The Global Financial System

A Functional Perspective

Dwight B. Crane
Kenneth A. Froot
Scott P. Mason
André F. Perold
Robert C. Merton
Zvi Bodie
Erik R. Sirri
Peter Tufano

"We believe the functional perspective provides a new and helpful way of looking at financial institutions and markets. An important purpose of the book is to show that this perspective can be constructively used to frame questions and seek answers about public policy issues, the strategy of financial institutions, the prospective structure of the industry, and so on. Thus, its intent is to lay the foundation for future work.

"We and other faculty involved in the Global Financial System Project have begun to study a number of issues using the functional perspective developed in this book. Current research efforts are focused on the challenges that financial systems will face in providing retirement income, the changing structure of the property and casualty insurance industry, the problems institutions face in allocating capital and measuring performance, and corporate risk management. Our hope is that others at academic institutions, financial organizations, and regulatory authorities will find the functional perspective helpful as they think carefully about the issues they face."

—From the Preface

ISBN 0-87584-622-x

THE GLOBAL FINANCIAL SYSTEM

A Functional Perspective

GLOBAL FINANCIAL SYSTEM PROJECT
HARVARD BUSINESS SCHOOL

Dwight B. Crane
Kenneth A. Froot
Scott P. Mason
André F. Perold
Robert C. Merton
Zvi Bodie
Erik R. Sirri
Peter Tufano

Harvard Business School Press
Boston, Massachusetts

CONTENTS

CHAPTER THREE

The Economics of Pooling

ERIK R. SIRRI AND PETER TUFANO

Financial systems facilitate *pooling,* or the aggregation of household wealth to fund indivisible or efficient-scale enterprises. Pooling is such an integral part of the financial system that it is difficult to imagine a world without it. In that counterfactual world, households could not jointly invest in projects. Firms could acquire no more external financing than a single household could provide, and businesses the size of Exxon, British Telecom, or Mitsubishi could not exist. Meaningful diversification would be beyond the reach of all but the wealthiest households, and significant portions of households' liquidity needs would remain unsatisfied. The economy would suffer large deadweight costs, with insufficiently capitalized firms operating at suboptimal scales and individuals holding inferior portfolios.

This chapter sets out the two subtly different levels at which pooling arrangements are structured. We document how the demands for pooling arise, both from producers who seek capital to run their firms, and from investors who seek liquidity and superior risk-bearing opportunities. Whenever pools are created, the potential exists for unintentional side effects that impose economic and social costs on investors and producers. The financing of projects with multiple outside investors, for example, creates problems arising from differences in information and incentives among the parties. Outside investors may worry about managers' effort and competence, and the decisions that managers and investors make

may be distorted by these concerns. If these distortions are large enough, their costs can dwarf the benefits of pooling.

Pooling can be carried out either through well-developed financial markets or through financial intermediaries. These two mechanisms allow different ways of dealing with difficulties that arise from pooling, such as informational asymmetries, agency costs, and liquidity costs. We illustrate this contrast by comparing delegated investment management, where pooling is accomplished through financial intermediaries, to asset securitization, where financial markets are used to pool investment wealth.

Although pooling is a stable function, changing laws, transactions costs, and information processing costs have altered the technology and structure used to form pools. We speculate on continuing evolution in pooling by considering limits to pooling as information, pricing, and contracting technologies continue to improve.

The Levels of Pooling Complexity

A world with absolutely no pooling would be characterized by autarky, in which each firm is independent or self-sufficient with a single owner. Every project or firm could have only a single supplier of capital, with a single bilateral contract between the firm and the sole investor specifying the rights and responsibilities of each party. In the extreme, the sole supplier of capital also runs the firm, thus forming a sole proprietorship. In autarky, firm size is thus limited by an individual's personal wealth and resources.

Adding a level of complexity allows the capital supplier to be distinct from the firm, with the arrangement governed by a single bilateral contract. If the capital supplier is a family member, the owner's contract may be implicit, governed by social norms or customs. More generally, the bilateral contract is explicit, prescribing the precise economic relationship between the owner and the capital provider. All these arrangements are forms of autarky in that the enterprise exists in a world of self-sufficiency.

To reach the simplest level of pooling requires the aggregation of household wealth to fund enterprise, accomplished by *multiple* bilateral contracts between households and a firm. For any one firm, the multiple bilateral contracts with investors could be the same, in which case all would be equity holders of the firm. Alternately, the investors could differ, and the firms might issue distinct debt and equity claims. Perhaps the most critical early advances in pooling through multiple bilateral contracts were the development of contract theory and the conception of a firm or corporation as a legal entity. In the Western world, for example, the earliest firm resembling what we call a corporation was the joint stock

company founded in 1553 as the "Russian Company."[1] In that endeavor, 28 persons each invested £6,000 in the common stock of the company to open up trade routes to Russia and China. What distinguished this entity is that it was defined as "one bodie and perpetuall fellowship and communaltie," and that it held legal rights of an individual: It could hold title, sue, and be sued under its own seal.

The creation of a legal entity that could serve as a vehicle for pooling was a critical development in facilitating the evolution of more complex pools. Without a legally defined "firm" or "corporation," investors would need a nexus of contracts binding one to each of the others, instead of linking each investor to a central legal entity or hub. Costs of commerce would be high, as if a telephone system were to connect each house to every other, instead of routing all calls into a central exchange.

A second level at which pooling takes place is through the creation of *multilateral contracts* between a set of investors and a set of firms. For example, thousands of investors can jointly entrust their wealth to a single mutual fund, which can then invest in hundreds of firms. The fund management company constructs bilateral contracts between mutual fund investor and fund, and between the fund and the firms in which it purchases equity or debt. Each mutual fund investor does not have a *direct* contract with each of the hundreds of firms he or she ultimately finances. This multilateral or multi-level contract conception of pooling produces entities that intercede between households and firms—financial intermediaries that take the form of banks, pension funds, mutual funds, and diversified conglomerates.

Pooling as multilateral contracting has a long history. In the United States alone, the first land banks were established in the early 1700s, the Bank of North America was established in 1781, the first insurance company in 1792, the first thrift in 1831, the first trust company in 1818, the first pension plan in 1875, and the first investment company in 1890.[2] Although all these financial institutions accomplish pooling, they differ with respect to the mix of other financial functions delivered, as well as the delivery mechanism. More recently, developments in multilateral contracting have produced pooling in the form of specific capital market instruments: mortgage- and asset-backed securities along with vehicles that repackage these pools to create instruments such as collateralized

1. See Scott (1912) for a historical study of the early development of the corporation. There are five earlier types of quasi-commercial organizations that Dewing (1934) identifies as prototypes of the corporation: the borough, the merchant guild, the fair, the chartered alien merchants, and the university. Even earlier firms resembling joint stock firms have been identified in Genoa, Italy, in the fourteenth century.
2. See Thygerson (1992), Chapter 8.

mortgage obligations. A mortgage-backed security allows many investors to finance hundreds of mortgages through a single conduit. Advances in pooling through multilateral contracting are enabled by developments that have removed legal impediments, but more importantly by systems and technologies that allow for low-cost and highly reliable collection, analysis, and processing of information.

The distinction between pooling as multiple bilateral contracts and as multilateral contracts is mirrored in the demand for pooling by enterprises and by households, as discussed below. Pooling benefits enterprises as they move from autarky to multiple bilateral contracts: With many investors, the firm can operate at an efficient scale. Pooling benefits households as they move from multiple bilateral to multilateral contracts: By joining with others, households can enjoy efficient diversification, monitoring, and liquidity.

The Demand for Pooling by Enterprises: Scale Economies

To maximize profits through economies of scale, firms must be free to select the size at which they will operate. Without pooling, autarky would prevail, and household wealth would impose binding capital constraints on firms and severely limit entrepreneurs' decisions. Absent pools created through bilateral contracting, most of the world's largest firms could not operate at their current scales. In a no-pooling world, as firms fail to enjoy scale economies, entrepreneurs and consumers would likely be less well-off.

Optimal Firm Size

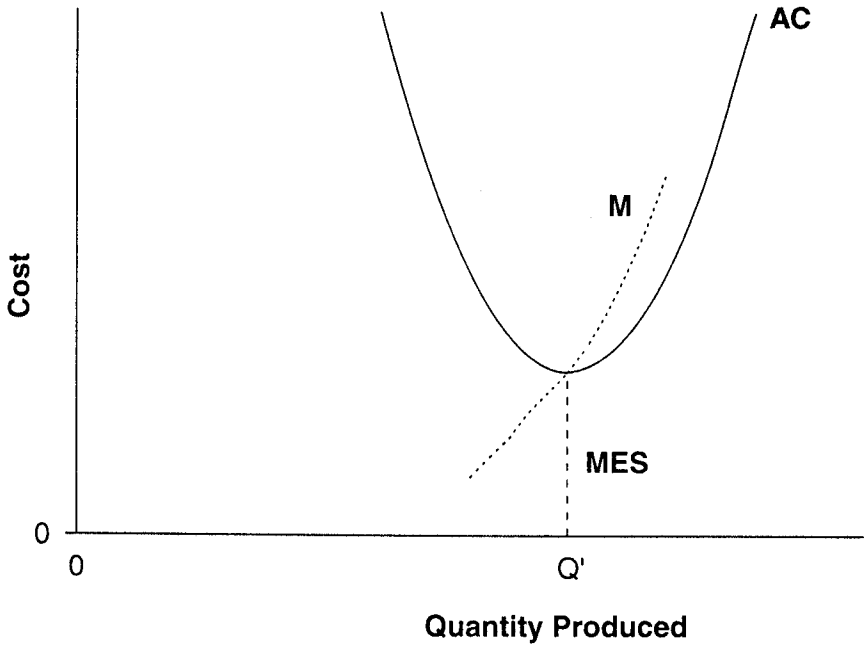
Elementary microeconomic theory demonstrates that, in a competitive economy, profits are maximized by minimizing costs. In the face of increasing marginal costs, a profit-maximizing entity would choose to produce at the lowest cost, or minimum efficient scale (MES) point, as shown in Figure 3-1. Absent capital constraints, technological considerations dictate optimal firm size in this stylized model of firms.

The notion that firm size is dictated by the production function of firms underlies an important strand of traditional industrial organization theory.[3] Plant-level scale economies are known to result from the use of specialized production processes and from economies of massed reserves or backup production facilities. Firm-level efficiencies result from exploiting economies in research and development, sales promotion, or capital raising [Scherer (1980, Chapter 4)]. Industry studies establish that sig-

3. See Scherer (1980) or Tirole (1988) for a review of this literature.

Figure 3-1 Costs of Production and Minimum Efficient Scale

Given a production technology, firms will choose output levels so that they operate at their minimum average cost if the industry is competitive. The curve AC is the average cost curve for the industry; curve M is the marginal cost curve. By definition, the marginal cost curve crosses the average cost curve at Q', which is the minimum average cost, or the minimum efficient scale (MES).



nificant scale economies exist. Table 3-1 reports a cross-industry study of minimum efficient scale that details the cost disadvantages small firms face. In the industries studied, if enterprise size shrinks by two-thirds, production costs rise an average of 6.8%, although they may increase by as much as 26%. These scale economies are not immaterial, given the thin profit margins in some industries, which confirms the important role of cost and scale considerations as determinants of firm size.

Were there no economies of scale, firm size would be indeterminate. Large firms would have no advantages over small firms, and we would be as likely to see large and small firms in every industry. Not surprisingly, this is not the case. Table 3-2 shows that large firms dominate capital-intensive industries, which presumably enjoy larger scale economies, e.g., industrial production, equipment manufacturing, and natural resources. Small firms dominate labor-intensive service industries that may enjoy lower economies of scale, such as repair services, legal services, and building contractors. Technological differences among industries lead to different optimal firm sizes, which in turn place varying demands upon the financial system to provide pooling.

Table 3-1 Industry, Scale, and Cost Advantages

For varied industries, the table lists the minimum efficient scale (MES) of operation in units of output produced. For each industry, the table also compares plant-level MES to total U.S. demand. The last column presents the rise in unit production cost if a given plant operating at MES shrinks to one-third its original size.

Industry	Minimum Efficient Scale (MES)	Percentage of U.S. Demand	Percentage by which Unit Cost Rises at One-Third MES
Beer Brewing	4.5 million (31 U.S. gallon) barrels per year capacity	3.4%	5.0%
Cigarettes	36 billion cigarettes per year; 2,275 employees	6.6	2.2
Cotton and Synthetic Broad-Woven Fabrics	37.5 million square yards per year; 600 employees in modern integrated plants	0.2	7.6
Paints	10 million U.S. gallons per year; 450 employees	1.4	4.4
Petroleum Refining	200,000 (42 U.S.-gallon) barrels per day crude oil processing capacity	1.9	4.8
Non-Rubber Shoes	1 million pairs per year; 250 employees on single-shift operation	0.2	1.5
Glass Bottles	133,000 tons per year; 1,000 employees	1.5	11.0
Portland Cement	7 million 376-pound barrels per year capacity	1.7	26.0
Integrated Steel	4 million tons per year capacity	2.6	11.0
Anti-Friction Bearings	800 employees	1.4	8.0
Refrigerators	800,000 units per year	14.1	6.5
Automobile Storage Batteries	1 million units per year; 300 employees	1.9	4.6

Source: F.M. Scherer, *Industrial Market Structure and Economic Performance,* Chicago: Rand McNally College Publishing, 1980, pp. 96–97.

