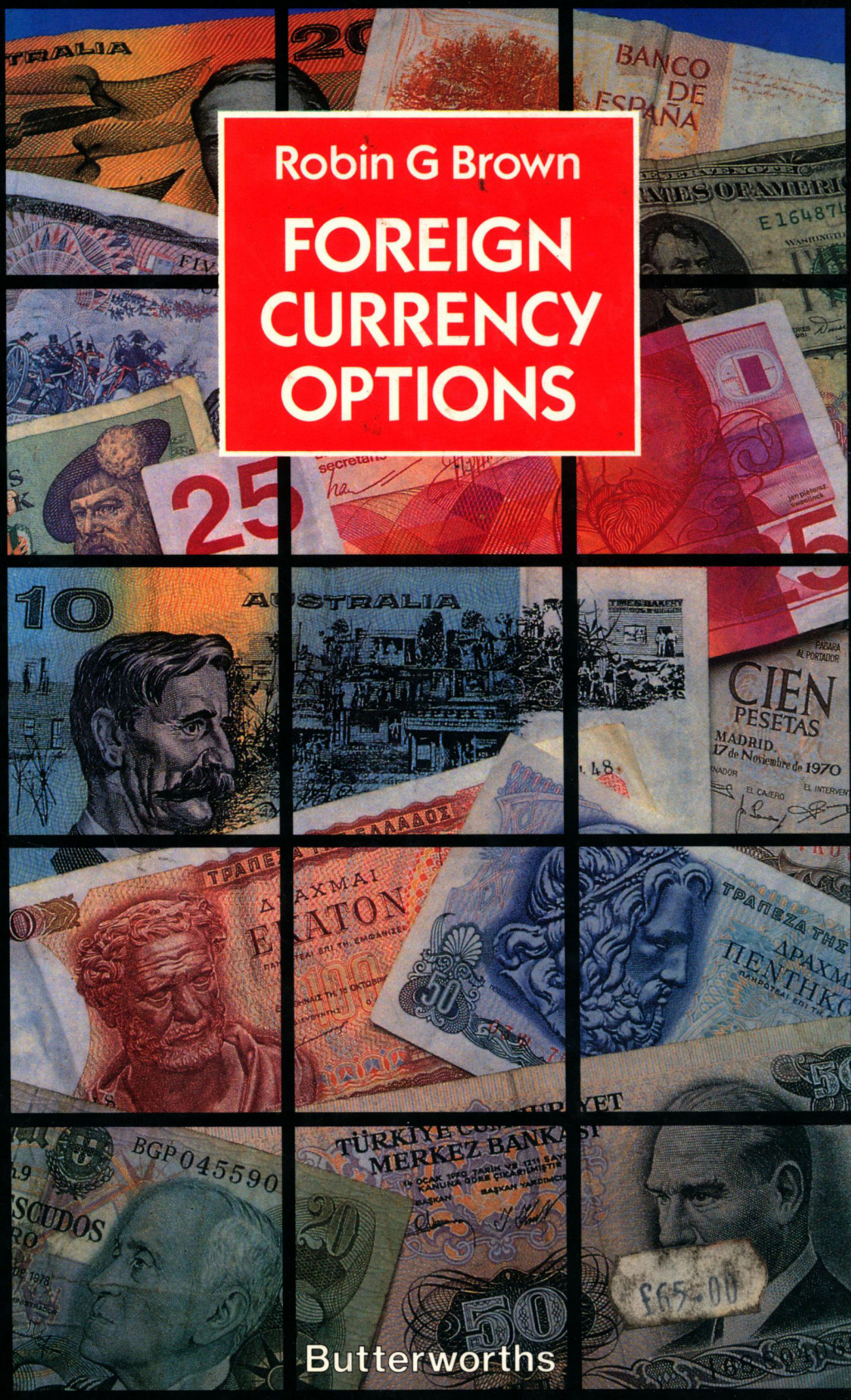
Robin G Brown
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Robin G Brown

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Foreign Currency Options

Preface

The motivation for this book came from two sources. Number one, my long suffering publishers Butterworths who, when they approached me, thought they were just commissioning another book. The second, and perhaps more important, motivation came from my own inability to find a book which was comprehensible to someone coming to the subject of currency options anew in the mid eighties. That is not to say that I was unable to find some very good books on options. There are numerous learned tomes, but they either dealt with the higher mathematics of the subject or were exclusively dedicated to stock options, where of course the critical mass of the options industry was centred at that time.

