

Some Pedagogical Pitfalls in the Definitions of Arbitrage, Hedging and Speculation

Imad Moosa

Monash University, Australia

The textbook definitions of arbitrage, hedging and speculation often misrepresent these operations. Arbitrage is typically defined to imply no risk, no use of own capital and the simultaneity of buy and sell transactions. These conditions may or may not hold. Hedging and speculation are invariably described to be diametrically opposite operations, given the difference in the tastes for risk of hedgers and speculators. It can be demonstrated that hedging is a speculative activity and that hedgers and speculators react to the same parameters.

JEL classification: G00; G10; G15

Keywords: Arbitrage, Hedging, Speculation

1. Introduction

Arbitrage, hedging and speculation are three concepts that constitute important pillars of finance. Indicative of this importance is the fact that the *Palgrave Dictionary of Money and Finance* (Newman et al., 1993) has extensive entries on each one of them. The concepts describe activities in which individuals and companies operating in financial and asset markets frequently indulge. They are crucial for the understanding of how financial markets work. For example, Dybvick and Ross (1993, p 43) argue that assuming no arbitrage is compelling because its presence is inconsistent with equilibrium when preferences increase with quantity. They further argue that the presence of arbitrage is not compatible with the existence of an optimal portfolio strategy for any competitive agent who prefers more to less. This is because there is no limit to the scale at which an individual would want to hold the arbitrage position. Shleifer and Vishny (1997) argue that arbitrage plays a critical role in the analysis of securities markets because its effect is to bring prices more closely to fundamental values, thus keeping markets efficient. Moreover, arbitrage forms the basis of pricing financial assets in a large number of situations (such as the pricing of futures contracts). Likewise, speculation has for a long time been recognized as an important concept, as it is obvious in the writings of Keynes (1930) and Hicks (1946). Similar importance is attached to hedging, a topic that has been dealt with extensively in the literature (see, for example, Connor, 1993).

Despite the importance of these concepts as pillars of modern finance, there seems to be some confusion as to what they really mean. This state of affairs has resulted from the fact that we tend to use generic and stereotyped definitions for these concepts to describe a diversified menu of operations, or versions of an operation, ignoring some overlapping and significant deviations from generalizations. For example, Tirole (1993, p 515) makes it clear that speculation has attracted a lot of attention not only because of its economic importance, but also because of “inconsistent definitions” and “occasional misunderstanding”.

The objective of this note is to highlight some of the issues and problems associated with the definitions of these concepts and the description of the underlying operations. In particular, it is argued that the use of stereotyped definitions for these concepts and generalized descriptions for the underlying operations gives rise to problems and confusion.

2. Textbook Definitions

Arbitrage is commonly defined as “the act of simultaneously buying and selling the same or equivalent assets or commodities for the purpose of making certain, guaranteed profits” (Eun and

Resnick, 1998, p 104). The *Palgrave Dictionary* defines an arbitrage opportunity as “an investment strategy that guarantees a positive payoff in some contingency with no possibility of a negative payoff and with no net investment” (Dybvic and Ross, 1993). Table 1 lists several other definitions of arbitrage that are commonly found in standard textbooks in the fields of international finance, investment and portfolio management, risk management, and corporate finance.

These definitions give arbitrage its perceived characteristics: (i) it is a riskless operation, (ii) it does not require net investment or the use of own capital, and (iii) the simultaneity of the buy and sell transactions. By referring to the definitions of Eun and Resnick (1998), Dybvic and Ross (1993) and those listed in Table 1, we can see that the first perceived characteristic of arbitrage (a risk-free operation) is indicated by expressions such as “certain guaranteed profits”, “guarantees a positive payoff”, “sure profit”, “no risk involved”, “riskless profit”, “profit with no risk”, “without risk”, “no risk”, and “zero risk”.