Table 3-2 Large Business- and Small Business-Dominated Industries in 1987

The table lists industries dominated by large firms (column 1), as measured by their share of total industry employment (column 2), and industries dominated by small firms (column 3), as measured by their share of total industry employment (column 4).

Large Business-Dominated Industry	Large Firms' Share of Employment	Small Business-Dominated Industry	Small Firms' Share of Employment
Tobacco Manufacturers	98.3	Miscellaneous Repair Services	97.3
General Merchandise Stores	95.3	Special Trade Contractors	94.5
Petroleum and Coal Products	93.2	Automotive Dealers and Service Stations	92.6
Transportation Equipment	92.1	Legal Services	92.2
Instruments and Related Products	83.5	General Building Contractors	87.8
Chemicals and Allied Products	83.2	Wholesale Trade: Durable Goods	87.4
Paper and Allied Products	77.0	Automotive Repair, Services, and Parking	84.3
Metal Mining	76.6	Personal Services	80.3
Primary Metal Industries	74.9	Wholesale Trade: Nondurable Goods	80.2
Electrical and Electronic Equipment	73.9	Furniture and Home Furnishing Stores	80.1

Table 3-2 (continued)

Large Business-Dominated Industry	Large Firms' Share of Employment	Small Business-Dominated Industry	Small Firms' Share of Employment
Food and Kindred Products	72.4	Amusement and Recreation Services	77.4
Textile Mill Products	72.0	Building Materials and Garden Supplies	75.9
Coal Mining	62.0	Engineering and Architectural Services	72.9

Source: The State of Small Business: A Report of the President, Washington, D.C.: United States Government Printing Office, 1992, pp. 76 and 85.

The Mismatch Between Optimal Firm Size and Family Wealth

Without pooling to aggregate household wealth to fund enterprises, firm size would be constrained by the wealth under the control of a single household. Pooling relieves society of this limitation, bridging firms' capital needs and households' investing needs. To document the degree that pooling addresses the mismatch between household wealth and firm size, we examine the capacity of individual households to fund enterprises, both now and decades ago.

Table 3-3 compares the external funds required by the largest publicly owned U.S. enterprises in 1992 with the wealth of the nation's richest families.[4] If each firm had to rely on a single household for its external financial requirements, virtually none of the largest U.S. firms could exist. For example, America's wealthiest family, the Waltons of Wal-Mart fame, with wealth of approximately $25 billion, could not provide enough financing for any of the top 48 firms in the United States.[5] Of the top 200 publicly traded firms, only three (Minnesota Mining and Manufacturing,

4. See Appendix A for a discussion of these data.
5. Of course, were they not able to pool and obtain initial capital from others, many wealthy families would have been unable to amass their wealth.

Table 3-3 Firm Size and the Wealthiest U.S. Family Units in 1991

The table presents the identity and wealth of the richest American families in 1991, and the largest firm whose entire market capitalization (including long- and short-term debt and equity) they could fund completely. The column "Rank" gives the firm rank based on the market capitalization of U.S. firms in 1991, with smaller numbers representing larger firms.

Family Name	1991 Wealth ($ billions)	Largest Firm Family Could Finance Completely	
		Rank	Name
Walton	24.9	49	Minnesota Mining & Manufacturing Co.
Du Pont	8.6	161	Conagra Inc.
Mars	8.0	170	Amerada Hess Corp.
Gates	6.4	207	Corestates Financial Corp.
Kluge	5.9	221	American Stores Co.
Newhouse	5.6	229	Upjohn Co.
Bass	5.1	253	Marion Merrell Dow Inc.
Rockefeller	5.0	259	Blockbuster Entertainment Corp.
Cargill	5.0	260	Medco Containment Services Inc.
Pritzker	4.6	287	Borden Inc.
Buffett	4.4	300	Morton International Inc.
Hearst	4.4	301	United Healthcare Corp.
Mellon	4.3	311	Hercules Inc.
Allen	4.1	321	Galen Health Care Inc.
Cox	4.0	329	Louisiana-Pacific Corp.
Wexner	3.7	347	Fluor Corp.
Koch	3.6	358	USAir Group
Hillman	3.3	378	Wrigley (Wm.) Jr Co.
Arison	3.3	379	Deluxe Corp.
Redstone	3.2	386	Aflac Inc.
Tisch	2.9	409	Nordstrom Inc.
Phipps	2.5	447	Sigma-Aldrich
Packard	2.4	459	Burlington Industries
Perot	2.2	491	Harris Corp.
Crown	2.1	508	Maxus Energy Corp.
Haas	2.1	509	Avery Dennison Corp.
Murdoch	2.0	524	Multimedia Inc.
Dorrance	2.0	525	Kansas City Southern Industries
Turner	2.0	526	Hawaiian Electric Industries
Scripps	1.8	560	Giant Food Inc.
Wattis	1.8	561	Costco Wholesale Corporation
Lauder	1.8	562	Ecolab Inc.
Annenberg	1.7	584	Illinois Central Corp.
Hall	1.7	585	Minnesota Power & Light
Stephens	1.7	586	Goodrich (B.F.) Co.
Simplot	1.7	587	Trinity Industries

Table 3-3 (continued)

Family Name	1991 Wealth ($ billions)	Largest Firm Family Could Finance Completely	
		Rank	Name
Ford	1.7	588	Comsat Corp.
Knight	1.6	604	Asarco Inc.
Bancroft	1.6	605	St Joe Paper Co.
Hillenbrand	1.6	606	MGM Grand Inc.
Fisher	1.6	607	Synoptics Communications Inc.
Van Andel	1.5	632	King World Productions Inc.
Blaustein	1.5	633	Dreyfus Corp.
Perelman	1.5	634	Provident Life & Accident
DeVos	1.5	635	Heilig-Meyers Co.
Gund	1.5	636	American National Insurance
Milliken	1.5	637	Cracker Barrel Old Country Store
Chandler	1.4	653	Kaufman & Broad
LeFrak	1.4	654	Lafarge Corp.
McCaw	1.4	655	IES Industries Inc.
Kerkorian	1.4	656	Informix Corp.
DeBartolo	1.4	657	Mark IV Industries Inc.
Hewlett	1.4	658	Noble Affiliates Inc.
Taubman	1.3	680	Universal Corp-Va
Hunt	1.3	681	Thomas & Betts Corp.
Davis	1.3	682	IMC Fertilizer Group
Heyman	1.3	683	Penn Traffic Co.
Helmsley	1.3	684	Catellus Development Corp.
Smith	1.3	685	Reliance Electric Co.
Bechtel	1.3	686	Fingerhut Companies Inc.
Kroc	1.3	687	Tandem Computers Inc.
Ziff	1.3	688	Stryker Corp.
Busch	1.3	689	Ball Corp.
Getty	1.3	690	Kaiser Aluminum Corp.
Gallo	1.3	691	Cintas Corp.
Hoiles	1.2	710	Nerco Inc.
Disney	1.2	711	Triton Energy Corp.
Field	1.2	712	Dean Foods Co.
Johnson, S.	1.2	713	Trinova Corp.
Stern	1.2	714	Plum Creek Timber Co.
Ludwig	1.2	715	IP Timberlands
Icahn	1.2	716	Tidewater Inc.
Reynolds	1.1	743	Nacco Industries
Johnson, E.	1.1	744	Adobe Systems Inc.
Mandel	1.1	745	Commonwealth Energy System
Murdock	1.1	746	Warnaco Group Inc.
Gaylord	1.1	747	RPM Inc-Ohio

Table 3-3 (continued)

Family Name	1991 Wealth ($ billions)	Largest Firm Family Could Finance Completely	
		Rank	Name
Bren	1.1	748	Orange & Rockland Utilities
Geffen	1.1	749	Central Hudson Gas and Electric
Fribourg	1.1	750	Carter-Wallace Inc.
Carlson	1.0	780	Clark Equipment Co.
Collier	1.0	781	Ferro Corp.
Cooke	1.0	782	Autodesk Inc.
Rudin	1.0	783	Scripps Howard Broadcasting
Malone	1.0	784	Family Dollar Stores
Brown	1.0	785	Wesco Financial Corp.
Dayton	1.0	786	Belo (A.H.) Corp.
Anschutz	1.0	787	First Brands Corp.
Lilly	1.0	788	Cilcorp Inc.
Reed	1.0	789	TNP Enterprises Inc.
Hill	1.0	790	Coors (Adolph)
Nordstrom	1.0	791	Hanna (M.A.) Co.
Kleberg	1.0	792	Pacificare Health Systems

Source: Losee (1992), and Seneker (1992).
Note: For details on the methods used to create this table, see Appendix A.

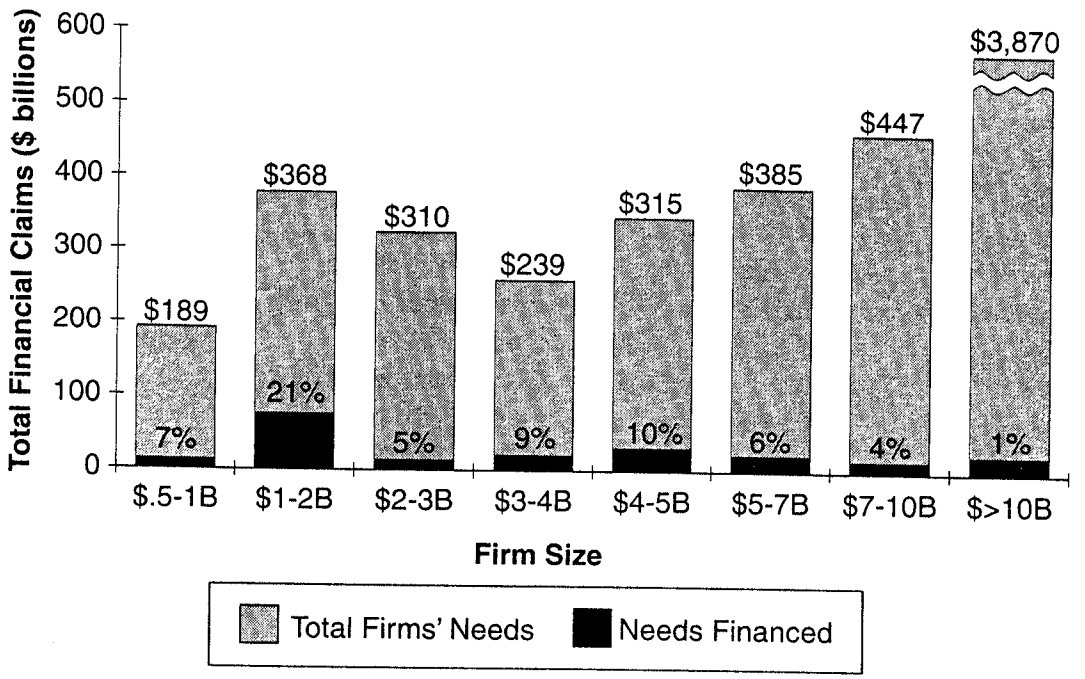
ConAgra, and Amerada Hess) could be funded completely by any single family.

Figure 3-2 shows the percentage of external funding requirements that could be provided by matching wealthy families to corporations one-to-one, broken down by the size of enterprise being funded. In the aggregate, without pooling, only 11.7% of U.S. firms with external capital needs exceeding $1 billion could be funded by single U.S. families.

The mismatch between household wealth and firm size is a long-standing feature of the U.S. economy. A comparison of U.S. family wealth and enterprise size in 1924, detailed in Appendix B and summarized in Table 3-4, reveals the robustness and importance of the pooling function. Of the largest 150 firms in the United States in 1924, only about one-third could have been funded by the wealth of individual families. The disparity between household wealth and firm size has widened; over seven decades, wealthy households have become less able to fund the nation's largest enterprises. Firms have grown faster than the wealth of even the richest families, as changes in technology, transportation, and labor have increased minimum efficient scales and the financial system has supported greater pooling.

Figure 3-2 The Relative Size of Largest U.S. Firms and the Wealthiest U.S. Families

The chart depicts the percentage of the funding needs of U.S. firms with enterprise value of $1 billion or more that could be provided by individual U.S. households with wealth of $1 billion or more, as of 1991. For example, there were $239 billion of firms with size $3–$4 billion, and of these, 9% of their financial needs could be met by families with wealth greater than $1 billion.



