's risk tolerance, the inverse of risk aversion. Only under very restrictive assumptions will the weights be such that to trade necessarily corresponds to no consensus and no trade to consensus.

1.5 Empirical literature

No empirical literature has sought to answer the fundamental question of whether there is any evidence, direct or indirect, supporting a game theoretic approach to asset pricing.

Mitchell and Mulherin (1994) analyse the effect of public information on market activity. The variable used to proxy information is the number of stories per day reported by Dow Jones on the Broadtape and in the Wall Street Journal. The study, based on a regression and correlation methodology, finds seasonalities by day of the week and month. The study also finds a positive and significant relationship between public information and trading volume, while the relation with returns is only weak and marginally significant.

Berry and Howe (1994) provide a paper very similar to the precedent in both methodology, use of the same proxy for information, and results. The main innovation consists in a particular attention to describing the timing and pattern of public information arrival in financial markets. Also relevant is the investigation of the influence of information on price volatility, with however insignificant results.

However, by explicitly avoiding consideration of endogenous information, i.e. information reporting the behaviour of the market, the paper avoids answering the question of how to model the market.

The next chapter tries to provide the answer to this question.

In conclusion, we have assessed the historical development of the literature relating information to trading. The main lead proposed by the theoretical literature is that trading

can be framed in a game theoretic environment. Yet serious difficulties exist in supporting this approach since (i) theoretically a multiplicity of equilibria arise among which no criterion supports an unequivocal choice and (ii) no empirical paper has been able to provide the right measure of information to represent inter-trader information.

Chapter 2

The determinants of trading volume: The case of the Milan Stock Exchange

2.1 Introduction

The aim of this chapter is to improve our understanding of the determinants of trading.

Various theories exist to frame security trading. Theories embedded in the strategic framework are those that at the moment seem able to explain a significant amount of empirical regularities. However the number and strength of the assumption necessary for these models has lead to criticism of the strategic approach. The recent assertion by O'Hara (1994) that game theoretic explanations require too much exogenous information is just one example.

We focus on one of the main implications of the strategic framework: the dependence of trading on mutual revelation of information, to test the validity of this group of theories.

Trading is generally linked to information, the positive relationship between information and trading being one of the most widely accepted in financial economics. The accepted notion is that a variation in the amount of information flowing to the market alters the information set available to investors inducing a variation in trading volume, so that more information maps into more trading, the influence of information being inversely related to time. Nevertheless a better comprehension of what motivates trading decisions is important in understanding the working of financial markets. Recently Brady (1988), has stressed that the understanding of volume behaviour is fundamental to understanding of market phenomena like crashes. To understand what motivates trading is also important in order to assess what traders require from trading systems in terms of transparency and immediacy of order execution.

Karpoff (1987) provides a review of the early literature on trading volume. French and Roll (1984) present one of the first attempts to test empirically the influence of information on trading. Using data on price the authors arrive at what they define as the "unpalatable'' conclusion that trading is mainly self generated, i.e. that trading activity generates trading activity. French and Roll (1984) are the first to hint that in

the data there might be some support for the game theoretic approach. However by simply establishing a single in data link between volatility, and trading in two subsequent periods, French and Roll (1984) cannot provide any definitive support for the theoretical framework for trading. The subsequent literature devoted limited effort towards verifying these conclusions. Harris (1987), assuming proportionality between transactions and informational events, finds a (Spearman) correlation between volume and number of trades. More recent attempts to test the link between trading volume and information are Mitchell and Mulherin (1994) and Berry and Howe (1994). These two papers analyse the relationship between information and trading, relying on a proxy for information. The support for the traditional theory is, once again, weak. Technical analysis has paid more attention to volumes (Pring (1991)) than the academic financial literature, where the main stage has been for pricing.

This chapter begins with testing the links between information and trading.

We focus on the amount of public information flowing to the market. By public information is meant information that all market participants know how to obtain and that is available to them at a roughly fixed price. Focusing on public information does not mean excluding the importance of private information. In fact we test the influence of insiders by testing the influence on trade of an aggregate (reporting information) generated inside the market. Examples might be trading, or price changes, beyond the norm.

The current paper extends the earlier work by Mitchell and Mulherin (1994) and Berry and Howe (1994) by considering information coming from inside the market.

Most of the previous studies focused on some specific kinds of information such as earnings reports and macroeconomic or political announcements. We try to bridge a gap in the literature by testing the influence of all information, both internal and external, on trading volumes. In order to consider the alternative compositions of information flowing to the market we gather the different types of information in different categories. Subsequently we test their influence on trading separately. Should any influence between trading volume and information crop up, the speed at which the market adjusts is important for efficiency considerations. Finally we attempt to quantify the reciprocal influence between the different informational aggregates and trading volumes and test for a reverse causality from volume to information.

Conventionally the connection between information and trading volume has been modelled after that between price changes and information. The causality goes from external influences to the market to trading volumes. The external influences (fundamentals) are summarised by the information exogenous to the market flowing to traders. The implication of this theory is that we must find little or no influence of internal information on trading volumes. Internal information is defined as that information which is generated by the trading itself. Furthermore the standard theory admits only a weak feedback from the market to information. An alternative stream of the literature admits the possibility of feedback from trading and suggests that trading might be self generated (Romer (1993)).

The main message of this chapter is that internally generated information is the aggregate which is most influential on trading volume. This is in agreement with Morris and Shin (1994) and Romer (1993). All the other information variables, if any, prove to have a very small direct influence on trading. It is found that the influence of information on trading activity has a more prolonged influence than market efficiency related theories normally would imply. We confirm here the slow reaction of the market to news (interpreted broadly) as recently found by La Porta et al. (1995). Our conclusion is that the market filters information, processing its content. The result is that the total effect is higher than the sum of the partial effects. The informational content of a piece of news is increased by the indication of the reaction of the market. The mutual revelation of information is then more important than the information itself. Trading generates trading as traders become aware of the market interpretation of any piece of news. The results support theoretical models which imply that market activity is driven by the trading process itself through the sequential revelation of information as in Romer (1993), De Long et al. (1990) and Morris and Shin (1994). According to our results the percentage of trading to be "self generated" is higher than that which is "externally generated". The fact that mutual revelation of information is an important factor in driving trading explains why the markets have a strong demand for immediacy in trading. This represents our contribution to the debate about mechanism design.

Obviously the chapter does not necessarily contradict the traditional empirical evidence showing the influence of information on trading. We do not question the proposition that special events in the life of the firm influence trading (e.g. Ziebart (1990), Kim and Verrechia (1991)). The present study is not an event study. The time interval considered is not limited to the three or four special weeks when reports are published. What our evidence shows is that over a year other factors might prove to be relevant.

We also test the assumption of one-way-influence from information to volume. This hypothesis is not justified according to our results. On the contrary, Granger causality between volumes and public information is generally symmetric. Only in one case do we find that the causality runs one way from information to trading and only in one case do we find one way causality from trading to information. We find that feedbacks from volume to information are relevant both from the quantitative and the qualitative point of view. Increases in trading volume bring about increases in the information flow which causes shifts in its qualitative composition. We find an impact of trading on the qualitative composition of information. As trading grows more attention is paid to the facts underpinning this growth. Information not directly exploitable decreases till all the relevant information about the event is produced or the event itself subsides. Some policy implications can be gained from this result. As the most influential category of information is endogenous information the implementation of a trading halt could stop the market from receiving the kind of information which is influential in its working. Moreover stopping trading activity could keep the envisaged mechanism of information tuning from working.

As far as information is concerned a second important set of results characterises this paper. By showing the time path of the influence of information on trading, we contribute to the debate about the influence of the different kinds of information on trading. No unique time pattern turns up in our data. The time profiles of this influence vary widely according to the informational aggregate considered. Moreover for each single aggregate the sign of the influence varies accordingly to the time period considered.

The data offer also an interesting characterisation of the contributions of the informational aggregates to trading fluctuations.

The outline of the rest of the chapter is as follows. In Section II we provide a background to our research, highlighting the major problems outstanding. In Section III we describe our data and outline the econometric methodology in use. Section IV presents a correlation analysis. In Section V we present our results for Granger-causality. Their implications as well as some possible interpretations are also presented. Section VI examines the dynamic links between information and market activity. In particular sub section A characterises the reciprocal dynamic influences between the levels of the different informational aggregates and trading volume. Some conclusions about the time behaviour of this influence are also drawn. Section B turns our attention to the role of information and trading in explaining each other's fluctuations. Section VII performs the same analysis as section V taking into account the link between savings and market activity. In the final section we draw our conclusions.

2.2 Review of the literature

The last decade has seen an increase in the academic interest in trading volume where the main stage has been for the theory of price. Practitioners of technical analysis have traditionally paid attention to trading volume. Pring (1991) and the references quoted therein are an example. The interest generated in the academic framework by the wide use of volume by the practitioners of technical analysis has been limited, but not absent. Blume et al. (1994), for instance, investigate the use of trading volume as a technical indicator for trading. In their model the authors develop a model that is standard in that some fundamentals are unknown to all traders and traders receive signals that are informative of fundamentals. However as supply is fixed the source of noise is the quality of information, in particular the precision of the signal of the distribution. Prices cannot provide full information on both the magnitude and their precision of the signals. Blume *et al.* (1994) show that volume provides information on the quality of information. As a consequence traders who use information contained in the market statistics will do better than traders who do not.

Brooks (1998) focuses his attention on volume when trying to predict stock index volatility. His findings demonstrate that predicting volume using volatility is likely to

be more fruitful from the point of view of forecasting accuracy, but forecasts of stock index volume are of no direct use in terms of an implication for trading or risk management. Furthermore the lagged stock market volume measures prove to have little effect in improving out of sample forecasting performance of volatility models.

To recap the main issues outlined in chapter 1 which are relevant to the empirical work in this chapter we provide here a brief summary of the arguments.

Some authors have looked for the possibility of endogenously generated trading. Karpoff (1987) links volume to idiosyncratic liquidity or speculative desires. De Long et al (1990) show that trading from the professional arbitrageurs may be a response to the behaviour of noise traders rather than of fundamentals. In an influential paper Romer (1993) develops the idea that neither irrationality nor exogenous information causes movements in prices. In his model trading is connected to the revelation of higher order expectations. Morris and Shin (1994) show that announcements not carrying any new information can in fact generate trading as they convey information about the beliefs of other traders.

In a paper using price data, French and Roll (1981) considered trading among the causes of trading. They conclude that self-generation is a possibility that should be looked at. In our knowledge very limited research has followed. Our research represents a step along this road. Moreover by testing the influence of volume on information we are able to draw inferences on the reverse relation.

Several papers produced evidence consistent with the implications of strategic theories. Gallant et al. (1992), Jones et al.(1994) and Keim and Madhavan (1995), for instance, find results that are interpretable both within the strategic and the competitive paradigms. Interestingly Gallant *et al.* (1992) reach the conclusion that prices lead volumes. This conclusion is in contrast to those of the technical analysts maintaining that volumes lead changes in prices (Pring (1991)).

The literature on the mixture of distributions also presents some empirical tests of the connection between information and trading. Harris (1987) for instance, assuming proportionality between number of trades and number of informational events, provides evidence supporting this connection. More recent attempts to test the influence of information on volume rely on data representing the flow of information

to the market. Mitchell and Mulherin (1994) and Berry and Howe (1994) proxy the amount of information flowing to the market with the number of headlines sent to the traders by specialised news suppliers. Mitchell and Mulherin (1994) find a relation between public information and daily trading volume. This relation is positive and robust to day of the week effects except for Fridays. The two proxies used to assess the importance of the news have no influence on trading volume. The general weakness of their results makes the authors conclude that there is still a considerable difficulty in linking trading volume and information. Berry and Howe (1994) focus on intra-daily data for information and trading volume. They divide the trading day in 13 sub-periods. Using regression analysis they find a positive relationship between public information and trading volume. The evidence reported in the paper, albeit qualified by the aggregate nature of the variable, is significant only in 5 of the 13 sub-periods.

2.3 The data and the model

2.3.1 Data description

This research deals with the relation between market activity and information in the Italian Stock Exchange during the period 1 st January 1994 to 31 st December 1994. The choice of the market has no particular theoretical justification and is purely data driven.

The data are daily. Daily data have been used by the previous literature. The justification for using daily data relies on the fact that a day includes an entire trading cycle, as shown by, for instance, Admati and Pfleiderer (1988) in the theoretical literature and Mitchell and Mulherin (1994) in the empirical field.

Overall we look as our data set as made of 220 day and 52 weeks cycles.

The comparison of intra-daily data would have obviously strengthened our result. However the lack of availability of data does not allow us to proceed further.

1994 has not been a particularly unusual year for the Italian economy, and the stock market in particular. The political situation recorded the presence of general and local election and the change of two governments. General elections are scheduled to take place any four years according to the Constitution. However no parliament has been in

place for its full term since the end of the war, so that anticipated elections cannot be seen as an unexpected event for the market.

The same is true for the government. Italian governments enjoy an average period in office of 15 months, so that the change from the Dini (centre left) government to the Berlusconi (centre-right) administration, is not an unexpected event either.

The economy did not experience any particular event either. GDP growth was positive at +2.1%, better then the previous year where a negative value was recorded, -1.2%, but lower than the following year, +3%. Inflation was declining throughout the year, falling from 4.2% in 1993 to 3.9% in 1994. Official discount rate as a consequence fell from 8% in 1993 to 7.50% in 1994.

The stock market was in a substantially stable year. The MIB index was at 9,246 on the 1st January 1994 and closed at 10,370 on the 31st December, a rise of 12%. The growth was steady throughout the period with larger volatility during the spring.

The data consist of a proxy for the information flowing to the market and various measures of market activity. The number of stories sent by AGI (Agenzia Giornalistica Italia), a wire news service, via its networked services is our proxy for information. Each headline counts as one observation. The service produced by AGI is particularly focused on economic news being expressly produced for Italian traders. The service works from 5 am to 1 am. The first headlines of each day report the major events of the day before as well as those of the night just passed. We split the data into smaller aggregates in order to assess the influence of the different kinds of information. These aggregates are:

1. news regarding quoted firms (IQUOT).
2. news about non-quoted firms (INOQUOT).
3. news about the Italian stock market (ITALMK).
4. political news (IPOL).
5. macroeconomic announcements (IFORECA).
6. information about foreign stock markets (IWORLD).
7. information about the exchange rate (IEXCHRATE).
8. information related to the prices and production of raw materials (IRAW).

9. total flow of information (ITOT).

The first aggregate encompasses all information focusing expressly on firms quoted on the market. In this aggregate we include acquired contracts, mergers and acquisitions and profit reports. The legal requirements for financial reporting in the Italian market are quite limited. Quoted firms have to report official communications about their activity every six months. Regulation requires member firms to transmit any release of information that could reasonably be expected to have an impact on its securities to the stock market authority and to at least two news services. Labour cost announcements and firm-trade union relationship are another major component of this aggregate. We have tried to make this category as consistent as possible in comparison with the others. If the headline reports information about two firms, one quoted and one non-quoted, the headline counts as one unit under this heading.

Aggregate 2 reports the same kind of information as above but for non-quoted firms.

Market generated information has been gathered in aggregate 3. It is indeed possible that a certain amount of news merely recounts movements in the price of securities or the market as a whole. We have gathered the information coming from inside the market in a single aggregate in order to test its characteristics and features relatively to the other informational aggregates. Much theoretical debate focuses on the information reported under this heading. It has been suggested that it does not carry any original piece of news and is therefore uninformative by definition. This literature often refers to it as stale news and assumes the absence of any relationship between this aggregate and trading volume. Mitchell and Mulherin (1994) consider the presence of headlines merely recounting movements in prices or volumes as a problem as it conveys redundant information. Another stream of the literature has on the contrary tried to provide an explanation for its importance, if only for its existence. In this part of the literature these announcements are called as "apparently uninformative announcements". Morris and Shin (1994) for instance show their importance in a strategic context. The apparently uninformative announcements convey information about the beliefs of others, a role played by no other aggregate. Finally, we notice that since this aggregate reports information about all abnormal

trades, it is through this aggregate that private information becomes known to the market[1].

Aggregate 4 includes declarations with no direct economic content from senior members or leaders of political parties, trade unions and confederations of employers. Being an election year, 1994 provides a good sample to test theories about the relevance of political information. Our data-set refers to trading days only.

Aggregate 5 gathers all macroeconomic announcements. The typical constituents of this aggregate are reports about employment, and about budget deficits, consumer price index releases and any other announcements regarding fiscal and monetary policy. Forecasts from the major financial institutions are also gathered under this heading. Market participants regard these announcements as having a large influence on the market. Not being connected with any specific firm or sector of the market the content of these announcements is alternatively interpretable. As Romer (1993) has recently stressed the effects of such announcements might be connected with the interpretation given by other traders.

Information from foreign stock markets is reported in aggregate 6.

As foreign goods markets are fundamental for any open economy we report in aggregates 7 and 8 all news whose content relates to exchange rates or the prices of raw materials.

Finally aggregate 9 is the sum of all the preceding aggregates. It simply represents the total amount of information arriving in the market in that day. For reasons to be explained later, throughout the paper this aggregate has been used in its first difference form.

Stock market activity is measured by trading volume. The data on the volume of trading in the Italian Stock Exchange refer to shares traded per day (VOL). The data have been obtained from the Italian Stock Exchange.

In order to improve the statistical properties of the model volume, this non-stationary aggregate, has been used in the first difference form. However, to provide an overview of the phenomenon under observation, the summary statistics in table 1 refer to the raw series.

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[1] I am indebted to Fabio Canova for stressing this point.

The results presented in table 1 contain interesting information. Qualitative differences between the different news flowing to the market have been particularly stressed in the recent literature. Interpreting some information seems to be easier for the market (Romer 1993). Information directly regarding firms (in our case IQUOT and INOQOT) has a narrower shift of possible interpretations than information about macro variables or the aggregate market (IFORECA, ITALMK). The relative proportion of unequivocal information is a key determinant of market stability. The theory about the influence of information on volume generally considers this kind of information as most relevant to trading.

Table 1 reveals that information regarding quoted firms (IQUOT) on average accounts only for 9.2% of the total information flowing to the market. The total of headlines regarding both quoted and non quoted firms (IQUOT, INOQUOT) makes up on average only 22.8% of the total.

Hence, the amount of information whose interpretation is unequivocal accounts for less than a third of total information flowing to the market. If the increase is concentrated in alternatively interpretable information, more information could not bring more stability. If more volume brings more information the effect is then unknown. The series regarding news announcements are stationary as reported in table 2B.

In order to avoid scale problems original volume data have been subjected to a logarithmic transformation. The log series were subsequently tested for stationarity. We are interested in stationarity, because it is a property of time series relevant to the choice of econometric technique we use here. We implement an ADF test at the lag length selected according to criteria explained in section 4.1; the results are reported in table 2B

Volume data are non-stationary. These series were differenced in order to get stationarity. In the differenced form they will be used throughout the rest of the paper. All subsequent statements pertaining to these series are then refers to the data in the differenced form.

Finally, significant seasonality cropped up from the daily volume data as lower trading on Mondays. This form of seasonality has been found frequently across stock markets. We adjust for this by introducing a dummy variable.

2.3.2 The model

The statistical methodology implemented in this chapter is based on the concept of vector autoregression or VAR methodology. The possible presence of feedbacks made us opt for using an econometric technique able to take them into account.

We have chosen this approach because of the emphasis placed on the interdependence among the variables. The methodology is based on an autoregressive process in vector form. This vector autoregression, or VAR, is analysed both in its typical form and in its inverted moving average, or MA, form, once the property of stationarity of the series involved is evaluated. Except the last regression our VAR's are bivariate. The form of our bivariate VAR is:

$$\begin{bmatrix} R_t \\ A_t \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \end{bmatrix} + \begin{bmatrix} \varphi_{11}^{(1)} & \varphi_{12}^{(1)} \\ \varphi_{21}^{(1)} & \varphi_{22}^{(1)} \end{bmatrix} \begin{bmatrix} R_{t-1} \\ A_{t-1} \end{bmatrix} + \ldots\ldots + \begin{bmatrix} \varphi_{11}^{(p)} & \varphi_{12}^{(p)} \\ \varphi_{21}^{(p)} & \varphi_{22}^{(p)} \end{bmatrix} \begin{bmatrix} R_{t-p} \\ A_{t-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \quad (1)$$

where R_t denotes aggregate returns; A_t denotes one of the informational aggregates; c_1 and c_2 are constants; ε_{1t} and ε_{2t} are error terms; $\varphi_{ij}^{(p)}$ are the autoregressive coefficients which are to be estimated; and p is the order of the VAR.

We assume ε_{1t} and ε_{2t} form a white noise innovation process (Lütkepohl ,1991, p. 9) and thus have zero expectations, constant variance and covariance at the same time period, and zero covariances between time periods. Thus if $[\varepsilon_{1t}, \varepsilon_{2t}]' = \mathbf{u}_t$, $E(\mathbf{u}_t)=\mathbf{0}$, and $E(\mathbf{u}_t \mathbf{u}_s') = \Sigma$ if $t=s$, $= \mathbf{0}$ otherwise, where Σ is a 2×2 positive definite symmetric matrix. In practice, one hopes that the p lags are sufficient to model all persistence in the VAR.

There are dangers in applying this model to differenced data. If the levels of the differenced series are cointegrated, the VAR becomes to an Error Correction Model (Hamilton, 1994, pp. 580-1) mis-specified by the omission of the error correction term. Such mis-specification, if present, would invalidate the conclusions drawn from

the VAR. Thus in any case where more than one differenced variable is included in a VAR analysis, the no-cointegration assumption is crucial to the interpretation of the results.

In the first part of the paper the analysis has been performed for each individual informational aggregate. In all series the initially proposed lag length has been 5 as we discuss more extensively below. The VAR is bidimensional as we are interested in the reciprocal influence between informational aggregates and market activity. The lags are equal in order to avoid identification problems.

2.4 Correlation Analysis

The results of the correlation analysis are reported in table 2. The correlation coefficient for the aggregate including all information (total) is 0.28. Correlation coefficients for subcategories are generally small as well never rising above 0.31. It is interesting to note that two aggregates, exchange rate information and political information, have negative correlation.

A Fisher exact test[1] performed on the different values of the correlation showed that all were statistically significant, except for the aggregate reporting information about exchange rates[2].

The table shows the correlation coefficient between the news categories volume. Only in the cases of total and of internally generated information does the correlation rise significantly above zero.

A similar result is reported in Mitchell and Mulherin (1994). The relatively weak relation between news aggregates and market activity could be due to the fact that many news announcements have distributional effects across firms, rather than allocative effect for the entire economy.

2.5 Lag length and Causality

2.5.1 Lag length

The step of choosing the order of the VAR is crucial both from the theoretical perspective and from the statistical one.

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[2] The form of the test is: $r/(1-r^2)^{1/2}/(n-2) \sim t$

Lag length is of the greatest importance for any conclusion about the market efficiency explanation of trading volumes. Efficient exploitation of information is at variance with an excessively long lag length.

The results we are going to obtain may be sensitive to the choice of lag length. To maximise the amount of information about alternative lag lengths we tested for the lag length using three different criteria, the Lütkepohl criterion (L), the Akaike information criterion (AIC) and the Schwartz criterion (SC). When the criteria provided different results disagreements were solved by an LR test in the form suggested by Hamilton (1994).

In the daily series the initially proposed lag length is 5, as five days is the working week in stock markets. Moreover week-ends seem to induce a substantial change in traders' information set whose importance has not been satisfactorily studied. In the case of information on quoted firms the lag length is 4 days. In our knowledge there are no studies reporting the delay in the reaction of trading volume to information. Yet something can be inferred from the literature connecting price reaction to information. In their classic study about the reaction of market prices to information Patell and Wolfson (1984) estimate that most of the market response occurs in the 5 to 15 minutes after the disclosure. These values seem to be widely accepted in the literature. In our case we can then conclude that the lag length proposed is not as short as is suggested by the literature on efficiency (Fama 1965) would require, (see Copeland and Weston 1992).

The main conclusion we can draw from this analysis relates to the daily financial aggregates. Informational aggregates have quite a prolonged influence on the market. This influence seems to last longer than the theory based on information efficiency would allow for. Information about the market is connected with faster reactions. On the contrary, in our results we see that information specifically referring to single firms is exploited with the longest lag.