Table 1
Definitions of Arbitrage in Standard Textbooks

Author(s)	Definition
Eun and Resnick (1998)	The act of simultaneously buying and selling the same or equivalent assets or commodities for the purpose of making certain, guaranteed profits (p 104).
Shapiro (2002)	The purchase of securities or commodities on one market for immediate resale on another in order to profit from a price discrepancy (p 607).
Rivera-Batiz and Rivera-Batiz (1994)	The simultaneous purchase and sale of a commodity or asset in different markets with the purpose of obtaining a sure profit from differential between the buying and selling price (p 23).
O'Brien (1996)	The simultaneous purchase and sale of essentially the same good at different prices (p 18).
Madura (1998)	Capitalizing on a discrepancy in quoted prices...there is no investment of funds tied up for any length of time and no risk involved in the strategy (p 203).
Jones (1998)	Arbitraders are speculators who seek to earn a return without assuming risk by constructing riskless hedges (543). Arbitraders are investors who seek discrepancies in security prices in an attempt to earn riskless profit (p 645).
Beal and McKeown (2000)	Arbitraders are individuals and firms who simultaneously buy and sell similar financial assets in different markets to profit from unequal prices (p 136).
Tucker et al (1994)	Simultaneous purchase and sale of the same security that results in a profit with no risk and no cost (p 577).
Kolb (1995)	The opportunity to earn a return without risk or investment (p 64).
Brailsford and Heaney (1998)	Arbitrage profits are generally defined to exist in situations where there are positive returns to be made from portfolios that have no risk and zero net investment (p 148).
Bodie et al (2002)	A zero-risk, zero-net investment strategy that still generates profits (p 978).
Strong (1993)	A generic word referring to the existence of a riskless profit (p 513).
Smith et al (1992)	The simultaneous purchase and sale of the same asset, or similar assets, with the objective of making a riskless profit (p 749).
Lee and Lee (2006)	Arbitrage is when traders buy and sell virtually identical assets in two different markets in order to profit from price differences between those markets (p 18).
Peirson et al (2002)	Buying an asset and simultaneously selling it for a higher price, usually in another market, to make a risk-free profit (p 868).
Bell and Kettell (1982)	Arbitrage is a general term describing the process of buying the money of one country in one foreign exchange market and selling it in another at a higher price (p 28).

I must point out, however, that not all of the listed definitions imply this perceived characteristic of arbitrage (for example, O'Brien, 1996; Beal and McKeown, 2000). The second perceived characteristic of arbitrage (no net investment is required) is indicated by expressions like “no investment of funds tied up for any length of time”, “no cost”, “without investment”, and “zero net investment”. This perceived property is reflected less frequently (than the first one) in the definitions, as the indicative expressions appear in only four of the definitions listed in Table 1. The

third perceived characteristic (the simultaneity of buying and selling) is encapsulated in eight of the definitions listed in Table 1, indicated by the use of the words “simultaneous” and “immediate”. While some of these conditions are satisfied in some arbitrage operations, it is rarely the case that all conditions are satisfied in one specific operation. I will, therefore, argue that the definitions and the implied characteristics of arbitrage are misrepresentations that cannot be generalized.