I found that many of these books left a number of questions unanswered. Perhaps the most important, and I believe still unanswered, question is "What is the correct method/model to use to price options?" I found it rather strange coming from a foreign exchange and money market background where arbitrage is the cornerstone of the industry that nobody had set about describing the "right" method or model. After a fairly short examination of the subject and a considerable amount of discussion with fellow practitioners in the market, I felt that I was not alone in this belief.

It came as a strange sort of release a few years on to see an article published in Risk magazine entitled "The Holes in Black-Scholes" written by Fisher Black, one of the co-authors of the original formula. It was rather comforting to see Professor Black discussing the same fundamental points and assumptions of the formula. One always felt that perhaps the authors of the various formulae had that one hidden "magic" ingredient which one had missed.

What I have tried to do with this book is, by using a building block approach, to lead the reader to a point where he will know what to expect and where he will have to make his own subjective judgement. I would certainly not advocate options as the panacea for all hedging problems, judicious use is certainly required, but I hope that I have provided here an understanding of how the instruments work and what factors impact on their price. I believe that options are 75% science and 25% art and so, if after reading this book the reader feels that there are unanswered questions, I hope that he will see that these are the questions to which he

must find answers. For example what type of distribution does this market follow? What type of risk reward scenario do I wish to use in my trading? Am I using the correct type of strategy to provide for the maximum pay back if my assumptions about the underlying markets are correct?

The one question which is most regularly asked is "If I write options and attempt to delta hedge using positions in the underlying currency, at what frequency should I readjust my hedge?" The answer to this question depends on correct assumptions being made about volatility (and the extent to which it is constant over the life of the option), relative interest rates and the way the market will react. I do not feel that it is possible to say that it is always correct to rehedge every move, or everyday. Neither is it appropriate to rehedge at every, say, twenty five basis points move in the underlying currency. In short I have not found a method which allows one to follow a rigid set of rules whilst delta hedging. Most of my colleagues in the market who attempt to delta hedge say that it is necessary to adopt a flexible approach and undertake some degree of under or over (anticipatory) delta hedging.

The introductory chapter which deals with definitions of foreign exchange risk is not intended to be more than a cursory glance through this most complex of subjects. I hope that my Corporate Treasurer friends will forgive me for oversimplifying what is an extremely complex task that they perform daily. Rather I had hoped in this chapter to give readers unfamiliar with the nature of foreign exchange risk an overview.

Listed exchange and money markets are constantly developing and if the information on listed markets is not entirely up to date, or the practices in the O.T.C. markets are not quite current, I hope that the reader will be understanding.

In the sections which deal with the Greek alphabet (delta, gamma, etc) I am indebted to Sheldon Natenberg, who is President of Professional Options Consultants in Chicago. Shelly is also an active options trader on the Board of Trade where he trades in the bond and grain option pits. If this were not enough, Shelly has also written a book on options entitled *Option Volatility and Pricing Strategies*. He certainly helped me to think through the segregation of risk in an option price and the subsequent management of that risk using the Greek alphabet tools.

Taxation and Accounting are always two very difficult areas for the non-specialist to explain. I have not attempted to re-write any information on this subject but have simply reproduced a feature from Futures and Options World which deals with these two subjects. I would like to thank the following individuals and their respective firms for giving me authority to use their work:-

Izabel Grindal	Futures and Options World
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The London Currency Options Market has in the past been likened to a club. I have always found the "members" most willing to give assistance to anybody who asks. It would be unfair to single out people for mention here, but this group have been of great value in providing a sounding post for ideas.

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Finally, I would like to record my thanks to my wife Lesley and sister Helen who spent so much time laboriously deciphering my handwriting and turning it into a manuscript.

Robin G Brown
September 1989

Contents

Chapter 1

What is the Nature of Foreign Exchange Risk?

