Conclusion: What We Do and Do Not Know about Finance

It is time to sign off. Let us finish by thinking about some of the things that we do and do not know about finance.

34-1 What We Do Know: The Seven Most Important Ideas in Finance

What would you say if you were asked to name the seven most important ideas in finance? Here is our list.

1. Net Present Value

When you wish to know the value of a used car, you look at prices in the secondhand car market. Similarly, when you wish to know the value of a future cash flow, you look at prices quoted in the capital markets, where claims to future cash flows are traded (remember, those highly paid investment bankers are just secondhand cash-flow dealers). If you can buy cash flows for your shareholders at a cheaper price than they would have to pay in the capital market, you have increased the value of their investment.

This is the simple idea behind *net present value* (NPV). When we calculate an investment project's NPV, we are asking whether the project is worth more than it costs. We are estimating its value by calculating what its cash flows would be worth if a claim on them were offered separately to investors and traded in the capital markets.

That is why we calculate NPV by discounting future cash flows at the opportunity cost of capital—that is, at the expected rate of return offered by securities having the same degree of risk as the project. In well-functioning capital markets, all equivalent-risk assets are priced to offer the same expected return. By discounting at the opportunity cost of capital, we calculate the price at which investors in the project could expect to earn that rate of return.

Like most good ideas, the net present value rule is "obvious when you think about it." But notice what an important idea it is. The NPV rule allows thousands of shareholders, who may have vastly different levels of wealth and attitudes toward risk, to participate in the same enterprise and to delegate its operation to a professional manager. They give the manager one simple instruction: "Maximize net present value."

2. The Capital Asset Pricing Model

Some people say that modern finance is all about the capital asset pricing model. That's nonsense. If the capital asset pricing model had never been invented, our advice to financial managers would be essentially the same. The attraction of the model is that it gives us a manageable way of thinking about the required return on a risky investment.

Again, it is an attractively simple idea. There are two kinds of risk: risks that you can diversify away and those that you can't. You can measure the *nondiversifiable,* or *market,* risk of an investment by the extent to which the value of the investment is affected by a change in the *aggregate* value of all the assets in the economy. This is called the *beta* of the investment. The only risks that people care about are the ones that they can't get rid of—the nondiversifiable ones. This is why the required return on an asset increases in line with its beta.

Many people are worried by some of the rather strong assumptions behind the capital asset pricing model, or they are concerned about the difficulties of estimating a project's beta. They are right to be worried about these things. In 10 or 20 years' time we may have much better theories than we do now. But we will be extremely surprised if those future theories do not still insist on the crucial distinction between diversifiable and nondiversifiable risks—and that, after all, is the main idea underlying the capital asset pricing model.

3. Efficient Capital Markets

The third fundamental idea is that security prices accurately reflect available information and respond rapidly to new information as soon as it becomes available. This *efficient-market theory* comes in three flavors, corresponding to different definitions of "available information." The weak form (or random-walk theory) says that prices reflect all the information in past prices. The semistrong form says that prices reflect all publicly available information, and the strong form holds that prices reflect all acquirable information.

Don't misunderstand the efficient-market idea. It doesn't say that there are no taxes or costs; it doesn't say that there aren't some clever people and some stupid ones. It merely implies that competition in capital markets is very tough—there are no money machines or arbitrage opportunities, and security prices reflect the true underlying values of assets.

Extensive empirical testing of the efficient-market hypothesis began around 1970. By 2009, after almost 40 years of work, the tests have uncovered dozens of statistically significant anomalies. Sorry, but this work does *not* translate into dozens of ways to make easy money. Superior returns are elusive. For example, only a few mutual fund managers can generate superior returns for a few years in a row, and then only in small amounts.[1] Statisticians can beat the market, but real investors have a much harder time of it.