Table 2
Definitions of Hedging and Speculation in Standard Textbooks

Author(s)	Hedging	Speculation
Rivera-Batiz and Rivera-Batiz (1994)	A transaction that occurs in order to close an open position in a given currency (p 26).	A speculator attempts to profit from changes in exchange rates. Depending on their expectations, speculators may enter the market either as buyers or sellers (p 26).
O'Brien (1996)	The use of a financial instrument to eliminate uncertainty about future base currency cash flows (p 116).	
Vaughan (1997)	A method of risk transfer accomplished by buying and selling for future delivery, whereby dealers and processors protect themselves against a decline or increase in market price (p 19).	
Beal and McKeown (2000)	Hedgers are individuals and firms who hold two or more financial assets in the expectation of offsetting price movements, due to non-random events, will assist them in eliminating risk (p 135).	Speculators are individuals and firms with profit as their motive, who hold financial assets for resale at a higher price (136).
Tucker et al (1994)	A transaction in which a trader tries to protect a pre-existing position in the spot asset market through the trading of derivative securities (p 581).	Investment strategies characterised by large risks that usually do not entail the trading of a spot asset (p 587).
Kolb (1995)	A hedge is a transaction that is designed to offset some existing or anticipated risk (p 589)	
Bodie et al (2002)	Investing in an asset to reduce the overall risk of a portfolio (p 982).	Undertaking a risky investment with the objective of earning a greater profit than an investment in a risk-free alternative (p 987).
Strong (1993)	The act of transferring unwanted risk to another market participant who is willing to bear it (p 520).	The purchase or sale of an asset in the expectation of a quick gain from changes in the price of that asset (p 527).
Bell and Kettell (1982)	Hedging refers to the act of avoiding or covering foreign exchange risk (p 26).	Speculation refers to the taking of foreign exchange risk or an uncovered position in the deliberate hope of making profit (p 28).
Smith et al (1992)	Making an investment in one asset and taking an offsetting position in another asset to reduce the risk of loss (p 755).	
Lee and Lee (2006)	Investing in an asset to reduce the overall risk of a portfolio (p 138).	Undertaking a risky investment with the objective of earning a greater profit than an investment in a risk-free alternative (p 254).
Peirson et al (2002)	Hedgers are individuals and companies who enter into contracts in order to reduce risk (p 872).	Speculators are individuals and companies who enter into contracts in order to profit from correctly anticipating price movements (p 876).

Hedging and speculation are normally defined to imply that they are diametrically opposite to each other, and the same applies to hedgers and speculators. The conventional wisdom is that

hedging is the covering of risk, whereas speculation is the deliberate assumption of risk in anticipation of profit. Hedgers are typically portrayed to hate risk and therefore they cover it, whereas speculators love risk and strive to bear it. Hedgers and speculators are, therefore, two different species with diametrically opposite tastes for risk.

Consider the definitions of hedging and speculation that appear in Table 2. These definitions indicate that hedging involves the “elimination”, “reduction” or “transfer” of risk.

Expressions such as “close an open position”, “eliminate uncertainty”, “protect themselves”, and so on imply that hedgers are completely risk averse and that they do not consider the hedge/no-hedge decision on the basis of expectations pertaining to future prices. On the contrary, the definitions imply that speculators assume “large risks” and act upon expectations. The view that hedging and speculation are diametrically opposite operations is quite evident in the definitions suggested by Bell and Kettell (1983), where hedging is the “act of avoiding or covering risk”, whereas speculation is the “taking of risk or an uncovered position” (Table 2).

The proposition that speculators assume risk is valid. What is not right, however, is to overlook the similarity between the decision to speculate/not-speculate and the decision to hedge/not-hedge. I will argue that hedging can be viewed as a speculative activity, demonstrating that (at least in some cases) hedgers and speculators behave in similar manners and react to the same parameters.

3. Arbitrage, Risk and Capital

Are particular types of arbitrage consistent with the generic definitions stated earlier? Consider first two-point arbitrage in the foreign exchange market. In this case arbitragers buy a currency in a financial center where it is cheap and simultaneously sell it where it is more expensive. The simultaneity of the buy and sell transactions is obvious in the description of this operation but it is not clear whether or not the condition of not using own capital is satisfied. Since the settlement of foreign exchange transactions takes two business days, not using own capital requires the arbitrageur to transfer the funds he receives from the selling of the currency to the counterparty from whom he bought it. Thus, not using own capital requires the arbitrageur to make the payment for the buy transaction only after receiving the proceeds from the sell transaction. A problem could arise here when the two financial centers involved in the operation fall in two different time zones (for example, Tokyo and New York). This task will be even more difficult in the case of triangular arbitrage, which entails selling a currency and then buying it back by going through three separate buy-sell transactions.