2.5.2 Granger causality

The definition of causality used in this chapter, as well as in the rest of the thesis, was first proposed by Granger (1969). According to this definition a time series X_t causes another series Y_t if adding past values of X_t to all the other relevant information in the universe improves the forecasts of Y_t. If X_t causes Y_t and Y_t causes X_t the process (X_t, Y_t) is a feedback system.

Sims (1972) provided an alternative test by which to examine causality. X_t causes another series Y_t if adding past, present and future values of X_t the future values of X_t are significant.

It is important to note that whichever of the two tests is actually used, what is actually tested is more a temporal ordering and a predictive ability rather than causality in its various philosophical senses. As a consequence Leamer (1985) stressing that both tests rely on temporal ordering has suggested using the word precedence instead of causality.

In order to test Granger causality we perform a Granger test. Cooley and LeRoy (1985) point out that the interpretation of the Granger causality test is an "unambiguous result only in the case of rejection of Granger non causality" (Cooley and LeRoy 1985, Page 299). The rejection of Granger non causality being one of our fundamental results, we can conclude that this critique levelled against VARs should only marginally affect our main results and their interpretation.

Table 4A reports the Granger causality between trading and information in the daily data.

We detect Granger causality between volume and information in 6 out of the 9 possible cases. The absence of causality between information about foreign markets, exchange rates and raw materials is noteworthy. In the first case it could be evidence of the absence of connections between the market we are considering and the others. When information about exchange rates is concerned the absence of any relationship is all but unexpected considering the

presence of highly developed derivative markets on currencies which allow the hedging against exchange rate risk. The presence of derivative markets for raw materials can well explain also the non influence between the informational aggregate reporting it and trading volumes. Any risk connected to the price of a currency or a raw material can be transformed into a cost quite easily.

The only case of unidirectional causality to volume regards information on quoted firms.

In the case of non-quoted firms the relation is again unidirectional but reverse. Some general conclusions can be gained from jointly considering lag length and Granger causality. According to our results the market does not entirely process all public information immediately. The longest lags are those of the aggregates reporting information about single firms, both quoted and not-quoted. This could provide evidence for the theories according to which it takes a certain period for traders to elaborate strategies based on public information. This view has been debated for a long time in the academic literature. On the contrary it is quite uncontroversial in the financial world[3] (Brady et al. (1988)). Delays could be due to the content of the information. As we reported at the beginning information about firms is not composed only from information about profits. A consistent part is composed from other news

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[3] "Potential buyers, such as value investors do not operate by formula and must have adequate time to assemble data and make calculations before they will commit to buy" Brady report chapter 6

[4] If the shocks are not independent the interpretation of the impulse response function is questionable since it is impossible sort out the sources from the responses to the impulses. To solve this problem we adopted the Choleski decomposition of the variance covariance matrix. We have chosen this decomposition as the set of assumptions it requires is quite limited. This identification restriction forces the system to become a recursive model, making the ordering of the variables important. The importance of the ordering increases in the magnitude of the correlation coefficients of the errors. However since in our case the correlation coefficients are sufficiently low (not shown), the importance of the ordering is quite limited and we can put informational aggregates first in order to emphasise the hypothesis of influence of information on trading.

[5] The average is evaluated as the average of the average contributions of each single aggregate (in both the orderings) to the variance in the trading volume series

whose interpretation is more difficult. The endorsement of new labour contracts is an example.

2.6 Dynamic analysis

2.6.1 Influence of information on volume

This section and the following one use innovation accounting to trace the dynamic properties of the system. The analysis is performed only where we detected Granger causality between the variables. The technique we use is that of impulse response analysis. The impulse response function describes the effect of a shock in one variable on the future values of the other[4].

Figures 1 to 5 report the plots of the impulse response functions for six informational aggregates that resulted in Granger causal connection with market activity. The vertical axis represents the magnitude of the responses in terms of unit standard deviations. The horizontal axis indicates time in days. The lag length at which the impulses subside coincides, most of the time, with that previously chosen. The length shown is three trading weeks (15 days).

We start our analysis focusing on the graphs reporting the influence of the different categories of information on trading volume and the index. The influence on these aggregates is shown only when significant.

The first general conclusion we gain from an overview of the graphs is that information has little influence on trading. Furthermore, disturbances coming from different informational aggregates have different effects on trading volumes and no strong similarity emerges from the data. However, some very general and loose patterns can still be identified.

One can interpret the behaviour of the impulse response functions as the result of operators waiting for a response from the market before exploiting completely the information received. Even if information is public the reaction of the market is uncertain to the single trader. The theoretical framework which seems to better fit is then that of a sequential game. Traders' strategies could organise trade as a sequence of stakes. After having forfeited the first stake, the submission of the following one is contingent upon the reaction of the market. As information about this first reaction is reported further trading is generated. The best representation of this is figure 1

representing the influence of information about quoted firms on trading volume. The influence seems to be sufficiently constant throughout the period. The cumulated effect (not shown) is almost zero. It is important to note the behaviour of the sign of the function, which keeps changing throughout the period and in no period is equal to that in the period before. Only at lag 4 does the effect unfold completely and becomes statistically significant.

A possible explanation of this result should take into account the characteristics of the information flowing to the market. The bulk of this aggregate is made up from information regarding acquisition of contracts, new investments and labour costs. Earning reports make a relevant contribution to this aggregate only during two of the 52 weeks in our data set. Sample surveys of the headlines provided by other news services about the markets in London (London Stock Exchange) and New York (NYSE) made us conclude that they were not significantly different. Obviously everyday information reports the facts of the ordinary life of the firm. This makes the content of this category of information equivocal as it is open to alternative interpretations. It also makes the actions resulting from this category of information connected to the other categories of information. The existence of several possible different interpretations is then the reason for the intermittent trading of the traders. The "iterative discovery procedure" is more effective the faster the execution of the orders. This explains why immediacy in executing the orders is so important for traders. The stronger the need to rely on internal information the stronger the need for immediacy. The fact that the cumulated influence of information on trade is negligible does not contradict the fact that during certain periods of the year or in some special occasion of the life of the firm trading is information driven. What the evidence seems to suggest is that if we consider long time horizons or ordinary periods instead of short time intervals, other factors might be relevant in explaining trading.

A second possible explanation one has to consider is that the volume series contain the aggregate of the shares traded over a day: as a consequence information relating to specific companies can be expected not to have much effect on the volume of the whole market.

More relevant is the response of volume to information about the market. Figure 2 depicts the influence of internal information on trading volume.

The influence is statistically significant, immediate, one day, and substantial in absolute value

Political information has influence on trading, but its absolute value is relatively low. Once again we show that the market takes some time to interpret this information. The influence is reported in Figure 3. Even if political information is thought to have a strong influence on stock markets, our results show that its influence is quite limited once assessed over longer periods. Again even if some special political event might affect the stock market, the influence of the "average" piece of political news is in line with that of the other informational aggregates.

Information about macro-variables flowing to the market has no significant influence on the market and is therefore not reported. Figure 4 report the influence of total information on the market. More information has positive influence over the index, but once again its small absolute size makes it negligible.

Since all the other aggregates proved to be marginally important our conclusion is that the evidence shows that the effect of total information is higher than the sum of the individual effects of its components. This could be due to many factors. The most likely is that the informational content of the index is increased by the indication of the reaction of the market. The mutual revelation of information is then more important than the information itself. Trading generates trading as traders become aware of the market interpretation of any piece of news. Our results support theoretical models maintaining that market activity is driven by the trading process itself through the sequential revelation of information as in Romer (1993), De Long et al. (1990) and Morris and Shin (1994).

Another explanation is that the activity in the market influences the entrance of investors triggering more trading. We investigate this possibility in the next section of the paper.

A final, general, conclusion suggested by our results is that more abstract the information, the longer it takes the market to be influenced by its content.

2.6.2 The influence of volume on information

Figures 5 to 8 represent the influence of trading volume on information. An overview of the graphs supports our previous finding of a feedback from volume to information. Shocks to trading volume have negative impact on the informational aggregates. This impact is more enduring for those general aggregates whose content is less firm-related. The impact is especially strong for political information and macroeconomic forecasts. The graphs seem to suggest that the quality of information be led by trading. The following story, suggested us by a practitioner, fits the data.. Consider a piece of news (whichever its nature) arriving at the market. The natural reaction is to exploit that information and try to know more about the fact that originated the news. As more specific information is sought by market participants, information with more general content receives less attention. It eventually decreases in size until all the relevant information about the event is produced or the event itself subsides. At this point information regains its usual long term composition. Such a behaviour can be influenced also by the exploitability of private information in the sense of the market requiring more readily exploitable information.

According to this explanation and to our results, periods of lively trading bring about more focused information as less informative aggregates become quantitatively less important.

The dynamic influence of trading volume on information about non-quoted firms is reported in figure 5.

The influence is negative throughout the period. In this case we could think of a qualitative feedback from the market with information focusing on a content more relevant to trading. The influence of trading as well as that of the index on endogenous information is not significant.

The dynamic effects of trading volume on political information, figure 6, are also consistent with this interpretation of the working of the market.

The next figure supports our intuition of qualitative feedback from volume to information. As stressed in Romer (1993) the interpretation of information about macro-variables might be equivocal for the traders. The influence exerted on the market is then subordinated to the aggregate interpretation. In the case of figure 7 we

see a decrease in the information about macro-variables in the same time span as the decrease of information about political events or non-quoted firms.

In contrast the influence of volume on the total information flowing to the market is once again negligible.

2.7 Variance decomposition

The next step of this chapter is to assess the contributions of one variable to the fluctuations of the other. In this section we are going to test the reciprocal influence on volatility between the information variables and trading volume. The measure of volatility is the variance of the series. The MA representation of the VAR provides the further possibility of exploring the relation among the variables under investigation. The technique is that of decomposing the forecast error variances. The forecast error variance decomposition describes the proportion of the movements in a sequence due to the shocks of the other variable rather than to its own shocks. The decomposition is shown with a 10 day forecast horizon.

The main conclusion from the tables 5 to 10 is that the informational aggregates, excluding exogenous information are of limited help in explaining the fluctuations in volumes. The average contribution[5] of the informational aggregates to the explanation of the variance of trading volume is 1.41 at the highest lag.

Endogenous and aggregate information perform better than any single aggregate in explaining trading variance. Its mean value between the two orderings is higher than the others and the standard deviation is only 6.3% of the mean. Nevertheless the portion of variance explained remains low.

It is worth noting that the maximum variance explained by volumes relates to political information. This provides further support for our theory about information. There is a feedback from traded volume to information. Affecting some aggregates more than others, volume changes the composition of the information flowing to the market. The feedback is then important more from a qualitative point of view than from a quantitative one.

2.8 Conclusions to part 1

Strategic theories of trading were first proposed by Keynes (1936) in his famous parallel between the stock market and beauty contests. Bagehot (1971) also hinted that trading might have been strategic. It has not until very recently, however, that a full formalisation of those theories has been provided.

Little empirical proof has been provided about the growing body of literature embedding trade into a strategic network or on its implication.

This research has tried to make a first step into this direction. The conclusions of the paper support the theories representing trade as due to the sequential revelation of information, such as those of Romer (1993) and Morris and Shin (1994). The agents seem to be aware of the effects of their actions, which they observe by considering the reaction of the market.

Public information affects trading for a period longer than a strict interpretation of market efficiency would allow. The period of the influence provides support for theories assuming traders following long term strategies. A feedback from trading volumes to the information flowing to the market is also detected. This feedback affects both the amount of information being provided and its composition. Higher volumes change the composition of the information flowing to the market, tuning it to the needs of the market. In our data set the type of information which proved to be more influential on trading volumes is the information produced inside the market. **The reason why information relating to single companies, usually regarded as highly important, has little influence on the market is that our volume data relate to the whole market.**

Overall the research shows that the more abstract the information, the longer it takes to influence trading.

Although we find that some informational aggregates influence trading, the evidence presented in this paper provides only a small step toward the complete understanding of this phenomenon. Other factors might prove to be important in explaining trading volume. Their influence might not even be through information. Possible candidates are inventory control techniques, variations in tastes for risk, and random or systematic infusions of cash.

Our research has some policy implications. As the most influential category of information is endogenous information, the implementation of a trading halt could stop the market from receiving the kind of information which is really important to its working. Moreover stopping trading activity could keep the envisaged mechanism of information tuning from working.

The results reported in this part are obviously limited to the Italian market. Data constraints keep us from replicating the results for other EU markets. However some characteristics of the Italian market makes us believe that the conclusions should not be radically different. A first characteristic of the Italian market leading suggesting this is that most operators working in the market are trained in the UK. Anecdotal evidence shows that a large part of the participants in the market have a UK experience either because it is part of their personal background or because they come from the UK branches of Italian financial firms or because they belong to international financial firms.

Furthermore a part of the trade orders developed in the Italian stock exchange originate abroad. This part is thought to be considerable, but difficult to assess particularly given the absence of more precise data.

Table 1
Summary statistics for the aggregates.
Daily observations. Period 1/1 /94-31/12/94.
IQUOT denotes information about quoted firms, INOQUOT denotes information about non quoted firms, ITALMK denotes information about national markets, IPOL denotes information about political events, IFORECA denotes information about macroeconomic variables/forecasts (inflation, discount rate etc.), IWORLD denotes information about the world stock market, IEXCHRA denotes information about the exchange rate, IRAW denotes information on raw materials, ITOT denotes total information flowing to the market. Mean denotes the mean number of observations per day. VOLVAL denotes total value of the shares traded per day. VOL denotes the volume in value of the shares traded per day.

Section A: informational aggregates.

Series	Mean	Standard error	Minimum value	Maximum value
IQUOT	20.88	11.81	1	77
INOQUOT	31.93	10.92	1	59
ITALMK	48.97	3.38	41	61
IPOL	38.35	18.85	1	123
IFORECA	32.75	10.75	7	40
IWORLD	28.96	3.74	7	40
IEXCHRA	18.93	3.53	12	47
IRAW	9.0	1.8	4	16
ITOT	226.74	35.77	124	348

Section B: Market activity

Series	Mean	Standard error	Minimum value	Maximum value
VOLVAL	761,395,344,570	350,023,518,500	277,644,113,000	2,165,731,929,000
VOL	206,611,430.6	91,841,088.9	70,283,385	566,583,616

Table 2A
Correlation among informational aggregates and information
IQUOT denotes information about quoted firms, INOQUOT denotes information about non-quoted firms, IPOL denotes information about political events. IFORECA denotes information about macroeconomic variables/forecasts (inflation, discount rate etc.), IWORLD denotes information about world stock markets, ITALMK denotes information about national markets, IPOL denotes information about political events, IEXCHRA denotes information about the exchange rate, IRAW denotes information on raw materials, ITOT denotes total information flowing to the market. VOL denotes the volume of the shares traded per day.

	iquot	inoqot	italmk	ipol	iworld	iforeca	iexch	iraw	total
VOL	0.30	0.21	0.31	-0.17	0.11	0.24	-0.04	0.2	0.29

Table 2B ADF test on logarithmic transformation at selected lag
The form of the test is

H0: non stationarity
H1: stationarity
Critical values: 5%=-2.874 1%=-3.459

Series	t-ADF
IQUOT	-3.141
INOQUOT	-3.416
IPOL	-11.193
IFORECA	-6.199
IWORLD	-7.232
ITALMK	-11.960
IEXCHRA	-8.671
IRAW	-7.629
ITOT	-10.300

Table 3
Lag length selected
Lag length suggested by the tests. IQUOT denotes information about quoted firms INOQUOT denotes information about non quoted firms ITALMK denotes information about national markets, IPOL denotes information about political events, IMACROFOR denotes information about macroeconomic variables/forecasts (inflation, discount rate etc.), IWORLD denotes information about world stock markets, IEXCHRA denotes information about the exchange rate, ITOT denotes total information flowing to the market. VOL denotes the volume of shares traded per day.

Section A: Lutkepohl(1990) test (Cube root of the Sample size)
The value proposed for the lag length is the same for all the variables since the sample size is unique.

Value = 6.2912

Section B: AIC, SC and LR test

Series	Lag selected
IQUOT	4*
INOQUOT	4*
ITALMK	2
IPOL	4
IMACROFOR	3
IWORLD	2*
IEXCHRA	2*
IRAW	2
ITOT	4*

- Disagreement between AIC and SC resolved by LR test

Table 4
Result of Granger causality test
IQUOT denotes information about quoted firms, INOQUOT denotes information about non quoted firms, ITALMK denotes information about national market, IPOL denotes information about political events, IMACROFOR denotes information about macroeconomic variables/forecasts (inflation, discount rate etc.). IWORLD denotes information about world stock market, IEXCHRA denotes information about the exchange rate, ITOT denotes total information flowing to the market. VOL denotes the volume in value of the shares traded per day.
The form of the test is: H_0 : No Granger causality

H_1 : Presence of Granger causality

α=5%

Causality Test vector	First component on second	Second component on first
1. y'=(IQUOT,VOL)	REJECTED (36.7)	ACCEPTED* (6.5)
2. y'=(INOQOT,VOL)	ACCEPTED* (1.6)	REJECTED (11.7)
3. y'=(ITALMK,VOL)	ACCEPTED (5.8)	REJECTED (9.3)
4. y'=(IPOL,VOL)	REJECTED (19.2)	REJECTED (19.9)
5. y'=(IFORECA,VOL)	REJECTED (21.5)	REJECTED (14)
6. y'=(IWORLD,VOL)	ACCEPTED (5.6)	ACCEPTED (4.9)
7. y'=(IEXCHRA,VOL)	ACCEPTED (1.1)	ACCEPTED (1.4)
8. y'=(IRAW,VOL)	ACCEPTED (4.5)	ACCEPTED (5.5)
9. y'=(ITOT,VOL)	REJECTED (9.7)	REJECTED (12.5)

*values not accepted at 1%

Table 5
Decomposition of variance for series VOL.
Percentage of the movements of the series VOL explained by the shocks in the series IQUOT or by its own shocks. STEP denotes the number of periods over which this influence develops. VOL denotes the volume of the shares traded per day. IQUOT denotes information about quoted firms

STEP	IQUOT	VOL
1	0.73	99.24
2	0.55	99.45
3	0.79	99.21
4	0.70	99.30
5	2.21	97.79
6	3.08	96.99

Table 6
Decomposition of variance for series INOQUOT
Percentage of the movements of the series INOQUOT explained by the shocks in the series VOL or by its own shocks. STEP denotes the number of periods over which this influence develops. VOL denotes the volume of the shares traded per day. INOQUOT denotes information about non quoted firms.

STEP	INOQUOT	VOL
1	100	0
2	98.52	1.48
3	97.59	2.41
4	96.65	4.35
5	92.81	7.19
6	91.97	8.02
7	92.07	7.92
8	91.98	8.02
9	91.64	8.35
10	91.25	8.75

Table 7 A
Decomposition of variance for series VOL
Percentage of the movements of the series VOL explained by the shocks in the series ITALMK or by its own shocks. STEP denotes the number of periods over which this influence develops. VOL denotes the volume of the shares traded per day. ITALMK denotes information about national markets.

STEP	ITALMK	VOL
1	1.90	98.10
2	3.05	96.95
3	4.15	95.85
4	5.37	94.63
5	6.77	93.23

Table 7 B
Decomposition of variance for series ITALMK.
Percentage of the movements of the series ITALMK explained by the variance of the series VOL or by its own. STEP denotes the number of periods over which this influence develops. VOL denotes the volume in value of the shares traded per day. ITALMK denotes information about national market.

STEP	VOL	ITALMK
1	0.32	99.68
2	0.55	99.45
3	0.56	99.43

Table 8 A
Decomposition of variance for series VOL
Percentage of the movements of the series VOL explained by the shocks of the series IPOL or by its own. STEP denotes the number of periods over which this influence develops. VOL denotes the volume in value of the shares traded per day. IPOL denotes information about political events.

STEP	IPOL	VOL
1	0.67	99.33
2	0.70	99.30
3	1.70	98.30
4	2.01	97.90

Table 8 B
Decomposition of variance for series IPOL
Percentage of the movements of the series IPOL explained by the shocks of the series VOL or by its own. STEP denotes the number of periods over which this influence develops. VOL denotes the volume in value of the shares traded per day. IPOL denotes information about political events.

STEP	VOL	IPOL
1	0.67	99.33
2	0.62	99.38
3	0.81	99.19
4	3.30	96.70
5	5.46	94.54
6	5.04	94.96

Table 9 A

Decomposition of variance for series VOL

Percentage of the movements of the series VOL explained by the variance of the series IFORECA or by its own. STEP denotes the number of periods over which this influence develops. VOL denotes the volume in value of the shares traded per day. IMACROFOR denotes information about macroeconomic variables/forecasts(inflation, discount rate etc.).

STEP	IFORECA	VOL
1	0.08	99.91
2	0.08	99.91

Table 9 B

Decomposition of variance for series IFORECA

Percentage of the movements of the series IFORECA explained by the shocks of the series VOL or by its own. Test performed with an order opposite to the preceding table. STEP denotes the number of periods over which this influence develops. VOL denotes the volume in value of the shares traded per day. IFORECA denotes information about macroeconomic variables/forecasts(inflation, discount rate etc.).

STEP	IFORECA	VOL
1	100	0
2	99.98	0.02
3	99.77	0.22
4	99.25	0.75
5	99.08	0.92
6	98.85	1.15

Table 10 A
Decomposition of variance for series ITOT
Percentage of the movements of series VOL explained by the shocks of the series ITOT or by its own. STEP denotes the number of periods over which this influence develops. VOL denotes the volume in value of the shares traded per day. ITOT denotes total information flowing to the market.

STEP	ITOT	VOL
1	4.37399	95.62601
2	4.52029	95.47971
3	4.83868	95.16132
4	4.88636	95.11364

Table 10 B
Decomposition of variance for series ITOT
Percentage of the movements of series ITOT explained by the shocks of the series VOL or by its own. STEP denotes the number of periods over which this influence develops. VOL denotes the volume in value of the shares traded per day. ITOT denotes total information flowing to the market.

STEP	ITOT	VOL
1	100	0
2	99.44022	0.55978
3	99.39386	0.60613
4	99.36141	0.63859

Figure 1: **VOL Response to IQUOT**
Response of trading volume, VOL, to a shock in the information regarding quoted firms, IQUOT. The confidence interval for the impulse response function always includes zero, except at lag 4.

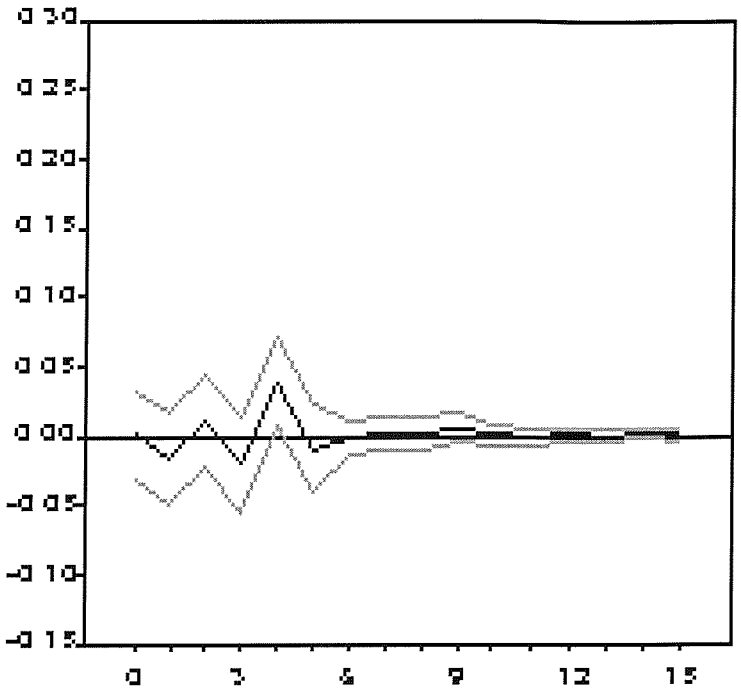


Figure 2: **VOL response to ITALMK**
Response of trading volume to a shock in the information regarding the behaviour of the market, ITALMK. The confidence interval for the impulse response function includes zero at all lags beyond 1.