For details on the methods used to create this chart, see Appendix A.

The gap between household wealth and enterprise scale is a worldwide phenomenon. Figure 3-3 summarizes information on the wealthiest families and largest enterprises in 22 countries. In virtually every country, single wealthy families can fund less than one-fourth of the capital needs of firms with total external financial needs of $1 billion. In highly industrialized countries like Japan, wealthiest households can support less than 2% of large firms' financial needs. These international imbalances of wealth and enterprise size can be supported only by substantial pooling of funds, both within and among countries.

The Effect of Pooling on Social and Private Welfare

Were firms not free to enter into multiple bilateral contracts, there would be social losses due to lower output and higher unit production costs, as well as substantial redistribution of wealth. Table 3-5 gives some indication of the magnitude of the social costs by examining the impact on a

Table 3-4 U.S. Family Wealth and U.S. Firm Size in 1924

The table lists the identities and wealth of the richest U.S. families in 1924, and the identity of the largest U.S. firm they could fund completely. Wealth figures are expressed in 1924 dollars. The column "Rank" gives the firm rank based on the market capitalization of U.S. firms in 1924, with smaller numbers representing larger firms.

Family Name	1924 Wealth ($ millions)	Largest Firm Family Could Finance Completely	
		Rank	Name
Rockefeller	$1,077	2	New York Central Railroad
Morgan Inner Group	728	4	AT&T
Ford	660	8	Chicago, Milwaukee & St. Paul Railway Co.
Harkness	451	13	Erie RR Co.
Mellon	450	14	Chicago & North Western Railway Co.
Vanderbilt	360	19	Illinois Central Railroad Co.
Standard Oil Group	356	20	Cities Service
Whitney	322	21	Chicago, Rock Isl. & Pacific Railway Co.
Du Pont	239	28	Denver & Rio Grande Railroad Co.
Mc Cormick	211	30	Wabash Railway Co.
Baker	210	31	Pennsylvania Co.
Fisher	194	35	Swift & Co.
Guggenheim	190	36	American Smelting & Refining
Field	180	38	Pacific Gas & Electric
Curtis-Bok	174	43	Cleveland, Cinncinati, Chicago & St. Louis Railway Co.
Duke	156	48	Chile Copper
Berwind	150	49	Minneapolis, St. Paul & Sault St. Marie Railway Co.
Lehman	129	58	Spokane, Portland & Seattle Ry Co.
Widener	119	62	Sears, Roebuck
Reynold	117	63	Standard Oil (California)
Astor	114	64	Ford Motor
Timken	111	66	American Can
Ryan	108	69	Pere Marquette Railway Co.
Foster	106	71	K.C. Southern Railway Co.
Winthrop	104	74	Colorado & Southern Railway Co.
Stillman	102	75	Singer Manufacturing
Pitcairn	100	77	Texas & Pacific Railway Co.
Warburg	97	81	Western Pacific Railroad Co.
Metcalf	91	87	Michigan Central Railroad Co.
Clark	90	88	International Harvester
Phipp	89	90	Chicago & Eastern Illinois Railroad

Table 3-4 (continued)

Family Name	1924 Wealth ($ millions)	Largest Firm Family Could Finance Completely	
		Rank	Name
Kahn	86	96	Gulf Oil
Johnson	75	104	National City Bank of N.Y.
Green	72	106	Mexican Petroleum
James	72	107	Atlantic Gulf & West Indies Steamship
Nash	66	116	Cuba Cane Sugar
Schiff	66	117	Deere & Co.
Patterson	61	119	Baldwin Locomotive Works
Hayden	60	121	Associated Oil
Patten	60	122	Union Oil of California
Blumenthal	54	126	National Lead
Tafts	54	127	Atlantic Refining
Weber	54	128	International Nickel
Deering	50	131	Vacuum Oil
Mills	48	134	General Chemical
Cochran	42	137	Inland Steel
Friedsam	42	138	Magnolia Petroleum
Higgins	42	139	Cudahy Packing
McLean	42	140	RJ Reynolds Tobacco
De Forest	41	141	Youngstown Sheet & Tube
Baruch	38	142	Procter & Gamble
Kirkwood	38	143	Chase National Bank
Tyson	36	144	Aluminum Company of America
Huntington	35	145	Great Northern Iron Ore
Storrow	35	146	WR Grace

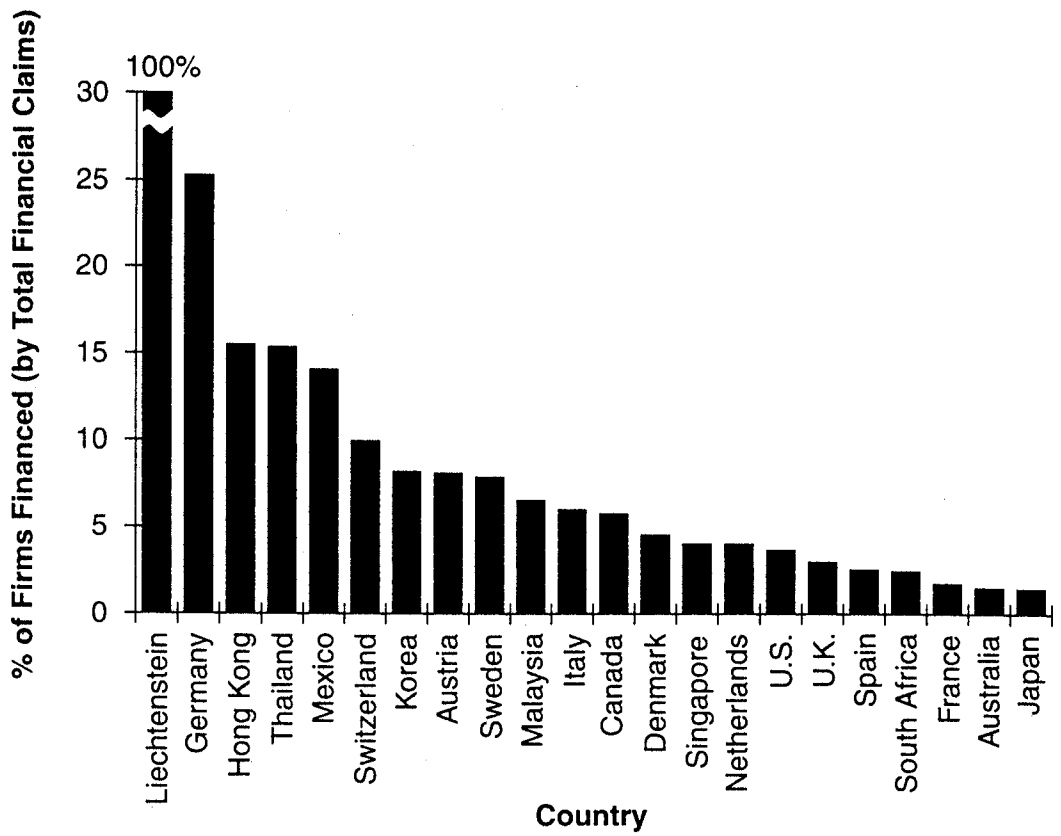
Source: Ferdinand Lundberg, *America's 60 Families,* New York: The Vanguard Press, 1937, pp. 26–27.

Note: For details on the methods used to create this table, see Appendix B.

single industry, were pooling to be forbidden. We compare the current worldwide automobile industry with the wealth of the wealthiest families around the globe. Even if the wealthiest families funded the auto industry to the exclusion of all others, the largest auto producer that could be supported would be Fiat, with annual unit production of under two million cars and trucks. There would be no firms the size of General Motors, Ford, Toyota, or Nissan. According to one study of economies of scale in the auto industry, even the largest automaker in a no-pooling world would fail to achieve minimum efficient scale in either research

Figure 3-3 International Firm Size and International Family Wealth

The chart displays the percentage of the funding needs of firms with enterprise value of $1 billion or more that could be provided by individual domestic households with wealth of $1 billion or more in 1991.



Note: For details on the methods used to create this chart, see Appendix A.

and development or financing.[6] Furthermore, a greater share of the world's autos would be produced by firms smaller than Fiat, which would fail to meet MES in production activities, causing consumers to pay more for the equivalent quality of car.[7]

Pooling also plays a critical role in the distribution of wealth. Without pooling, an initial skewed distribution of household wealth would create

6. Rhys (1989) uses statistical analyses to estimate minimum efficient scales (MES) for ten activities in the auto industry. MES ranges from 250,000 units for painting, to 1 million units for engine block casting, to 5 million units for research and development.
7. Compensating mechanisms would certainly evolve in a no-pooling auto industry. Smaller firms could specialize and vertically integrate by coordinating their activities to capture the appropriate economies at each step of the production process. Yet it is reasonable to speculate that auto consumers would be served more poorly by this fragmented industry structure that incurred higher transactions and coordination costs.

Table 3-5 The World Auto Industry and World Family Wealth

The table contrasts the size and output of the largest 15 passenger car manufacturers in the world with the assets of the world's wealthiest families in 1991. The table indicates that the largest four auto manufacturers could not be funded by any single family unit.

Company Name	1992 Units Produced (000s)	Country	Total Financial Claims ($ billion)	Hypothetical Funding Family	Wealth ($ bil.)	Country
General Motors	7,146	USA	$141.5	none		
Ford Motor	5,764	USA	126.9	none		
Toyota Motor	4,696	JPN	74.0	none		
Nissan	2,983	JPN	44.8	none		
Fiat	2,231	ITA	34.8	Sultan Waddaulah	$37.0	Brunei
Chrysler	2,159	USA	32.5	none		
Daimler-Benz	688	DEU	26.7	none		
Honda	1,828	JPN	21.7	Walton	24.9	United States
Volkswagen	3,499	DEU	19.7	none		
Mitsubishi Motors	1,832	JPN	13.4	none		
BMW	580	DEU	10.6	Mori	13.0	Japan
Mazda	1,460	JPN	10.4	Queen Elizabeth	11.7	U.K.
Isuzu Motors	473	JPN	9.6	Tsutsumi	10.0	Japan
Peugeot	2,050	FRA	9.2	King Fahd	10.0	Saudi Arabia
Volvo	123	SWE	8.3	Du Pont	8.6	United States

Source: Ward's Automotive Yearbook 1993, Ward's Automotive, Southfield, MI, 59, and *Automotive News,* May 26, 1993, p. 3, Compustat Global Vantage.

Note: See Appendix A for more details.

a similar distribution of enterprise size. Yet, if economies of scale existed, larger firms could earn supernormal profits in a system where prices are set by higher-cost smaller competitors. Over time, these higher profits might allow large firms to grow even larger and more profitable, exacerbating disparities in firm size or permitting large firms to drive small firms out of business. The richer firms would grow richer, as would the richer households. As poorer households could not join together to fund competitive firms, the initial uneven distribution of wealth would grow more pronounced.

Pooling, however, allows funds to flow from less wealthy households to large efficient businesses, permitting poorer citizens to benefit as part-owners of these profitable firms. Similarly, it permits funds to flow to capital-starved enterprises, allowing entrepreneurs with good projects but little cash to operate their firms at more efficient scales. As returns accrue to successful entrepreneurs, wealth imbalances are reduced through market forces. Through pooling, financial markets simultaneously affect both industry structure and income distribution.

The social benefits of pooling come at a cost. Multiple bilateral contracts produce a dispersed ownership base. The greater the degree of pooling or dispersion of ownership, the greater the problems of asymmetric information. As households own smaller fractions of a larger number of the productive enterprises, their incentives to monitor each firm fall and they prefer to free-ride in the costly monitoring of others. Managers can take actions unobservable to, and not in the best interests of, outside investors (the moral-hazard problem), or they may be able to disguise important information (adverse selection). Although these problems exist in a world without pooling, they are likely to be exacerbated by pooling and diffuse ownership.[8]

Alternative Forms of Pooling Capital

From a firm's perspective, the extent to which its capital is widely held—the degree of pooling—has important implications. Research shows that firms can increase their market value by increasing the number of investors knowledgeable about the firm. Merton (1987) demonstrates that, in a world of imperfect information, increasing the number of investors (or, in our terminology, increasing the amount of pooling) reduces a firm's cost of capital and increases its market value. This benefit arises through

8. Jensen (1993) argues that the largest firms may actually be less efficient than small firms, citing firms like General Motors with inadequate corporate governance systems that may have squandered shareholder money.

Table 3-6 Sources of Capital for Privately Owned Enterprises

Type	Debt Capital	Equity Capital
Internal Sources	Loans from owners	Capital stock of the founder(s) or the proprietor's equity Retained earnings of the firm
Informal External Sources	Loans from family members and friends Trade credit from suppliers and customers	Investment by individuals as informal participants
Financial Intermediaries	Lending by depository or nondepository financial institutions Secured or unsecured debt	Venture capital European-Style Investment Corporations (ESIC)
Public Markets	Bond issues Asset securitization	Common and preferred stock issues

Source: Adapted from *The State of Small Business: A Report of the President,* Washington, D.C.: United States Government Printing Office, 1992, p. 265.

improvements in the quality and quantity of information available to potential investors.