Consider now covered interest arbitrage, which consists of taking a short position on one currency and a long position on another currency while covering the long position in the forward market. Not using own funds is possible only if the arbitrageur can borrow funds. However, the textbook exposition of covered interest arbitrage invariably starts by assuming that an investor has a certain amount of capital that she may invest in the domestic or foreign markets.¹ This exposition eventually leads to the derivation of the covered interest parity condition. Thus, the derivation of this condition, which precludes arbitrage, is typically based on the assumption of using own funds. However, it remains true that the same condition can be derived by assuming that the arbitrageur initially borrows funds. But borrowing funds is not the same as not using own funds in the case of two-point arbitrage, where no borrowing is required.

The no-risk condition is satisfied in the case of covered interest arbitrage, since all of the decision-making parameters (interest and exchange rates) are known in advance (that is, at the time when the decision to indulge in arbitrage is taken). This is not so for uncovered interest arbitrage in which the long position is not covered in the forward market. Uncovered interest arbitrage is risky because one of the decision variables is the expected spot exchange rate. Hence, uncovered arbitrage

¹ To derive the covered interest parity condition, Copeland (2005, Chapter 3) explains covered arbitrage in terms of an investor with initial capital and two available strategies (domestic and foreign). The operation, in this case, involves the use of own funds.

is a speculative activity that does not satisfy the no-risk condition. Moreover, a significant length of time elapses between the buy and sell transactions. Simultaneity is far away from being the case here.²

Finally, consider arbitrage in the spot and forward commodity markets. In this case arbitrage is triggered by the violation of the cost of carry relation (see, for example, Moosa and Al-Loughani, 1995 and Moosa, 2000). If the spot price of a commodity plus the cost of carry is lower than the forward selling price, then arbitragers will make profit by buying spot and selling forward. Otherwise, they will make profit by buying forward and short selling spot. While simultaneity is obvious, and so is the absence of price risk, the no-use of own capital does not seem to be the case.

Shleifer and Vishny (1997) present a strong critique of the textbook definition of arbitrage, particularly the propositions that it requires no capital and entails no risk. They argue that almost all arbitrage operations require capital and that it is typically risky. They further argue that arbitrage is invariably conducted by a relatively small number of highly specialized investors using other people's capital. They present some examples to demonstrate the proposition that the textbook definition of arbitrage does not describe realistic trades and that the discrepancies (price anomalies) become particularly important when arbitragers manage other people's funds. They further point out, by referring to the futures markets, which arbitragers can in reality incur losses because two futures contracts traded on two different exchanges have somewhat different trading hours, settlement dates and delivery terms. If prices move rapidly, the value of assets an arbitrageur delivers and the value of assets delivered to him may differ, exposing him to additional risk of losses.

Unfortunately, the ideas put forward by Shleifer and Vishny (1997) have not yet found their way to finance textbooks, but some financial economists would argue that textbook definitions of arbitrage are pragmatic simplifications of the concept. I disagree with this proposition on the grounds that it is possible to come up with a simplified definition of arbitrage that is still more representative of the facts on the ground (see below).

Furthermore, I disagree with two points raised by Shleifer and Vishny: (i) that the textbook definition of arbitrage does not describe realistic trades; and (ii) that price anomalies become particularly important when arbitragers manage other people's funds. Even if the textbook definition of arbitrage does not represent realistic trades (perhaps because the underlying opportunities do not arise or may not persist in practice), they still serve as pricing conditions. Important examples are the no-arbitrage conditions for three-point arbitrage and covered interest arbitrage, which are the pricing conditions for cross and forward exchange rates, respectively. As far as the second point is concerned, I have already demonstrated that in the case of covered interest arbitrage it does not make a difference for the no-arbitrage condition whether the arbitrageur uses own funds or other people's funds.