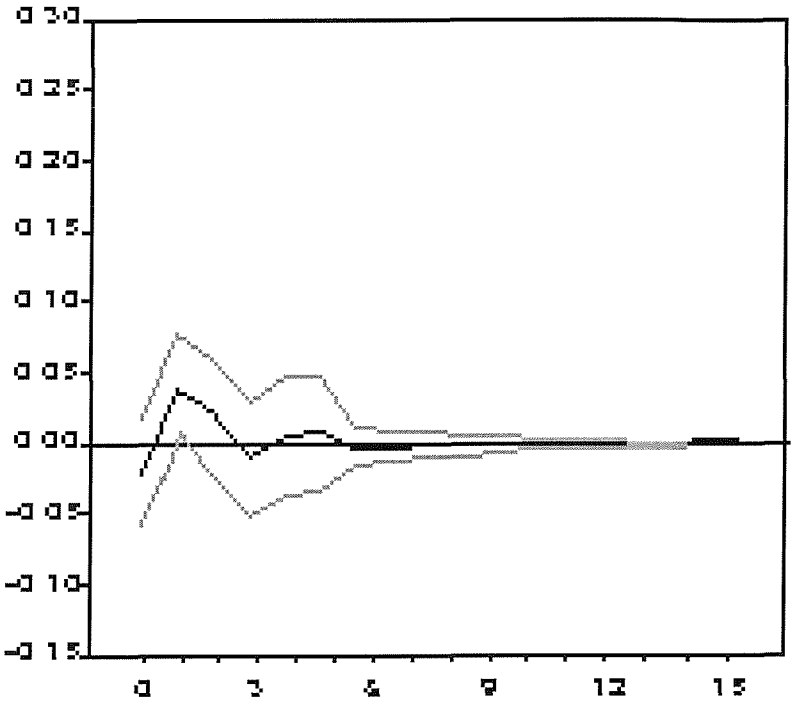


Figure 3: **VOL response to IPOL**
Response of trading volume, VOL, to a shock in the information regarding political events, IPOL. The confidence interval for the impulse response function always includes zero, except at lag 3. Notice the small scale of the response.

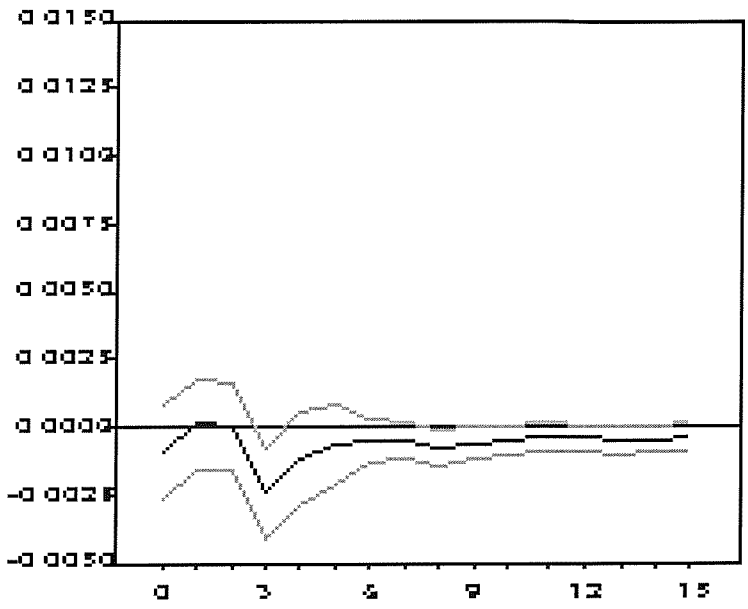


Figure 4: **VOL response to ITOT**
Response of trading volume to a shock in total information, ITOT. The confidence interval for the impulse response function includes zero at all lags.

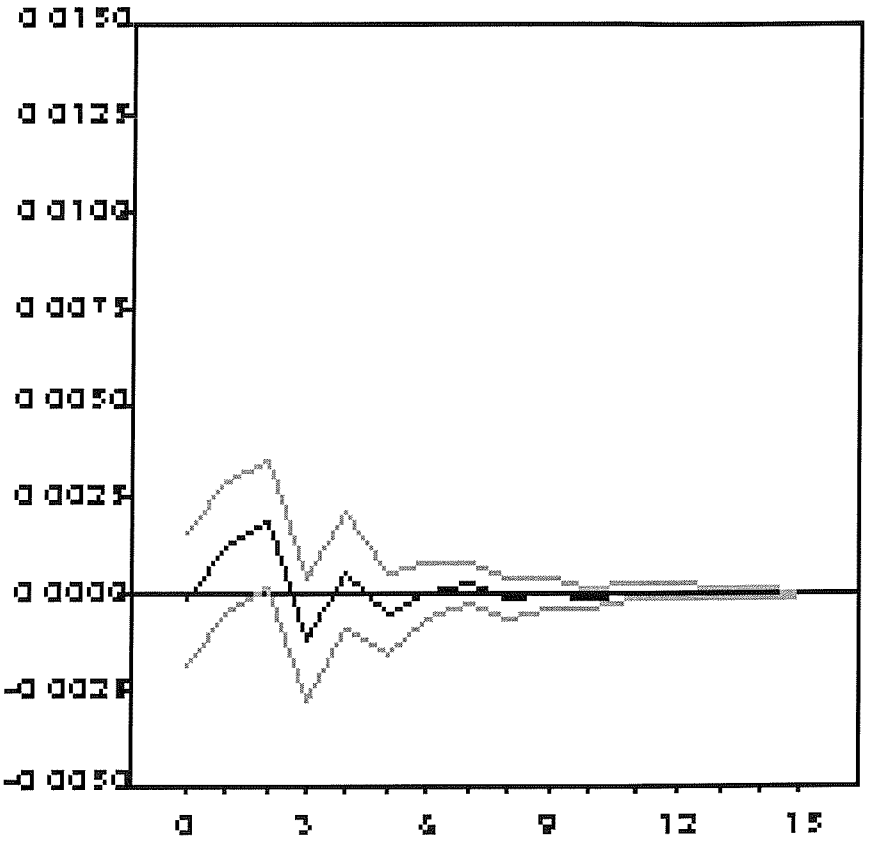


Figure 5: **INOQUOT response to VOL**
Response of information about non-quoted firms INOQUOT to a shock in volume, VOL. At all lags up to 4, the confidence interval for the impulse response function does not include zero

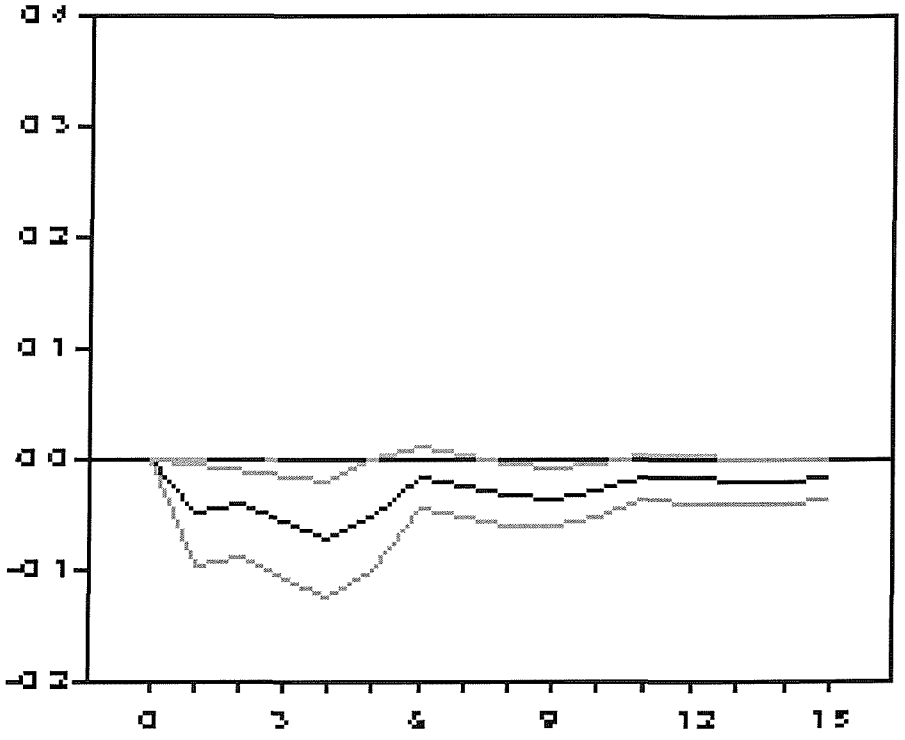


Figure 6: **IPOL response to VOL**
Response of the information regarding political events IPOL to a shock in trading volume VOL. The confidence interval for the impulse response function includes the zero at all lags up to lag 3.

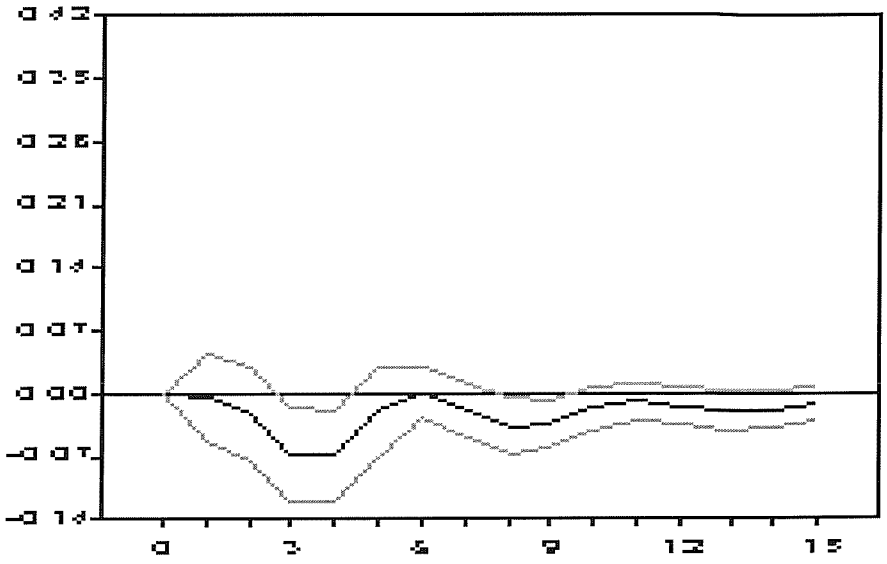


Figure 7: **IMACROFOR response to VOL**
Response of the information regarding macroeconomic forecasts, IMACROFOR, to a shock in the volume VOL. The confidence interval for the impulse response function includes the zero at all lags but lag 2.

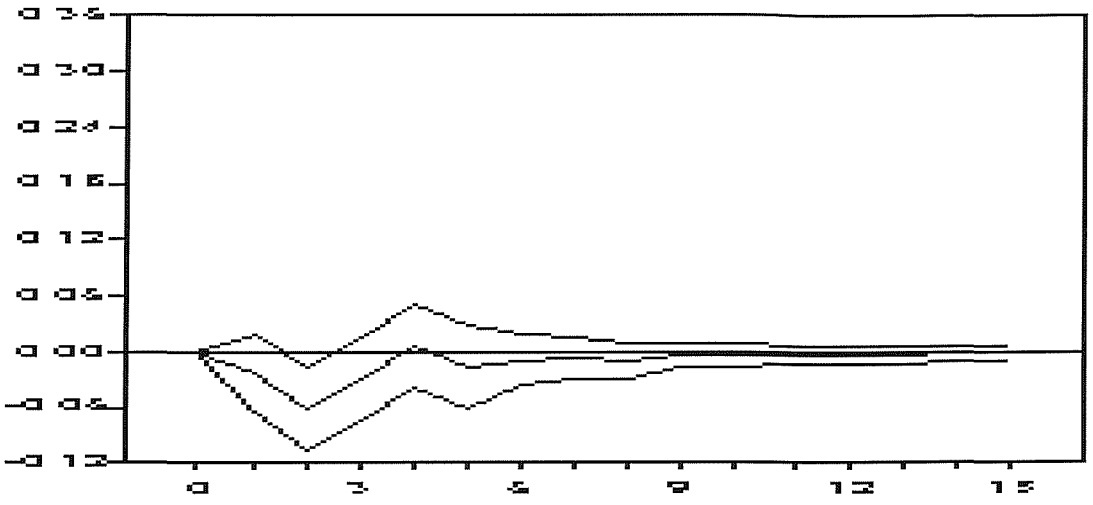
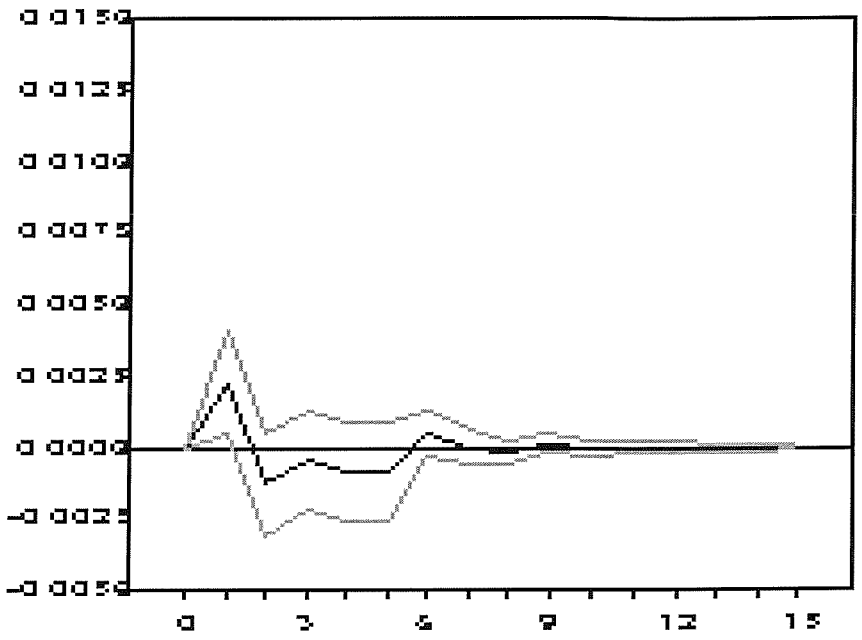


Figure 8: **TOT response to VOL**
Response of total information, TOT, to a shock in trading volume, VOL.
The confidence interval for the impulse response function always includes zero, except at lag 2. Notice however the small scale of the response.



PART 2

Chapter 3

"I fear that in a market downturn, those who don't understand risk may react precipitously and carelessly." Arthur Levitt, Chairman of SEC.

Unit trust flows and aggregate market returns: the UK case

3.1 Introduction and previous literature

Micro-economic studies of US mutual funds have identified a strong positive relationship between new investment into a mutual fund and the historical performance of the fund. In essence the US evidence seems to suggest that fund performance is a crucial determinant of a fund's ability to attract investment in the future (see for example Patel *et al* (1990), Ippolito (1992), or Chevalier *et al* (1997)). An important implication of these results is that if investors are responding to aggregate market performance when they make investment decisions, then this positive relationship between fund performance and fund flows raises the possibility that a downturn in security prices will lead to an increase in mutual fund redemptions. In the case of a sharp decline in asset prices (*e.g.*. an equity market crash), there exists the possibility that mutual fund outflows associated with the decline will reinforce and exacerbate any market downturn causing a downward spiral in asset prices analogous to a "run" on retail bank deposits. The potential for systemic instability through the existence of a positive feedback relationship between mutual fund flows and aggregate market returns has been cited as a possible justification for expanding bank-type prudential regulation to mutual funds (see for example Kaufman (1994)). The increased investment in mutual funds in the USA has been to the detriment of more traditional bank deposits creating the opportunity for retail investors to move into and out of the securities markets in a very short period[1]. As an indication of the scale of this industry – at the end of 1997 US commercial banks held assets valued at $4,700 billion, while US mutual fund assets were valued at $4,500 billion (see The Financial Times, 22nd April 1998). There exists the prospect then that the USA will be the first country to have a mutual fund industry bigger than its more traditional banking sector. Despite the size of this industry in the US the federal government employs 200 people to supervise this industry, compared with the

[1] Although an additional source of instability is, in Kaufman's opinion, the short-term objectives of mutual fund managers

40,000 it employs to monitor the banking sector. It is clear then that a "run" on mutual funds could have catastrophic implications for the US (and global) financial system.

Formal studies of the relationship between US market performance and mutual fund flows have failed to identify the potentially damaging positive feedback relationship. Using monthly data Warther (1995) undertakes an empirical investigation of the relationship between mutual fund net sales and aggregate equity returns in the USA finding evidence to suggest that mutual fund flows and security returns are "significantly" correlated, the correlation being 0.48 at lag 0. Warther also finds little evidence of positive feed-back trading by mutual fund investors as when regressing flows on returns, the coefficient on returns is either of the wrong sign or insignificant. Using an alternative approach Remolona *et al* (1997) also explore the connection between aggregate market returns and market fund flows in the USA, concluding that the short term effects of market returns on mutual fund flows are too weak to sustain a feedback mechanism between flows and returns.

The UK's unit trust[2] industry has also experienced a dramatic change in its importance relative to more traditional investment vehicles over the last few years (although not quite so impressive a change as witnessed in the USA). In 1980 total UK unit trust holdings represented just 2.1% of UK GDP; at the time of writing this figure has risen to 17.8%. The purpose of this paper is to determine whether a positive feedback mechanism exists between unit trust flows and aggregate returns in the UK's stock and bond markets. As we are interested in the unit trust sector's influence on security markets, stocks or bonds, we will try to consider the effects of the action of both the investors and the fund managers. In order to identify the relationship between the two variables of interest we utilise the Vector Autoregressive approach of Sims (1980). In anticipation of our results, we find little evidence of a positive feedback mechanism between unit trust net acquisitions and aggregate bond and stock returns. We do find however a positive relationship running from aggregate bond and stock returns to unit trust bond and stock net acquisitions respectively. The remainder of this chapter is organised as follows: in Section 2 we briefly describe the UK unit trust market and the data which we use; in Section 3 we describe our methodology and report our results; in Section 4 we take a more detailed look at the structure of the UK's

[2] Unit trusts are the UK's equivalent of the USA's mutual funds

unit trust industry; and finally, we draw conclusions in Section 5.

3.2 Data

3.2.1 The growing importance of UK Unit trusts

The first unit trust - the *Great Britain to Foreign and Colonial Government Trust* - was established in London in 1868. However despite their age these investment vehicles remained relatively unimportant in terms of their size until the early 1980s. Since this time there has been a dramatic increase in UK unit trust holdings. In Figure 1 we plot both nominal total holdings (Panel A) and real total holdings (deflated by a consumer price index) of UK unit trusts since 1970.

The Figure shows that there has been a clear increase in total real unit trust holdings beginning around 1983/4 and a very rapid increase in holdings over the last 7 years. This growth in unit trust holdings (and popularity) has also been witnessed in similar US mutual fund growth over approximately the same period (see Kaufman (1994)). To put the increasing popularity of these investment vehicles in another context, in 1980 the total holdings of UK unit trusts represented 2.1% of UK GDP, whereas at the time of writing total holdings represent now 17.8% of UK GDP. Hence, unit trust holdings have grown by a factor of almost 9, whereas pension fund investment as a proportion of GDP (although representing a much greater total of UK securities investment) has grown by a factor of just over 3. The growth in pension fund holdings however, does not represent the same risk of systemic instability since pension funds are only withdrawn by investors on retirement. As a proportion of GDP however, the UK's unit trust industry is not as large as the USA's mutual fund industry, where Remolona *et al* (1997) report that total mutual fund assets represent 36% of GDP in the USA.

3.2.2 Aggregate bond and equity market return data

We use quarterly data in this paper spanning the period 1980Q1 to 1997Q2, 70 data in total, where all of this data was obtained from Datastream International. We use the FTSE-A All Share Index to calculate aggregate equity market returns. This index is a weighted index, which is composed of approximately 850 firms that are listed on the London Stock

Exchange (LSE). This broad market index is particularly suited for our purposes since the objectives of many different UK equity trusts are stated in terms of this index (see AUTIF (1997)). Unit Trusts, whose prices are a direct derivation of the underlying equity holdings, are excluded from this index. As well as examining the relationship between unit trust equity net acquisitions and aggregate equity returns, we also examine the relationship between unit trust net acquisitions of UK government gilts and a price index of UK government gilts - the FTA-All Share Government Bond index. In our empirical work below we use the end quarter return on each index as proxies for the aggregate performance of these markets.

In order to eliminate the distorting influence of the aggregate price level on unit trust equity net acquisitions following Warther (1995) we normalise, or deflate both net acquisition series. We considered a number of procedures, for example, we deflated the series by quarterly UK savings, UK GDP and by total unit trust holdings, but the procedure which proved to be most satisfactory[3] involved normalising the series by using the previous quarter's aggregate market value. In the case of equity net acquisitions we used the market value of the FTSE-A All Share index. For UK unit trust government bond net acquisitions we used the market value of the FTA-All Share Government Bond index. We use these "deflated" flows in our empirical analysis below.

Unlike previous studies of this nature we do not focus upon net sales of units but upon the quarterly net acquisitions of UK equity and government bonds by the UK unit trust sector. This choice between net sales and net acquisitions as a representation of "flows" is not trivial. The correlation between the two series is 0.70 for stock acquisitions (0.89 in the US (see Warther 1995)), but only 0.40 for bonds. However, we believe that by using net acquisitions instead of net sales we can capture the decision making behaviour of unit trust managers.

As managers have some discretion as to the form of investment between equities, bonds and cash, for instance, it seems that to best capture the market impact of unit trusts activity, we should use net acquisitions.

[3] Satisfactory in terms of not importing variance into the processed series or in terms of maximising the

3.3. Testing for a positive feedback mechanism

In this section of the paper we use Sim's (1980) VAR methodology to test for the presence of a positive feedback mechanism between unit trust net acquisitions and the aggregate market.

3.3.1. Methodology

The possible presence of a positive feedback relationship between the variables of interest means that we should use an econometric technique which is designed to identify such a relationship. We have thus chosen the Sims' VAR approach because of the emphasis placed upon the interdependence among the explanatory variables. The methodology itself is based upon a vector autoregressive process, or VAR, which is analysed in both its typical form and in its inverted moving average (MA) form once the stationarity properties of the series have been evaluated. The form of our bivariate VAR is as in Chapter 2 above:

$$\begin{bmatrix} R_t \\ A_t \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \end{bmatrix} + \begin{bmatrix} \varphi_{11}^{(1)} & \varphi_{12}^{(1)} \\ \varphi_{21}^{(1)} & \varphi_{22}^{(1)} \end{bmatrix} \begin{bmatrix} R_{t-1} \\ A_{t-1} \end{bmatrix} + \ldots\ldots + \begin{bmatrix} \varphi_{11}^{(p)} & \varphi_{12}^{(p)} \\ \varphi_{21}^{(p)} & \varphi_{22}^{(p)} \end{bmatrix} \begin{bmatrix} R_{t-p} \\ A_{t-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \quad (1)$$

where R_t denotes aggregate returns; A_t denotes one of the deflated net acquisition series; c_1 and c_2 are constants; ε_{1t} and ε_{2t} are error terms; $\varphi_{ij}^{(p)}$ are the autoregressive coefficients which are to be estimated; and p is the order of the VAR. The assumptions concerning the properties of ε_{1t} and ε_{2t} are given in Chapter 2, as are the reservations to be made when using differenced variables which may be part of a cointegrated system. Unit root test results are given in Table 9.

The procedure involves the analysis of the response of the variables of interest to external shocks to the system and subsequently involves the analysis of the contribution of one variable to the temporal variation in the other, which in turn involves decomposing the forecast error variances. The forecast error variance decomposition allows us to identify the proportion of the movement in one variable which is due to movements in the other variable as opposed to movement in its own past values.

3.3.2 An analysis of unit trust net acquisitions of UK ordinary shares

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explanatory power of the VARs (see below)

The choice of the VAR lag length to be used in the Sim's procedure is an important issue. To support this choice we adopt a procedure based upon a likelihood ratio test which compares two alternative lag lengths as recommended by Sims (1980). The result of the tests suggest the use of a lag length of order 9[4]. Using a VAR of order 9 we now assess the relationship between UK unit trust net equity acquisitions (NEA) and aggregate equity market returns (RFTA) by calculating the relevant impulse response functions. These results are presented in Figure 2. Diagnostic statistics from PC-FIML are given in Table 10.

The impulse response functions and respective standard error bands indicate that a 1-Standard Deviation shock in aggregate returns has a marginally significant impact upon net acquisitions, although the impact does not remain for long. However, an equivalent shock in UK ordinary share net acquisitions has no significant influence upon aggregate equity returns. In Panel A of Table 1 we present the variance decomposition of the two series using a 24 month forecast horizon. A significant proportion of each time series is explained by its own past values: net equity acquisitions explain 79% of its own past values, while the equivalent value for aggregate returns is nearly 84%. As a further check of the Sims' results we also undertake Granger causality tests (in parentheses) which do confirm the low correlation between the two series: the null of no significant effect running from net equity acquisitions to aggregate returns receives strong support with a p-value of 0.35, while the influence of returns on acquisitions is credible at the 90% threshold. This evidence indicates that while unit trust equity market activity is influenced by the performance of the equity market, the converse is not true and therefore we find no evidence here of a positive feedback relationship[5].