Other forces lead firms to seek narrow investor bases. Firms may face increasing marginal costs of identifying additional numbers of investors; at the extreme, the transactions costs of finding one million investors, each contributing $100, are likely to be substantially more than the costs of finding a smaller number of larger investors. Increasing the size of its investor base also tends to drive a firm toward ever-more-distant investors. As larger distances must be spanned—both in terms of geography and in terms of initial knowledge of the firm—the cost of raising funds increases. (Chapter 4 discusses the link between geographical separation and higher costs, and Chapter 7 deals with the relationship between informational distances and costs.)

There are a variety of specific means by which pooling is accomplished. Table 3-6 shows various pooling mechanisms, characterized by the source of pooled funds and the type of claim issued. To fund its needs, a firm

may rely on some or all of these pooling vehicles. Fund sources differ by their increasing distance, crudely measured, from the current investor base. A firm can raise money from its existing owners, from noninvestors who have private knowledge about the firm or its owners, from financial intermediaries, from broad clienteles who respond to offerings in public markets, or from the government (which in turn raises its funds through taxation). Investors may be knowledgeable venture capitalists, family members or friends, traditional intermediaries like banks or insurance companies, a widespread clientele of households and mutual funds responding to a public offering, or the government (through specific research funding or issue of guarantees). These diverse institutions all fulfill the pooling function, albeit in different forms, benefits, and costs.

Table 3-7 presents a snapshot of extent to which firms rely upon external financing (or pooled funds) in the United States and in nine developing countries. An International Finance Corporation study finds that, to fund their growth, firms in less developed countries use far more external financing (pooling) than do firms in developed nations. In Korea, for instance, 85% of the large-firm growth between 1970 and 1984 was funded by externally generated funds, but externally generated capital (pooled funds) funded only 24% of large-firm needs in the United States [Singh and Hamid (1992)].

In communist and socialist regimes, governments are the primary pooling mechanisms, centralizing capital raising (taxation), investment (central planning), and management activities. This centralization of pooling has costs, most notably inefficient resource allocation and inadequate monitoring. Recent experience in privatizing much of the wealth in post-communist Central and Eastern Europe shows that the transition away from government pooling mechanism has not been trouble-free. Poland's and Czechoslovakia's attempts to restructure their country's pooling mechanisms have had to contend with low private savings levels and an attendant disparity between household wealth and necessary enterprise size. Because households have insufficient resources to buy all of the national productive capacity outright, shares in the nation's firms have been distributed to households through asset sales, leases, and voucher systems.

These economies' pooling needs have been addressed by governmental fiat, as the government distributed enterprise ownership to its citizens through multiple bilateral contracts. At the same time, banks and private intermediaries resembling mutual funds arose to collect the households' vouchers and, in turn, issue them shares in funds—multilateral pooling vehicles. These mutual fund-like intermediaries deliver informa-

Table 3-7 Capital Structures and Funding Sources of Selected Countries

For the largest 50 companies in each country, the table lists the after-tax retention ratio and the percent of growth financed by internal funds (retained earnings), long-term debt, and external equity.[1] (The fractions do not sum to 1.00 across each row because funding of short-term liabilities is omitted.)

			Sources of Funds		
Country	Years	After-tax Retention Ratio	Internal Finance	External Long-Term Debt	External Equity
United States	1970–79	0.60[2]	0.52	0.21	0.03
Korea	1980–87	0.59	0.12	0.45	0.40
Pakistan	1980–86	0.46	0.58	0.16	0.12
Mexico	1984–88	NA	0.17	0.03	0.76
India	1980–88	0.67	0.36	0.46	0.11
Turkey	1982–87	0.24	0.18	0.16	0.61
Malaysia	1983–87	0.45	0.42	0.02	0.31
Jordan	1980–87	0.40	0.06	0.16	0.12
Thailand	1983–87	0.47	0.17	0.16	0.84
Zimbabwe	1980–88	0.61	0.58	0.00	0.43

Source: "Corporate Financing Decisions in Developing Countries," A. Singh and J. Hamid, Technical Paper, International Finance Corporation, 1992, p. 11 and p. 43.

1. The number of firms in Jordan and Turkey is 35 and 38, respectively. The data for the United States are for a larger (unspecified) number of firms.

2. These data are for 1970–1984.

tion gathering, monitoring, and liquidity services to their shareholders. The move from multiple bilateral contracts to multilateral pooling also illustrates the "innovation spiral," as the innovation of vouchers provided the raw material from which another new product (funds) was created.

Pooling's role in support of large-scale efficient enterprise is clear. Without a means to draw upon the resources of multiple households, firms would be forced to operate at considerably reduced and less efficient scales. Consumers and producers would suffer because prices would be higher and output lower than in a world where firms could expand by aggregating capital. Although it imposes costs due to the dispersion of

ownership, pooling is the bridge between small households and large firms. It provides small firms with access to capital, and small savers with access to attractive investments.

The Demand for Pooling by Households: Efficient Liquidity and Diversification

Even if firms could operate at efficient scales without pooling, households' independent demands for pooling would ensure its role in the financial system. Without pooling, households could own only assets that they could buy in totality. All but the wealthiest households would have a single investment, or at most a few. We have already seen how, without pooling, poorer households would be denied opportunities to invest in the largest, most profitable, firms. Equally important, pooling permits households to have many small investments instead of a few large holdings, improves their ability to meet liquidity needs, and (through multilateral pooling vehicles) permits low-cost diversification and monitoring.

Diversification

Individuals tend to be risk-averse in that they prefer to bear less variation in return for any given expected return. Variation in return, or risk, can be reduced through diversification, whereby investors spread their wealth among a large number of imperfectly correlated ventures rather than concentrating on a small number of firms. Diversification lowers the overall variability or risk of a portfolio's return without lowering its expected return.[9] In a practical sense, diversification—especially low-cost diversification—would not be attainable without pooling as accomplished through multilateral contracts.

Without multiple bilateral contracts, real assets would be indivisible. As a result, households with modest wealth would be forced to invest in one, or at most a few, small enterprises, exposing themselves to significant nonsystematic risk.[10] They could not invest in a broad portfolio that

9. Diversification is an important component of portfolio theory, which was developed by Markowitz (1959). For diversification to be of benefit to investors, assets in the portfolio must be less than perfectly correlated. In general, the less correlated the assets, the greater the potential gains to diversification. A fully diversified portfolio is one that retains only market risk, which is the sensitivity of assets to economy-wide fluctuations. A fully diversified portfolio is insensitive to firm-specific events such as strikes and bankruptcies.
10. In a frictionless market described by the Capital Asset Pricing Model (CAPM), investors are not compensated for bearing diversifiable or nonsystematic risk, as the investors can

would permit them to shed firm-specific or idiosyncratic risk. It would appear as if asset divisibility alone—or the existence of multiple bilateral contracts—would provide households with the diversification they demand. To see this, assume firms issue debt or equity in denominations small enough to be purchased by most households. Households could diversify their holdings by purchasing claims of a large number of firms. Were there no transactions or information-gathering costs, were shares completely divisible, and were managing a portfolio of securities effortless, every household could create a fully diversified portfolio.

Yet there are a multitude of costs and other frictions.[11] Some costs arise from fixed costs of trading, such as processing and "ticket" charges by brokers who execute trades on behalf of clients. The presence of fixed charges makes it more expensive for an individual to buy $1,000 each of ten securities than $10,000 of one security. Other charges, like the bid–ask spread, are more subtle: the "lemons" problem, encountered by buyers and sellers of used cars, is a factor in the cost of buying securities too. Sellers of stock tend to have information about poor future prospects for that firm; buyers of stock will have the opposite. This leads naturally to an information-induced "spread" between the buy (ask) and the sell (bid) price for a security, a type of transactions cost.

If transactions costs are included in the pooling calculus, small households' ability to diversify on their own becomes more problematic. Households must trade off transactions costs associated with a large number of small holdings with the benefits that stem from full diversification. If a household puts all its wealth into one stock, it can minimize its direct transactions costs. Yet this household will fall far short of creating a diversified portfolio. Alternatively, holding its wealth constant, the household could buy small amounts of many tradable assets and incur larger transactions cost per dollar of wealth invested. *Gross of costs,* such a portfolio is more likely to deliver the mean and variance of a well-diversified portfolio; transactions costs, however, can offset or eliminate the benefits of diversification.

The *gross* benefits of diversification (before deducting transactions costs) are graphed in Figure 3-4. Using a historic series of returns on New York

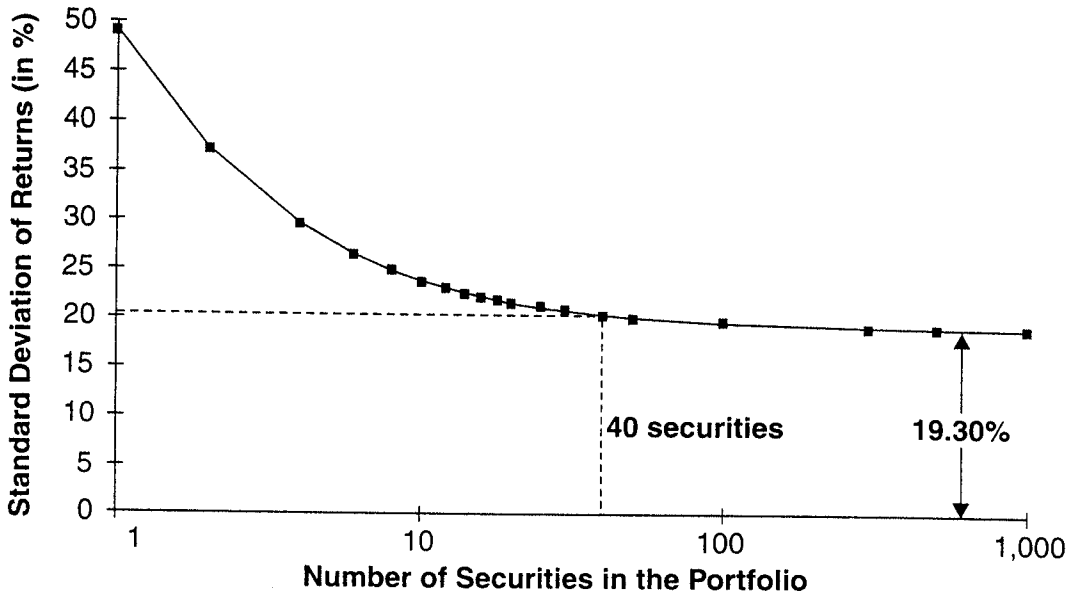
---

eliminate this risk costlessly through diversification. In a market with transactions costs, asset returns may compensate investors for holding a poorly diversified portfolio [Mayshar (1979)]. Our analysis, however, assumes that investors are not adequately compensated for bearing diversifiable risk.

11. Academic theory has attempted to explore the effect of market imperfections on equilibrium asset prices, portfolio choice, and social welfare. For examples, see Mayshar (1979) or Merton (1987).

Figure 3-4 The Effect of Portfolio Diversification

The chart shows the standard deviation of a portfolio's return as the number of securities in the portfolio increases. After about 40 securities, the portfolio risk flattens out and approaches 19% per year.



Stock Exchange equities as an example, we show how a portfolio's standard deviation of returns, which is a measure of its riskiness, falls as the number of securities in the portfolio increases. For example, with four stocks the portfolio has a standard deviation of 30% per year. Notice that, as the number of stocks increases, the standard deviation falls until it levels off at 19.3% per year, which is the variance of the equity market as a whole. The majority of the variance reduction is achieved by holding around 40 securities, the "minimum efficient scale" to form a fully diversified portfolio. This portfolio, on the basis of its standard deviation, is about as risky as a fully diversified market, and can be expected to deliver the same expected return.

Can individual investors achieve this degree of diversification in a world with pooling at the corporate level, realistic transactions costs, and no multilateral pooling (financial intermediaries such as banks or mutual funds)?[12] To answer this question empirically, we examine the transactions costs borne by five representative households who each purchase a portfolio of 40 equities. Each representative household has total wealth (net worth) equal to each of the five net worth quintiles of the U.S. population.