Sometimes, distinction is made between "subjective" and "objective" arbitrage. While objective arbitrage is based on objectively observed pricing discrepancies (such as two-point and three-point arbitrage in the foreign exchange market), subjective arbitrage is based on the subjective forecasting of cash flows. The latter includes investments based on perceived differences between price and the present value calculated from forecast cash flows (see, for example, Murphy, 2000). I would tend to think that what is called subjective arbitrage is not arbitrage but rather speculation. In Moosa (2002), for example, distinction is made among speculative decisions based on (i) technical rules, (ii) fundamental rules, and (iii) fundamental discretion. The definition of the so-called subjective arbitrage is effectively speculation based on fundamental rules whereby an asset is bought when it is undervalued by x percent and sold when it is overvalued by x percent. In this case the extent of

² Copeland (2005, p 90) describes uncovered interest arbitrage as "loosely referred to as arbitrage", because it involves risk, arguing that this is why "it is an activity more like speculation than arbitrage". According to Copeland, the crucial words are "riskless profit". The problem with this argument is that even covered arbitrage involves risk, in this case credit risk as opposed to foreign exchange risk. Moosa (2003, pp 39-40) suggests five reasons why uncovered arbitrage may be called arbitrage. Perhaps the most compelling reason is that, like covered interest arbitrage, it is triggered by the violation of an equilibrium condition (uncovered interest parity), albeit this condition involves the expected exchange rate as a parameter.

undervaluation or overvaluation is measured by the difference between the observed market price and value as judged by the underlying fundamentals. If subjective arbitrage is indeed arbitrage, I am not sure then what speculation is.³

So, is there after all a generic definition of arbitrage? Although the term “arbitrage” is used to describe a number of different operations, it may still be possible to come up with a generic definition. Such a definition would be based on two characteristics that are common to all of the operations described earlier. The first is that these operations aim at exploiting price anomalies in one or more markets. The second is that each operation is triggered by the violation of a pricing equilibrium condition. This condition is the equality of the exchange rates across financial centers in the case of two-point arbitrage; the consistency of cross rates in the case of triangular arbitrage; the equality of the forward spread and the interest rate differential (covered interest parity) in the case of covered interest arbitrage; the equality of the expected change in the exchange rate and the interest rate differential (uncovered interest parity) in the case of uncovered interest arbitrage; and the cost of carry relation in the case of commodity spot-forward arbitrage. In all cases, arbitrage restores the equilibrium condition by changing the forces of supply and demand in the underlying markets. Hence, a plausible generic definition of arbitrage is the following. Arbitrage is a profit-seeking operation aimed at exploiting the price anomalies arising from the violation of an equilibrium pricing condition.⁴ This definition says nothing about the absence of risk, about the use of own capital, or about the simultaneity of buy and sell transactions. It is the closest thing to a valid generic definition of arbitrage.

4. Hedging and Speculation

The definitions of hedging and the description of hedgers stated earlier are based on the assumption that the hedger’s objective is to minimize risk rather than to maximize expected utility, the latter being dependent on risk as well as expected return. It is arguable that risk minimization without any regard to the effect on expected return cannot be optimal (see, for example, Cechetti, Cumby and Figlewski, 1988). This is because risky assets are priced to earn expected premium over the riskless rate. Hence, hedging away the risk must imply hedging away the expected return to bearing that risk, which may not be desirable. It is indeed the case that only a totally risk averse agent can make a hedging decision without taking into account the impact on both risk and return. In practice, hedgers are aware of the trade-off between risk and return, and this is why they may hedge partially or selectively. This is also why they may remain exposed to market risk on part of their position or for some time. Therefore, hedgers do not hedge automatically but take expectation-based decisions on whether or not to hedge. Joseph (2000) and Marshall (2000) provide survey evidence supporting this proposition.

It is also possible to show that speculators and hedgers may base their decisions (to speculate or not to speculate, and to hedge or not to hedge) on the same decision variables. For this purpose, consider the model of pricing futures contracts proposed by Moosa and Al-Loughani (1995) and its extension in Moosa (2000). In this model speculators have an excess demand function for futures contracts that can be written as $X_t^s = \beta(E_t S_{t+1} - F_t^{t+1})$, where X_t^s is excess demand by speculators, $E_t S_{t+1}$ is the value of the spot price expected to prevail at $t+1$, E_t is the expected value operator conditional on the information available at time t , F_t^{t+1} is the price of a one-period futures contract and $\beta > 0$. Speculators have an incentive to enter the market whenever there is a difference between $E_t S_{t+1}$ and F_t^{t+1} .