3.3.3 An analysis of unit trust net acquisitions of UK government securities

We use the same methodology to analyse the relationship between the UK government gilt

[4] We used alternative criteria to determine the appropriate lag length. The AIC procedure suggested a lag length of 12, while the SC procedure had its minimum at 4. Taking into account the potential for a loss of explanatory power and also degrees of freedom considerations, we decided that a VAR of order 9 would be most appropriate

[5].We conducted the same tests using the UK's USM Index, which is an index of small capitalisation UK stocks, but the results were unchanged and therefore in the interests of brevity we do not present these results here

market and UK unit trust net acquisitions of UK government gilts. The choice of lag length was again determined by the procedure of likelihood ratio tests of models with alternative lags as recommended by Sims (1980). This procedure, indicated that a lag length of 8 would be most appropriate[6]. The impulse response functions derived from this system are shown in Figure 3.

The results are similar to those which are presented in Figure 2 and Table 1: an increase in the return on the bond index (RBI) has a positive and marginally significant impact upon net government bond acquisitions (NAB), but the converse is not true. Therefore we again find no evidence of a positive feedback mechanism. An assessment of the variance decomposition from the system using a forecast horizon of 8 quarters is presented in Table 2. Net government bond acquisitions explain 86% of their own past values while the return on the aggregate UK government bond index explains nearly 89% of its own past values. Granger causality tests (Table 2, in parentheses) again confirm the low correlation between the series; the null that net bond acquisitions have no effect on changes in the bond returns receives strong support with a p-value of 0.70., while tests of the converse relationship yields a p-value of 0.10.

The test used so far is the classical linear Granger test. One obvious problem of this test is, obviously, its low power in assessing non linear causal relations. Hiemstra and Jones (1994) propose such a test based on an approach first proposed by Baek and Brock (1992). In particular Hiemstra and Jones (1994) propose improvements to the test which make it robust to the presence of structural breaks in the series and contemporaneous correlation in the errors of the VAR model. In brief the notion of causality adopted in the paper is that we have non linear non causality in the Granger sense if the probability that two arbitrary m length vectors X_t are within a distance e of each other and the two lag vectors of Y_t being also within a distance e of each other and conditional upon the lag vectors of X_t only being within a distance e of each other[7].

[6] The AIC and SC procedures suggested a lag length of 3 and 2 respectively, however, explanatory power and degrees of freedom considerations suggested that we should choose a lag length of 8. Using the 2 and 3 lags gave substantially similar conclusions

[7] See Brooks (1998) for a complete explanation and derivation of the test.

The evidence produced by the application to the equity series of the Hiemstra and Jones (1994) does not substantially improve upon the general result of low cross influence among the series. We calculated the test for Lx and Ly, lag vectors of X and Y, of 2 and a value of m=1. Following Brooks (1998) we calculated the test for e = 0.5; 1; 1.5 on a VAR 4 the lower value indicated by the SC test. Some simulations to produce small sample critical values suggested that only one value was marginally significant, making us conclude that non linear Granger causality testing somewhat reinforced our results of low reciprocal influence across the series.

3.4 A closer examination of the structure of the UK unit trust industry

Our results in Section 3 above indicate that while a positive relationship runs from the aggregate market to net acquisitions in the case of both the equity and government bond markets in the UK, the converse is not true and hence we do not find evidence of a positive feedback relationship in either market. In order to understand more fully the empirical results in Section 3, we conduct further analysis of the UK's unit trust industry. In this section of the paper we examine: the range of unit trusts offered in the UK; the typical fee structure of UK unit trusts; the average holding period of UK unit trust units; and finally, the liquidity of UK unit trusts over our sample period.

3.4.1 Structure and fees

The UK's Association of Unit Trusts and Investment Funds (AUTIF) defines seven categories of trusts by investment type: ***Cash Trusts***, which invest at least 80% of their assets in money market instruments (cash and near cash) such as bank deposits and very short term fixed interest securities; ***Bond Trusts*** which invest in UK and world fixed interest securities; ***Bond and Equity Trusts***, which invest at least 80% of their assets in either equities or fixed interest securities; ***UK Equity Trusts,*** which invest at least 80% of their assets in UK equities; ***International Equity Trusts*** who spread at least 80% of their capital on equities across most of the world's major stock markets, including the UK; ***Regional Equity Trusts*** which focus on geographical regions outside of the UK; and ***Specialist Trusts*** which focus on the shares of companies in particular industries (e.g. energy or property) or on particular investment targets (e.g. bear funds). Unit trusts can be marketed directly via the unit trust manager, or indirectly through financial advisers, company sales persons or stockbrokers. In Table 3 we report the number of funds which

make up each of the investment categories. As we can see equity related trusts are far more numerous in the UK than fixed income related funds. There are more details in Tables 7-8.

A unit trust's fee structure will determine the ease with which investors can liquidate their unit holdings and thus will be very important in either encouraging, or discouraging a "run" on unit trust funds. If initial charges are high then short horizon investment will clearly be discouraged. Ippolito (1992) and Chordia (1996) both provide evidence in support of the effectiveness of these charges in stabilising US mutual fund flows. The most important fee in the UK unit trust industry is the **bid-offer spread** which can be as high as 8% of the fund's value. Table 4 presents some summary statistics with respect to this fee, which is typically higher for equity based unit trusts compared with bond, or cash trusts. The fee is taken "up front" by 87.0% of UK unit trusts and averages around 4.13 %. Another type of fee used in the UK relates to the "early surrender" of a fund, known as an **exit charge**. Unfortunately we could not obtain any central record of UK unit trust exit charges. To obtain more information about this charge we conducted a poll of unit trust managers[8]. We discovered that only 6% of the respondents charged this fee, which could be as high as 5% of the final value of the fund. We also found that the size of the exit fee was inversely related to the length of the investment period. Our results indicate then that exit fees are not in common usage in the UK's unit trust industry. Finally, UK unit trusts also charge an **annual fee** to cover administration costs. This fee is levied by nearly all funds in all of the investment categories and we present a summary of this charge in Table 5. The table shows that annual unit trust charges in the UK average around 1.0% of the fund's value, with equity related funds charging a slightly higher annual fee than non-equity related funds.

Another important aspect of unit trust investment is the size of the minimum lump sum requirement and perhaps more importantly, the availability of regular monthly savings versions of the funds. We believe that it is less likely that regular savings unit trust investors will withdraw money in the event of a market downturn, than an investor who has invested a larger one-off lump sum in a trust. In fact one of the key benefits of regular savings plans is that investors can take advantage of "pound cost averaging". In other words, regular savings plans will benefit greatly from frequent downturns in the market

[8] This poll consisted of a combination of telephone and postal enquiries on 4th November 1997. The poll was

during the life of the investment since in these periods the investor will be buying more units per pound. In Table 6 we present summary statistics regarding the minimum entry requirements for UK unit trusts. On average the minimum lump sum is just under £5,000, although in nearly every category of unit trust there are some funds which have no minimum lump sum restrictions. On average nearly 97% of funds do have a minimum lump sum requirement. While the average minimum lump sum of £5,000 may be prohibitive to some small investors, as we can see, an investor's minimum regular monthly savings commitments can be as low as £20 per month, where the average minimum regular saving commitment is just under £50. Unfortunately we were not able to obtain information regarding the proportion of unit trust investment made by households in a regular savings form compared to a lump sum form. It would seem logical to assume that the higher the proportion of regular savings compared with lump sum unit trust investment, the lower would be the probability of a "run" on unit trust funds. Although we cannot provide figures for the proportion of unit trusts who offer a regular savings option to investors, even a casual perusal of the national press will reveal that most major unit trust management groups offer regular savings schemes as an alternative to a discouragingly large minimum lump sum investment.

We therefore believe that the combination of the fee structure of UK unit trusts, plus the relatively low lump sum minimums and availability of regular savings plans, may discourage short-horizon investment behaviour and may thus explain our failure to find evidence of a positive feedback relationship between net acquisitions and aggregate market performance.

3.4.2 The turnover of unit trust units

The fee structure for UK unit trusts which we outlined in Section 4.1 above is designed, we believe, to encourage longer term investment objectives among unit trust holders. So do UK unit trust holders have a long-term outlook? Firstly, we know that there has been a large increase in unit trust total assets - by the end of 1997 unit trust total holdings amounted to £160 billion, the majority of which was held by 9 million private investors. The growth in the popularity of unit trusts and ordinary shares (as shown in Figure 4) seems

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based upon a random sample of 5% of the funds listed by AUTIF(1997)

to have been at the expense of more traditional asset holdings like bank deposits and government securities, thus implying that portfolios of UK households have now become inherently more risky.

The increase in the percentage of shares held directly by UK households is in sharp contrast with the decrease registered in the US (Morgan 1994) and also in Italy (see next chapter) and is probably due directly to the privatisation programmes of the Thatcher government in the 1980s.

We can obtain an idea of the average holding period of unit trust units by calculating the following "repurchase ratio" (REP):

$$REP = \frac{\text{Repurchase of unit trust units per month}}{\text{Total unit trust holdings}} \qquad (2)$$

During our sample period this ratio has ranged between 0.2% and 2.0%, reaching a peak in October 1987, before which it is usually less than 1%. This moderate turnover rate indicates that unit trusts are indeed treated as long-term investment vehicles and thus, despite the size of the industry, do not appear to pose a threat to the stability of the financial system.

3.4.3 Unit trust liquidity

One way of looking at the perceptions of unit trusts managers' with respect to the possibility of a "run" is to look at a measure of fund liquidity. Fund managers will clearly wish to meet the demand from their unit holders to repurchase units as soon as possible. Unit trusts are obliged to buy their units back at the request of the investor. They must therefore stand ready to redeem units at short notice. From this point of view the units are similar to demand deposits although the redemption price is variable. The similarity to deposits is stronger for those money market trusts providing chequebooks. According to the results of our poll, 85% of the funds begin redemption procedures only after a written redemption request has been received. Redemptions are generally honoured at the 10:00am price. The settlement is an average of 5 working days with a minimum of 2 and a maximum of 7. The settlement period on the London Stock Exchange is currently the buy/sell day plus 5, t+5. The stock exchange settlement period was previously based upon a two-week

accounting period. Now any gap between payment to shareholders and receipt from sales is virtually eliminated, drastically reducing the need for liquidity. The need for liquid assets and credit lines is consequentially reduced.

In Figure 5 we plot the ratio of UK unit trust bank borrowings as a proportion of total holdings in Panel A, and also the ratio of cash plus bank deposits to total holdings in Panel B.

We can see that bank borrowing as a proportion of total assets (Panel A) and the real value of cash and deposits (Panel B) both rose sharply prior to the crash of 1987. In the case of Panel A, this sharp increase in bank borrowing is difficult to interpret. It may have been caused by increased costs associated with advertising such funds at the height of the bull market. At the time money was cheap as interest rates were at a relatively low level. In Panel B the real increase in cash and deposits may simply reflect an increase of investment into these funds which could not be invested rapidly enough to reduce cash and deposit holdings to more "normal" levels, or it may have reflected a concern of unit trust managers that there would be an increase in net redemptions when the bull market ended. Figure 5 then provides some evidence to suggest that liquidity levels can be unstable in times of crisis.

Given the length of time it takes to liquidate unit trust units in the UK, along with their historically low turnover and the high entrance costs associated with buying unit trust units, it seems that any "precipitous" behaviour following a sharp market downturn is more likely to be caused by fund managers than by unit trust investors.

3.5 Conclusions

Recent US research has focused upon the linkages between net mutual fund flows and their impact upon aggregated equity market returns. If a positive feedback relationship exists between these investment flows and stock returns then there exists the possibility that a market downturn or crash will be exacerbated by corresponding net outflows as mutual fund investors withdraw funds, which could force equity prices down further thus causing a "run" on mutual fund assets. Using data from UK capital markets we analyse the relationship between aggregate market returns and the net acquisitions of UK unit trusts

units to determine the nature of the relationship between these acquisitions and aggregate returns. Our results suggest that increases in equity and government bond prices lead to an increase in unit trust net acquisitions, but that these net acquisitions do not have a corresponding impact upon aggregate returns. We believe that our failure to identify a positive feedback relationship between the series of interest is due to the structure of the UK's unit trust industry. The fee structure, the relatively modest minimum lump sum values, the availability of regular savings unit trusts all combine to bring about a very low turnover of unit trust units. In addition, the redemption procedures in the UK mean that there could be a considerable delay between the decision to sell and the execution of that sale. While a 5 day delay seems quite short, in the context of a short market crash, it may have a considerable dampening effect.

Table 1
Variance decomposition percentage at a 24 month forecasting horizon.
In parenthesis are reported the p-values for the Granger test at lag 8. The null of the test is that all lagged coefficients of the variable in the row on the one of the column are equal to zero; RFTA denotes the returns on the Financial Times All Share Index; NEA net acquisition of UK Company ordinary shares normalised by market capitalisation.

Percentage of forecast error variance (P-value of Granger Causality Test)	Shock to	Shock to
	RFTA	NEA
RFTA	86	13 (0.10)
NEA	24 (0.40)	79

Table 2
Variance decomposition percentage at a 24 month forecasting horizon.
In parenthesis are reported the p-values for the Granger test. The null of the test is that all lagged coefficients of the variable in the row are equal to zero. RBI denotes the first difference on the yield to redemption index on the Financial Times All Share Index; NAB denotes the net acquisition of British Government securities normalised by market value.

Percentage of forecast error variance (P-value of Granger Causality Test)	Shock to	Shock to
	RBI	NAB
RBI	89	11 (0.10)
NAB	14 (0.70)	86

Table 3
Unit Trusts in the sample

Class of Trust	Number
Money market	
Cash	30
Bond	
Gilts	107
Bond & Equities	
Mixed	23
Mixed Income	46
Equities	
Income	86
Growth	158
Growth & Income	163
Small Caps	77

Table 4
Summary statistics on the initial and exit charge levied in the different types of funds.
Trusts Collecting charges as % of total denotes the number of trusts imposing charges as a percentage of the total of funds on offer.

	Initial charge				Exit Fees		
Class of Trust Objective	Mean	Min	Max	Trusts Collecting charges as % of total	Mean	Min	Max
Money market							
Cash	0. 81	0	6	17. 4	0	0	0
Bond							
Gilts	3. 40	0	6	83. 17	0	0	£25+ VAT*
Bond & Equities							
Mixed	4. 17	0	6	86. 95	2. 5	0	5**
Mixed Income	4. 63	0	8	95. 65	1. 7	0	5**
Equities							
Income	4. 78	0	6	96. 51	0	0	0
Growth	4. 57	0	6	91. 13	0	0	0
Growth & Income	4. 2	0	7. 5	85. 27	0	0	0
Small Caps	4. 39	0	6	94. 80	0	0	0
UK Funds total	4. 13	0	7. 5	86. 61	0. 2	0	5**

* fixed amount
**sliding to 1% after 5 years.
NB: The data on exit fees are the result of a poll conducted by the author.

Table 5
Summary statistics on the annual charge levied in the different types of funds.
Trusts restricting as % of total denotes the number of trusts imposing annual charges as a percentage of the total of funds on offer.

	Annual charge			
Class of Trust Objective	Mean	Min	Max	Trusts restricting as % of total
Money market				
Cash	0. 61	0. 4	1. 5	100
Bond				
Gilts	0. 96	0. 10	1. 5	100
Bond & Equities				
Mixed	1. 2	0	1. 5	91. 13
Mixed Income	1. 24	0	1. 5	95. 65
Equities				
Income	1. 18	0	1. 5	98. 83
Growth	1. 25	0	1. 75	98. 10
Growth & Income	1. 05	0	2	98. 16
Small Caps	1. 18	0	1. 75	96. 10
UK Funds total	1. 11	0. 03	1. 70	97. 96

Table 6
Summary statistics on the minimum lump sum and monthly investment required in UK unit trusts
Trusts restricting as % of total denotes the number of trusts imposing minimum lump sum initial investment as a percentage of the total of funds on offer.

	Lump Sum Amount				Monthly minimum saving		
Class of Trust Objective	Mean	Min	Max	Trusts restricting as % of total	Mean	Min	Max
Money market							
Cash	4465.6	250	50000	100	93.6	20	500
Bond							
Gilts	3743.9	0	75000	95. 32	47.4	20	250
Bond & Equities							
Mixed	7043.4	0	50000	95. 65	42.8	20	50
Mixed Income	3858.7	0	100000	95. 53	55.6	25	200
Equities							
Income	1737.8	0	50000	97. 67	48.0	20	125
Growth	6734.2	0	100000	96. 83	47.7	0	250
Growth & Income	5982. 21	0	100000	96. 31	47.7	20	250
Small Caps	8292.2	0	250000	97. 4	43.8	20	100
UK Funds total	5363.9	10. 9	102789	96. 65	49.6	15. 7	218

Table 7
Classification of unit trusts according to investment objective

Class of Trust	Target as percentage of investment
Money market	
Cash	80% in money market instruments
Bond	
Gilts	80% in UK fixed interest securities
International Fixed Income	80% fixed interest securities
Bond & Equities	
UK Mixed or Balanced	80% in UK fixed interest securities or equities. Yield up to 120% of FTall
Mixed or Balanced Income	80% in UK fixed interest securities or equities. Yield in excess of 120% of FTall
International Mixed or Balanced	80% in fixed interest securities or equities. Yield in excess of 120% of FTall
Equities	
UK Equity Income	80% in UK equities. Yield in excess of 110% of FTall
Growth	80% in UK equities. Primary objective capital growth.
Growth & Income	80% in UK equities. Yield between 80 and 110% of FTall
Small Caps	80% in UK equities of companies part of FTSE Small Cap Index.
International Equities	
Equity Income Fund	80% in equities. Yield in excess of 110% of FTSE World Index
International Growth	80% in equities. Primary objective capital growth
Global Emerging Market	80% in assets directly or indirectly in emerging markets as defined by World Bank
Fund of Funds	100% in other trusts
Investment Trust	100% in Investment Trusts
Regional Equities	
North America	80% in North America securities
Europe	80% in European securities. UK assets less or equal to 80%
Japan	80% in Japanese securities
Far East	80% in Far Eastern securities. Japanese assets less to 80%
Far East (excluding Japan)	80% in Far Eastern securities. Japanese assets excluded
Specialist	
Commodity and Energy	80% in commodity or energy securities
Financial and Property	80% in financial or property securities
Pension	Available only in a unit trust personal pension plan
Index Bear	Inversely track the performance of an index by utilising derivatives

Source: AUTIF(1997)

Table 8
Unit trust management groups by total fund value (£ million)

Management Group	Total Fund Value	No of Funds	Average Value
Schroder	11771	30	392. 36
M&G Securities	8522	34	250. 64
Mercury Fund	5594	48	116. 54
Gartmore Fund	5523	43	128. 44
Perpetual	5474	20	273. 7

Source: AUTIF(1997)

Table 9
9.1 Unit root tests 5%=-2.91-1%=3.54

Net acquisition of share Lags	t-adf	t-prob	F-prob
9	-2.8307	0.6938	
8	-3.4671*	0.4765	0.6938
7	-3.5901**	0.7081	0.7196
6	-3.9570**	0.4631	0.8489
5	-4.2109**	0.0518	0.8559
4	-3.6050**	0.5234	0.4198
3	-4.7986**	0.8045	0.4929
2	-6.1507**	0.0454	0.5968
1	-6.1447**	0.8521	0.3180
0	-10.671**		0.3994

Lag-Return on FT ALL	t-adf	t-prob	F-prob
9	-2.1049	0.7928	
8	-2.3356	0.4737	0.7928
7	-2.8174	0.2690	0.7491
6	-3.7850**	0.2542	0.6193
5	-3.6476**	0.4394	0.5481
4	-3.7100	0.3421	0.5988
3	-5.2569	0.1175	0.6016
2	-5.2415**	0.8074	0.4384
1	-7.019	0.0433	0.5332
0	-7.6550		0.2846

9.2 Correlation tests
Correlation RFTALL-NEA = 0.26
Fisher exact test $r/\{[(1-r^2)^{1/2} / (n-2)]\} = 13$

Table 10
Test statistics for VAR.
All tests are as defined in Doornik and Hendry (1997) p. 266 ff.
1. Equation S.E. and residual sum of squares
Sigma = 0.0847161 RSS = 0.2798959732

2.correlation of URF residuals

	NEA	RFTALL
NEA	1.0000	
RFTALL	-0.051890	1.0000

3. Standard deviations of URF residuals

NEA	RFTALL
0.0047170	0.084716

4. Likelihood and measure of goodness of fit
4.1
loglik = 476.94899 log|Ω| = -16.4465 |Ω| = 7.2006e-008 T = 58
log|Y'Y/T| = -15.5142
4.2 R^2
R^2(LR) = 0.606367 R^2(LM) = 0.365346

4.3 F tests
F-test on all regressors except unrestricted, F(36,76) = 1.2537 [0.2031] variables entered unrestricted: Constant

F-tests on retained regressors, F(2, 38)

NEA_1	4.77260	[0.0142] *
NEA_2	0.914197	[0.4095]
NEA_3	1.14486	[0.3290]
NEA_4	1.10260	[0.3424]
NEA_5	0.488191	[0.6175]
NEA_6	1.30439	[0.2832]
NEA_7	1.64047	[0.2073]
NEA_8	0.345559	[0.7100]
NEA_9	0.0134237	[0.9867]
RFTALL_1	0.253682	[0.7772]
RFTALL_2	2.05544	[0.1420]
RFTALL_3	0.217701	[0.8054]
RFTALL_4	0.687835	[0.5088]
RFTALL_5	0.308297	[0.7365]
RFTALL_6	0.0792336	[0.9240]
RFTALL_7	0.227767	[0.7974]
RFTALL_8	0.956386	[0.3933]
RFTALL_9	0.0428050	[0.9581]

5.Correlation of actual and fitted

NEA	RFTALL
0.67805	0.52455

6.Other tests

6.1 Autocorrelation in residuals:

NEA:Portmanteau (corrected Box-Pierce) 7 lags = 0.68227
RFTALL :Portmanteau 7 lags = 0.90963
NEA: AR 1- 4 (LM) F(4, 35) = 0.66712 [0.6191]
RFTALL :AR 1- 4 F(4, 35) = 0.85355 [0.5012]

6.2 Normality

NEA: Normality $Chi^2(2)$= 3.3395 [0.1883]
RFTALL : Normality $Chi^2(2)$= 9.669 [0.0080] **

6.3 ARCH

NEA: ARCH 4 F(4, 31) = 0.31099 [0.8684]
RFTALL :ARCH 4 F(4, 31) = 0.067276 [0.9913]

6.4 Heteroscedasticity - White:

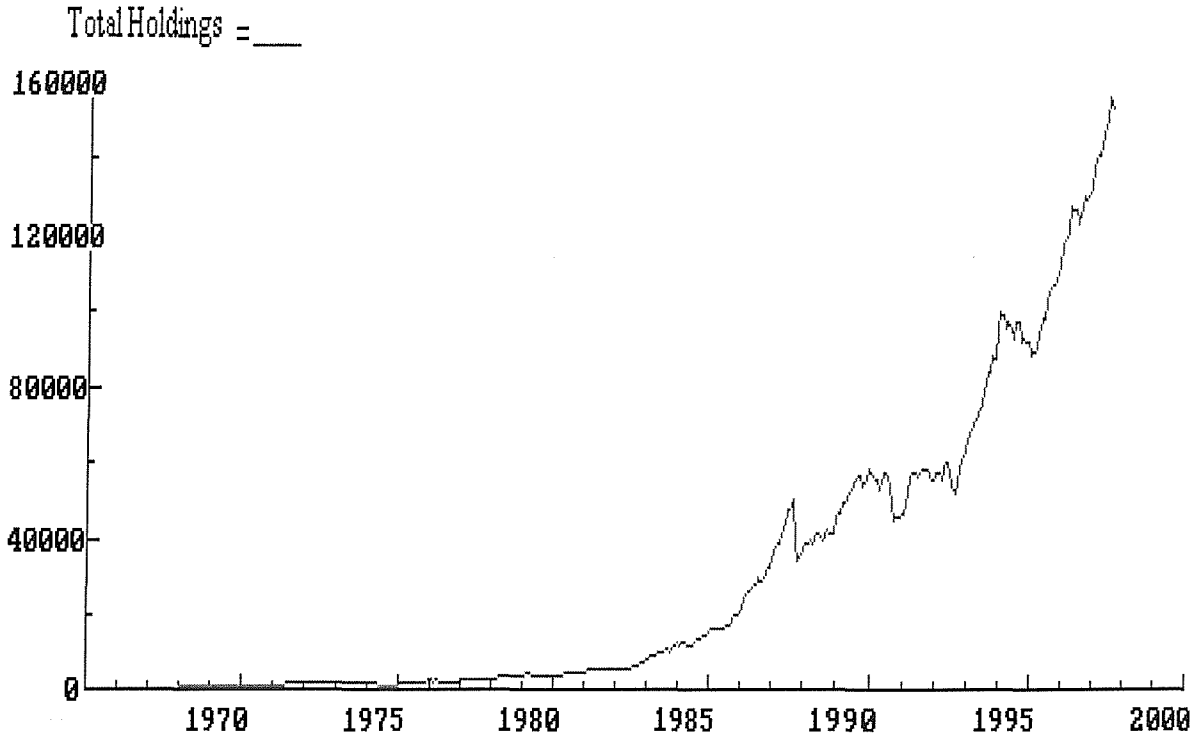
NEA:Xi^2 F(36, 2) = 0.10069 [0.9996]
RFTALL :Xi^2 F(36, 2) = 0.08494 [0.9999]

6.5 Vector tests:

Vector portmanteau 7 lags= 3.4873
Vector AR 1-4 F(16, 60) = 1.0648 [0.4072]
Vector normality Chi2(4)= 12.934 [0.0116] *
Vector Xi^2 $Chi^2(108)$ = 106.98 [0.5095]

Some evidence of non-normality apart, the tests suggest the specification is generally satisfactory.

