PEF, **1** (1): 77–83, March, 2002. © 2002 Cambridge University Press
DOI: 10.1017/S1474747201001032 Printed in the United Kingdom

International pension swaps

ZVI BODIE
Boston University School of Management, Boston, MA 02215, USA
(*e-mail:* zbodie@bu.edu)

ROBERT C. MERTON
Harvard Business School

Abstract

During the past twenty years, swap contracts have become key financial 'adapters' linking diverse national financial systems to the global financial network. Today banks and investment companies around the world use swaps extensively to manage their currency, interest-rate, and equity-market risks and to lower their transaction costs. Yet pension funds, which have grown rapidly over that same 20-year period, hardly use swaps at all. This paper suggests how pension funds could use swaps to achieve the risk-sharing benefits of broad international diversification and hedging while avoiding the 'flight' of scarce domestic capital to other countries. The paper also shows how swaps can be used to lower the risks of expropriation and to lower the other transaction costs of investing in other countries.

1 Introduction

A swap contract consists of two parties exchanging (or 'swapping') a series of payments at specified intervals (say, every six months) over a specified period of time (say, ten years). The payments are based upon an agreed principal amount (called the 'notional' amount), and there is no immediate payment of money between the parties. Thus, as in forward and futures contracts, the swap contract itself provides no new funds to either party. The size of each swap payment is the *difference* between the actual value of the item specified in the contract (for example, an exchange rate or an interest rate) and the value specified in advance in the contract.

For example, consider a currency swap between a US firm doing business in Germany and a German firm doing business in the US. Assume that the US company expects to receive net revenues of 150 million euros per year from its German operations over the next 10 years, and the German firm expects to receive net revenues of 100 million dollars per year from its US operations. Both firms are exposed to currency risk that they would like to hedge. So they enter a currency swap.[1]

[1] The example is from Bodie and Merton (2000). For a more complete introduction to swaps see Brown and Smith (1995).

https://doi.org/10.1017/S1474747201001032 Published online by Cambridge University Press

Assume that the swap calls for the US firm to swap euros for dollars with the German firm on a notional principal of $100 million over ten years at a fixed exchange rate of 1.5 euros per dollar with annual payments.[2] If the actual exchange rate turns out to be 1.5 euros per dollar at the end of each year, then no cash will ever change hands during the 10-year life of the contract. If, however, the exchange rate at the end of the first year is greater than 1.5 euros per dollar – say 2 – then the German firm must pay the US firm the difference (0.5 in this case) times the notional principal of $100 million. Thus the size of the first annual payment will be .5 euros per dollar × $100 million or 50 million euros. This payment exactly offsets the *loss* in the dollar value of the US firm's net revenue from German operations and the *gain* in the euro value of the German firm's US operations. If the actual exchange rate turns out to be *less* than 1.5 euros per dollar, then the US firm must pay the German firm and the direction of cash flow is reversed.

During the past 20 years swaps such as this one have become the main financial adapters linking diverse national systems to the global financial network.[3] By focusing on the function of risk transfer while leaving the flow of capital largely untouched, swaps have minimized the need for wholesale institutional change while enabling financial systems to integrate smoothly.

Around the world today banks and investment companies use swaps extensively to manage their exposures to currency, interest-rate, and equity-market risks and to lower their transaction costs. The international swap business has grown from virtually nothing in 1980 to a huge volume today. It is difficult to find precise data because swaps are not traded on exchanges, but the notional value of all swap contracts at the end of 2000 was estimated to be approximately $60 trillion, a sum equal to the total world GDP in that year.[4]

Yet pension funds, which have grown rapidly over the same 20-year period, hardly use swaps at all. We believe the time has come to change this situation.

Many studies have documented the potential gains to pension-fund beneficiaries from international risk sharing.[5] By diversifying across world markets, there is significant improvement in the efficient frontier of risk versus expected return. Yet in general, pension funds are constrained by legislation to invest largely within their own country's borders.[6] A common rationale for such restrictions is to reduce the risk of capital 'flight' – the risk that the outflow of investment funds will far exceed the inflow of investment funds from abroad, thus stifling growth in the local economy. Another rationale is that pension money contributed on behalf of current workers should be invested 'at home' to enhance employment opportunities for those same workers rather than workers elsewhere.