4. Value Additivity and the Law of Conservation of Value

The principle of *value additivity* states that the value of the whole is equal to the sum of the values of the parts. It is sometimes called the *law of the conservation of value.*

When we appraise a project that produces a succession of cash flows, we always assume that values add up. In other words, we assume

$$\begin{aligned}\text{PV(project)} &= \text{PV}(C_1) + \text{PV}(C_2) + \cdots + \text{PV}(C_t)\\ &= \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + \cdots + \frac{C_t}{(1+r)^t}\end{aligned}$$

[1] See, for example, R. Kosowski, A. Timmerman, R. Werners, and H. White, "Can Mutual Fund 'Stars' Really Pick Stocks? New Evidence from a Bootstrap Analysis," *Journal of Finance* 61 (December 2006), pp. 2551–2595.

We similarly assume that the sum of the present values of projects A and B equals the present value of a composite project AB.[2] But value additivity also means that you can't increase value by putting two whole companies together unless you thereby increase the total cash flow. In other words, there are no benefits to mergers solely for diversification.

5. Capital Structure Theory

If the law of the conservation of value works when you add up cash flows, it must also work when you subtract them.[3] Therefore, financing decisions that simply divide up operating cash flows don't increase overall firm value. This is the basic idea behind Modigliani and Miller's famous proposition 1: In perfect markets changes in capital structure do not affect value. As long as the *total* cash flow generated by the firm's assets is unchanged by capital structure, value is independent of capital structure. The value of the whole pie does not depend on how it is sliced.

Of course, MM's proposition is not The Answer, but it does tell us where to look for reasons why capital structure decisions may matter. Taxes are one possibility. Debt provides a corporate interest tax shield, and this tax shield may more than compensate for any extra personal tax that the investor has to pay on debt interest. Also, high debt levels may spur managers to work harder and to run a tighter ship. But debt has its drawbacks if it leads to costly financial distress.

6. Option Theory

In everyday conversation we often use the word "option" as synonymous with "choice" or "alternative;" thus we speak of someone as "having a number of options." In finance *option* refers specifically to the opportunity to trade in the future on terms that are fixed today. Smart managers know that it is often worth paying today for the option to buy or sell an asset tomorrow.

Since options are so important, the financial manager needs to know how to value them. Finance experts always knew the relevant variables—the exercise price and the exercise date of the option, the risk of the underlying asset, and the rate of interest. But it was Black and Scholes who first showed how these can be put together in a usable formula.

The Black–Scholes formula was developed for simple call options and does not directly apply to the more complicated options often encountered in corporate finance. But Black and Scholes's most basic ideas—for example, the risk-neutral valuation method implied by their formula—work even where the formula doesn't. Valuing the real options described in Chapter 22 may require extra number crunching but no extra concepts.

7. Agency Theory

A modern corporation is a team effort involving a number of players, such as managers, employees, shareholders, and bondholders. For a long time economists used to assume without question that all these players acted for the common good, but in the last 30 years they have had a lot more to say about the possible conflicts of interest and how companies attempt to overcome such conflicts. These ideas are known collectively as *agency theory*.

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[2] That is, if

$$\text{PV(A)} = \text{PV}[C_1(\text{A})] + \text{PV}[C_2(\text{A})] + \cdots + \text{PV}[C_t(\text{A})]$$
$$\text{PV(B)} = \text{PV}[C_1(\text{B})] + \text{PV}[C_2(\text{B})] + \cdots + \text{PV}[C_t(\text{B})]$$

and if for each period t, $C_t(\text{AB}) = C_t(\text{A}) + C_t(\text{B})$, then

$$\text{PV(AB)} = \text{PV(A)} + \text{PV(B)}$$

[3] If you *start* with the cash flow C_t(AB) and split it into two pieces, C_t(A) and C_t(B), then total value is unchanged. That is, PV[C_t(A)] + PV[C_t(B)] = PV[C_t(AB)]. See Footnote 2.

Consider, for example, the relationship between the shareholders and the managers. The shareholders (the *principals*) want managers (their *agents*) to maximize firm value. In the United States the ownership of many major corporations is widely dispersed and no single shareholder can check on the managers or reprimand those who are slacking. So, to encourage managers to pull their weight, firms seek to tie the managers' compensation to the value that they have added. For those managers who persistently neglect shareholders' interests, there is the threat that their firm will be taken over and they will be turfed out.

Some corporations are owned by a few major shareholders and therefore there is less distance between ownership and control. For example, the families, companies, and banks that hold or control large stakes in many German companies can review top management's plans and decisions as insiders. In most cases they have the power to force changes as necessary. However, hostile takeovers in Germany are rare.