Figure 1. Holdings of the Unit Trust Sector. Panel A Total Holdings of the UK Unit Trust Sector; Panel B Real Total Holdings of UK Unit Trust Sector



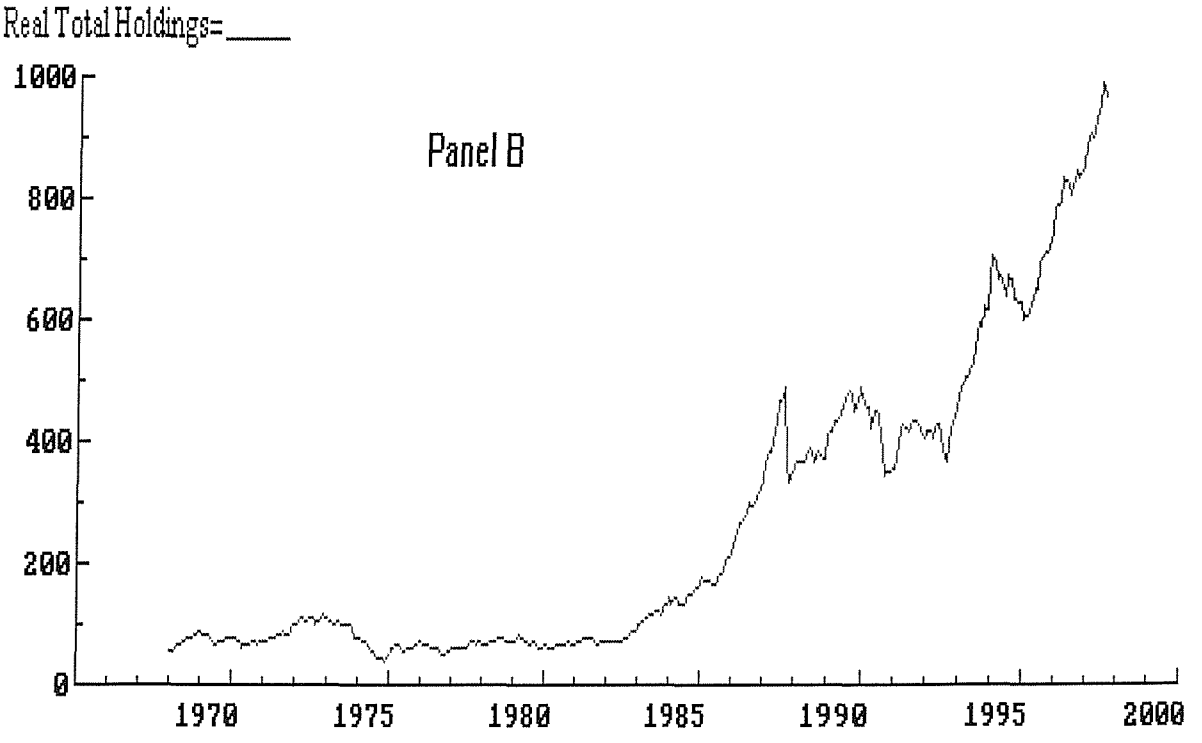


Figure 2. Impulse Responses. Panel A: Response of Net Acquisitions (NEA) to a 1-Standard Deviation Shock in Returns (RFTA). Panel B: Response of Returns (RFTA) to a 1-Standard Deviation Shock in Net Acquisitions (NEA)

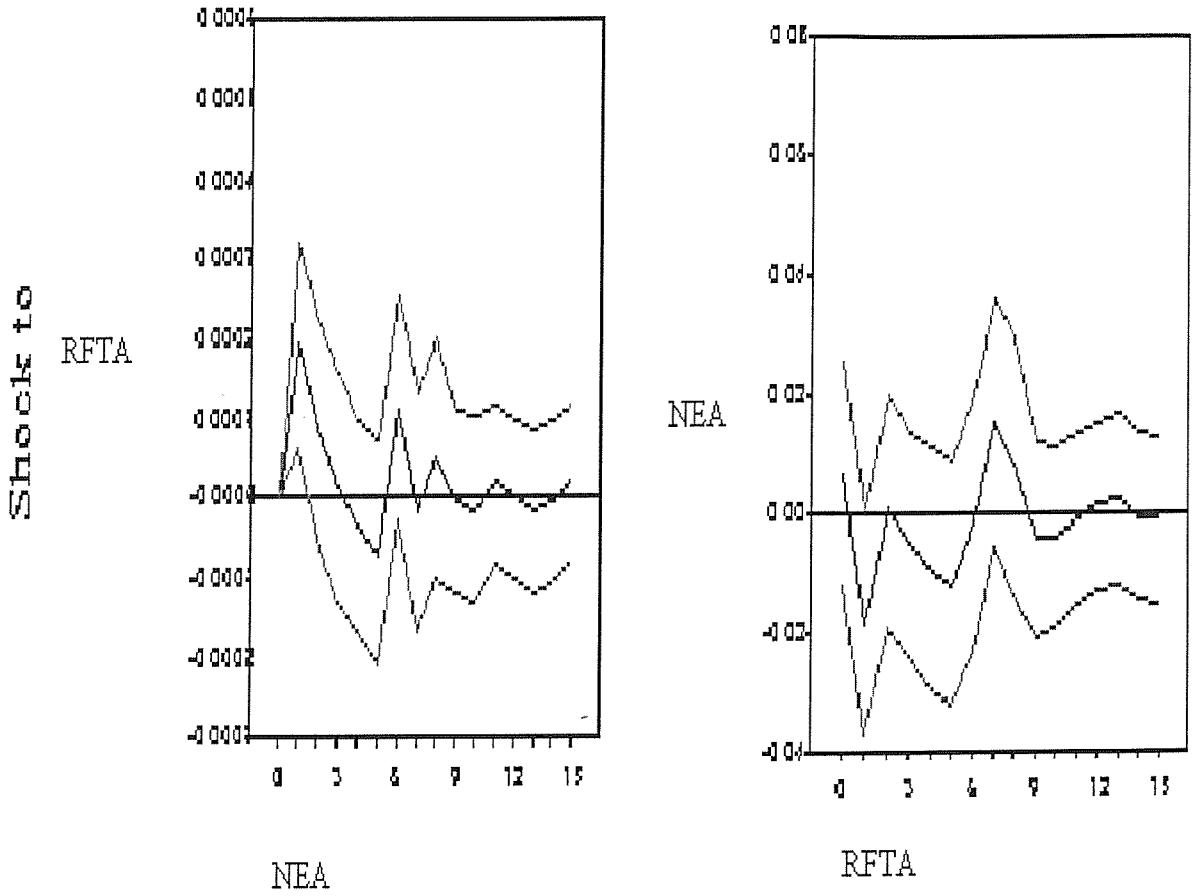


Figure 3. Impulse Responses. Panel A: : Response of Returns (RBI) to a 1-Standard Deviation Shock in Net Acquisitions (NAB) Panel B Response of Net Acquisitions (NAB) to a 1-Standard Deviation Shock in Returns (RBI).

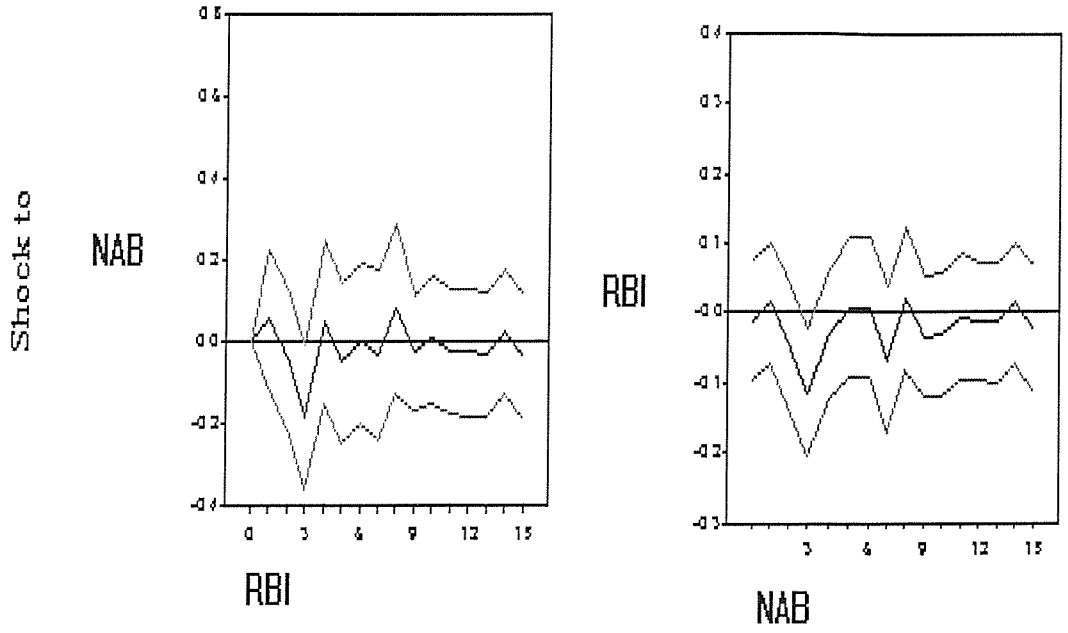


Figure 4. Personal Sector Holdings of Financial Assets. Panel A Personal Sector Holdings of Unit Trust Units as a Percentage of Total Financial Wealth; Panel B Personal Sector Holdings of pension fund quote as percentage of total financial wealth; Panel C Personal Sector Holdings of Government Securities as a percentage of total financial wealth; Panel D Personal Sector Holdings of Deposits (Bank sight plus Building Society) as a percentage of total financial wealth; Panel E Personal Sector Holdings of Shares as a percentage of total financial wealth.

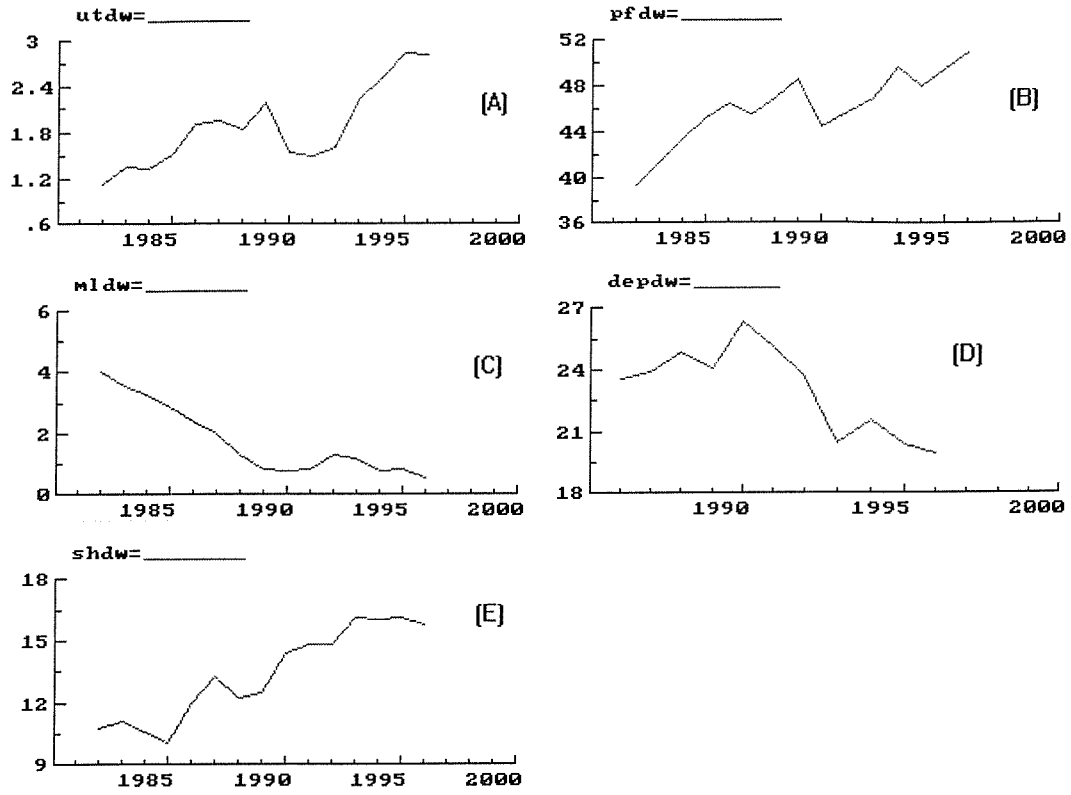
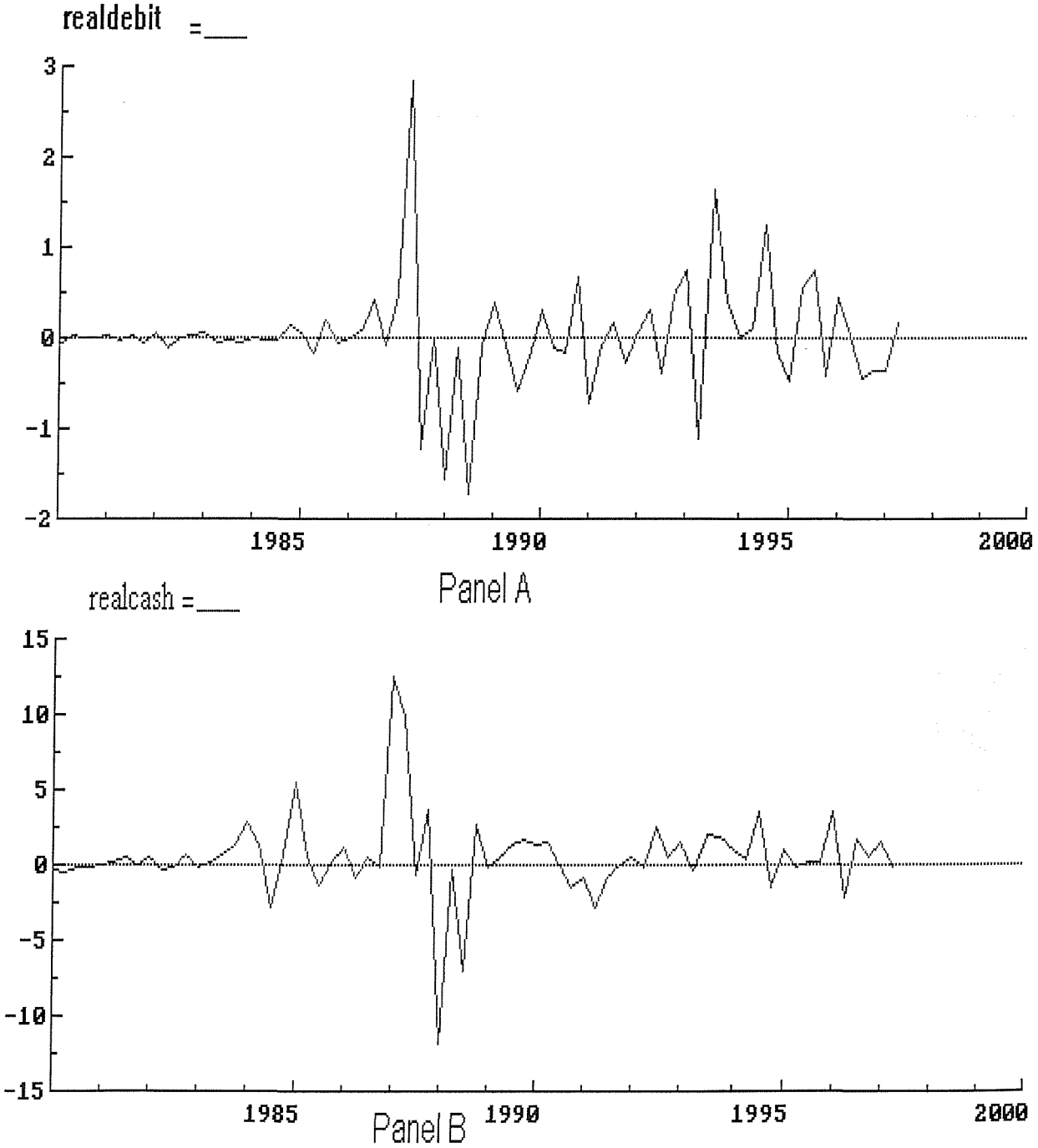


Figure 5. Liquid Assets and Liabilities of the Unit Trust Sector. Panel A: Real value of the bank borrowing of the unit trust sector. Panel B: Real values of Cash and deposits of the unit trust sector.



Chapter 4

Unit trust flows and aggregate market return in Italy

4.1. An extension beyond Anglo Saxon markets

The previous chapter has shown that the evidence for the existence of a virtuous/vicious circle between security prices and the unit trust sector net acquisitions is rather weak. The evidence for the UK substantially matches the one for the US. It can be argued that a financial system centred on markets requires the presence of efficient and "expert" investors. Moreover by facilitating the influence of investors on the management of firms (La Porta et al 1997 and 1998) this system also discourages irrational behaviour not supported by changes in fundamentals.

These same arguments are not valid in other financial systems based on intermediaries, such as those in continental Europe (Steil 1998). In these systems firms obtain their capital monthly through intermediaries, e.g. banks. Markets, such as the bond and the stock ones, are less developed and receive less attention from both firms and investors. The difficulty in penetrating company accounts as well as in influencing the management of the firms keeps investors from taking an active roles in the management of the firms, and as a consequence in gaining a full understanding of the value of the share. In these kinds of markets momentum trading gains credibility.

This chapter investigates exactly this point by extending the testing of the hypothesis to a market in continental Europe, in particular the Italian market. The Italian market exemplifies the aforementioned characteristics of continental markets. La Porta et al (1997) place Italy, along with Germany and France, in the group of countries where investors rights are less protected. Other various studies (Barca 1995) support these findings and report the variability and volatility of Italian stock and bond market.

The Italian market shows then a perfect benchmark on which to test the validity of the virtuous/vicious circle outside an Anglo-Saxon perspective.

4.2 The Italian stock market.

The somewhat, and up to now only partly explained growth of units trust shown in the UK after 1985, is repeated in Italy where a remarkable growth of the unit trust sector has been

registered in the last decade. The first Italian unit trust[1] was established in 1985. At the end of the same year unit trust holdings were 1.74% of the GDP. By the end of 1996 the proportion had risen to 14%.

Unit trust growth has happened to the detriment of other forms of investment such as deposits and direct holding of financial assets, as it has occurred in the context of stable savings. From this point of view unit trust sector growth is just a reorganisation of the market. Concerns are that unit trusts are not simply reorganising the financial markets but that they are changing it. The strong growth and uniform structure of unit trusts has raised concerns about their influence on the stability of the financial markets. Much attention has concentrated on the positive correlation between flows and returns.

Correlation between flows of funds into the unit trusts and returns in the stock or bond market have raised concerns that a positive feedback process could be present. The possibility is that market returns cause the flows and contemporaneously the flows cause the returns. It is a common view that unit trusts are one of the causes of the recent sharp increase in stock price levels and volatility in the Italian exchange as well as almost all the major markets. A negative shock to returns could start a downward spiral very similar in development and consequences to a bank run. The possibility of systemic instability caused by runs has been cited as a reason for expanding bank-type prudential regulation to unit trusts.

The purpose of this chapter is to assess whether such a mechanism exists in the Italian stock and bond market. Implicitly we estimate the role that Italian unit trusts might have in transmitting financial shocks. We concentrate on macro, i.e. aggregate flows of funds into and out of the stock or bond market. No attention is devoted to intra market/intra fund dynamics. Nevertheless we will highlight some feature of Italian unit trusts which might shed light on the problem under investigation.

We use the net acquisitions of the unit trust sector in the stock and bond market. As a consequence our results are more complete than those presented in the previous literature on other markets since we take into account the behaviour of the managers. Our conclusions relate to the final and actual influence of the unit trust sector on the stock and bond markets as they are concerned with the influence of the behaviour of both managers and investors.

[1] The terms unit trust and mutual fund will be used interchegeably to translate the Italian term Fondo Comune di Investimento Mobiliare di Diritto Italiano.

Our study suggests that a two-way causation is at work in the bond market. In the equity market we find influence of returns on flows but not the reverse. Evidence from various sources seems to imply that the investors are loss averse and tend not to sell in market downturns. Even if flows do decrease during downturns, no evidence exists that this starts significant and lasting negative outflows.

The structure of the paper is as follows: **Section 1** summarises the literature on the argument; **Section 2** describes the data and sources of information used in this paper; **Section 3** describes the Italian market for unit trusts; **Section 4** describes the behaviour of the unit holders; **Section 5** quantifies the strength of the relation between flows and markets; **Section 6** provides our conclusions.

4.3 Previous research

Academic literature on Unit Trusts in Italy is very limited. The relative youth of the phenomenon, the marginal role played by the stock market in the Italian financial system and the relative inadequacy of data all contribute to this absence.

In contrast, the unit trust sector has attracted a vast amount of interest from the media and from non-academic writers. In the absence of a more formal body of knowledge it is to this kind of literature that we must turn our attention, for "anedoctal" evidence on the phenomena we wish to investigate.

In an interview with the Corriere della Sera, the major Italian newspaper, Ricky Tempestini, head of the Italian desk at Goldman Sachs, (Corsera 23/4/.1997) maintains that unit trusts are behind the growth in the level and volatility of the Italian Stock market. Obviously no formal line of reasoning is presented. However, the interviewee makes it clear that the influence of unit trusts is due to the action of investors, which he identifies mostly as households. No specific mention is made of the possibly destabilising actions of managers.

In a series of articles dedicated to the best investing strategy for households, Il sole 24 ore, the most important Italian financial paper, explains the advantages of unit trusts investments (e.g. Il sole 24 ore 1997). The tone of the articles is always that of treating unit trust investment as a long-term investment. The horizon most quoted as advisable is five years.

In daily questions to the same news paper, investors ask various questions about assessing unit trust investments. The general impression from the interviews is, once again, that of a medium to long term approach to the market. The tone of the letters seems to denote a low

level of knowledge of various stock market quantities such as risk-weighted returns and volatility. The notion of riskiness is to be seen clearly in all the letters. Most of the investors moreover seem to think that there "might be no time to escape".

4.4 The data and the model

4.4.1 The Data

In the previous chapter we mentioned that the time span over which the virtuous/vicious circle should unfold is not clear. Kaufman (1994) had clearly in mind quite a long period before investors could start it. Others, e.g. Remolona (1997) had a different point of view and considered months, and possibly shorter horizons, as most appropriate. Investigating the UK we conducted the investigation on net acquisitions using quarterly data. In the case of Italy the data available are monthly. The availability of monthly data allows us a stricter comparison with US research, and in the case of verification of UK results, lends credibility to those results.