It can be demonstrated that the behavior of hedgers is identical to the behavior of speculators.

³ Uncovered interest arbitrage is the closest operation to subjective arbitrage, but financial economists consider it a speculative activity (for example, Copeland’s description that it is “more like speculation than arbitrage”).

⁴ If this definition is adopted, there is no problem classifying uncovered interest arbitrage as arbitrage.

Consider first long hedgers who buy futures contracts. For these hedgers, the expected cost of hedging (which they are willing to accept to avoid uncertainty) is the difference between the futures price and the expected spot price, i.e. $F_t^{t+1} - E_t S_{t+1}$. Naturally, the smaller the expected cost, the greater will be the demand for futures contracts, implying that excess demand by long hedgers is a positive function of $E_t S_{t+1} - F_t^{t+1}$. Conversely, the expected cost of hedging for short hedgers is $E_t S_{t+1} - F_t^{t+1}$. Since short hedgers are suppliers of futures contracts, supply will decrease (excess demand will increase) as the expected cost of hedging increases. Again, excess demand is a positive function of $E_t S_{t+1} - F_t^{t+1}$. It is obvious that the expected cost of long hedgers, $F_t^{t+1} - E_t S_{t+1}$, is equivalent to the expected profit made by speculators who buy spot and sell futures, whereas the expected cost of short hedgers, $E_t S_{t+1} - F_t^{t+1}$, is equivalent to the expected profit made by speculators who buy futures and short sell spot. Hedgers and speculators act upon the same variables, and this is why the underlying model does not distinguish between them.

From a theoretical perspective, models of the optimal hedge ratio are based on a variant of the theory of optimal portfolio selection. Hedging, therefore, is nothing more or less than a special version of portfolio diversification. While optimal portfolios are constructed with the objective of reducing risk (for a given rate of return) in mind, residual risk remains because the underlying decision is made on the basis of expectation. By considering the options of hedging versus no hedging and full hedging versus partial hedging (which is what happens in practice), hedgers take as much risk as speculators, which is inconsistent with the standard definitions of hedging.

5. Conclusion

The generalizations and misrepresentations that typically contaminate the definitions of the concepts of arbitrage, hedging and speculation convey the wrong message. Arbitrage is an activity encompassing a number of operations that do not necessarily share the characteristics implicit in the conventional wisdom that arbitrage is a riskless operation, that it does not require the use of own funds, and that it involves simultaneous buy and sell transactions. It is suggested that arbitrage should be defined in terms of two other characteristics that are common to all types of arbitrage: the exploitation of price anomalies and the violation of an equilibrium pricing condition.

Similarly, it is normally claimed that hedgers dislike risk and cover it in all cases, whereas speculators like risk and strive to bear it. This note has demonstrated that hedging does not involve an automatic decision to minimize or eliminate risk and that hedging is a speculative activity that involves utility maximization where utility is a function of risk and expected return. Speculators and hedgers behave in similar manners, which make hedging a speculative activity.

References

- Beal, D. and W. McKeown, 2000, *Personal Finance*. Wiley Australia, Brisbane.
- Bell, S. and B. Kettell, 1982, *Foreign Exchange Handbook*. Graham and Thornton, London.
- Bodie, Z., A. Kane, and A. Marcus, 2002, *Investments* (5th international edition). McGraw Hill, New York.
- Brailsford, T. and R. Heaney, 1998, *Investments: Concepts and Applications in Australia*. Harcourt Brace, Sydney.
- Cechetti, S.G., R.E. Cumby and S. Figlewski, 1988 Estimation of the Optimal Futures Hedge. *Review of Economics and Statistics* 70, 623-630.
- Connor, G., 1993, Hedging, in Newman et al., vol. 2, 299-302.
- Copeland, L., 2005, *Exchange Rates and International Finance*. Pearson Education Limited, (U.K.).
- Culp, C. and M. Miller, 1995, Hedging in the Theory of Corporate Finance: A Reply to our Critics. *Journal of Applied Corporate Finance* 8, 121-127.
- Dolde, W., 1993, The Trajectory of Corporate Financial Risk Management. *Continental Bank Journal of Applied Corporate Finance*, 6, 33-41.