We discussed the problems of management incentives and corporate control in Chapters 12, 14, 32, and 33, but they were not the only places in the book where agency issues arose. For example, in Chapters 18 and 24 we looked at some of the conflicts that arise between shareholders and bondholders, and we described how loan agreements try to anticipate and minimize these conflicts.

Are these seven ideas exciting theories or plain common sense? Call them what you will, they are basic to the financial manager's job. If by reading this book you really understand these ideas and know how to apply them, you have learned a great deal.

34-2 What We Do Not Know: 10 Unsolved Problems in Finance

Since the unknown is never exhausted, the list of what we do not know about finance could go on forever. But, following Brealey, Myers, and Allen's Third Law (see Section 29.5), we list and briefly discuss 10 unsolved problems that seem ripe for productive research.

1. What Determines Project Risk and Present Value?

A good capital investment is one that has a positive NPV. We have talked at some length about how to calculate NPV, but we have given you very little guidance about how to find positive-NPV projects, except to say in Section 11.2 that projects have positive NPVs when the firm can earn economic rents. But why do some companies earn economic rents while others in the same industry do not? Are the rents merely windfall gains, or can they be anticipated and planned for? What is their source, and how long do they persist before competition destroys them? Very little is known about any of these important questions.

Here is a related question: Why are some real assets risky and others relatively safe? In Section 9.3 we suggested a few reasons for differences in project betas—differences in operating leverage, for example, or in the extent to which a project's cash flows respond to the performance of the national economy. These are useful clues, but we have as yet no general procedure for estimating project betas. Assessing project risk is therefore still largely a seat-of-the-pants matter.

2. Risk and Return—What Have We Missed?

In 1848 John Stuart Mill wrote, "Happily there is nothing in the laws of value which remains for the present or any future writer to clear up; the theory is complete." Economists today are not so sure about that. For example, the capital asset pricing model is an enormous step toward understanding the effect of risk on the value of an asset, but there are many puzzles left, some statistical and some theoretical.

The statistical problems arise because the capital asset pricing model is hard to prove or disprove conclusively. It appears that average returns from low-beta stocks are too high

(that is, higher than the capital asset pricing model predicts) and that those from high-beta stocks are too low; but this could be a problem with the way that the tests are conducted and not with the model itself.[4] We also described the puzzling discovery by Fama and French that expected returns appear to be related to the firm's size and to the ratio of the book value of the stock to its market value. Nobody understands why this should be so; perhaps these variables are related to variable *x*, that mysterious second risk variable that investors may rationally take into account in pricing shares.[5]

Meanwhile scholars toil on the theoretical front. We discussed some of their work in Section 8.4. But just for fun, here is another example: Suppose that you love fine wine. It may make sense for you to buy shares in a grand cru chateau, even if doing so soaks up a large fraction of your personal wealth and leaves you with a relatively undiversified portfolio. However, you are *hedged* against a rise in the price of fine wine: Your hobby will cost you more in a bull market for wine, but your stake in the chateau will make you correspondingly richer. Thus you are holding a relatively undiversified portfolio for a good reason. We would not expect you to demand a premium for bearing that portfolio's undiversifiable risk.

In general, if two people have different tastes, it may make sense for them to hold different portfolios. You may hedge your consumption needs with an investment in wine making, whereas somebody else may do better to invest in a chain of ice cream parlors. The capital asset pricing model isn't rich enough to deal with such a world. It assumes that all investors have similar tastes: The hedging motive does not enter, and therefore they hold the same portfolio of risky assets.

Merton has extended the capital asset pricing model to accommodate the hedging motive.[6] If enough investors are attempting to hedge against the same thing, the model implies a more complicated risk–return relationship. However, it is not yet clear who is hedging against what, and so the model remains difficult to test.

So the capital asset pricing model survives not from a lack of competition but from a surfeit. There are too many plausible alternative risk measures, and so far no consensus exists on the right course to plot if we abandon beta.

In the meantime we must recognize the capital asset pricing model for what it is: an incomplete but extremely useful way of linking risk and return. Recognize too that the model's most basic message, that diversifiable risk doesn't matter, is accepted by nearly everyone.