The period investigated ranges from January 1985 to June 1997[2]. The period covered is then shorter than the one covered using UK data. As mentioned later in the paper, unit trusts acting in the Italian market before 1985 were incorporated under the Luxembourg law. Some data are indeed available for the pre-1985 period. However, the reliability of the data and the limited importance of the phenomenon before that date , made us opt for ignoring all data before 1985. The data for flows are provided by the Bank of Italy in its electronic publication "Database for Public Information" (BIPCD). Unit trust behaviour can be represented by net sales of units or by the net acquisitions of the sector in each asset market. The first aggregate focuses on the capital flows while the second includes managers' behaviour. Warther (1995) records the correlation between net sales and net acquisitions at 0.89 in the case of stocks. A similar value of the correlation might suggest the problem of choosing between net sales and net acquisitions for modelling is trivial. In our case the correlation between unit trust unit net sales and net acquisition of ordinary shares is 0.37 for ordinary shares. The level of the correlation is lower than the one recorded both in the UK, 0.7, (see previous chapter) and the US, 0.89 (Warther 1995). The value for Government securities is 0.57 versus 0.4 for the UK case.

[2] Longer series and different time spans are sometime available. Their use is signalled.

The choice of the aggregate to be used to represent the influence of unit trusts on the market is, as it was in the UK case, not trivial. We decided to focus on net acquisitions to capture the final influence of unit trusts on the market for the reasons given above.

Overall Italian fund managers seem to be somewhat more cautious than their UK counterparts as they are more prone than UK managers to invest in bonds (a low volatility market), but less in stocks.

Figure 1 shows the behaviour of the series for net acquisitions

The returns are calculated using the values of the price index in the last trading day of the month. We compute returns as the ratio of the first difference on the index to the value in the previous month.

$R_t = (P_t - P_{t-1}) / P_{t-1}$

P_{t-i} = value of the index in time t-i , i=0,1

Given the low level of change in dividend levels between years and in order to make our results consistent with the previous literature dividends are omitted.

Two indices measure the behaviour of the stock market. The indices are the Globale Banca Commerciale Italiana, BCI, and the Indice for the Restricted Market (Mercato Ristretto), IMR. The index BCI includes all the Italian shares traded on the Official List. The base value is as at 31 December 1972.

Lee and Ready (1991) provide empirical evidence for the hypotheses that investors' sentiment is particularly important for the prices of smaller stocks. Since unit trust flows are often reported to be a measure of investor sentiment our next step consists in assessing the connection between unit trust flows and returns on small stocks. As a measure for returns on the shares of smaller companies we use the returns on the index for the restricted market (Mercato Ristretto). The Mercato Ristretto was originally set up in 1977. The main purposes of this markets are two; to provide an environment where companies can get accustomed to being part of a stock market before passing to the Official List, and to supply the benefits of quotation to smaller companies unable to fulfil the requirement to access the main market. The composition of the list is a characteristic of the Ristretto worth mentioning. Most of the shares traded on the Mercato Ristretto have always been banks. The general index for the market was calculated weekly up until 30 June 1987, as meetings were held with that frequency. The general index is also produced on a daily basis. The databank Datastream is

the provider of the index for the official list in the Italian Stock Exchange. CED-Borsa, the information processing centre of the Italian Stock Exchange provides data on the Mercato Ristretto.

A project is currently under consideration with the aim of completing an overhaul of this market along the lines taken by other European stock exchanges.

The returns in the bond market were calculated using the values of the gross price index in the last trading day of the month. We compute returns as the ratio of the first difference of the index to the value in the previous month

4.4.2 Methodology

The statistical methodology implemented here is again the Sims' VAR methodology. The possible presence of feedbacks made us opt for using an econometric technique able to take them into account.

The form of our bivariate VAR is the same as in the previous chapter. We repeat it here for easiness of reading:

$$\begin{bmatrix} R_t \\ A_t \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \end{bmatrix} + \begin{bmatrix} \varphi_{11}^{(1)} & \varphi_{12}^{(1)} \\ \varphi_{21}^{(1)} & \varphi_{22}^{(1)} \end{bmatrix} \begin{bmatrix} R_{t-1} \\ A_{t-1} \end{bmatrix} + \ldots\ldots + \begin{bmatrix} \varphi_{11}^{(p)} & \varphi_{12}^{(p)} \\ \varphi_{21}^{(p)} & \varphi_{22}^{(p)} \end{bmatrix} \begin{bmatrix} R_{t-p} \\ A_{t-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \quad (1)$$

where R_t denotes aggregate returns; A_t denotes one of the deflated net acquisition series; c_1 and c_2 are constants; ε_{1t} and ε_{2t} are error terms; $\varphi_{ij}^{(p)}$ are the autoregressive coefficients which are to be estimated; and p is the order of the VAR. The assumptions concerning the properties of ε_{1t} and ε_{2t} are given in Chapter 2, as are the reservations to be made when using differenced variables which may be part of a cointegrated system.

The first step is based on an impulse response analysis reporting the response of the system to external shocks.

The next step of this paper is to assess the contribution of one variable to fluctuations in the other. The technique is that of decomposing the forecast error variances. The forecast error variance decomposition describes the proportion of the movements in a series due to the shocks of the other variable rather than to its own shocks. As the forecasting horizon increases the proportion of the variance explained converges.

4.5 The market

Unit trusts started regular operations in Italy in 1985, even though some Luxembourg based ones had been active on the Italian market for some time before. The law 23/3/1983 n 77, with successive additions [3] is the act regulating the activity of the unit trust sector in Italy.

Sections 1, 2, and 2-bis of the Law 77/1983 deal with the form of the trust.

The constitution of a unit trust is as a trust deed to which the parties are a custodian, and a manager. The two parties must act independently of each other, but must not necessarily be two independent institutions. The manager company is responsible for investment and administration and for making a market in the units. The custodian which must be a bank, is responsible for holding the records of securities held and traded and checking the general regularity of the operations of the fund managers. It must not necessarily be the material custodian of the fund.

Finally precious metal funds are not allowed in Italy.

Subsection 4 of section 3 establishes that unit trusts have a settlement period of up to 15 days to honour redemptions. As the settlement period in Milan is t+5, (buy/sell date plus five working days), we do not find the potential emergence of a gap between payment to shareholders and proceeds from security sales, as is the case in the US (Fortune 1997).

4.6 Growth of the unit trust sector

4.6.1 Growth of the funds and changes in the financial system

The value of the unit trust holdings has increased remarkably in the last decade. Their importance on the whole of the financial system remains however quite limited. Table 1* shows that the holdings of unit trusts at the end of 1996 were equal to 14 % ofGDP. The equivalent ratio for the loans to residents from the banking system was 78%. Italy still does not exhibit the decrease in importance of traditional intermediaries envisaged by Kauffmann (1994) as a major danger for the future stability of financial systems.

The links between the unit trust sector and the banking sector represent one of the possible channels through which shocks in the stock market could be transmitted to the real economy. Transmission could come in two ways. The first way is through non-repayment or

[3] D.L. 25/1/1992 n 83; D.L. 25/1/1992 n 89; L. 5/11/1992 n 429.

delayed payments of the loans that unit trusts receive from banks. The second is in a sudden withdrawal of the funds that unit trusts hold in bank accounts.

The first link, credit to unit trusts, is in the Italian case limited by the Italian law. Subsection 5, Section 4, of law 77/1983 limits the ability of the unit trusts to take on credit to more than 10% of the value of the fund. The length of the loans is restricted to be short term by the general Bank of Italy regulations.

The importance of credit from the banking sector to the unit trust sector can be investigated empirically. The series we have available to carry out this investigation can only give an approximate solution to the problem since it relates to the loans to unit trusts, investment trusts, investment banks and other minor types of financial institutions. Yet even if the aggregate is larger than needed the ratio to the loans to non-industrial firms is very low (FINDIND).

The ratio has shown a tendency to decrease in the last decade, but started to grow again in 1997. For the banking sector as a whole the assets and liabilities connected to the unit trust sector are generally marginal. Yet they are subject to sudden increases in value when the financial sector is under stress.

The second channel cannot, at the moment be investigated, as data on the phenomenon are not recorded. However, informal assessment by the Bank of Italy estimates deposits of the whole financial sector, excluding banks, in the banking sector as less than 1% of the sight /call deposits.

4.6.2 Unit Trusts and Household Financial Portfolios.

Figure 3 provides evidence of the growing importance of unit trusts amongst private individuals. The growth of unit trust units as a percentage of financial wealth held by the personal sector has also been remarkable; the percentage increasing from 2 to 7 % from 1992 to 1997. The decrease in shares and Government securities has been significant, the proportions falling from 27 to 16 % for the first and from 12.5 to 7% for the second.

Holdings of unit trust units seem to have grown to the detriment of shares and treasury bills (BOT) while proportions of wealth held as longer term Government securities and deposits remained substantially stable.

An interesting question in the context of our study is how long, on average, a private investor remains in a unit trust. We can obtain a rough idea of this time period by considering the repurchase ratio (based on monthly data) , which we define as:

$$REPDTOT = \frac{\text{Repurchase of unit trust units}}{\text{Total unit trust holdings}} * 100$$

The ratio has a mean of 2.83% varying from 0.14 (January 1985) to 6.43 in September 1992.

The turnover rates are quite moderate, even if somewhat higher than in the UK, where the peak is 2%. It is worth mentioning the fact that the peak is connected to a macro event, the exit of the Lira from the ERM, rather than to a major fall in the market, as in the UK case.

Overall, as in the UK case, the moderate turnover lends credibility to the hypothesises that investors treat such vehicles as long-term investments, and thus, reduces the credibility of the hypothesis that the sector poses a threat to the stability of the financial system.

4.7 Unit trusts and the stability of the equity market

We focus on the net acquisition of the unit trust sector in the stock market. As we have already noted our results, taking into account also the behaviour of managers, are more complete than those presented in the previous literature. Our conclusions relate to the final and actual influence of the unit trust sector on the stock market.

In order to limit the spurious influence of increases in prices in this case also data have been normalised by the corresponding market value at the end of the previous quarter. In this normalised form they will be used throughout the paper.

The particular structure of the unit trusts is often quoted as a major factor responsible for the present levels and volatility of the markets. The most quoted piece of evidence is the correlation between returns, and flows towards the unit trust sector. Remolona *et al.* (1997) notice that various authors had in mind different notions of correlation between flows and returns. Kaufman (1994), for instance, considers a correlation between returns over an unspecified period, a bear market, and short-term flows.

The correlation between returns and net sales of units on the equity market at different lags is reported in Table 3. The evidence shows that correlation between returns and net sales is weak and barely significant.

The correlation between returns and normalised net acquisition of shares by the unit trust sector is reported in the following table, table 4. Returns are negatively related to past acquisitions, but the evidence is too weak to lend support to the price pressure hypothesis.

Stock net acquisitions present a certain degree of autocorrelation increasing up to lag 4 and steadily decreasing afterwards. This autocorrelation makes a substantial component of the flows predictable using past values providing further support to the choice of a VAR model.

The choice of the lag length is a crucial step for the results following. To support this choice we adopt a procedure based on a likelihood ratio test comparing the two alternative lag lengths as recommended by Sims (1980). The result of the tests suggests a lag length of 9. Alternative criteria were also tried. The AIC suggested 12 lags, whereas the SC had its minimum at 6. Taking into account loss of explanatory power and degrees of freedom considerations we decided that a lag of 9 was the most appropriate.

The main concern about unit trusts and returns has been that a negative (positive) external shock to one of the variables could start a downward (upward) self-sustaining spiral of increases (decreases) in prices and flows. In order to assess the importance and time span of the reciprocal influences of the variables we perform an impulse response analysis. The identification restriction adopted here is the Cholesky decomposition. A criticism usually levelled against this is that the ordering of the variables influences the results. This criticism does not apply to our results since the low correlation between the estimated errors makes the ordering less important[4]. This is also shown by the analysis the other way round.
In no case do the flows and the returns prove to have a statistically significant influence on each other.

[4] In the case of acquisitions(NEA) for instance, the contemporaneous correlation with returns on the official list (Re) was 0.16; with returns on the ristretto it was 0.23. Similar values are shown by all the other series.

The next step in this paper is to assess the contributions of one variable to the fluctuations of the other. The technique is that of decomposing the forecast error variances. The forecast error variance decomposition describes the proportion of the movements in a series due to the shocks of the other variable rather than to its own shocks. As the forecasting horizon increases the variance explained converges. In table 5 the decomposition is shown at a 24 month forecast horizon. Each time series explains most of its own past values as anticipated; unexpected acquisitions explain 87 % of their own values while returns explain nearly 92% of their own values. Granger causality tests (in parentheses) confirm the low connection between the series; the null of no effects of the acquisitions on returns receives strong support with a p-value of 0.63, (table 5).

This analysis of the variance of the time series of returns casts light on the volatility of returns. Insofar as volatility is measured by variance, the supposition that mutual funds are an important factor in explaining the levels and variance of returns in the Official List of the Italian Stock Market cannot be supported on the basis of our evidence. It would also be interesting to assess volatility directly.

Lee and Ready (1991) provide empirical evidence for the hypotheses that investors' sentiment is particularly important for the prices of smaller stocks. Since unit trust flows are often reported to be a measure of investor sentiment our next step consists in assessing the connection between unit trust flows and returns on small stocks. As a measure for returns on shares of smaller companies we use the returns on the index for the restricted market (Mercato Ristretto). The restricted market was originally set up to provide an easier route to the market for small and medium sized companies which did not qualify for a full listing. Most of the shares traded on the Mercato Ristretto have always been banks; however, for some years, the presence of insurance companies' and other sectors' shares made it possible to set up at least three indices reportin, respectively, banks, insurance companies and the rest. The exit from the Ristretto of insurance companies made the presence of banks preponderant once again.

The findings are similar to those obtained above. The following figure, figure 6, shows our results reporting that no significant influence exists between returns and flows. The results of variance decomposition and Granger causality perfectly mimic those for the Official List.

4.8 The unit trusts and the stability of the bond market

The Italian bond market is characterised by a wide range of choices among alternative interest rate arrangements and maturities.

At the end of December 1996 the Italian government bond market had outstandings totalling ITL 2017 trillion (US$1.2 trillion). Not all bonds are traded in the regulated market but all outstanding liquid issues, as well as all new issues, are included.

The analysis of the bond market relies on net acquisitions of bonds. The series used is the sum of monthly net acquisitions of long term (more than five year) bonds (BTP and CTO) (NBA).

Table 6 reports the correlation between first difference in price index and net sales.

The correlation between normalised net sales and returns is shown in table 7. In this case the correlation is quite limited and falls below 0.2 at lag 3.

The procedure adopted to find investigate the order of the VAR is the same as in the case of equities. The result of the tests suggests a lag length of 9. Alternative criteria were tried as well. The AIC and the SC both suggested 1. Explanatory power and degrees of freedom reasons suggested the choice of a lag of 9. We cannot provide a satisfactory explanation for the size of the gap. However trials with lag 1 gave substantially similar results.

The impulse responses are shown in figure 7. On the contrary of what we have seen in the stock market a feedback system is at work here.

The influence of the ordering is not substantial, but in contrast to the result above the correlation of the errors is quite high and significant at 0.45.

Variance decomposition and Granger causality tests confirm that a feedback system is in place in the bond market.

4.9 Cross influence

The final step of the research is to verify if any cross influence exists between the two markets. In accordance with our previous result we find that returns on the stock market (official list) influence (negatively) the flows towards the bond market, but not the reverse. Flows towards the stock market are not affected by the returns in the bond market.

4.10 Conclusions

The Italian unit trust industry has enjoyed a significant increase in importance after its creation in 1985. Concerns have been raised as to the behaviour of the managers and participants to the trusts. Most observers noticed that a strong correlation was present between fund flows and returns in both the stock and the bond markets. This correlation has been interpreted as reciprocal causation between market returns and net acquisition flows able to amplify any upward/downward spiral.

In the case of the stock market our analysis shows that correlation is not causation; no significant connection between the two series can be inferred from the data. The major explanation of this seems to be the fact that even if unit trusts have recently increased their weight in the financial markets their influence is still too limited to be felt. In contrast a feedback system is in place in the Bond market. The results for the stock market are in line with those obtained in the UK case, lending credibility to those data. In the case of the bond market the results are different. However the limited value of the influence makes the difference less remarkable.

4.11 Summary of Part 2

Part 2 of the thesis tackles the concern that financial markets might become more unstable because of disintermediation, the declining importance of traditional intermediaries such as banks, and the growth of new investment vehicles, such as unit trusts and hedge funds. Using data from UK and Italian capital markets we analyse the relationship between market returns and the acquisitions of unit trusts units to determine the influence of the unit trust sector on the stock and bond markets. Our results suggest that increases in equity and government bond prices lead to an increase in unit trust acquisitions, but that these net acquisitions do not have a corresponding impact upon aggregate returns. We believe that our failure to identify a positive feedback relationship between the series of interest is due to the structure of the unit trust industry which favours a long term approach to this form of investments by households. The fee structure, the relatively modest minimum lump sum values, the availability of regular savings unit trusts all combine to bring about a very low turnover of unit trust units.

The relative sophistication of UK market participants is then one of the reasons of the implicit stability of the UK and US markets. However there is coincidence of conclusions with Italy, a typical and less sophisticated continental financial system.

Overall then we find no room for increased systemic instability because of the growth of the unit trust sector in either intermediary-based or market-based financial systems.

Table 1
Relative importance of different assets in the financial sector.
ASSETS denotes the aggregate assets of the unit trust sector (bn. ITL) ASDGDP denotes total unit trust holdings as a percentage of GDP, LOAN denotes total loans to residents (bn. ITL), LOANDGDP denotes total loans to residents as a percentage of GDP

	ASSETS	ASDGDP	LOAN	LOANDGDP
1985	19784	1.74	N/A	N/A
1986	65077	5.58	N/A	N/A
1987	59454	4.95	N/A	N/A
1988	51565	4.13	N/A	N/A
1989	49165	3.83	662456	51.63
1990	47379	3.61	769610	58.71
1991	56191	4.23	880181	66.39
1992	60663	4.55	979905	73.50
1993	110093	8.35	1016193	77.12
1994	130168	9.66	1026881	76.27
1995	126802	9.149	1076813	77.70
1996	197544	14.15	1095086	78.47

Table 2
Summary statistics from 1985:1 to 1997:6
NASH net acquisition of Italian company ordinary shares (ITL bn.); NABDD net acquisition of BTP and CTO (ITL bn.), NEA net acquisition of Italian company ordinary shares (ITL bn.) divided by market capitalisation, percentage. NBA net acquisition of BTP and CTO divided by market capitalisation percentage.

Series	Mean	Std Error	Min	Max
NASH	134.05	462.03	-1090	2048
NABDD	456.04	1623.35	-3340.63	7796.11
NEA	0.00013	0.00046	-0.001	0.002
NBA	0.05	0.16	-0.30	0.78

Table 3
Correlation.
NES denotes the value of sales of unit trust units, net of repurchases; Re denotes returns on the Milan Banca Commerciale Italiana Index; -i for i=1,2,3 denotes the aforementioned series lagged of 1,2,3 periods.

	NES	Re
NES	1	
Re	**0.20**	1
NES-1	0.87	**0.12**
Re-1	**0.28**	0.1
NES-2	0.75	**0.16**
Re-2	**0.26**	0.03
NES-3	0.71	**0.08**
Re-3	**0.18**	0.09

Table 4
Correlation.
Re denotes returns on the Milan Banca Commerciale Italiana Index; NEA net acquisition of Italian ordinary shares (£ mln) divided by market capitalisation; -i for i=1,2,3 denotes the aforementioned series lagged of 1,2,3 periods.

	Re	NEA
Re	1	
NEA	**0.37**	1
Re-1	0.1	**0.2**
NEA -1	**0.1**	0.49
Re-2	0.04	**0.2**
NEA -2	**0.17**	0.54
Re-3	0.09	**0.27**
NEA -3	**0.14**	0.63

Table 5
Variance decomposition percentage at a 24 month forecasting horizon.
Variance decomposition percentage at a 24 month forecasting horizon. In parenthesis are reported the p-values for the Granger test. The null of the test is that of no Granger causality of the variable in the row on the one on the column. The null is that all lagged coefficients of the variable on the row are equal to zero. NEA denotes net acquisition of equities standardised by the market size, Re the return on the market portfolio.

Percentage of forecast error variance (P-value of Granger Causality Test)	Shock to	
	Re	NEA
Re	92	8 (0.17)
NEA	13 (0.63)	87

Table 6
Correlation.
NBA denotes net acquisitions of bonds normalised by total market value of the bond market; Rb denotes the first difference in the price index; -i for i=1,2,3 denotes the aforementioned series lagged of 1,2,3 periods.

	Rb	NBA
Rb	1	
NBA	0.37	1
Rb-1	0.15	**0.28**
NBA-1	**-0.18**	0.48
Rb-2	0.01	**0.21**
NBA-2	**-0.12**	0.34
Rb-3	0.07	**0.15**
NBA-3	**-0.08**	0.24

Table 7

Variance decomposition percentage at a 24 month forecasting horizon.

In parenthesis are reported the p-values for the Granger test. The null of the test is that of no Granger causality of the variable in the row on the one on the column. NBA denotes net acquisitions of bonds normalised by total market value of the bond market; Rb denotes the first difference in the redemption yield index.

Percentage of forecast error variance	Shock to	
	Rb	NBA
Rb	64	36 (0.001)
NBA	17 (0.03)	83

Figure 1: Panel A: Net acquisition of ordinary shares (NEA); Panel B: Unit Trust equity unit net sales (NES).