Even in the absence of legal limitations on foreign investing by pension funds, there are other significant barriers. Among the most important are the risk of expropriation

[2] In reality the contractual rate will be set in accordance with the term structure of forward rates of exchange prevailing in the market at the time the contract is struck.
[3] Swap contracts function like electrical adapters, which allow travelers to use the same appliances in any country despite the diverse types of electric outlets.
[4] Hutchinson (2001).
[5] Reisen (2000).
[6] For a list of restrictions imposed by governments in OECD member countries, see OECD (2000).

https://doi.org/10.1017/S1474747201001032 Published online by Cambridge University Press

by foreign governments (including heavier taxes imposed on foreign investors) and transaction costs. These costs can be so large that they offset any diversification benefits that would otherwise accrue.

This paper describes how swap contracts can be used to achieve the goal of improved international risk-sharing without violating restrictions on capital outflows to other countries. Moreover, we will show how swaps can mitigate the other barriers to investing abroad – expropriation risk and high transaction costs.

2 The international swap market

The international swap business began in the 1980s. In the early years, there was little credit arbitrage between different bond markets, and swaps were used to take advantage of the interest-rate differentials. Even poorly rated US corporations could borrow at relatively attractive interest rates in the Swiss franc market, while highly rated institutions, such as the World Bank, could borrow at relatively better rates in the dollar market. Hence the swap was a transaction attractive for both parties – the US corporation ended up with relatively cheap dollar loans, the World Bank with cheap Swiss franc loans.[7]

Other multinational borrowers quickly imitated the successful transactions of the swap innovators, and, as the segmentation of international bond markets was broken down, the 'easy' gains became rare. A new organization was formed, the International Swap Dealers Association (ISDA), with the task of standardizing swap contracts across national jurisdictions. The ISDA standard document was finalized in 1985. Swaps then came to be transacted in much larger volumes, at much smaller spreads.

Today, new types of swaps are relatively easy to create and can be implemented quickly. One of the pioneers in the swaps industry explains the process as follows:[8]

> The swap industry is structured as a web of bilateral contracts, as opposed to a 'hub-and-spoke' exchange model. This has been an important catalyst for innovation. A new form of swap is created as soon as two consenting counter-parties can agree to terms, as opposed to the slower and more cautious consensus process required to implement changes on an exchange. The race for new ideas progresses as fast as the most innovative pair of counter-parties, with the lead changing hands constantly.
>
> This process of rapid innovation and co-opting of each other's ideas has reduced the hedging costs of caps and swap options. The narrowing margins in these products in turn reduced the cost of hedging barrier options. A spiral of innovation building on the foundation of past ideas has built a rich array of powerful tools to solve larger and more complex problems for clients.

3 The gains from international risk-sharing

The most direct benefit of international risk-sharing is the improvement each country can achieve in the efficient portfolio frontier (EPF) faced by its citizens (through investment intermediaries such as mutual funds and pension funds).[9] The global equity markets can be used to achieve better diversification, and the global fixed-

[7] Hutchinson (2001).
[8] Hancock (2001).
[9] For an explanation of the efficient portfolio frontier and how it is derived, see chapter 12 in Bodie and Merton (2000).

https://doi.org/10.1017/S1474747201001032 Published online by Cambridge University Press

income markets can be used to achieve better hedging opportunities.[10] In a partial equilibrium setting, in which we treat the world risk-free real interest rate and the world market price of risk as given, the possible improvements are illustrated in Figure 1.