3. How Important Are the Exceptions to the Efficient-Market Theory?

The efficient-market theory is strong, but no theory is perfect; there must be exceptions.

Now some of the apparent exceptions could simply be coincidences, for the more that researchers study stock performance, the more strange coincidences they are likely to find. For example, there is evidence that daily returns around new moons have been roughly double those around full moons.[7] It seems difficult to believe that this is anything other than a chance relationship—fun to read about but not a concern for serious investors or financial managers. But not all exceptions can be dismissed so easily. We saw that the

[4] See R. Roll, "A Critique of the Asset Pricing Theory's Tests: Part 1: On Past and Potential Testability of the Theory," *Journal of Financial Economics* 4 (March 1977), pp. 129–176; and, for a critique of the critique, see D. Mayers and E. M. Rice, "Measuring Portfolio Performance and the Empirical Content of Asset Pricing Models," *Journal of Financial Economics* 7 (March 1979), pp. 3–28.

[5] Fama and French point out that small firms, and firms with high book-to-market ratios, are also low-profitability firms. Such firms may suffer more in downturns in the economy. Thus size and book-to-market measures may be proxies for exposure to business-cycle risk. See E. F. Fama and K. R. French, "Size and Book-to-Market Factors in Earnings and Returns," *Journal of Finance* 50 (March 1995), pp. 131–155.

[6] See R. Merton, "An Intertemporal Capital Asset Pricing Model," *Econometrica* 41 (1973), pp. 867–887.

[7] K. Yuan, L. Zheng, and Q. Zhu, "Are Investors Moonstruck? Lunar Phases and Stock Returns," *Journal of Empirical Finance* 13 (January 2006), pp. 1–23.

stocks of firms that announce unexpectedly good earnings continue to perform well for a couple of months after the announcement date. Some scholars believe that this may mean that the stock market is inefficient and investors have consistently been slow to react to earnings announcements. Of course, we can't expect investors never to make mistakes. If they have been slow to react in the past, perhaps they will learn from this mistake and price the stocks more efficiently in the future.

Some researchers believe that the efficient-market hypothesis ignores important aspects of human behavior. For example, psychologists find that people tend to place too much emphasis on recent events when they are predicting the future. If so, we may find that investors are liable to overreact to new information. It will be interesting to see how far such behavioral observations can help us to understand apparent anomalies.

During the dot.com boom of the late 1990s stock prices rose to astronomic levels. The Nasdaq Composite Index rose 580% from the beginning of 1995 to its peak in March 2000 and then fell by nearly 80%. Such gyrations were not confined to the United States. For example, stock prices on Germany's Neuer Markt rose 1,600% in the three years from its foundation in 1997, before falling by 95% by October 2002.

This is not the only occasion that asset prices have reached unsustainable levels. In the late 1980s there was a surge in the prices of Japanese stock and real estate. In 1989 at the peak of the real estate boom, choice properties in Tokyo's Ginza district were selling for about $1 million a square foot. Over the next 17 years Japanese real estate prices fell by 70%.[8]

Maybe such extreme price movements can be explained by standard valuation techniques. However, others argue that stock prices are liable to speculative bubbles, where investors are caught up in a scatty whirl of irrational exuberance.[9] Now that may be true of your Uncle Harry or Aunt Hetty, but why don't hard-headed professional investors bail out of the overpriced stocks? Perhaps they would do so if it was their money at stake, but maybe there is an agency problem that stems from the way that their performance is measured and rewarded that encourages them to run with the herd.[10]

These are important questions. Much more research is needed before we have a full understanding of why asset prices sometimes get so out of line with what appears to be their discounted future payoffs.

4. Is Management an Off-Balance-Sheet Liability?

Closed-end funds are firms whose only asset is a portfolio of common stocks. One might think that if you knew the value of these common stocks, you would also know the value of the firm. However, this is not the case. The stock of the closed-end fund often sells for substantially less than the value of the fund's portfolio.[11]

All this might not matter much except that it could be just the tip of the iceberg. For example, real estate stocks appear to sell for less than the market values of the firms' net assets. In the late 1970s and early 1980s the market values of many large oil companies

[8] See W. Ziemba and S. Schwartz, *Invest Japan* (Chicago, IL: Probus, 1992), p. 109.