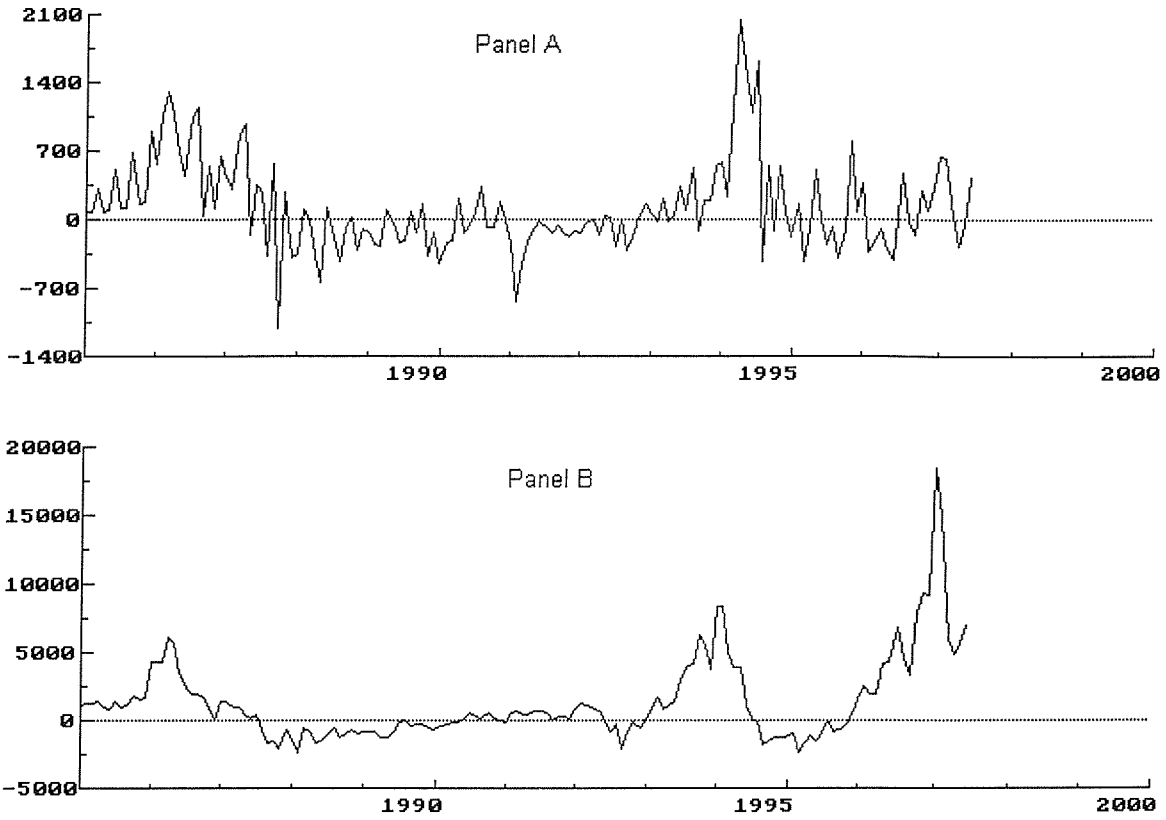


Figure 2: Bank loans to financial institutions, ratio as percentage of loans to non financial firms (findind)

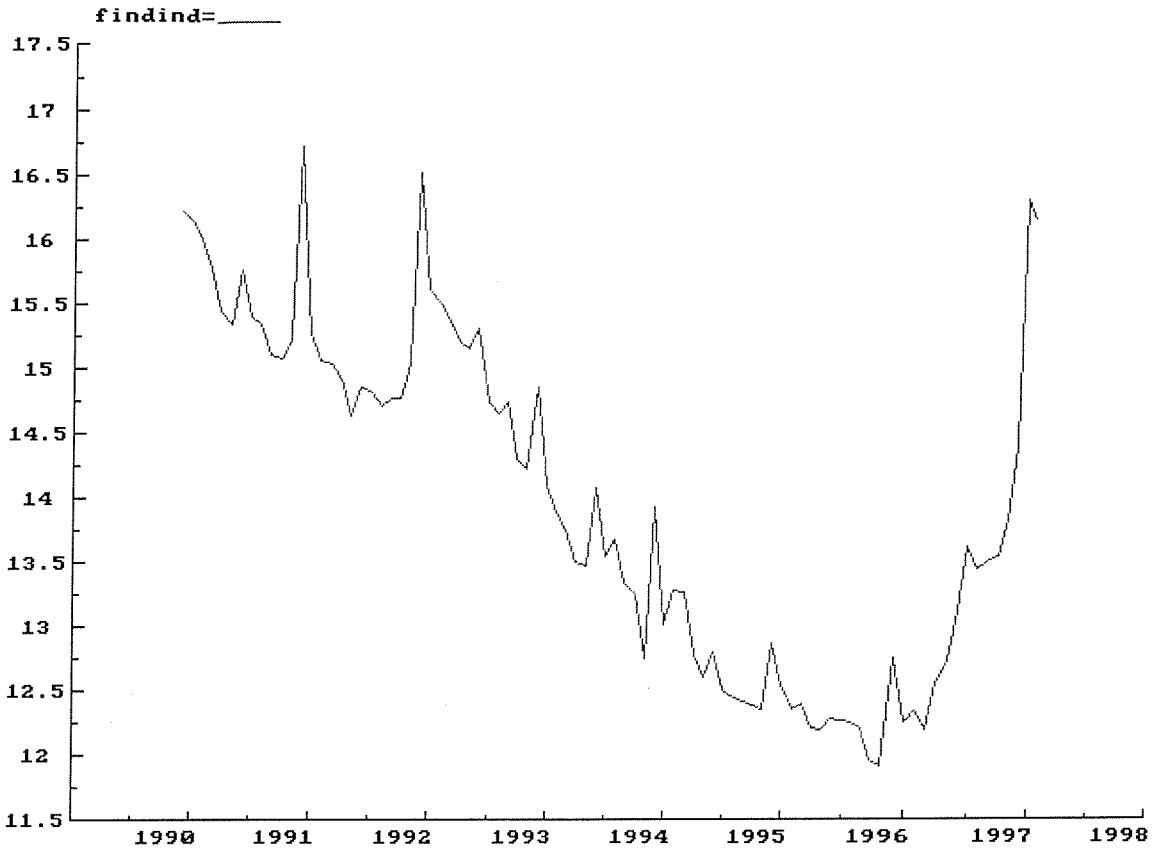


Figure 3: Personal Sector Holdings of Financial Assets Panel A Personal Sector Holdings of Shares as a percentage of total financial wealth; Panel B Personal Sector Holdings of Unit Trust Units as a Percentage of Total Financial Wealth; Panel C Personal Sector Holdings of Deposits as a percentage of total financial wealth; Panel D Personal Sector Holdings of short term Government Securities as a percentage of total financial wealth; Panel E. Personal Sector Holdings of long term Government Securities as a percentage of total financial wealth.

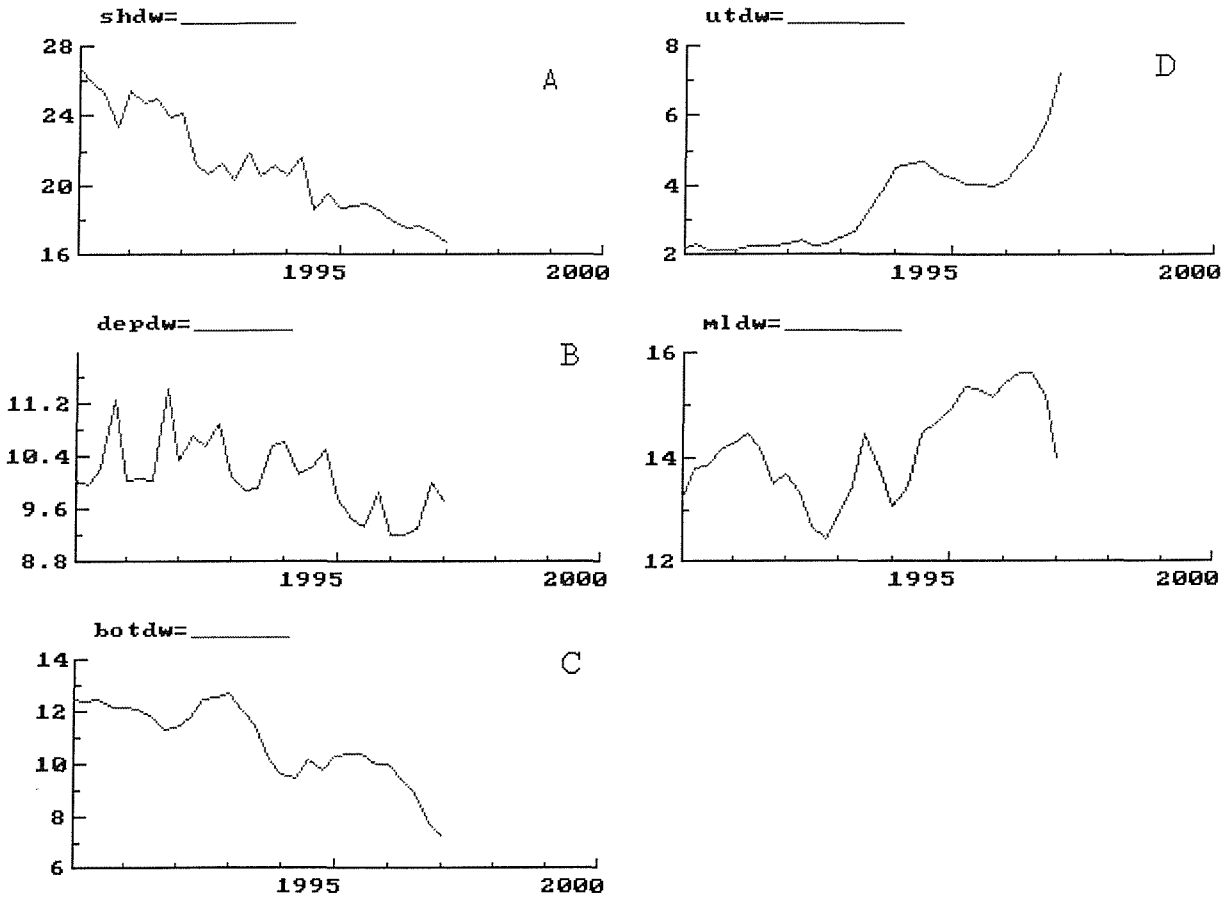


Figure 4: The repurchase ratio

The ratio of the repurchase of unit trust units to total unit trust holdings in Italy.

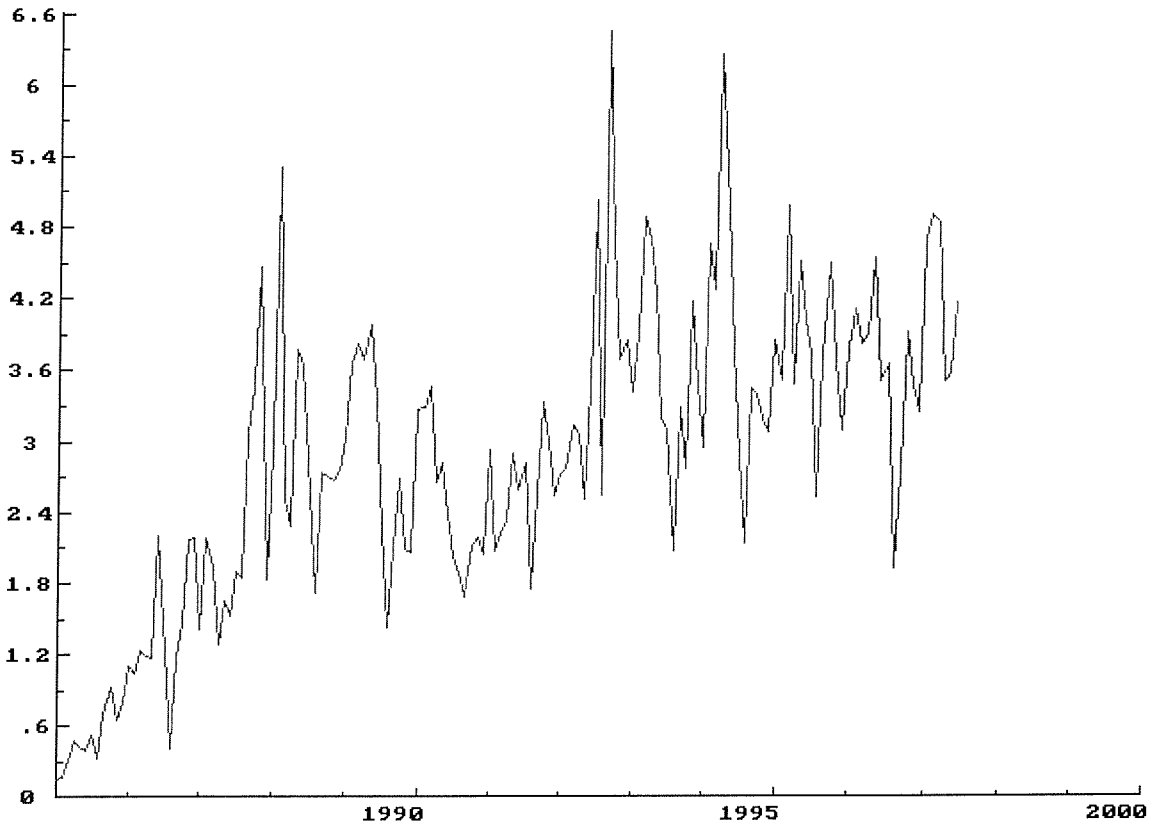


Figure 5: Impulse Responses. Panel A: Response of Share Returns (Re) to a 1-Standard Deviation Shock in Net Acquisitions of Shares (NEA) Panel B: Response of Net Acquisitions in Shares (NEA) to a 1-Standard Deviation Shock in Share Returns (Re).

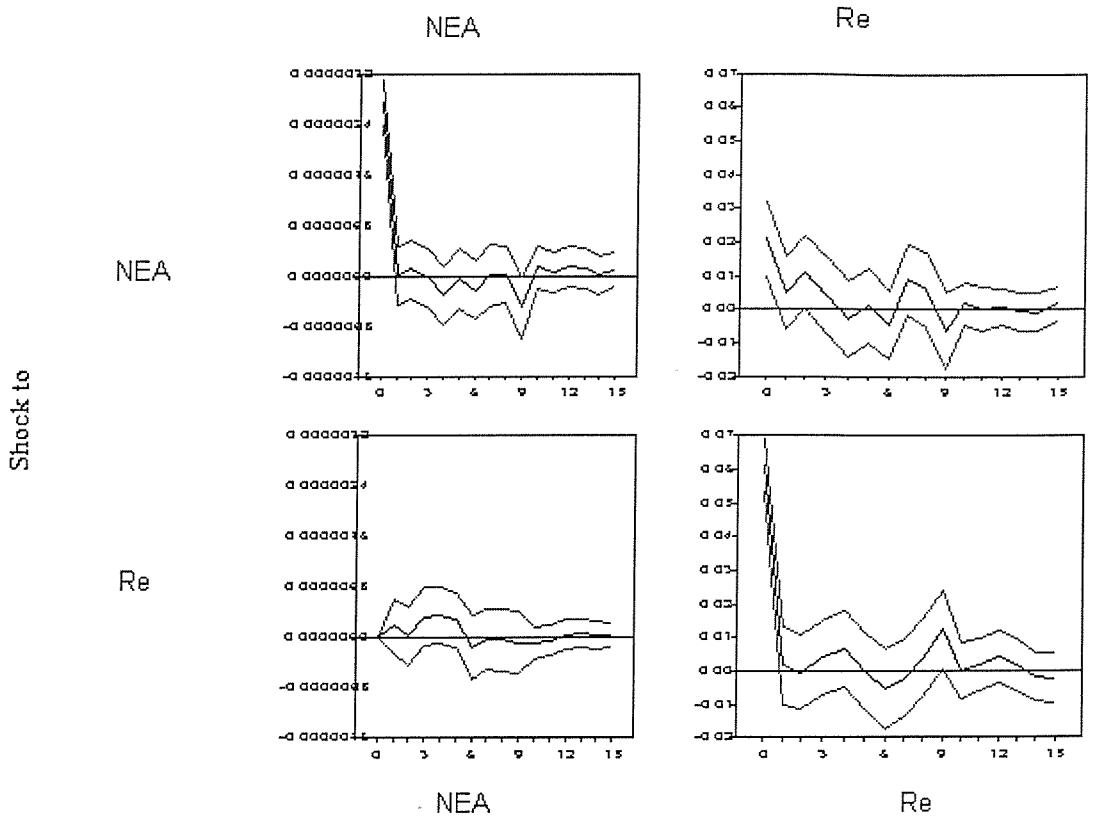


Figure 6: Impulse Responses. Panel A: Response of Share Returns in the Ristretto (RIMR) to a 1-Standard Deviation Shock in Net Acquisitions of Shares (NEA) Panel B: Response of Net Acquisitions in Shares (NEA) to a 1-Standard Deviation Shock in Share Returns in the Ristretto (RIMR).

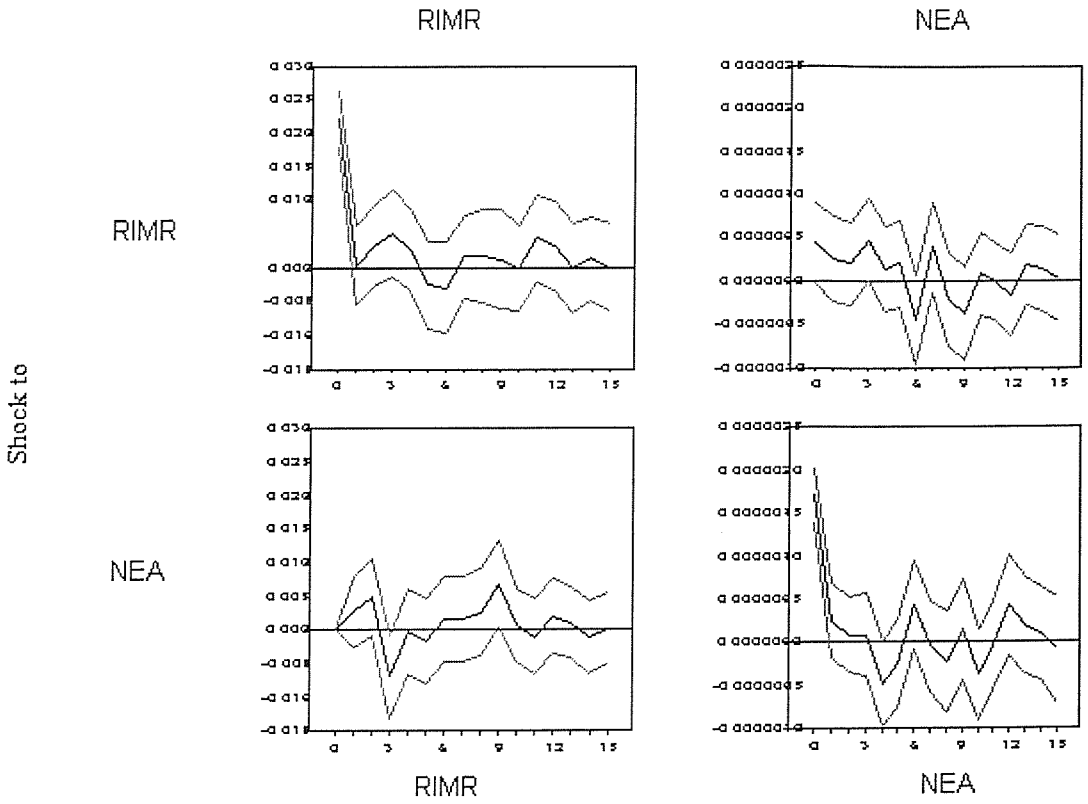
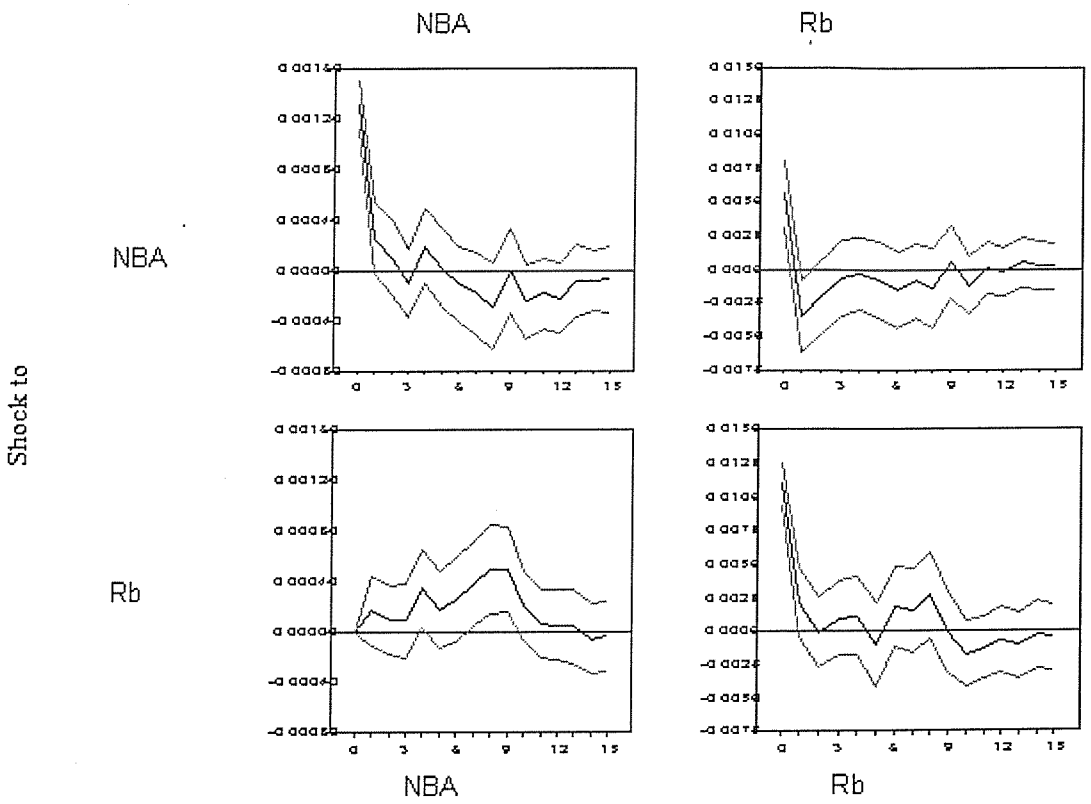


Figure 7: Impulse Responses. Panel A: Response of Returns (RB) to a 1-Standard Deviation Shock in Net Acquisitions of Government Securities (NBA) Panel B: Response of Net Acquisitions in Government Securities(NBA) to a 1-Standard Deviation Shock in Returns (Rb). (17.pic)



PART 3

Chapter 5

Stock returns and inflation

5.1. Introduction

This paper examines the relationship between inflation and the rates of return on stocks using UK data. The Fisher (1930) hypothesis states that the nominal interest rate can be expressed as the sum of a real return and an expected rate of inflation.

However, conspicuous evidence shows a negative relationship between asset returns and inflation in the US data. Various theoretical papers have been developed to explain this fact which goes against the Fisher hypothesis and the belief that stocks are a hedge against inflation. Firth (1979) was the first to show that the same relation holds in the UK case. Firth's evidence is based on data from 1935 to 1976.

We assess the causal relations and dynamic interactions between inflation, returns and those variables that the theory has indicated as relevant to this relationship.

The purpose of the paper is to investigate whether the negative correlation between stock returns and inflation applies to the UK during the last 16 years. Should Firth's and US findings apply, we test which of the links proposed to explain the US evidence do not apply to the UK. The two most credited explanations for the US evidence are provided by Fama (1981) and Geske and Roll(1983). Both theories centre on monetary stability and the conduct of monetary policy. Fama (1981) provides a money demand justification. Stock returns are determined by forecasts of real variables. A decrease in expected output is then reflected in decreasing stock returns. Given the decrease in output the demand for transactional money falls while nominal money supply does not vary resulting in increasing inflation. Geske and Roll (1983) provide a money supply explanation.

Our major findings are: 1) as in Firth (1979) we verify the Fisher hypothesis for the UK. 2) Stock returns appear to cause real activity in a temporal-Granger sense, but they do not seem to exert the same influence on inflation.

The outline of the rest of the chapter is as follows.

Section I highlights the previous literature on this topic. In Section II we describe our data and outline the econometric methodology in use. In Section III we present our results based on correlation and VAR analysis. In the final section we draw our conclusions. Their implications as well as some possible interpretations are also presented.

5.2 Review of the literature

Our paper relates to three main streams of the literature.

The first is in theoretical finance. The theoretical financial literature does not agree on the sign of the relation between inflation and stock market returns. A first body of thought suggests that the returns move in parallel with the inflation rate. According to these theories investors would be on average hedged against the loss of purchasing power. The basis of these theories is the Fisher hypothesis on interest rates. The Fisher hypothesis (1930) states that the return on assets is composed of a real part, a part connected with the behaviour of inflation and a possible risk premium. A variation of the part connected to prices, should, *ceteris paribus*, be reflected in a variation of the nominal rate in the same direction. In the Fisherian framework we find several papers investigating the connection between stock markets and inflation.

Another stream of the literature argues that a negative relation between inflation and stock market returns exists. Kessel (1956) connects the negative relation between inflation and stock market returns to the accounting position of the firms. Inflation benefits debtors and damages creditors. It has then a negative influence on the assets of net creditors. This mechanism is not convincing as far as non-financial firms are concerned since they are most of the time net debtors. The argument is for the same reason more relevant for the financial firms. These have a wider range of positions. The relation between stock market returns and inflation is also investigated by Bodie (1976). The results presented in the paper are that there is a negative relation between real returns and inflation, both expected and unexpected. His conclusion is that in order to be hedged against inflation short selling is the only possible option.

Feldtsein and Summers (1979) argue that the negative relation between inflation and returns has its origin in the tax system since inflation substantially increases the effective tax rate on capital income.

Modiglian and Cohn (1979) develop their paper with the aim of assessing the informational efficiency of the market as well as the paradigm of rational expectations. The evidence presented in the paper supports an explanation based on the irrationality of agents. Agents would be subject to monetary illusion in assessing stock market returns resulting in a continuous under-estimation of values. Monetary illusion would be the cause of two errors. The first consists in the fact that the present value is obtained by discounting the

profits at the nominal interest rate. The second is that profits are capitalised at their nominal value. This conclusion has been repeatedly criticised. Geske and Roll (1983), for instance, note that this conclusion is faulted insofar as it relies on irrationality. Such a conclusion is always available for any economic activity.

Macro approaches have been suggested to account for the negative relation between inflationary expectations and stock prices. These involve expectations about real variables. Both approaches consider monetary instability as the cause of financial instability.

Fama (1981) focuses on the US economy. The main result of the paper consists in showing that the negative relation between expected inflation and real returns from the stock market is spurious. Agents would be able to forecast the consequences of slumps in economic activity. These slumps would cause an increase in money supply due to the decreased need for transactional balances. This increase in money supply causes increased inflation expectations and thus the negative relation. The core of the argument is the rationality of the operators who realise that an exogenous shock will trigger the above mentioned mechanism. The role of the market is that of signalling the start of this cycle.