12. The analysis here is in the spirit of Statman (1987).

Table 3-8 The Transactions Costs of Acquiring a Portfolio of 40 Common Stocks

The table tabulates the transactions costs of directly creating diversified equity portfolios of 40 stocks for households. The households are divided into quintiles based on median household income. The table shows family net worth, the amount invested per firm, number of shares per firm (assuming an average of $40/share), and commissions based on currently quoted discount broker rates.*

Quintile	Net Worth ($)	Investment Per Company (40 companies)($)	Number of Shares per Company	Round-trip Commission ($)	Commissions Paid per $ Invested (%)
bottom	$ 4,324	$ 108.10	2.7	$3,120	72%
2	19,694	492.35	12.3	3,120	16
3	28,044	701.10	17.5	3,352	12
4	46,253	1,156.33	28.9	3,972	9
top	111,770	2,794.25	69.9	5,956	5

*Households are grouped into five quintiles by income using data from the U.S. Department of Commerce's Survey of Income and Program Participation in *Household Wealth and Asset Ownership: 1988* (U.S. Government Printing Office, 1990). For each of these quintiles, median net worth is reported (Table B, p. 3), repeated above in the first column. This net worth was invested in 40 firms, assuming an average price per share of $40, before commissions, with a per-company dollar investment and number of shares purchased reported in the second and third columns. The round-trip commission costs for purchasing this number and dollar amount of shares are calculated on the basis of commission schedule for a major U.S. discount brokerage firm, using current rates, and reported in the fourth and fifth columns.

Thus, the poorest household has total net worth of $4,324, and the wealthiest has net worth of about $112,000. For each household, we calculate how many shares of each of the 40 firms they will own, given an average stock price of $40 per share. Round-trip commissions are reported on the basis of recent retail quotations given by a major discount brokerage.

The results are shown in Table 3-8; it shows that transactions costs to establish a 40-firm portfolio are high, in an absolute sense. For the median investor, over 12% of net worth is consumed in commissions alone. Were bid–ask spreads and recurring charges such as portfolio rebalancing costs and custodial fees included, the costs of creating a 40-stock portfolio would be even higher. Clearly a household with net worth less than $50,000 would pay dearly to attempt to create a 40-stock diversified portfolio.

Instead of buying shares in 40 firms, the five households might elect to buy stocks only in units of round lots (groups of 100 shares), thereby minimizing transactions costs, although at the expense of poorer diver-

Table 3-9 Household Wealth, Transactions Costs, and Diversification

The table presents the total cost of buying a portfolio of stocks, subject to the constraint that shares are only purchased in units of round lots. The second column lists the number of round lots purchased and the third column the standard deviation of the resulting portfolio. The fourth column presents the difference in expected return between this portfolio and a levered position in a fully diversified equity portfolio with the same total risk. It is essentially the market penalty for bearing undiversified risk. The return reduction and the commission costs are combined in the last column to give the all-in economic cost of holding such a portfolio compared to holding a costless fully diversified equity mutual fund.*

Quintile	Median Net Worth ($)	Number of Round Lots Purchased	Standard Deviation of Portfolio	Penalty for Undiversified Risk in (%)	Round Trip Commissions ($)	Round Trip Commissions (%)	Total Cost with 7-year Holding Period (%)
bottom	$ 4,324	1.1	48.0	9.26%	$ 170	3.93%	9.82%
2	19,694	4.9	28.3	2.91	$ 808	4.10	3.49
3	28,044	7.0	25.8	2.11	1,154	4.11	2.69
4	46,253	11.6	23.8	1.46	1,912	4.13	2.05
top	111,770	27.9	21.1	0.58	4,598	4.11	1.16

*Households are grouped into five quintiles by income using data from the U.S. Department of Commerce's Survey of Income and Program Participation in *Household Wealth and Asset Ownership: 1988* (U.S. Government Printing Office, 1990). For each of these quintiles, median net worth is reported (Table B, p. 3), and reported above in the first column. This net worth is divided into round-lots of 100 shares, at an average price of $40 per share, or $4,000 per round lot, giving the number of round lots purchased in column 2. The standard deviation of a portfolio with that number of different firms was calculated according to the methodology in Statman (1987) and is given in column 3. The fourth column reports the return that investors would demand if forced to bear this higher level of risk, calculated consistent with Statman's analysis. The fifth and sixth columns give the commissions paid to execute this strategy, using the current commission schedule of a major U.S. retail discount brokerage firm. The final column represents the annualized cost of the strategy, assuming a seven-year holding period. This cost is the annual return reduction (column 4) plus one-seventh of the round-trip commissions (column 6).

sification.[13] If this strategy is followed, the median investor could buy less than seven round lots (see Table 3-9). The median investor would face a standard deviation of 25.8% per year, higher than the risk of a fully diversified index. Assuming that the market does not price diversifiable

13. The existence of round-lot costs is a peculiarity of the U.S. institutional structure. More generally, any cost structure that has both a fixed and a variable component, such as a fixed "ticket" charge as well as a "per share" charge, will exhibit this concavity over order quantity.

risk, the household is uncompensated for being less than fully diversified; the additional 6.5% of variation is a cost borne by the risk-averse investor. Because of wealth constraints, the investor is unable to lower this residual excess risk.

We can quantify the cost of this additional risk by comparing the partially diversified portfolio of round lots to a fully diversified index portfolio constructed to entail minimal transactions costs, such as an index mutual fund. If we borrow money and invest in the index fund, we can achieve the same risk (standard deviation) as the investor's partially diversified portfolio. The partially diversified portfolio involves the same amount of risk as the levered index fund, but provides no additional return above the market return, because the risk arises through underdiversification, not leverage. The difference in returns is the economic cost of partial diversification.

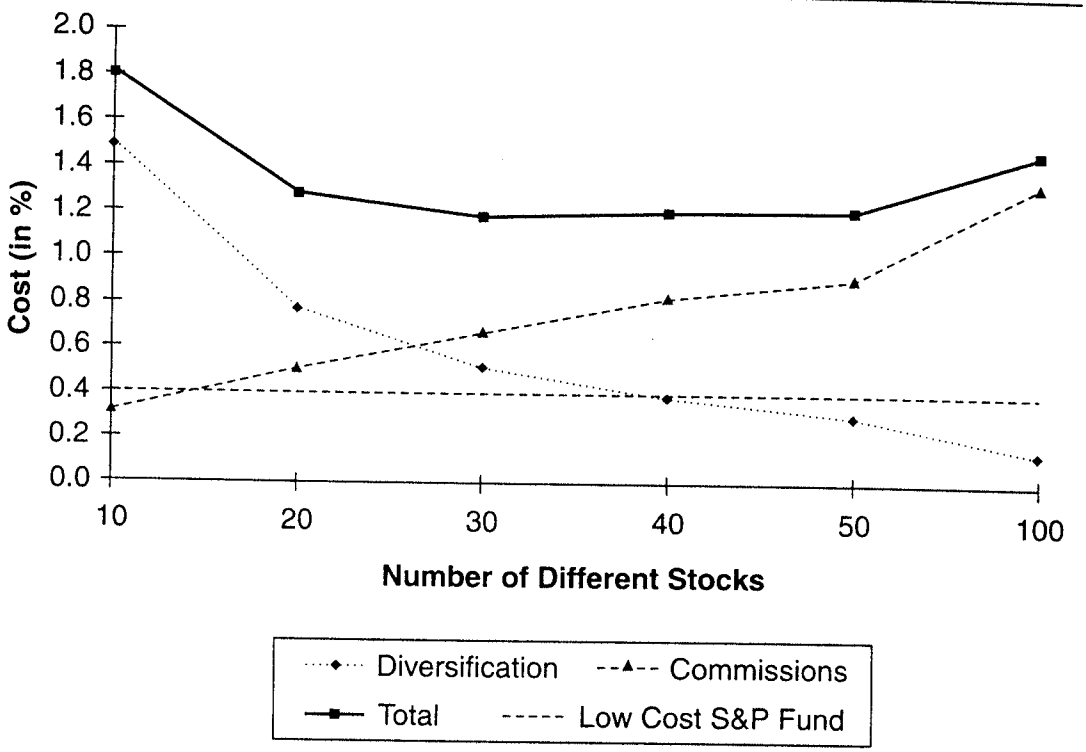
To estimate the magnitude of this cost, assume a riskless rate of 2% per year, and a return on the S&P 500 of 6.2% per year above the risk-free rate. By borrowing 34 cents for every dollar invested in the index, we can construct a levered fully diversified portfolio with an identical standard deviation as the partially diversified one. The return of this portfolio is 10.3% (2% + 6.2% × 1.34). The difference of 2.1 percentage points over 8.2% is the cost of partial diversification; that is, an individual could lever the index portfolio by 34%, take on the same risk as produced in the partially diversified portfolio, and receive 2.1 percentage points more return. Notice in the fourth column of Table 3-9 that the penalty for undiversified risk then drops to as low as 58 basis points for the wealthiest individuals but is as high as 926 basis points for the lowest net worth category. The last two columns of the table show the estimated round-trip commissions for the position and the total annualized cost of investing, assuming a seven-year holding period typical of mutual fund investors.[14]

These back-of-the-envelope calculations have several immediate implications for businesses that provide pooling services, such as mutual funds or unit trusts. By comparing the multilateral pooling vehicles to the alternatives consumers can construct using only bilateral contracts, we can calculate how much consumers should be willing to pay to achieve a fully diversified portfolio. A provider of pure pooling services could, in the absence of competition, charge between 116 and 982 basis points of return *per year* for providing a diversified equity portfolio, and be cheaper than consumers' other alternatives. Because the average mutual fund account size is about $11,000, the extra charge would seem to be closer to

14. From Sirri and Tufano (1993a), this is taken as the ratio of aggregate annual mutual fund redemptions to the aggregate size of funds.

Figure 3-5 Relative Costs of Diversification, Commissions, and Mutual Funds

The chart illustrates the cost of producing diversification through the direct purchase of equity securities or through the purchase of indexed mutual funds for a U.S. investor seeking $100,000 of equity exposure. The costs of direct holdings include lack of diversification and commissions. The cost of the representative indexed mutual fund is simply the annual expense ratio of the fund.



the high end of the scale.[15] For the median investor with net worth of $28,044, annual costs of 2.69% amount to $750 per year. With around 80 million households in the United States, this suggests that households seeking diversification on their own would incur costs of $60 billion per year, which could be reduced dramatically through multilateral pooling vehicles. The figure is meant to be suggestive rather than precise, but it explains some of the tremendous growth in retail asset management products.

The two experiments suggest a clear trade-off between transactions costs and inadequate diversification. Figure 3-5 graphs this trade-off for a hypothetical investor with $100,000. As she increases the number of different stocks held, her opportunity losses relative to a fully diversified index fall. At the same time, the round-trip commissions annualized over a seven-year holding period rise as the size of transactions falls. Taking

15. Investment Company Institute (1993).

both of these costs into account, she would minimize the total costs of synthetic indexing by holding approximately 30 stocks.[16] Thus, for the investor with $100,000 seeking broad equity exposure but lacking multilateral pooling vehicles, manufacturing a close substitute costs 150 to 200 basis points per year in total costs.

For all but the wealthiest investors, the pooled alternative has significantly lower costs. As a comparison point, Figure 3-5 also shows the costs (fees charged) for a pooled index portfolio offered by one leading mutual fund vendor. By joining with other investors through mutual funds or other financial intermediaries, an investor can diversify at relatively low costs. For our investor with $100,000, the fully pooled vehicle has costs roughly two-thirds lower than the optimal "direct" investment.

Although this analysis is cast in terms of the current institutional structure of the United States, the lesson has broader applicability: just as economies of scale in production technologies lead firms to demand pooling services, economies of scale in securities transactions cause households to do the same. Without access to pooling, all but the wealthiest households would find diversification impossible to attain.

Liquidity

Households face both predictable and unpredictable needs for cash, whether occasioned by medical emergencies, college tuition, or new home purchases.[17] Households could hold much of their wealth in cash to accommodate potential cash flow needs, but this would severely constrain the returns they could earn. Instead, households prefer to keep most of their wealth invested in real assets, but maintain the ability to make incremental investments or sell some amounts at low frictional costs, which we define as *liquidity.*

Without pooling, a household's ability to buy or sell incremental investments would be limited, as only purchases and sales of *entire* assets would be permitted. Unless its cash needs exactly match the size of its existing assets, the household would bear transactions costs to sell one asset, use a part of the proceeds to fund its immediate cash needs, and then bear additional transactions costs as it reinvests the difference in

16. This analysis ignores differential bid–ask spreads and costs of rebalancing, and places no value on the investor's time spent constructing, tracking, and monitoring the portfolio.

17. In the absence of pooling, the household's demand for liquidity is driven not only by its own needs, but also by the cash flow needs of the firms it finances. A household financing a firm that has seasonal or unpredictable cash flow needs, such as a farm or a toy manufacturer, would need to ensure that it has sufficient cash to fund the firm's peak cash needs.

another business. For example, without pooling, parents funding a child's college education might have to liquidate their investments in businesses.

From the perspective of a potential buyer, however, such a sale would be indistinguishable from a sale motivated by a realization that an investment has poor expected future returns. This is the "lemons" problem that afflicts products whose quality is difficult to discern by inspection.[18] The presence of "lemons" in the resale market lowers average prices for both quality- and liquidity-motivated sellers, making the consumption shocks more costly to households.