9 See C. Kindleberger, *Manias, Panics, and Crashes: A History of Financial Crises*, 4th ed. (New York: Wiley, 2000); and R. Shiller, *Irrational Exuberance* (Princeton, NJ: Princeton University Press, 2000).

[10] Investment managers may reason that if the stocks continue to do well, they will benefit from increased business in the future; on the other hand, if the stocks do badly, it is the customers who incur the losses and the worst that can happen to the managers is that they have to find new jobs. See F. Allen, "Do Financial Institutions Matter?" *Journal of Finance* 56 (August 2001), pp. 1165–1174.

[11] There are relatively few closed-end funds. Most mutual funds are *open-end*. This means that they stand ready to buy or sell additional shares at a price equal to the fund's net asset value per share. Therefore the share price of an open-end fund always equals net asset value.

were less than the market values of their oil reserves. Analysts joked that you could buy oil cheaper on Wall Street than in West Texas.

All these are special cases in which it was possible to compare the market value of the whole firm with the values of its separate assets. But perhaps if we could observe the values of other firms' separate parts, we might find that the value of the whole was often less than the sum of the values of the parts.

Whenever firms calculate the net present value of a project, they implicitly assume that the value of the whole project is simply the sum of the values of all the years' cash flows. We referred to this earlier as the law of the conservation of value. If we cannot rely on that law, the tip of the iceberg could turn out to be a hot potato.

We don't understand why closed-end investment companies or any of the other firms sell at a discount on the market values of their assets. One explanation is that the value added by the firm's management is less than the cost of the management. That is why we suggest that management may be an off-balance-sheet liability. For example, the discount of oil company shares from oil-in-the-ground value can be explained if investors expected the profits from oil production to be frittered away in negative-NPV investments and bureaucratic excess. The present value of growth opportunities (PVGO) was negative!

We do not mean to portray managers as leeches soaking up cash flows meant for investors. Managers commit their human capital to the firm and rightfully expect a reasonable cash return on these personal investments. If investors extract too great a share of the firm's cash flow, the personal investments are discouraged, and the long-run health and growth of the firm can be damaged.

In most firms, managers and employees coinvest with stockholders and creditors—human capital from the insiders and financial capital from outside investors. So far we know very little about how this coinvestment works.

5. How Can We Explain the Success of New Securities and New Markets?

In the last 30 years companies and the securities exchanges have created an enormous number of new securities: options, futures, options on futures; zero-coupon bonds, floating-rate bonds; bonds with collars and caps, asset-backed bonds; catastrophe bonds, . . . the list is endless. In some cases, it is easy to explain the success of new markets or securities; perhaps they allow investors to insure themselves against new risks or they result from a change in tax or in regulation. Sometimes a market develops because of a change in the costs of issuing or trading different securities. But there are many successful innovations that cannot be explained so easily. Why do investment bankers continue to invent, and successfully sell, complex new securities that outstrip our ability to value them? The truth is we don't understand why some innovations in markets succeed and others never get off the ground.

And then there are the innovations that do get off the ground but crash later, including many of the complex and over-rated securities backed by subprime mortgages. Subprime mortgages are not intrinsically bad, of course: they may be the only route to home ownership for some worthy people. But subprime loans also put many homeowners in nasty traps when house prices fell and jobs were lost. Securities based on subprime mortgages caused enormous losses in the banking industry. A number of new securities and derivatives went out of favor during the crisis. It will be interesting to see which will remain permanently consigned to the dustbin, and which will be dusted off and recover their usefulness.

6. How Can We Resolve the Payout Controversy?

We spent all of Chapter 16 on payout policy without being able to resolve the payout controversy. Many people believe dividends are good; others point out that dividends attract more tax and therefore it is better for firms to repurchase stock; and still others believe that, as long as the firm's investment decisions are unaffected, the payout decision is irrelevant.