This book will introduce the reader to foreign currency options and advise on their uses and ways in which the attendant risks can be controlled. However, before embarking on the subject of foreign currency options, the question of foreign exchange risk is worth discussing.

TRANSACTION RISK

When an exchange of goods or services takes place between an individual or corporate body domiciled in one country and one domiciled in another, it is reasonable to assume that one of the parties will have to pay or receive currency which is not his domestic currency. This transaction in its own right does not present any particular problems if the exchange of goods and subsequent payment takes place immediately, because the party which undertakes the exchange transaction will be able to ascertain that the rate of exchange which governs the transaction in goods or services is at, or close to, the current rate of exchange. He can then cover his risk by purchasing or selling the foreign currency for his domestic currency immediately.

By its nature international trade is much more complex, often requiring one party to offer credit terms or to invoice in a third currency which is neither the domestic currency of the buyer or the seller. Once again, this does not present the two parties to the trade transaction with insurmountable problems, because in the case of deals which include credit terms, both the buyer and the seller can contract with their bank to deliver or receive the foreign currency at a predetermined time in the future and at a predetermined rate in exchange for their domestic currency. This will eliminate any exchange risk.

In the case of transactions which take place in a third non-domestic currency, even when credit terms are involved, the buyer and seller can contract with their bank to deliver or receive the foreign currency at a predetermined rate in exchange for his domestic currency either immediately (in the case of no credit terms being involved) or at a predetermined time in the future (if credit terms are involved). This will eliminate any

exchange rate. This scenario is true for most major convertible currencies but may be subject to depth of the forward market or the lifespan of the trade transaction, but it is usual to be able to cover major convertible currencies up to one year forward. There may be exchange control requirements in some currencies which preclude these types of forward transactions or in the case of third world currencies no viable forward market, but bodies involved in international trade will be aware of these factors before agreeing to be invoiced in such currencies.

Tendering for an overseas contract

The example used here is that of a UK based company which is tendering for an overseas contract worth USD10 million with a period from tender to adjudication of six months and a current exchange rate Pound to Dollar of 1.80. For simplicity's sake, assume that there is no discount or premium on forward Sterling, i.e. US Dollar and Sterling interest rates are at the same level.

Tender price is USD 10 million at 1.80 = £5 555 556. When the tender is lodged the exporter has a potential risk for six months of USD 10 million. He can at that stage assume that his tender will be successful and sell USD 10 million in the forward market at a rate of 1.80, or assume that the tender will be unsuccessful and do nothing, bearing the full risk himself. Neither choices are satisfactory because he is unsure of the outcome of the tender and he is also unsure of the direction of the Pound to Dollar exchange rate. Therefore, the best he can achieve is to cover his risk. If he is lucky, he may make a profit by selling forward but not being awarded the contract. If the exchange rate goes in his favour, his forward contract could be closed out at a profit. Obviously there are an unsatisfactory number of contingencies in this transaction. At worst he will incur substantial exchange losses.

The following table shows the potential profits and losses under various scenarios.

A. Sell forward at 1.80	= £5 555 556
I Tender is successful	Full hedge is achieved.
II Tender is unsuccessful	(a) Spot is 1.80, he will close out with no profit or loss
	(b) Spot is 1.90, he will close out with a profit of US cents 10 per Pound
	USD 10 million @ 1.80 = £5 555 556
	USD 10 million @ 1.90 = £5 263 158
	Profit of £ 292 398

(c) Spot is 1.70, he will close out with a loss of US cents 10 per Pound.

USD 10 million @ 1.80 =	£5 555 556
USD 10 million @ 1.70 =	£5 882 353
Loss	£ 326 797

B. Do nothing until he knows the outcome of the tender

I Tender is successful

(a) Spot is 1.80, he will sell forward the foreign currency at the rate at which he had budgeted with no profit or loss.

(b) Spot is 1.90, he will sell forward foreign currency at a loss of US cents 10 per Pound

USD 10 million @ 1.80 =	£5 555 556
USD 10 million @ 1.90 =	£5 263 158
Loss of	£ 292 398

(c) Spot is 1.70, he will sell forward the foreign currency at a rate which is US cents 10 per Pound better than the budget.