The all-or-nothing nature of transactions in a hypothetical no-pooling world precludes owners from sending credible signals that their sales are not motivated by their superior information. If pooling were permitted, the household could continue to hold a portion of the partially disposed asset, and thus signal its continued interest in, and optimism about, the business.[19]

Thus, pooling affects the provision of liquidity in three ways. It separates the liquidity needs of firms from their investors. It permits the partial purchase and sale of assets, which in turn allows households to hold small pieces of large, high-returning businesses. And it reduces the frictional costs of transactions caused by informational asymmetries. By supporting liquidity, pooling therefore reduces a household's needs to hold cash, or conversely increases their ability to fund productive investments.

Monitoring

In a world without multilateral contracts, households, as the sole providers of external capital, must conscientiously monitor the management of the firms they fund. Conflicts of interest will arise between the managers and the household providing the productive capital. For instance, managers, because they are employees, not owners, may not work as hard as the household wants. They may choose excessively safe projects in an effort to preserve their jobs, or they may consume the firm's resources disproportionately through managerial perquisites. These are "agency problems," documented in the work of Jensen and Meckling (1984). Remote owners cannot efficiently structure arrangements so that agents, the managers, will act in their interests. For the household, this complicates

---

18. See Akerlof (1976) for a formal treatment of this problem, or Glosten and Milgrom (1985) and Easley and O'Hara (1987) for application to securities markets.
19. In a world without pooling, other elements of liquidity might actually improve. Search costs to identify potential buyers of entire businesses might actually fall in a no-pooling world because of the strong incentives for private parties to develop efficient markets for the transfer of large investment blocks.

the choice of investment projects and makes risk management all but impossible.

Just as a centralized intermediary can provide efficient diversification and liquidity, so too can it provide low-cost monitoring. The evolution of early pooling ventures, such as nineteenth century New England banks studied by Lamoreaux (1991), demonstrates the relationship of pooling and monitoring. Unsure what investments were of high quality, and with their relatively small amounts of wealth, New England families invested in uninsured deposits of local banks that were dominated by insiders who controlled the boards and the lending policies. Even though these directors often elected to lend a high fraction of bank capital to themselves or their associates, they were known to local depositors to be of good standing, and thus depositors willingly entrusted their funds to these banks. The undoing of many of these banks occurred in the late nineteenth century, when the New England economy was transformed from a net demander to a net supplier of capital, and loans were required to be made at arm's-length. As their directors had never cultivated any credit analysis skills (and perhaps had little interest in depositors' welfare once their own personal firms were financed), their monitoring skills were inadequate, and these banks failed to survive.

Monitoring takes time, effort and skills, as investors must collect, process, and interpret timely information. Some of this monitoring activity is independent of the size of the investment, but economies of effort may be realized as the information gained from monitoring can be used and expensed over a larger investment base. Pooling lets households delegate the monitoring function to professionals who can devote substantial resources to overseeing their firms.

Pooling via multilateral contracts does not eliminate the household's need for monitoring; rather it changes the object of its attention. Instead of monitoring the managers of hundreds of diverse firms, households must watch the managers of a single pool. If this pool manager is in the business of producing information about their investments, the household will benefit if this information is credibly passed along to them at a relatively low marginal cost. If the financial institution is opaque, however, this benefit may not be realized, and the household will have to structure a contract with the pool manager to align their interests with those of the investors.

Summary

Household demands for pooling arise from three sources: a need for efficient risk management through diversification, a need for liquidity,

and a need for efficient monitoring. These three rationales, in conjunction with firms' large capital needs, explain the prominent role pooling plays in virtually all economies—from very primitive to highly developed economies, in both capitalistic and socialistic societies.

Two Multi-level Pooling Mechanisms: Financial Institutions and Financial Markets

Multi-level or multilateral pooling mechanisms that link enterprises and households can be structured in many different ways. Two generic mechanisms are financial institutions (or intermediaries) and financial markets. To illustrate pooling through financial institutions we examine *delegated investment management,* where investors hire agents to identify and manage financial investments. An alternative to this actively intermediated process is pooling through the financial markets in the form of *asset securitization.* Securitization depends on the ability to segregate a collection of financial claims and to restructure their risky cash flows to increase their attractiveness to investors or to lower financing costs for issuers.

Two of many methods to accomplish pooling, these illustrations demonstrate how intermediaries or financial markets serve similar functions. Most pooling mechanisms lie between these two polar cases, incorporating both active intermediation and direct pooling through capital markets. Which method is most appropriate depends on its relative cost as determined by the nature of assets pooled and by the composition of the investor base.

Pooling and Investment Management Services

To obtain efficient diversification, liquidity, and monitoring, households holding lumpy, poorly diversified portfolios could enter into a series of financial swaps with one another. This approach has the disadvantages that monitoring and coordinating the actions of each of the participants is likely to be highly costly; contracting would require the simultaneous consent of many parties; rebalancing might be difficult to execute; and each household would be subject to the complicated, multi-party credit risk of all of the other households unless the contributed assets could be made bankruptcy-remote. Rather than each household dealing with tens, hundreds, or thousands of other households directly, it is more efficient for each household to contract with a single intermediary that provides investment management services, as we have defined multilateral contracting via pooling.

The intermediary may be a relatively transparent entity such as a

mutual fund, whose assets and investment strategies are visible.[20] Or, the intermediary may be more opaque, such as a securities firm, commercial bank, or hedge fund. In either case, the role of the intermediary is to identify feasible investments, select those with suitable performance characteristics, execute the necessary transactions, and distribute the economic returns of these claims to investors. Such an intermediary may be an agent of either the investors, the business enterprise, or both.

Advantages of intermediate pooling. There are at least three conditions under which a financial intermediary or institution can prove to be an efficient pooling vehicle: (1) when the assets require extensive costly monitoring; (2) when the intermediary can acquire information unavailable to or costly to investors; and (3) when the institution can produce claims unavailable in the market.

First, intermediate pooling is effective when pooled funds are used to purchase an asset that requires *monitoring*. Suppose a small firm anticipates cash flow needs for two years to fund expansion, and wants funding from a financial institution in the form of a term loan. Monitoring this investment involves careful observation of the financial position and the actions of the borrower. Covenants may be broken and need to be renegotiated during the loan's life, which makes the loan more difficult to sell to a broad clientele that may lack the skills to monitor performance and renegotiate contracts as needed. Commercial banks regularly confront these problems as issuers of middle-market loans, as do insurance firms that hold privately placed notes. In contrast, Treasury securities require virtually no monitoring and negotiating.

Because the intermediary must actively represent the interests of the ultimate holders of the pool, its contract with investors must align its incentives with theirs, or reflect costs of possible misalignment. Opaque intermediaries, such as banks, for example, could fund themselves solely with equity. The quality of an institution's loan portfolio, however, is not observable, making it difficult for investors to distinguish between a "good bank" and a "bad bank." Townsend (1979) has shown that funding a financial institution through equity will result in inefficient risk-sharing. He shows that it is preferable for a loan originator to issue risky debt to the outside investors and retain a residual claim of the loan for itself. The originator thus reduces the burden of outside monitoring, and is free to

20. In the United States, regulations require mutual funds to disclose their holdings quarterly and to state their investment guidelines in a prospectus. These rules could be made more or less stringent depending on a regulator's objectives. In theory, the open-end mutual fund informs investors about the status of their investments with only the slightest delay.

invest in and enjoy the economic benefits of risky and somewhat opaque projects.[21]

Active intermediation may be preferred when intermediaries can *acquire or process information that investors find unavailable or costly.* This ability may arise from the intermediaries' past investments, scope economies arising from the collection and corroboration of real-time data from multiple sources, economies of scale of information collection, superior valuation models, or its ability to respond quickly to market anomalies. The belief that fund managers have superior information and investing skills is central to mutual fund marketing appeals [Sirri and Tufano (1993b)]. Venture capitalists market a similar set of skills both to investors and to young firms needing capital. Access to the "deal flow" provides a vantage point from which to identify superior investments, and their prior experiences, management skills, and contacts allow venture capitalists to provide entrepreneurs with benefits beyond the risk capital they deliver [Sahlman (1990)]. The case for delegated investment management is also made by hedge funds that profit by taking large arbitrage positions to exploit minute pricing discrepancies uncovered by continuously scanning global markets in real time. For many mutual funds, venture capitalists, hedge funds, and other delegated investment managers, an institution's *raison d'être* is its superior information skills.

Finally, pooling may take place through an institution when *the intermediary produces claims that are otherwise unavailable in the marketplace.* To manage risk, for example, a household may seek insurance against declines in an equity portfolio, or choose a contract that allows it to keep pace with rising college or housing costs. Were these claims not traded in the market, an institution might emerge as the vehicle for delivering them, either by executing a dynamic trading strategy on its customers' behalf or through underwriting, in which the intermediary takes principal risk. As an example of the former, early forms of portfolio insurance delivered equity holders protection against drops in their portfolio using dynamic trading strategies [see Kyrillos and Tufano (1994)]. More recently, risk management investments targeted to households have begun to appear in the form of "life-cycle" funds, with risk/return characteristics matched to the ages of targeted investors. A life-cycle fund may invest more heavily in high-risk securities early in investors' life, deferring capital gains whenever possible. As time passes, the fund's composition might shift to

---

21. We observe this solution in practice in Lamoreaux's (1991) study of New England commercial banking in the 1800s. Bank directors, who were insiders, were the ultimate equity holders in the intermediary, and the outside depositors were issued risky demandable debt.

lower-risk, fixed-income securities. Additionally, the fund might hedge against inflation, and other macroeconomic risks. The fund may trade only in listed securities, but it provides a dynamic mix of the securities that is unavailable otherwise, which gives rise to active intermediation.

In summary, intermediaries may be particularly well-suited to serving as a mechanism for pooling funds when the underlying investments require substantial ongoing information collection, monitoring, recontracting, or trading.

Costs of intermediated pooling. Pooling via intermediaries is not costless. The separation of principals and agents gives rise to predictable and costly conflicts between intermediaries and their customers. Managers of mutual funds have the potential to engage in self-dealing by trading against their own funds. Conflicts of interest among investors and managers of financial pools are perhaps even more pronounced in the banking and savings and loan industries. Here, the existence of a guarantee on the face value of deposits weakens depositors' incentives to monitor management, and the division of claims between depositors and equity holders leads to additional conflicts of interest among the various investors.[22]

Esty (1994) studies these conflicts of interest in savings and loans institutions, focusing on how organizational form affects the propensity of the pool managers (the managers of the savings and loans) to take on additional risk. Increased riskiness benefits shareholders at the expense of depositors (or, in the case of insured deposits, the government insurer).[23] In theory, high levels of equity ownership by managers of savings and loans give them incentives to increase risk, which transfers value from depositors/insurers to shareholders. Esty's evidence is consistent with this hypothesis. He finds that the structure of organizational claims affects risk-taking behavior: Managers of stock institutions and those with greater leverage assumed greater risks than mutual savings and loans and less levered firms.

Judging whether an investment manager has earned a sufficient return for the investment risk borne is a difficult task. The ongoing debate over whether there are any skilled investment managers at all [e.g., see Grinblatt and Titman (1989) or Ippolito (1989)], or whether good performance is just an artifact of an inaccurate measurement technique [Brown,

22. Such a guarantee may be explicit, as it is in the United States at present, or it may be implicit, as in some of the Scandinavian countries and Japan.

23. Equity holders in a levered firm essentially hold a call option on the firm, with an exercise price equal to the face value of the debt. By increasing the volatility of the firm, they will increase the value of their call, leading to what is typically referred to as the "asset substitution" problem, in which equity holders prefer to substitute more risky assets for less risky ones.

Goetzmann, Ibbotson, and Ross (1992)] attests to the difficulty of measuring the investment performance of intermediaries. This performance measurement task is complicated when intermediaries undertake investment strategies as principals by underwriting the financial claim on the firm's own account.

As an example, consider an index-linked savings certificate sold by an investment bank, which promises to pay depositors a return linked to the performance of a stock index, such as the S&P 500 or Dow Jones Industrial Average. These contracts are principal obligations of the issuer, yet the way the issuer funds the obligation is opaque to the investor. An index mutual fund, by contrast, can deliver a similar payout, with the fund manager buying and holding a portfolio of securities in a trust on behalf of the client.

The return to both investments will depend on the level of the S&P, but the return to the investor in the savings certificate also depends on the solvency of the issuer. As Merton (1993) points out, intermingling these risks may be inefficient and costly, and many customers of financial intermediaries prefer their claims to be relatively insensitive to the fortunes of the issuer. As the demand for more finely tailored investment products rises, an increased reliance on principal contracts will make this aspect of intermediated pooling's costs of increasing concern to investors. The market's recent response to these concerns has been to establish high-credit-quality subsidiaries to offer certain products, such as derivatives.