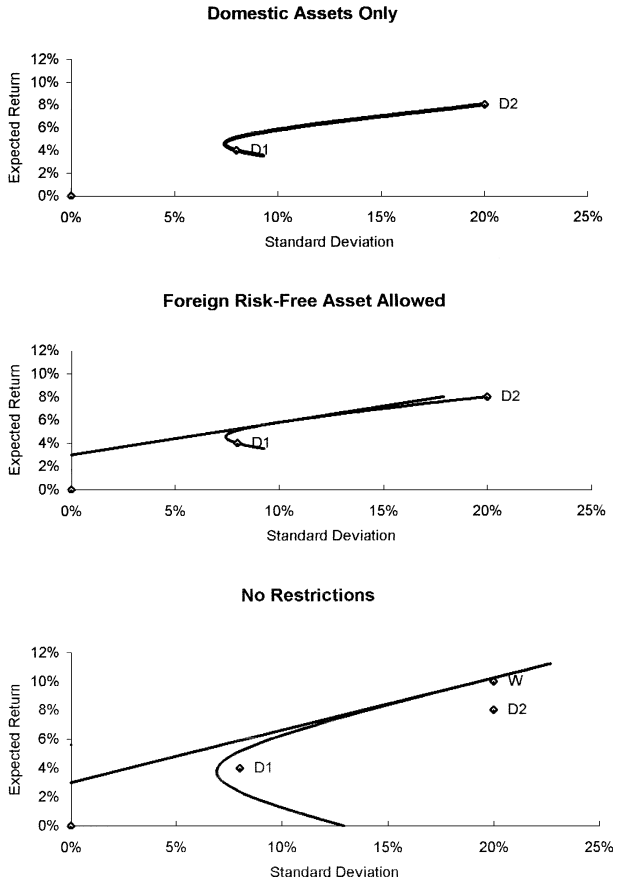


Fig. 1. Gains from international risk sharing: restricted versus unrestricted efficient portfolio frontiers

The top graph in Figure 1 shows the restricted EPF when local investment intermediaries can only invest domestically and there is no domestic risk-free asset.[11] Risk (standard deviation of the annualized rate of return) is measured along the horizontal axis, and reward (mean expected rate of return) is measured along the vertical axis. The EPF is the curve connecting points D1 and D2. The least risky investment alternative corresponds to the point at the extreme left of the curve – the

[10] We use the term *diversify* to mean distributing the portfolio among many risky assets. We use the term *hedge* to mean eliminating risk by taking an offsetting position in another asset. In this terminology, substituting a risk-free asset for risky assets in the portfolio is hedging.

[11] It is customary in the US and other well-developed, politically stable countries to treat the debt obligations of the national government as risk free. But there are many countries where this assumption is not valid and there are no domestic entities capable of offering a risk-free fixed-income asset to investors.

https://doi.org/10.1017/S1474747201001032 Published online by Cambridge University Press

minimum-risk portfolio. In our graph even the minimum-risk portfolio has considerable risk.

The middle graph in Figure 1 shows what happens to the EPF when domestic investment funds are allowed to invest in the world risk-free asset but *not* in world risky assets. The EPF becomes a straight line sloping up from left to right, and starting at the risk-free rate of return (3% in the graph). There is a single optimal combination of domestic risky assets (at the point of tangency between the straight line and the curve through D1 and D2). The new EPF offers local investors better risk and reward combinations than the old one in the top graph. The slope of the EPF in the middle graph is the domestic market tradeoff between expected reward and risk.

Finally, the bottom graph in Figure 1 shows the completely unrestricted case where local investors can invest anywhere and in any assets. The EPF is now the straight line connecting the risk-free rate of return on the vertical axis with point W, which represents an optimally diversified global portfolio. The EPF in the bottom graph has a higher slope than the one in the middle graph indicating that the unrestricted EPF *dominates* the restricted one in terms of risk and reward opportunities.

Inefficient risk-sharing affects both large-country and small-country citizens. However, the potential gains from less-restricted international risk-sharing are greatest for citizens of the smaller countries with domestic economies that are by necessity less well diversified. The ability to hedge and diversify equity price risk internationally would allow smaller countries to specialize more in their domestic production according to the principle of comparative advantage. Thus a small country that had a comparative advantage in producing high-tech components for computers and other electronic devices – for example, Israel with a population of 6 million or Taiwan with a population of 22 million people – could specialize without being overly exposed to the volatility in the prices of the equity shares of the local corporations engaged in that specialized production.

4 Equity swaps as a method of diversifying internationally

Let us now illustrate how an equity swap would enable a small country to diversify internationally without violating restrictions on investing capital abroad.[12] Suppose that small-country pension funds that already own the domestic equity were to enter into swaps with a global pension intermediary (GPI). In the swap, the total return per dollar on the small country's stock market is exchanged annually for the total return per dollar on a market-value weighted-average of the world stock markets. This exchange of returns could be in a common currency, dollars, as described or adjusted to different currencies along similar lines to currency swaps. The magnitudes of the dollar exchanges are determined by the 'notional' or principal amount of the swap to which per dollar return differences apply.

Without pursuing the details of implementation, we see that the swap effectively transfers the risk of the small-country stock market to foreign investors and provides the domestic investors with the risk-return pattern of a well-diversified world portfolio. Since there are no initial payments between parties, there are no initial

[12] This swap innovation was first proposed by Merton (1990).

https://doi.org/10.1017/S1474747201001032 Published online by Cambridge University Press

capital flows in or out of the country. Subsequent payments, which may be either inflows or outflows, involve only the *difference* between the *returns* on the two stock market indices, and no 'principal' amounts flow.