Perhaps the problem is that we are asking the wrong question. Instead of inquiring whether dividends are good or bad, perhaps we should be asking *when* it makes sense to pay high or low dividends. For example, investors in mature firms with few investment opportunities may welcome the financial discipline imposed by a high dividend payout. For younger firms or firms with a temporary cash surplus, the tax advantage of stock repurchase may be more influential. But we don't know enough yet about how payout policy should vary from firm to firm.

The way that companies distribute cash has been changing. An increasing number of companies do not pay any dividends, while the volume of stock repurchases has mushroomed. This may partly reflect the growth in the proportion of small high-growth firms with lots of investment opportunities, but this does not appear to be the complete explanation. Understanding these shifts in company payout policy may also help us to understand how that policy affects firm value.

7. What Risks Should a Firm Take?

Financial managers end up managing risk. For example,

- When a firm expands production, managers often reduce the cost of failure by building in the option to alter the product mix or to bail out of the project altogether.
- By reducing the firm's borrowing, managers can spread operating risks over a larger equity base.
- Most businesses take out insurance against a variety of specific hazards.
- Managers often use futures or other derivatives to protect against adverse movements in commodity prices, interest rates, and exchange rates.

All these actions reduce risk. But less risk can't always be better. The point of risk management is not to reduce risk but to add value. We wish we could give general guidance on what bets the firm should place and what the *appropriate* level of risk is.

In practice, risk management decisions interact in complicated ways. For example, firms that are hedged against commodity price fluctuations may be able to afford more debt than those that are not hedged. Hedging can make sense if it allows the firm to take greater advantage of interest tax shields, provided the costs of hedging are sufficiently low.

How can a company set a risk management strategy that adds up to a sensible whole?

8. What Is the Value of Liquidity?

Unlike Treasury bills, cash pays no interest. On the other hand, cash provides more liquidity than Treasury bills. People who hold cash must believe that this additional liquidity offsets the loss of interest. In equilibrium, the marginal value of the additional liquidity must equal the interest rate on bills.

Now what can we say about corporate holdings of cash? It is wrong to ignore the liquidity gain and to say that the cost of holding cash is the lost interest. This would imply that cash always has a *negative* NPV. It is equally foolish to say that, because the marginal value of liquidity is equal to the loss of interest, it doesn't matter how much cash the firm holds. This would imply that cash always has a *zero* NPV. We know that the marginal value of cash to a holder declines with the size of the cash holding, but we don't really understand how to value the liquidity service of cash and therefore we can't say how much cash is enough or how readily the firm should be able to raise it. To complicate matters further, we note that cash can be raised on short notice by borrowing, or by issuing other new securities, as well as by selling assets. The financial manager with a $100 million unused line of credit may sleep just as soundly as one whose firm holds $100 million in marketable securities. In our chapters on working-capital management we largely finessed these questions by

presenting models that are really too simple or by speaking vaguely of the need to ensure an "adequate" liquidity reserve.

A better knowledge of liquidity would also help us to understand better how corporate bonds are priced. We already know part of the reason that corporate bonds sell for lower prices than Treasury bonds—companies in distress have the option to walk away from their debts. However, the differences between the prices of corporate bonds and Treasury bonds are too large to be explained just by the company's default option. It seems likely that the price difference is partly due to the fact that corporate bonds are less liquid than Treasury bonds. But until we know how to price differences in liquidity, we can't really say much more than this.

The crisis of 2007–2009 has again demonstrated that investors seem to value liquidity much more highly at some times than at others. Despite massive injections of liquidity by central banks, many financial markets effectively dried up. For example, banks became increasingly reluctant to lend to one another on an unsecured basis, and would do so only at a large premium. In the spring of 2007 the spread between LIBOR and the interest rate on Treasury bills (known as the TED spread) was .4%. By October 2008 the market for unsecured lending between banks had largely disappeared and LIBOR was being quoted at more than 4.6% above the Treasury bill rate.[12]

Financial markets work well most of the time, but we don't understand well why they sometimes shut down or clog up, and we can offer relatively little advice to managers as to how to respond.

9. How Can We Explain Merger Waves?

Of course there are many plausible motives for merging. If you single out a *particular* merger, it is usually possible to think up a reason why that merger could make sense. But that leaves us with a special hypothesis for each merger. What we need is a general hypothesis to explain merger waves. For example, everybody seemed to be merging in 1998–2000 and again in 2006–2007, but in the intervening years mergers went out of fashion.