USD 10 million @ 1.80 =	£5 555 556
USD 10 million @ 1.70 =	£5 882 353
Windfall profit	£ 326 797

II Tender is unsuccessful

Nothing happens as there is no foreign currency and no forward contract. No profit or loss.

The tendering company is, however, faced with a further dilemma. If the company tenders for a significant number of contracts and enjoys a low success rate, it would be nonsense to suggest that every one which is based on a foreign currency should be hedged using currency options. In this respect, option premiums could potentially prove extremely expensive. Commercial judgements will need to be used. It would, however, be argued that the tendering company will be best know its likely chance of success. It can then choose between the three alternatives, i.e. do nothing, cover and bear the full risk, or utilise options and establish the maximum degree of risk on the day the tender is lodged.

Issuing price lists denominated in a foreign currency

Price lists denominated in a foreign currency are normally issued and are valid for a six or twelve month period and sales budgets are compiled for similar periods. As in the case of a tender, the exporting company has to make assumptions about the potential future income, in this case, will sales meet budgets and in addition, will potential buyers seek discounts if the exporter's domestic currency cheapens in value?

Sales denominated in US Dollars are budgeted at USD 500 000 per month for the first six months of the year and the current Pound to Dollar exchange rate is 1.80 with no premium or discount on forward Sterling. The company issuing the price list is a UK company and therefore has an exchange risk for six months on USD 3 million at a rate of 1.80 (end December rate) = £1 666 667

A. Sell forward USD at 1.80 = £1 666 667

I Sales figures are met

(a) Spot is at 1.80 when sales are made. No profit or loss as budgeted rate and sales rate are the same.

(b) Spot is at 1.90 when sales are made. No profit or loss as rate at which forward sale is undertaken is same as budget rate.

(c) Spot is 1.70 when sales are made. Opportunity cost of US cents 10 per Pound.

USD 3 million @ 1.80 =	£1 666 667
USD 3 million @ 1.70 =	£1 764 706
Opportunity cost	£ 98 039

In example (*c*), it is possible that the buyer might seek a discount because of the cheapening of Sterling viz the US Dollar. It would not be possible to provide the discount because the exporter is locked in at an exchange rate of 1.80. This could prove to be a problem in a competitive situation. If a competitor has not sold his anticipated foreign currency income forward for his domestic currency and could therefore grant a discount, this situation could lead to sales resistance in cases where a currency moves by a significant amount e.g. Pound to Dollar from 1.80 to 1.60.

II Sales figures are not met

(a) Spot is at 1.80, close out the existing forward sale with no profit or loss as

both original forward rate and closing out rate are the same.

Alternatively, any residual forward contracts could be extended by means of a swap transaction to cover the second six months of anticipated sales.

(b) Spot is at 1.90, close out the existing forward sale, this will give rise to a profit of US cents 10 per Pound.

USD 3 million @ 1.80 =	£1 666 667
USD 3 million @ 1.90 =	£1 578 947
Profit	£ 87 720

Alternatively, any residual forward contracts could be extended by means of a swap transaction to cover the second six months of anticipated sales. This would give rise to the same profit of US cents 10 per Pound with the profit being realised when the original deal is extended. However, the new forward deals will be entered into based on an exchange rate of 1.90.

(c) Spot is at 1.70, close out the existing forward sale. This will give rise to a loss of US cents 10 per Pound.

USD 3 million @ 1.80 =	£1 666 667
USD 3 million @ 1.70 =	£1 764 706
Loss	£ 98 039

Alternatively any residual forward contracts could be extended by means of a swap transaction to cover the second six months of anticipated sales. This would give rise to the same loss of US cents 10 per Pound with the loss being realised when the original deal is extended. However, the new forward deals will be entered into based on an exchange rate of 1.70.

B. Do not enter any forward sales of foreign currency but sell when received

I Sales figures are met

(a) Spot is at 1.80 when conversion is made. No profit or loss as budgeted rate and conversion rate are the same.