Pooling and Securitization

Though institutions such as banks or mutual funds may play an active and ongoing role in the pooling of household investments, pooling can also be performed more directly in the capital markets through *asset securitization.* Asset securitization is an example of the financial markets' ability to satisfy the pooling function without an ongoing intermediary. In this case, financial intermediaries play an important role in setting up a capital market pool, but typically play a minor role throughout its later life.

In broad terms, a securitized instrument is a traded financial asset representing a direct claim on the cash flows of a segregated collection of assets held in a special-purpose trust. Although this definition is broad enough to include trusts whose underlying assets are liquid claims, such as closed-end mutual funds, we focus on underlying assets that are not actively traded in efficient and liquid markets. Securitization facilitates the pooling of wealth in three instances: (1) when the assets pooled are homogeneous in nature; (2) when assets do not require substantial ongo-

ing monitoring and servicing; and (3) when liquidity can be added to otherwise illiquid assets through liquidity stripping.

To create a securitized asset, an underwriter or originator initially collects a portfolio of financial assets, segregates them into a trust, and then writes a collection of financial claims against this trust. Identifying appropriate claims to be placed in the trust involves considerable skill, as does the process of distributing the resultant securitized claims to investors. Once these processes end, the originator or underwriter generally has only a minimal role in the management of the pool. Most often the role is administrative, and quite often the underwriter bears no risk after the pool is distributed.

The types of assets amenable to securitization as a pooling mechanism are somewhat restricted. First, the assets to be securitized must be of a *relatively homogeneous nature.* Because there is no investment manager to act as the investors' agent and as an intermediary, the probability distributions for the cash flow from the pool must be transparent. In one instance, a relatively small number of assets are securitized so that investors in the trust can assess the riskiness of each asset individually. For example, investors in a real estate investment trust that holds a few properties can observe them, assess their condition, and verify the likelihood of the future promised cash flows. More frequently, however, a securitized pool includes many assets whose risk/return characteristics are homogeneous so that investors can rely on statistical information to estimate the pool's cash flows. Issuers and underwriters of such securitizations generally provide investors with data about the historical realizations of payments, default rates, and credit status.

The most important example of such a vehicle is the mortgage-backed security (MBS), which has revolutionized housing finance in the United States. The pooling of groups of similar home mortgages into a trust, in part bypassing costly intermediation by depository institutions, allows investors to fund housing directly. Prepayment and default rates, which are important in determining a mortgage security's value, can be modeled from historical data.

The second instance in which securitization facilitates pooling is when the underlying assets require *little individual servicing or monitoring.* It is difficult to structure a contract giving agents the proper incentives to service and monitor the assets in a securitized pool. The holders of the securitized claim are the beneficiaries of the servicing or monitoring, but all the costs are incurred by the servicer, who may have limited financial interest in the pool. At the same time, a large number of assets makes it impractical for investors to verify servicing quality. Thus, securitization seems most applicable when ongoing servicing is quite limited, such as

for home mortgages. The mortgage holder collects and distributes payments, and initiates default procedures if payments are not made. Renegotiation of such a loan is quite rare. In addition, third-party guarantees of the securitized pool, provided by the government or private parties, eliminate servicing quality from investors' concerns about the security.[24] Securitization has been used successfully to finance a wide range of assets, including accounts receivable, and loans for autos, boats, and mobile homes.

One place asset securitization has failed to date to make much headway because of the need for ongoing monitoring is in financing commercial bank portfolios of commercial and industrial (C&I) loans. As of mid-1994, U.S. commercial banks had $603 billion worth of C&I loans on their portfolios. Banks, which are opaque financial institutions, could potentially lower their costs of funding high-quality C&I loans if they could segregate and fund them separately from the rest of their assets. Although banks might like to segregate loans and sell them to the capital markets, these loans require detailed and continuous monitoring by the lender, and typically involve renegotiation of contract terms, security, loan covenants, and loan maturity over their life. Incentive contracts may provide for banks to share in the loan losses, but such an arrangement requires loans to remain on the banks' regulatory accounting books, increasing capital charges.[25]

A third instance when pooling may take the form of securitization is when bundling assets *enhances the liquidity* or lowers the cost of trading securities. Large bid–ask spreads represent payments from buyers and sellers, as a group, to compensate market makers for holding inventory and for bearing losses resulting from trading with informed buyers and sellers. The market maker must not only finance these shares held in inventory, but also bear the risk of adverse price movements. Market makers will also lose in trading with informed parties, and because of adverse selection, traders will be drawn disproportionately from those who are informed.

For infrequently traded securities, and for those with high degrees of informational asymmetry, large bid–ask spreads are common. Traditionally, intermediaries served as the vehicle to fund these types of firms and projects. We have recently begun to see asset securitization accomplish

---

24. An important innovation in this market was issuance by the government of a guarantee on the ultimate payment of the principal of the mortgage. For a discussion of such guarantees, see Bodie and Merton (1992).
25. One place C&I loan securitization has been successful is in the case of Fremont Financial Corporation, a small non-bank intermediary that lends to middle-market borrowers on a fully secured basis. For a discussion, see Sirri (1994).

this pooling task and, in so doing, enhance liquidity in these assets through the process of liquidity-stripping. The bundling of many illiquid assets diminishes the market maker's risk of suffering by trading with informed traders, as the informed must have superior information about the *entire bundle* of assets. Furthermore, bundling increases the traded asset's unit scale of and frequency of trading, reducing the relative inventory a market maker must hold. These factors can reduce the required bid–ask spread.[26]

Consider an investor who would like to invest in a diversified portfolio of international securities for one month, but finds the round-trip spreads charged on national exchanges too large to justify the investment.[27] As an alternative, the investor can purchase the securities, place them in a trust, and then sell over-the-counter claims against the entire portfolio of illiquid stocks to shed all or some of the exposure. The claims sold can be equity swaps, options, or pure equity participations in the pool. The sale is executed on a diversified portfolio so that informational concerns vanish (it is improbable for an investor to have credible private information about a large group of firms). Liquidity problems are minimized as well, because the diversified portfolio claim is an attractive and often traded security among passive and quantitative international equity managers. A clear example of this can be seen in formation of a diversified portfolio composed of individually purchased shares of stock in the S&P 500. Buyers of stocks encounter spreads of 50 basis points, but buyers of a pooled substitute (index futures) face 3 basis point spreads.

This form of securitization immobilizes the underlying assets once purchased, and subsequent trading can be accomplished through securitized OTC or exchange-traded claims. We see this structure used by Leland O'Brien Rubinstein in their SuperTrust products. The underlying asset purchased is a basket of S&P 500 stocks, and against these immobilized assets a variety of claims are carved out.[28] The immobilized basket of 500 stocks need never be traded, but the claims written against them could trade freely—at far lower transactions costs and higher liquidity than the underlying basket.

Limits to Multilateral Pooling

Will financial systems ultimately be populated with mammoth multilateral pools? Focusing on the benefits and costs of pooling, increasing size

---

26. See Merton (1993).
27. Perold and Sirri (1994) document that one-way all-in cost for a U.S. investor trading a portfolio of EAFE stocks is 1.39%.
28. See Kyrillos and Tufano (1994).

beyond a certain point may not be economical. The benefits of diversification level off after a certain point: Adding additional securities to an already well-diversified portfolio has virtually no impact on the reduction in risk. In the case of monitoring, larger pools may have greater bargaining power in negotiations with the firms in which they invest, although these gains must be offset by costs that households bear in overseeing a large pool manager. To capitalize on security selection skills, larger pools may be efficient in that they allow a skilled investment manager to identify mispriced securities and buy more of them rather than less. It has been shown that excessively large pools may be disadvantaged, however, facing higher costs of executing trades, especially for thinly traded securities.[29] Finally, beyond some point, identifying investors may become prohibitively expensive, especially given that marketing costs can account for perhaps as much as half of a fund's expenses [Sirri and Tufano (1993b)].

We should recognize, however, that the activities undertaken by pools need not be accomplished in one organization, and thus it might be oversimplistic to discuss the "size" of a pool. For example, the pooling of capital to fund home mortgages has been decomposed: Loan origination, loan servicing, and capital raising have been separated. The optimal size for each of these activities within the multilateral pool might be different.

Has pooling progressed to its most "mature" form? No, continuing evolution is almost certain. Shortcomings in legal structure and contract rights continue to be impediments to advances in pooling. Although we might tend to overlook the impact of the legal system on pooling, effective pooling technologies like securitization require an ability to freely transfer ownership of assets such as mortgages and to pass the attendant cash flows and legal obligations through the securitization structure.

In some countries and market sectors, laws and regulations on the transfer of property stymie the development of securitization. In Japan, for example, one step toward facilitating securitization was the 1993 passage of a law that simplified the transfer of property: through this law, perfection of the transfer is expedited, doing away with some of the formalities of the general law.[30] Though securitization is thought to be well-developed in the United States, laws and regulations in certain sectors prevent further advances. In the health care field, for example, laws and tax regulations make the transfer of receivables difficult. Some critics have argued that changes in these laws will facilitate securitization and in turn lower health care costs.[31] The future evolution of pooling,

29. See Perold and Salomon (1991).
30. See Lawden (1993).
31. See Salathe (1994).

especially through securitization, cannot be separated from legal and regulatory developments.

Perhaps more important, advances in information technology and financial engineering technology will support evolution of pooled vehicles. Improvements in information technology have driven certain types of transactions costs to the point that structures are now possible that could not have even been imagined 30 years ago. For example, a single credit card securitization might pool several million accounts; the flows to investors represent the ongoing receivables charged to each of the accounts included in the pool. This transaction is only feasible given low data-processing costs to assemble timely information on credit card payments and balances.[32] If the widely distributed communications technologies such as the Internet become the primary means of moving both information and funds, the costs of marketing, reporting, transfer, and customer service of most financial transactions would likely fall dramatically.

While we cannot predict the exact changes that these shifts in costs will have, almost certainly they will give rise to new means of pooling. Even today, we see financial services firms and information service providers positioning themselves to capitalize on new means of marketing financial products to consumers. With a new and low-cost channel to household saving, we could witness future innovations as dramatic as last decade's pooling of millions of credit card receivables.

Financial engineering technology is also likely to have a great impact on pooling. Traditional multilateral pools such as banks or mutual funds have offered investors relatively standardized investments. For example, most mutual funds offer investors a single claim: a pro rata claim in the equity of the pool. One could imagine an indexed pool that is more customized: The pool would hold a broad-based index and each investor could choose whether to incorporate downside protection or to limit or augment exposure for rises in the index. Obviously, the investor could create these positions by investing in the pure index fund and then acquiring puts and calls separately. Or, the pool could offer the customized index claims by aggregating the demands of investors and buying or manufacturing the necessary derivatives to manage the net exposure of the pool. Although individuals could create these customized investments on their own, institutional investors are likely to enjoy lower costs of designing, monitoring, and executing the necessary derivative trades, especially for customized products such as those indexed to real (as opposed to nominal) returns.

---

32. For a case of asset-backed receivables, see Mason et al. (1995), pp. 287–330.

The future of pooling may be toward "mass customization," where the efficiency gains of large size are combined with the benefits of tailoring products to individuals' needs. Mass customization has been a topic of great interest among strategists, manufacturing experts, and marketers, and may describe future developments in pooling as well. Continued development and validation of pricing and risk management models will support this latent trend toward tailoring financial products to the needs of suppliers and demanders of capital. Of course, these developments must be supported by—or at least not be impeded by—laws and regulations.

Summary

Pooling is so pervasive in financial systems that it can easily be taken for granted. It aggregates wealth and facilitates large indivisible investments, benefiting both owners of productive firms and investors. Without access to multiple investors through multiple bilateral contracts, owners of firms that demand capital would be forced to operate their businesses at scales far below the optimum level for productive efficiency. Hence, the ability to pool wealth is a requirement for efficient production, and firms require well-developed pooling mechanisms to access sufficient low-cost funds.

Investors need to put their surplus funds to work and manage the risks of their portfolios. If restricted to investing in whole operations, investors would hold inferior investment portfolios, deprived of the benefits of diversification and liquidity that arise from investing in a large number of different firms. Thus, their desire to modify the risk/return characteristics of their investments at low cost forces investors to seek pooling, particularly the multi-level form of pooling, in which they join with other investors to fund many enterprises simultaneously.

If firms need external funds to produce efficiently, and individuals need investments to earn high returns per unit of risk, the two parties share a desire to reduce costs. At its core, pooling achieves these tandem goals. From a firm's perspective, pooling allows production at levels of technology and scale so that unit costs are minimized. From an individual's view, pooling helps achieve the highest return per unit of risk because it permits economical risk-sharing.

Although pooling can primarily be thought of as a means to minimize costs, both of firms and of individuals seeking diversification and monitoring, it serves other functions. Pooling provides households and firms with liquidity, facilitating the purchase and sale of incremental amounts of firm ownership. Furthermore, it plays a role in the distribution of wealth, by allowing the less well-to-do a chance to join with others to invest in profitable assets that otherwise would be out of reach.