There are other instances of apparent financial fashions. For example, from time to time there are hot new-issue periods when there seem to be an insatiable supply of speculative new issues and an equally insatiable demand for them. We don't understand why hard-headed businessmen sometimes seem to behave like a flock of sheep, but the following story may contain the seeds of an explanation.

It is early evening and George is trying to decide between two restaurants, the Hungry Horse and the Golden Trough. Both are empty and, since there seems to be little reason to prefer one to the other, George tosses a coin and opts for the Hungry Horse. Shortly afterward Georgina pauses outside the two restaurants. She somewhat prefers the Golden Trough, but observing George inside the Hungry Horse while the other restaurant is empty, she decides that George may know something that she doesn't and therefore the rational decision is to copy George. Fred is the third person to arrive. He sees that George and Georgina have both chosen the Hungry Horse, and, putting aside his own judgment, decides to go with the flow. And so it is with subsequent diners, who simply look at the packed tables in the one restaurant and the empty tables elsewhere and draw the obvious conclusions. Each diner behaves fully rationally in balancing his or her own views with the revealed preferences of the other diners. Yet the popularity of the Hungry Horse owed much to the toss of George's coin. If Georgina had been the first to arrive or if all diners could have pooled their information before coming to a decision, the Hungry Horse might not have scooped the jackpot.

[12] See M. Brunnermeier, "Deciphering the Liquidity and Credit Crunch 2007–2008," *Journal of Economic Perspectives* 23 (Winter 2009), pp. 77–100.

Economists refer to this imitative behavior as a *cascade*.[13] It remains to be seen how far cascades or some alternative theory can help to explain financial fashions.

10. Why Are Financial Systems So Prone to Crisis?

The crisis that started in 2007 was an unwelcome reminder of the fragility of financial systems. One moment everything seems to be going fine; the next moment markets crash, banks fail, and before long the economy is in recession. Carmen Reinhart and Kenneth Rogoff have documented the effects of banking crises in many countries.[14] They find that systemic banking crises are typically preceded by credit booms and asset price bubbles. When the bubbles burst, housing prices drop on average by 35% and stock prices fall by 55%. Output falls by 9% over the following two years and unemployment rises by 7% over a period of four years. Central government debt nearly doubles compared with its precrisis level.

Our understanding of these financial crises is limited. We need to know what causes them, how they can be prevented, and how they can be managed when they do occur. We reviewed the roots of the latest crisis in Chapter 14. But crisis prevention will have to incorporate principles and practices that we discussed in other chapters, such as the importance of good governance systems, well-constructed compensation schemes, and efficient risk management. Understanding financial crises will occupy economists and financial regulators for many years to come.[15] Let's hope they figure out the last one before the next one knocks on the door.

34-3 A Final Word

That concludes our list of unsolved problems. We have given you the 10 uppermost in our minds. If there are others that you find more interesting and challenging, by all means construct your own list and start thinking about it.

It will take years for our 10 problems to be finally solved and replaced with a fresh list. In the meantime, we invite you to go on to further study of what we *already* know about finance. We also invite you to apply what you have learned from reading this book.

Now that the book is done, we sympathize with Huckleberry Finn. At the end of his book he says:

> So there ain't nothing more to write, and I am rotten glad of it, because if I'd a' knowed what a trouble it was to make a book I wouldn't a' tackled it, and I ain't a'going to no more.

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[13] For an introduction to cascades, see S. Bikhchandani, D. Hirschleifer, and I. Welch, "Learning from the Behavior of Others: Conformity, Fads, and Informational Cascades," *Journal of Economic Perspectives* 12 (Summer 1998), pp. 151–170.

[14] See C. Reinhart and K. Rogoff, "The Aftermath of Financial Crises," *American Economic Review* 99 (May 2009), pp. 466–472.

[15] For a review of the current literature on financial crises see F. Allen, A. Babus, and E. Carletti, "Financial Crises: Theory and Evidence," *Annual Review of Financial Economics* 1, forthcoming.