(b) Spot is at 1.90 when conversion is made. Loss of US cents 10 per Pound as budget rate is 1.80 but conversion is made at 1.90

USD 3 million @ 1.80 =	£1 666 667
USD 3 million @ 1.90 =	£1 578 947
Loss	£ 87 720

(c) Spot is at 1.70 when conversion is made. Profit of US cents 10 per Pound between budget rate of 1.80 and conversion rate of 1.70

USD 3 million @ 1.80 =	£1 666 667
USD 3 million @ 1.70 =	£1 764 706
Profit	£ 98 039

Example (*c*) above is the opposite of A.I(*c*) and would allow for the offer of a discount in an attempt to increase sales.

II Sales figures are not met

As no forward contracts have been entered into and no income will be received, no profit or loss arises.

If sales figures are partially met, say, to the extent of USD 1 million the following would occur.

(a) Spot is at 1.80 when conversion occurs, no profit or loss as budget and conversion are at the same rate of exchange.

(b) Spot is at 1.90 when conversion occurs, there is a loss of US cents 10 per Pound as budget is at 1.80 but conversion takes place at 1.90

USD 1 million @ 1.80 =	£	555 555
USD 3 million @ 1.70 =	£	526 315
Loss	£	29 240

(c) Spot is at 1.70 when conversion is made, profit of US cents 10 per Pound between budget rate of 1.80 and conversion rate of 1.70

USD 1 million @ 1.80 =	£	555 555
USD 3 million @ 1.70 =	£	558 235
Profit	£	32 680

Again, example (*c*) above is the opposite of AI(*c*) and would allow for the offer of a discount in an attempt to increase sales.

COVERING BALANCE SHEET TRANSLATION RISK EXPOSURE

At the end of each financial year it is usual for companies with overseas subsidiaries to convert the foreign currency value of the subsidiary into domestic currency terms for balance sheet purposes. This exercise can mean that the domestic currency value of the subsidiary can fluctuate quite violently because of exchange rate movement even though the foreign currency value is constant or even appreciates. One method of eliminating exposure of this nature is for the parent company to borrow the equivalent value of the subsidiary in foreign currency, thus, the asset and liability will fluctuate at the same rate. (The following examples assume this is not done.)

In this example, take a UK company with a US based subsidiary with a value of USD 10 million and a last financial year end rate of exchange of 1.80.

A. Do nothing in the forward exchange markets between balance sheet dates

(a) If spot rate is 1.80 at next balance sheet date. No profit or loss because last transaction rate and current transaction rate are the same.

(b) If spot rate is 1.90 at next balance sheet date, there is a loss of US cents 10 per Pound, last translation rate 1.80, current valuation rate 1.90.

Last value of assets	USD 10 million @ 1.80 =	£5 555 556
Current value of assets	USD 10 million @ 1.90 =	£5 263 158
	Translation loss	£ 292 398

(c) If spot rate is 1.70 at next balance sheet date, there is a profit of US cents 10 per Pound, last translation rate 1.80, current valuation rate 1.70

Last value of assets	USD 10 million @ 1.80 =	£5 555 556
Current value of assets	USD 10 million @ 1.70 =	£5 882 353
	Translation profit	£ 326 797

These profits and losses are of course valuation of asset, profits and losses from one financial year to the next.

B. Sell in the forward foreign exchange market the foreign currency value of the subsidiary for domestic currency for the next financial year end

(a) If spot rate is 1.80 at next balance sheet date. No profit or loss occurs because the asset value in domestic currency terms remains constant on translation

(b) If spot rate is 1.90 at next balance sheet date there is a foreign exchange profit when the forward exhange deal is closed out or extended but a revaluation loss on the asset. This will give rise to a cash flow surplus but the profit and loss may not be neutral for tax purposes.

Asset last value	USD 10 million @ 1.80 =	£5 555 556
Asset current value	USD 10 million @ 1.90 =	£5 263 158
	Revaluation loss	£ 292 398
Forward exchange deal	USD 10 million @ 1.80 =	£5 555 556
Current value	USD 10 million @ 1.90 =	£5 263 158
	FX profit and cash flow surplus	£ 292 398

(c) If spot rate is 1.70 at next balance sheet date, there is a foreign exchange loss when the forward exchange deal is closed out or extended but a revaluation profit on the