For example, on a notional or principal amount of \$1 billion, if, *ex post*, the world stock market earns 10% and the small-country market earns 12%, there is only a flow of $(0.12–0.10) \times \$1$ billion or \$20 million out of the country. Furthermore, the small-country investors make net payments out precisely when they can 'best' afford it: namely, when their local market has outperformed the world markets. In those years in which the domestic market under-performs the world stock markets, the swap generates net cash flows into the country to its domestic investors. Hence, in our hypothetical example, if the small-country market earns 8% and the world stock market earns 11%, then domestic investors receive $(0.11–0.08) \times \$1$ billion = \$30 million, a net cash inflow for the small country. Moreover, with this swap arrangement, trading and ownership of actual shares remain with domestic investors.

Foreign investors also benefit from the swap by avoiding the costs of trading in individual securities in the local markets and by not having the problems of corporate control issues that arise when foreigners acquire large ownership positions in domestic companies. Unlike standard cash investments in equities or debt, the default or expropriation exposure of foreign investors is limited to the difference in returns instead of the total gross return plus principal (in our example, \$20 million versus \$1.12 billion).

The potential exposure of foreign investors to manipulation by local investors is probably less for the swap than for direct transactions in individual stocks. It is more difficult to manipulate a broad market index than the price of a single stock. Even if settlement intervals for swaps are standardized at six months or one year, the calendar settlement dates will differ for each swap, depending upon the date of its initiation. Hence, with some swaps being settled every day, manipulators would have to keep the prices of shares permanently low to succeed.

Furthermore, with the settlement terms of swaps based on the per-period rate of return, an artificially low price (and low rate of return) for settlement this year will induce an artificially high rate of return for settlement next year. Thus, gains from manipulation in the first period are given back in the second, unless the price can be kept low over the entire life of the swap. Since typical swap contract maturities range from two to ten years (with semi-annual or annual settlements), this would be difficult to achieve.

5 Fixed-income for equity swaps as a method of hedging equity risk

The hypothetical equity swap just described enables pension funds to achieve broader international diversification. A different type of swap could enable them to hedge equity risk altogether.[13] This would be particularly important for people in countries where there is no local entity, including the government, capable of issuing fixed-income securities that are free of all risk.

[13] This would correspond to a movement in Figure 1 from point D or W towards point F on the vertical axis.

https://doi.org/10.1017/S1474747201001032 Published online by Cambridge University Press

This second type of swap would call for the pension fund to swap the total return on its equity portfolio for a risk-free interest rate denominated in a 'strong' currency or in units of constant purchasing power. This hypothetical swap would work the same way as the one in the previous example, except that the net cash flows produced by the swap would result in the pension fund receiving a risk-free rate of return. The counter-party must have a very good credit rating, or the swap must be guaranteed by a third party with a strong credit rating. As in the previous example, the pension fund would have to make payments to the swap counter-party only in years when its equity portfolio outperforms the risk-free rate.

6 Conclusion

The swap innovation described in this paper is *not* designed to circumvent the objective of regulations to prevent domestic capital flight. Instead, it is designed to eliminate (or at least reduce) the unintended and undesirable 'side effects' of this policy on efficient diversification.

It is entirely feasible to implement this innovation today. The contracting technology is well-developed and well-tested. What is required is the knowledge and willingness of pension sponsors to seize the opportunity and pension regulators to permit it.

References

Bodie, Z. and Merton, R. C. (2000) *Finance*, p. 290. Upper Saddle River, NJ: Prentice Hall.

Brown, K. C. and Smith, D. J. (1995) *Interest Rate and Currency Swaps: A Tutorial*. Charlottesville, VA: Financial Analysts Research Foundation.

Hancock, P. (2001) Functional finance. Speech to International Swap Dealers Association, April.

Hutchinson, M. (2001) The global derivatives market. United Press International, Thursday, April 12.

Lessard, Donald R. (1973) International Portfolio Diversification: A Multivariate Analysis for a Group of Latin American Countries. *Journal of Finance*, June, 619–633.

Merton, R. C. (1990) The financial system and economic performance. *Journal of Financial Services Research* **4**(December): 263–300.

OECD, Organization for Economic Cooperation and Development (2000) Survey of investment regulation of pension funds. DAFFE/AS/PEN/WD (2000) 13/REV2.

Reisen, H. (2000) *Pensions, Savings and Capital Flows*. London: Edward Elgar Publishing.

https://doi.org/10.1017/S1474747201001032 Published online by Cambridge University Press