Geske and Roll (1983) suggest a mechanism based on the consequences of the expenditures of the Federal Government. Government revenues are based on corporate and personal taxes. When stock prices vary, *e.g.* decrease, in response to anticipated changes in economic conditions, personal and corporate incomes move in the same direction inducing a similar change in government revenues. Given largely fixed government expenditures the result is a deficit. Since larger debt is monetized by an accommodating central bank, the final outcome is inflation.

Solnik (1983) investigates the Geske and Roll hypothesis using data referring to the seventies. They find clear support for this hypothesis in countries with accommodating monetary authorities (*e.g.* the UK) but a less clear one for countries with non-accommodating authorities.

Kaul and Sejhun (1990) investigate the effects of a variation in relative prices on the relation between inflation and stock market returns. The results prove once again that the relation between inflation and stock market returns is spurious. This relation is indeed a proxy for the negative relation between stock market returns and variations in relative

prices. The authors show that the supply shocks that took place in the seventies had a negative influence on income and then on the stock market.

Firth (1979) employs a regression model to test the relationship between inflation and the rates of returns using British data in the period 1935-1976. Firth finds support for the Fisher effect.

5.3 Data and methodology

5.3.1 Data

The data used in this research are provided by Datastream. The time span is the month and the period under investigation stretches from January 1982 to December 1997.

This period is relevant in UK economic history since it includes a period of high inflation and a period of lower moderate inflation. Stock markets have as well undergone important changes during this period such as the Big Bang in the LSE in 1986.

Inflation variables are constructed using data from the CSO. The series for inflation are computed as the first difference of the price index.

$INF_t = (P_t - P_{t-1}) / P_{t-1}$

P_{t-i} = value of the index in time t-i, i=0,1

The series used is retail prices (RPI). Expected inflation is estimated from the difference between conventional and indexed gilts spot rates. Since inflation indexed government bonds were not issued before 1982, our study starts at this date.

Variability of relative prices is estimated as inter-market price variability. The measure we use is the cross sectional variation of price movements in different markets around the inflation rate, considered as the average price change for the entire economy. The series of relative prices rely on five individual good price series: alcoholic drink, food, clothing, rents and fuel and electricity.

$$\Pi^{rel}_t = [(1/n)\Sigma^N_{i=1} (\pi_{it} - \pi_t)^2]^{0.5}$$

where : π_{it} denotes change in the price index for the good i=1, ,5 between period t and period t-1

π_{t-1} denotes change in the retail price index between period t and period t-1

Domberger (1987) documents a positive relationship between inflation and relative prices in the UK. Debelle and Lamont (1995) have similar results for the US. On the contrary Reinsdorf (1994), using data with a time span including the early eighties, finds an inverse relation between inflation and relative prices.

The measure of real activity we are going to use in this paper is the change in the industrial production index. This measure is used in both Fama(1981) and Geske and Roll (1983). We chose changes in industrial production because of the sensitivity of the results to the measure used and the fact that our purpose is to apply Fama's and Geske and Roll's theories in an European context. Several possible alternatives have been proposed to measure real activity as real activity can be measured in various ways and the results are contingent on the measure adopted. Ram and Spencer fail to corroborate this relation measuring real activity as the number of wholly unemployed as a proportion of the total population. However we prefer to use industrial production because of the relative slowness with which these measures react to the business cycle in less flexible labour markets such as the European ones.

The value actually used in the following VAR is the result of an ARIMA based one step ahead forecast. Unexpected changes are calculated as the difference between the actual and the forecast (expected) values. We adopt this "neutral" approach to avoid modelling conditional expectations using a structural model of the business cycle which would be far beyond the scope of this study. The previous literature, *e.g.* Fama (1981), use actual growth rates displaced by one period. The use of ARIMA is connected to our desire to avoid entering the debate about expectations and to the finding that measures of growth of real activity are close to white noise in their dataset.

The returns are calculated using the values of the price index in the last trading day of the month. We compute returns as the ratio of the first difference on the index to the value in the previous month.

$R_t = (P_t - P_{t-1}) / P_{t-1}$

P_{t-i} = value of the index in time t-i , i=0,1

Real returns are calculated as nominal returns less the expected inflation rate.

Theoretical econometrics has established as a widely agreed result that inference is misleading if the variables in a regression contain stochastic trends due to unit roots. In order to determine if levels of inflation and stock market returns contain stochastic trends we implement a Dickey-Fuller (1979) test on the variables. The presence of unit root in the data allows the possibility of a long run equilibrium relationship between the variables under investigation resulting in a cointegrating relationship.

The variables under investigation are integrated of different order with the returns series integrated of order 0, I(0) and the inflation and dispersion series integrated of order 1, I(1). The data under investigation reject the existence of any possible long term equilibrium relation between the variables.

5.3.2 Methodology

The statistical methodology implemented in this chapter is the Sims' VAR methodology[1]. The possible presence of feedbacks made us opt for using an econometric technique able to take them into account.

We have chosen this approach because of the emphasis placed on the interdependence among the variables. The methodology is based on an autoregressive process in vector form. This vector autoregression, or VAR, is analysed both in its typical form and in its inverted moving average (MA) form, once the property of stationarity of the series involved is evaluated. We adopt a VAR(p) system in n variables whose form is:

$$\mathbf{X}_{j,t} = \nu_j + \Sigma_i \alpha_{j,i}\mathbf{X}_{t-i} + \Sigma_{k,i} \beta_{j,k,i}\mathbf{Y}_{k,t-i} + \varepsilon_{jt}$$

Where $\alpha_{j,i}$, $\beta_{j,k,i}$ denote the influence of one variable on the other, j, k= 1.....n

ν_j denotes the constant j = 1,.., n.

$X_{j,t-i}$ denotes the variable under investigation at time t-i, i= 1....p, j=1...n.

$Y_{k,t-i}$ denotes the explanatory aggregates at time t-i, i=1...p, k=1..n

ε_{jt} denotes the errors at time t, j= 1...n.

In all series the initially proposed lag length p has been 12 as we discuss more extensively below. The lags are equal in order to avoid identification problems.

5.4. Empirical evidence

Table 1* reports summary statistics on the data.

[1] Regression techniques similar to those of the previous literature were also tried but are omitted here as their results are very similar to the ones reported.

Our first step consists in estimating the correlation between the inflation levels and the variability measure. Table 2 reports the values of the correlation for variables under investigation[2],[3].

Real stock returns and inflation are also negatively correlated with an average value of -0.05 over the first 12 lags of inflation. The weak relation between expected inflation and real rates has been tested for significance using a Fisher exact test showing that it is indeed significant. The evidence points towards a different behaviour of the time series for the London Stock Exchange, from those for the US stock markets. This discrepancy, already reported in Firth (1979) supports the Fisher Hypothesis in the UK case.

The claim that an increase in real stock returns anticipates increases in industrial production does not find a decisive support in our data. Stock returns are positively correlated with growth in industrial production at some lags and negatively correlated at others. The absolute values are generally low and the average correlation insignificantly above zero.

Inflation is negatively associated with subsequent growth in industrial production, contrary to the theories that envisage the benefits given by inflation to firms as debtors (Kessel, 1953), but in accordance with Geske and Roll (1983).

Relative price variability is positively associated with expected inflation as well as with inflation, presenting a value of 0.03 in the first case, table 2, and 0.21 in the second, (not shown). These results agree with those presented in Domberger (1987). Similar findings have been documented in the US by Bebelle and Lamont (1985) and Parsley (1996), but not Reisdorf (1994). Relative price variability is weakly positively associated with industrial production for the first three lags, 0.05 at lag one for instance, to fall towards zero at later lags.

The investigation is based on a four variable VAR system with a constant and 9 lags. The lags have been selected using a likelihood ratio procedure as in Hamilton (1994). Other procedures pointed towards shorter lags, albeit not unanimously. The hypothesis that the negative relations between stock returns and inflation are proxying for positive relations

[2] Remember that we are using ARIMA forecasts relating to the following period

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between stock returns and real variables can be disaggregated into three steps using changes in inflation rates.

The first step is to document the negative relation between inflation and real activity. The negative link between inflation and real activity is the fundamental determinant of the negative relation between stock returns and inflation in the US sample. This relation is negative in Geske and Roll (1983) due to the monetization of debt and to insufficient money demand elasticity in Fama (1983)

In our case little support is found in favour of this hypothesis as shown in Figures 1 and 2.

The result is supported also by the variance decomposition of the forecast variances. At a 24-step horizon inflation and price variability explain 4 and 2 % of the variance of industrial production respectively. The real rate of return on stocks on the contrary explains about 10%.

The second step is to assess the relation between stock returns and inflation.

The influence of stock returns on both measures of inflation is extremely small and only marginally significant (Figures 3 and 4).

The results of the impulse response function are confirmed by variance decompositions, where stock returns provide the lowest contribution to the forecast variance of inflation (7%) and price dispersion (8%).

Equally irrelevant is the influence from inflation to stock returns, both as measured by the impulse response function, and by the variance decomposition. This finding does not corroborate the results in Ram and Spences (1983), who found unidirectional causation from inflation to stock returns using a bivariate causal test[4]. In our case, as in Firth (1979) the Fisher hypothesis results are verified.

The main link supporting the Fama and Geske and Roll explanations is the positive relation between stock returns and real activity. We found that shocks in real rates of return influence real activity. Real rates of returns moreover play the most relevant role in explaining real activity forecast variance with a value of 10%.

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[3] The results of the first 12 lags were tested, but are omitted here. We report in the text any interesting findings linked to longer lag correlations.

[4] We tested the relation in the context of a bivariate VAR obtaining the same result.

The view that stock returns are a leading indicator of real activity is widely held in the markets, (Pring 1991) and provides the rationale for the theories basing pricing on a stream of dividends.

Real activity shocks also have an influence on real stock returns with a contribution to returns error variance equal to 10%.

5.5. Conclusions

Using data from the UK in the last twenty years a VAR based causal analysis is conducted on the causal interactions and dynamic relations among real stock returns and inflation. The aim is twofold. First, trying to assess the validity of the Fisher hypothesis in the dataset, and second, comparing our causal chains with those proposed by the literature to explain the failure of Fisher hypotheses in the US.

Our major findings are: 1) Stock returns appear to cause real activity in a temporal-Granger sense, but they do not seem to exert the same influence on inflation. 2) As in Firth (1979) we verify the Fisher hypothesis for the UK[5].

Possible extensions of the paper to other countries with different monetary policy regimes, or to the UK using different techniques are possible.

[5] The analysis reported in this chapter has been produced for Italy as well. However problems with the consistency with the data made us choose not to publish the results here.

Table 1
Descriptive statistics
EINF denotes expected inflation; DIP denotes variation in industrial production; DISP denotes the measure of price dispersion/relative price variability; ERS denotes the real rate of return on stocks.

Series	Obs	Mean	Std Error	Minimum	Maximum
EINF	183	3.679	0.367	2.7147	4.6788
DISP	185	0.873	0.645	0.074	3.933
ERS	183	0.85	4.683	-26.888	13.559
DIP	186	0.184	1.073	-3.846	3.325

Table 2
Correlation matrix for monthly inflation.
EINF denotes expected inflation; DIP denotes variation in industrial production; DISP denotes the measure of price dispersion/relative price variability; ERS denotes the real rate of return on stocks

	EINF	DISP	DIP	ERS
EINF	1			
DISP	0.03	1		
DIP	-0.11	0.05	1	
ESR	-0.21	0.08	0.005	1

Figure 1. Impulse Responses. Response of industrial production (DIP) to a 1-Standard Deviation expected inflation (EINF).

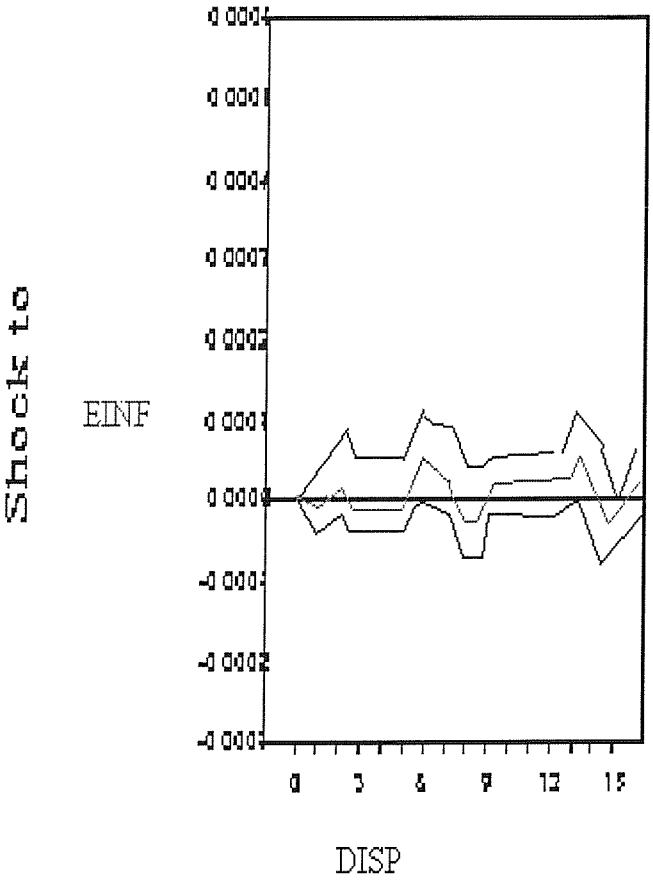


Figure 2. Impulse Responses. Response of industrial production (DIP) to a 1-Standard Deviation in dispersion of prices (DISP).

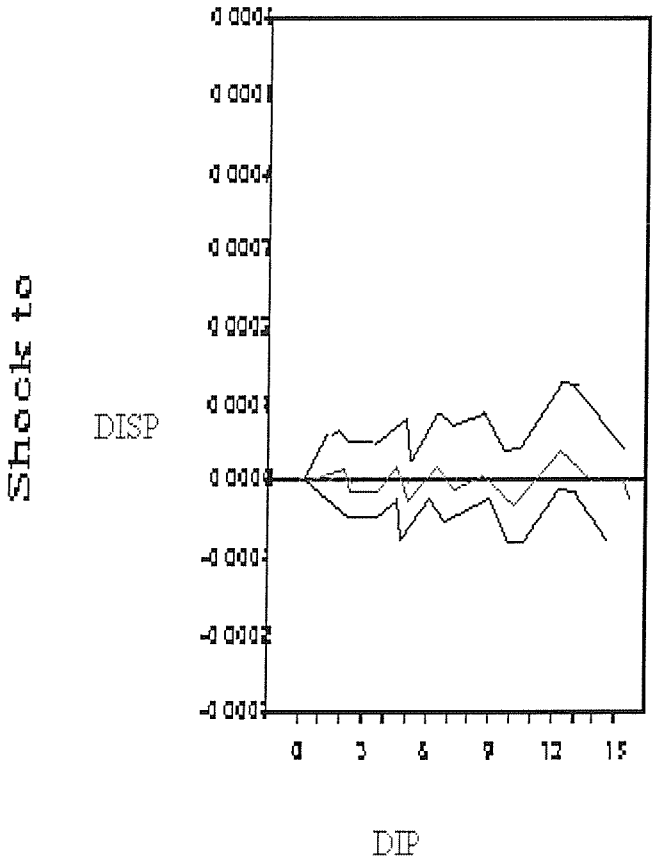


Figure 3. Impulse Responses. Response of expected inflation (EINF) to a 1-Standard Deviation in stock returns (ERS).

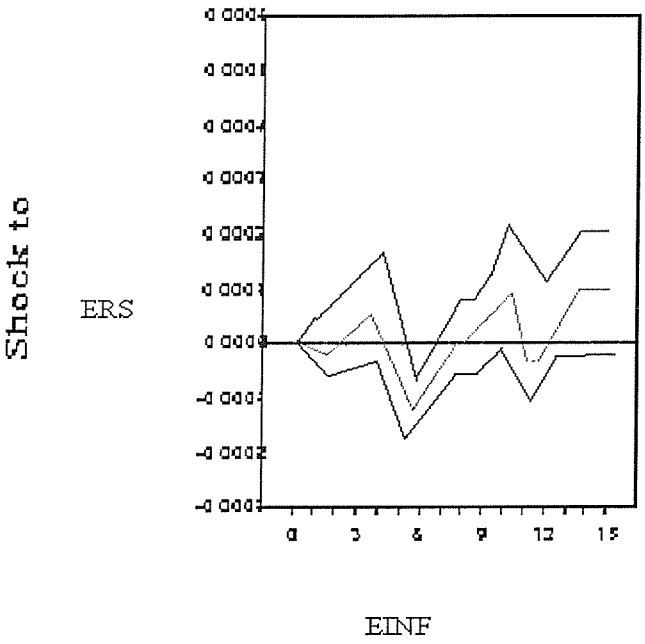
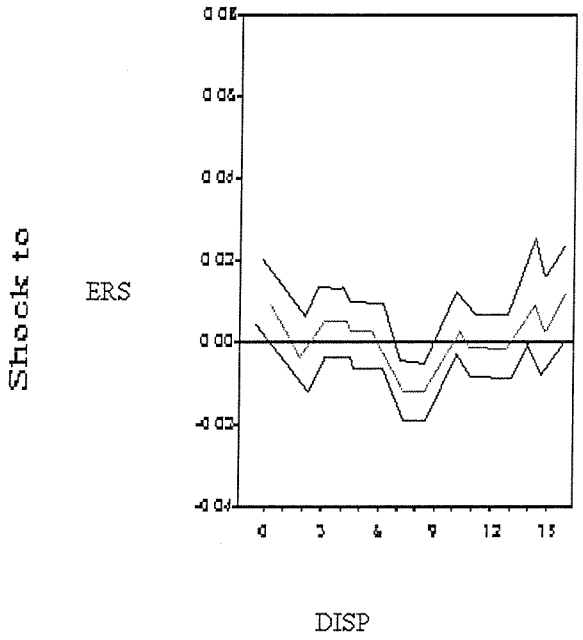


Figure 4. Impulse Responses. Response of stock returns (ERS). to a 1-Standard Deviation in dispersion of prices (DISP)



CONCLUSIONS

Chapter 6

Conclusions

Using the Sim's (1980) VAR methodology this thesis has investigated three issues in financial economics.

In Part 1 of this thesis we presented a first step towards providing empirical support for strategic modelling of financial markets. Keynes (1936) first proposed strategic theories of trading in his famous parallel between the stock market and beauty contests; Bagehot (1971) also hinted to the strategic nature of trading. It was not until very recently, however, that a full formalisation of those theories has been provided. The conclusions in chapter 2 support those theories that represent trading as being the result of sequential revelation of information, as in Romer (1993) and Morris and Shin (1994). To our knowledge and to that of some theoreticians in the field this is one of the few proofs up to now which has been provided to underpin strategic formalisations of trading.

Agents seem to be aware of feedback effects of their actions, which they observe by considering the reaction of the market. The evidence of the influence provides support for models which assume that traders follow long term strategies. A feedback effect from trading volumes to the information flowing to the market is also detected. This feedback affects both the amount of information being provided and its composition. Higher volumes change the composition of the information flowing to the market, tuning it to the needs of the market. In our dataset the type of information which proved to have the greatest influence upon trading volumes is the information produced inside the market.
Although we find that some informational aggregates influence trading, the evidence presented in this paper provides only a small step towards the complete understanding of this phenomenon. Other factors might prove to be important in explaining trading volume, their influence not even being through information. Possible candidates are inventory control techniques, variations in tastes for risk and random or systematic infusions of cash.

The results reported are obviously limited to the Italian market because of data constraints, however it would be interesting to assess the differences across different financial markets.

Part 2 of the thesis tackles a second issue. There is a wide concern among practitioners and regulators that financial markets might become more unstable because of disintermediation, the declining importance of traditional intermediaries such as banks, and the growth of new investment vehicles, such as unit trusts and hedge funds. Using data from UK capital markets we analyse the relationship between market returns and the acquisitions of UK unit trusts units to determine the influence of the unit trust sector on the stock and bond markets. Our results suggest that increases in equity and government bond prices lead to an increase in unit trust acquisitions, but that these net acquisitions do not have a corresponding impact upon aggregate returns. We believe that our failure to identify a positive feedback relationship between the series of interest is due to the structure of the UK's unit trust industry. The fee structure, the relatively modest minimum lump sum values, the availability of regular savings unit trusts all combine to bring about a very low turnover of unit trust units.

The relative sophistication of UK market participants is then one of the reasons of the implicit stability of the UK market, at least from this point of view. However, if the same conclusion applied to less sophisticated markets this conclusion might be less convincing. Italy, endowed with a typically continental financial system, provides a suitable benchmark to test the UK (and US) conclusions.
The unit trust industry in Italy has enjoyed a significant increase in importance after 1985. Observers noticed that a strong correlation was present between fund flows and returns in both the stock and the bond markets. This correlation has been interpreted as reciprocal causation between market returns and net acquisition flows able to amplify any upward/downward spiral.

In the case of the stock market our analysis shows that correlation is not causation; no significant connection between the two series can be inferred from the data. The major explanation of this seems to be the fact that even if unit trusts have recently increased their weight in financial markets their influence is still too limited to be felt. In contrast, a feedback system does exist in the bond market. The results for the stock market are in line with those obtained in the UK case, lending credibility to those data. In the case of the bond market the results are different. However, the limited value of the influence makes the difference less remarkable.

Overall then we find no room for the instability concern in either the UK or Italian markets.

Finally part three of the thesis investigated the relation between stock market returns and inflation. The topic was a typical problem tackled during the high inflation spell running from the early 70s to the mid 80s, and has attracted less interest more recently. During the last two years, however, the possibility of deflation has stirred interest in the subject once again. Chapter 5 fills the aforementioned gap in the empirical literature and tries to contribute to the new debate.
Using data from the UK in the last twenty years a VAR-based causal analysis is conducted on the causal interactions and dynamic relations among real stock returns and inflation. The aim is twofold: first, to assess the validity of the Fisher hypothesis in the dataset; and second, to compare our causal chains with those proposed by the literature to explain the failure of the Fisher hypotheses in the US.

Our major findings are: firstly, that stock returns appear to cause real activity in a temporal-Granger sense, but they do not seem to exert the same influence on inflation; and secondly that, as in Firth (1979) we verify the Fisher hypothesis for the UK, so that in our database we do not find support for any theory linking the recent growth in the stock market to deflation.

Further research

The most obvious extension of this work would be to extend the research to other countries with different monetary policy regimes, or to the UK using different techniques.
The different chapters do however provide useful indications on how to progress in the solution of problems. It is to these indications that we now focus our attention to.

In chapter two we find that some informational aggregates influence trading. However the evidence presented in this paper provides only a small step toward the complete understanding of this phenomenon. Other factors might prove to be important in explaining trading volume. Their influence might not even be through information. Possible candidates are inventory control techniques, variations in tastes for risk and random or systematic infusions of cash.
Variations in tastes for risk, linked to real influences such as payments to pensioners or consumption needs, seem a particularly promising field. The chapter provides in some way an European benchmark for previous American studies reporting the long term influence of different kinds of information on market activity. Such a benchmark is however completely absent for event studies. Recent studies, e.g. Cutler *et al.* (1989) and Fleming and Remolona (1997) have shown, and compared, the importance of single different pieces of information in accounting for the sharpest price changes and most active trading episodes. An European equivalent would provide an interesting piece of research with possible policy implications. Finally an assessment of intra-daily influence would be extremely interesting should the data be available.

Chapters three and four face the problem of whether we can identify a feedback in the stock and bond markets between returns and net acquisition flows. An extremely interesting extension of the models would be to differentiate the reaction of different segments of the investor's community. In fact, the growth of online trading and, in general the easier and faster access to security markets caused by the internet, might make decisions taken by single individuals more relevant with respect to those taken by professional investors, *e.g.* insurance companies. Our dataset does not differentiate between reactions of different investors. Recent evolutions could be destabilising, and households may be less loss averse than professional investors, or the reverse.

Chapter five could provide interesting leads into understanding the reaction of the Fisher relationship to different economic environments. The stability of the relationship in periods characterised by different inflationary thrusts across countries with different degrees of central bank independence is a possible interesting extension.

Another possible extension could consist in assessing the relationship in the Fisher equation at an European level. The growth of the pan European security market has made investors less sensitive to single State inflation and returns. It could then be interesting to build the time series of most used Euro indices, e.g. Eurostoxx or FTSE Eurotop, and assess the Fisher relation with (possible) past results of the HICP.

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