Pools can be designed in many different ways. When extensive monitoring, renegotiation, and servicing are required, pooling may best be accomplished through a financial intermediary that maintains an active role throughout the life of the investment. In other cases, where the assets require less ongoing maintenance, direct pooling through securitization may be preferable.

The evolution of pooling has been shaped by legal and technological developments. Nations' laws have clearly affected the type of pooling that has taken place. Pooling as we know it presumes that entities such as corporations can be endowed with certain legal rights, including the rights to hold and to transfer property. Important legal developments centuries ago supported bilateral contracting through the creation of the corporate form. Important legal developments today remove impediments to the transfer of title to pooled vehicles.

Technological developments have also affected pooling. Most recently, computing technology has made possible securitization in which literally millions of individual claims are bundled together and sold to investors. Further developments in information technology and financial engineering are likely to affect pooling in the near future. Of these, the possibility of "mass customization" of multilateral financial pools presents an intriguing possibility combining the efficiency gains of large pools with the delivery of tailored financial services such as risk management.

Appendix A: Household Wealth and Enterprise Funding Needs, 1991

Data on individual/family wealth and total financial claims on public firms are collected from several sources. For individual and family wealth, data come from *Fortune* [Losee (1992)] and *Forbes* [Seneker (1992)]. The combined set contains 326 family groups residing in 42 countries. Where dollar amounts differ for the same family or individual, the *Forbes* number is used. All individuals within the same family group (immediate family, related by marriage, or related and having the same last name) are combined. *Forbes* and *Fortune* estimate "net worth" and "wealth" using estimates of the market value of the families' wealth.

Data used to calculate the total amount of financial claims on a given company are compiled from Global Vantage, a financial reporting package similar in form to COMPUSTAT, but including financial accounts from many of the largest non-U.S. companies. By its construction, Global Vantage includes data only on the larger foreign companies and those with accessible financial accounting. Since our analysis is concerned mainly with publicly traded companies having total financial claims of $1 billion or more, this limitation should not produce any significant bias.

To collect company-specific data, the database of over 8,000 companies is first screened to eliminate those companies without any publicly available market value (i.e., those without any publicly traded securities or without publicly available price quotations on the securities). From this subset (over 7,000 companies in 35 countries), the value of all financial claims on each company is calculated.

Total financial claims are defined as all external debt and equity of the consolidated company. The variable DT (defined as long-term debt plus short-term borrowings) is used for total external debt valued at book value. For total equity, the variables PCAPT, MIB, and MKVALI are summed. PCAPT, or total preferred capital, represents the total book value of all types of preferred stock outstanding. As with debt, book value is considered the closest available proxy for market value. MIB, or minority interest as a balance sheet item, captures the value of any external financial claims or subsidiaries. Finally, the variable MKVALI represents the total market value of the company's common equity. All values are translated into dollars at the first fiscal year-end rate. Where separate market values for different classes of equity of the same company are listed, these are combined into one aggregate market value data item.

Available company data are then compared to family wealth data. Twenty-two countries have both available company information and families or individuals with wealth of $1 billion or more.[33] The full data set for these 22 countries includes 2,218 companies with total financial claims of $1 billion or more, and 269 families or individuals with wealth of $1 billion or more.

A family or individual is considered able to finance a given firm if the total wealth of the individual/family is equal to or greater than the total value of financial claims on that firm. The individual or family is always considered able to finance the largest firm possible (ranked by total financial claims). If more than one individual/family is able to finance a firm, the wealthiest individual/family is used, and the remaining individuals/families are able to finance the next-largest-claims company, and so on. Where one individual/family is able to finance more than one firm (as in the case of Liechtenstein), all firms able to be financed are noted.

---

33. For 20 countries, the *Forbes* and *Fortune* lists note the presence of billionaires, although no firms appear on Global Vantage as having publicly traded shares and external claims of $1 billion or more. These countries are: Argentina, Brazil, Brunei, Chile, Colombia, Greece, India, Indonesia, Israel, Jordan, Kuwait, Lebanon, Macau, Morocco, Philippines, Saudi Arabia, Taiwan, Turkey, UAE, and Venezuela. Thirteen countries had firms with publicly traded claims and external funding in excess of $1 billion, but no billionaires according to the *Forbes* and *Fortune* lists. These are: (Netherlands) Antilles, Belgium, Bermuda, Cayman Islands, Finland, Ireland, Liberia, Luxembourg, New Zealand, Norway, Panama, Papua New Guinea, and the (British) Virgin Islands.

In the case of several individuals/families all having exactly $1 billion in wealth, companies under $1 billion in total claims are included in the "$1 billion +" category until the individual/family list is exhausted, with the sole exception of Mexico, where there are more families/individuals than firms with $1 billion in wealth/claims and less. Accordingly, one individual and one family are not used, each having total wealth of $1 billion.

Appendix B: Household Wealth and Enterprise Funding Needs, 1924

Data on individual/family wealth and total financial claims on public firms come from several sources. For individual and family wealth, a data set is compiled from Lundberg (1937). Lundberg estimates the gross fortune of each individual or family group as of 1924. Total calculated fortune is derived from aggregate income disclosed on 1924 tax returns. Lundberg characterizes his estimates as conservative, given the other sources of hidden income common at the time. The total data set includes 60 families.

The largest 100 companies from 1917, ranked by total asset size, are identified using a list compiled by *Forbes* (1987). The largest 50 railroads of 1917, as reported by the U.S. Interstate Commerce Commission (1919), are then determined. The two lists are combined, yielding 146 data items (four railroads are included in the *Forbes* list).

Total financial claims are defined as total debt plus equity, measured at book value. Book value is defined as capital stock (both common and preferred) plus any surplus account. The companies' 1917 financials come from Poor's Manuals, the Interstate Commerce Commission report on railroads, and, in some cases, actual annual reports.[34] Each company is then ranked by total financial claims.

A family or individual is considered able to finance a given firm if the total wealth of the individual/family is equal to or greater than the total value of financial claims on that firm. The individual or family is always considered able to finance the largest firm possible (ranked by total financial claims). If more than one individual/family is able to finance a firm, the wealthiest individual/family is used, and the remaining individuals/families are taken as able to finance the next-largest-claims company, and so on.

To determine which families/individuals would qualify as billionaires

34. Data for four banks (First National City Bank, Guaranty Trust Co. of N.Y., Chase National Bank, and National Bank of Commerce) are obtained from annual reports, year ending 1917.

in 1993, the CPI index is used to adjust each wealth figure to 1993 dollars. Given this methodology, only those individuals/families with 1924 wealth of $125.6 million or more are considered equivalent to today's billionaires.

References

Akerlof, George (1976), "The Market for Lemons: Quality Uncertainty and the Market Mechanism," *Quarterly Journal of Economics,* 84, (3): 488–500.

Compustat Global Vantage. *Automotive News,* (1993), May 26: 3.

Bodie, Zvi, and R.C. Merton (1992), "On the Management of Financial Guarantees," *Financial Management* (Winter): 87–109.

Brown, S.I., W. Goetzmann, R. Ibbotson, and S. Ross (1992), "Survivorship Bias in Performance Studies," *Review of Financial Studies,* 5: 553–580.

Dewing, A.S. (1934), *Study of Corporate Securities,* New York: Ronald Press.

Easley, David and Maureen O'Hara (1987), "Price, Trade Size, and Information in Securities Markets," *Journal of Financial Economics,* 19: 69–90.

Esty, Ben (1994), "Organizational Form, Residual Claims, and Incentives: A Study of Risk-Taking in the S&L Industry," Harvard Business School Working Paper, Boston.

Glosten, Larry, and Paul Milgrom (1985), "Bid, Ask and Transaction Prices in a Specialist Market With Heterogeneously Informed Traders," *Journal of Financial Economics,* 14: 71–100.

Grinblatt, Mark, and Sheridan Titman (1989), "Mutual Fund Performance: An Analysis of Quarterly Portfolio Holdings," *Journal of Business,* 62: 393–416.

Investment Company Institute (1993), *Mutual Fund Fact Book,* Washington, D.C.: ICI.

Ippolito, Robert (1989), "Efficiency with Costly Information: A Study of Mutual Fund Performance, 1965–84," *Quarterly Journal of Economics,* 104: 1–23.

Jensen, Michael C. (1993), "The Modern Industrial Revolution, Exit, and the Failure of Internal Control Systems," *Journal of Finance,* 48 (3): 831–880.

Jensen, Michael C., and William H. Meckling (1984), "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," in *The Modern Theory of Corporate Finance,* Michael C. Jensen and Clifford W. Smith, Jr., eds., New York: McGraw-Hill.

Kyrillos, Barbara, and Peter Tufano (1994), "Leland O'Brien Rubenstein Associates: SuperTrust," Harvard Business School Case No. 294-050, Boston.

Lamoreaux, Naomi (1991), "Information Problems and Banks' Specialization in Short-Term Commercial Lending: New England in the Nineteenth Century," in *Inside the Business Enterprise,* Peter Temin, ed., Chicago: University of Chicago Press.

Lawden, James (1993), "Japanese Securitization—In for a Major Boost?" *International Financial Law Journal,* (9): 29–31.

Losee, Stephanie, and Ani Hadjian (1992), "The Billionaires List," *Fortune,* September 7: 98–138.

Lundberg, Ferdinand (1937), *America's 60 Families,* New York: The Vanguard Press: 26–27.

Markowitz, Harry M. (1959), *Portfolio Selection,* New Haven, CT: Yale University Press.
Mason, Scott, Robert C. Merton, André Perold, and Peter Tufano (1995), *Cases in Financial Engineering,* Englewood Cliffs, N.J.: Prentice Hall.
Mayshar, Joram (1979), "Transaction Costs in a Model of Capital Market Equilibrium," *Journal of Political Economy,* 87 (4): 673–700.
Merton, Robert C. (1993), "Financial Intermediation: A Functional Perspective," Harvard Business School Working Paper No. 93-020, Boston.
——— (1987), "A Simple Model of Capital Market Equilibrium with Incomplete Information," *Journal of Finance,* 42 (3): 483–510.
Perold, André (1993), "BEA Associates: Enhanced Equity Funds," Harvard Business School Case 293-024, Boston.
Perold, André, and Robert Salomon (1991), "The Right Amount of Assets Under Management," *Financial Analysts Journal,* 47 (May/June): 31–39.
Perold, André, and Erik Sirri (1994), "The Cost of International Equity Trading," Harvard Business School Working Paper (May) Boston.
Rhys, Garel (1989) "Smaller Car Firms—Will They Survive?" *Long Range Planning,* 22 (5): 22–29.
Sahlman, William A. (1990), "The Structure and Governance of Venture-Capital Organizations," *Journal of Financial Economics,* 27 (2): 473–521.
Salathe, Gregory (1994), "Reducing Health Care Costs through Hospital Accounts Receivable Financing," *Virginia Law Review,* 80 (2): 549–576.
Scherer, F.M. (1980), *Industrial Market Structure and Economic Performance,* Chicago: Rand McNally College Publishing.
Scott, W.R. (1911), *The Constitution and Finances of English, Scottish, and Irish Joint Stock Companies to 1720,* Cambridge: Cambridge University Press, 3 volumes.
Seneker, Harold, ed. (1992), "The World's Billionaires," *Forbes,* July 20: 148–224.
Singh, A., and J. Hamid (1992), "Corporate Financing Decisions in Developing Countries," Technical Paper, International Finance Corporation: 11–43.
Sirri, Erik R. (1994), "Fremont Financial Corporation," Harvard Business School Case 294-054, Boston.
Sirri, Erik R., and Peter Tufano (1993a), "Buying and Selling Mutual Funds: Flows, Performance, Fees, and Services," Harvard Business School Working Paper 93-017, Boston.
——— (1993b), "Competition and Change in the Mutual Fund Industry," in *Financial Services: Perspectives and Challenges,* Samuel L. Hayes, III, ed., Boston: Harvard Business School Press.
Statman, Meir (1987), "How Many Stocks Make a Diversified Portfolio?," *Journal of Financial and Quantitative Analysis,* 22 (3): 353–363.
Thygerson, Kenneth (1993), *Financial Markets and Institutions,* New York: HarperCollins.
Tirole, Jean (1988), *The Theory of Industrial Organization,* Cambridge: MIT Press.
"The Top 100—1917" (1987), *Forbes,* July 13: 122–123.
Townsend, Robert (1979), "Optimal Contracts and Competitive Markets with Costly State Verification," *Journal of Economic Theory,* 21: 265–293.

U.S. Interstate Commerce Commission (1919), *Statistics of Railways in the United States for the Year Ended December 31, 1917*, Washington: Government Printing Office.

Ward's Automotive Yearbook 1993, Ward's Automotive International, Southfield, MI: 59. Compustat Global Vantage.