- Dybvic, P.H. and S.A. Ross, 1993, Arbitrage, in Newman et al., vol. 1, 43-49.
- Eun, C.S. and B.G. Resnick, 1998, *International Financial Management*. Irwin-McGraw Hill, Boston.
- Hicks, J., 1946, *Value and Capital* (second edition). Oxford University Press, Oxford.
- Jones, C.P., 1998, *Investments: Analysis and Management* (6th edition). Wiley, New York.
- Joseph, N.L., 2000 The Choice of Hedging Techniques and the Characteristics of UK Industrial Firms. *Journal of Multinational Financial Management* 10, 161-184.
- Keynes, J.M., 1930, *A Treatise on Money, The Collected Writings of John Maynard Keynes*, vol 2, Chapter 29. Macmillan, London.
- Kolb, R.W., 1995, *Investments* (4th edition). Kolb Publishing Company, Boulder (CO).
- Lee, C-F and A.C. Lee (eds), 2006, *Encyclopaedia of Finance*. Springer Science, New York.
- Madura, J., 1998, *International Financial Management* (5th edition). South-Western College Publishing, Cincinnati (OH).
- Marshall, A.P., 2000, Foreign Exchange Risk Management in UK, USA and Asia Pacific Multinational Companies. *Journal of Multinational Financial Management* 10, 185-212
- Moosa, I.A., 2000, Arbitrage, Hedging, Speculation and the Pricing of Crude Oil Futures Contracts. *Keio Economic Studies* 37, 53-61.
- Moosa, I.A., 2002, Exchange Rates and Fundamentals: A Microeconomic Approach. *Economia Internazionale* 55, 551-571.
- Moosa, I.A., 2003, *International Financial Operations: Arbitrage, Hedging, Speculation, Financing and Investment*. Palgrave, London.
- Moosa, I.A. and N.E. Al-Loughani, 1995, The Effectiveness of Arbitrage and Speculation in the Crude Oil Futures Market. *Journal of Futures Markets* 15, 167-186.
- Murphy, A., 2000, *Scientific Investment Analysis*. Quorum Books, Westport (CT).
- Newman, P., M. Milgate, and J. Eatwell, 1993, *The New Plagrave Dictionary of Money and Finance*. Macmillan, London.
- O'Brien, T.J., 1996, *Global Financial Management*. Wiley, New York.
- Pierson, G., R. Brown, S. Easton and P. Howard, 2002 *Business Finance* (8th edition). Sydney, McGraw-Hill Australia.
- Rivera-Batiz, F.R. and L.A. Rivera-Batiz, 1994, *International Finance and Open Economy Macroeconomics* (2nd edition). Macmillan, New York.
- Shapiro, A.C., 2002, *Foundations of Multinational Financial Management* (4th edition). Wiley, New York.
- Shleifer, A. and R.W. Vishny, 1997, The Limits of Arbitrage. *Journal of Finance*, 52, 35-55.
- Smith, R.K., D.L. Proffitt and A. Stephens, 1992, *Investments*. West, Minneapolis/St Paul.
- Strong, R.A., 1993, *Portfolio Construction, Management and Protection*. West, Minneapolis/St Paul.
- Tirole, J. (1993) Speculation, in Newman et al., vol. 3, 513-515.
- Tucker, A.L., K.G Becker, M.J. Isimbabi and J.P. Ogden, 1994, *Contemporary Portfolio Theory and Risk Management*. West, Minneapolis/St Paul.
- Vaughan, E.J., 1997, *Risk Management*. Wiley, New York.