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Discontinuities in the Distribution of Great Wealth: Sectoral Forces Old and New

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ANALYTICAL APPROACH

Economists usually examine wealth as a combination of inheritance, income, savings, and investments, and typically analyze the relationship of these factors to human capital attributes to explain wealth disparity between different individuals and social groups. From this perspective, the lower the level of economic resources the lower the likelihood of accumulating wealth, whether directly or indirectly as a return to human capital investments such as education. In the only published academic study of the "Forbes Four Hundred," for example, Canterbery and Nosari (1985) explore a "vita" or life-cycle theory of personal wealth distribution. While inheritance and conservation of wealth through asset diversification are expected to yield average or linear rates of return, entrepreneurship and rentmanship are predicted to provide exponential growth rates in wealth; the sector location of wealth is presumed most relevant with a career or mature vita, where returns vary with monopoly power. OLS regression results with the 1982 Forbes data confirm the importance of inheritance and active employment as explanatory variables. Although differential rates of return by sector are also evident, Canterbery and Nosari (1985: 1082) conclude that for the "super-rich it would be impossible to assign these returns to human capital (enterpreneurship) or physical capital (rents)."

Sociologists often study the social contexts in which wealth dynamics operate, with a focus on how structural impediments affect the stratification of economic opportunity and outcomes by race, ethnicity, and gender. In comparison to white Americans, for example, the wealth accumulation prospects of black Americans are adversely affected by lower levels of access to housing and lending markets, as a function of institutionally-based racial discrimination and weak bargaining power (Oliver and Shapiro 1995: 36-37; 8-9). It is common practice when using income surveys as data sources to take earned income as a return to attributes either of workers, employment status, and/or human capital; sometimes income is used as a proxy for wealth. We are interested more broadly in the division of labor within society, and in the distribution of wealth by economic sector. In our view, differential returns to employment and human capital, and differential outcomes for demographic groups, vary by sectors of business activity.

In a provocative 1907 publication G.P. Watkins (1907/1971:140-47) studied the types of property and enterprise most conducive to the generation and concentration of wealth. He thought that the "agglomeration of riches" depended on the form of capital and the area of the economy in which it was employed, rather than on political power or personal attributes. Using lists of American millionaires published by the New York Tribune in 1892 and the World Almanac in 1902, Watkins classified large fortunes by occupational sectors. Rentiers and

financiers were conspicuous on both lists, while the Tribune list in particular showed that agriculture generated relatively few millionaires compared with manufacturing, transportation, and mining. Watkins thought agriculture was a diminishing source of great fortunes because at that time it was not based on large-scale production and the corporate form of organization, two defining elements of industrial capitalism.

Almost one-fourth of the millionaires listed by the World Almanac were identified as "capitalists," a type whom Watkins (1907/1971: 37, 147) characterized in the case of bankers by the telling phrase "curators of abstract property." He recognized that "abstract property," paper property like stocks, bonds, and mortgages, facilitated the concentration of ownership and control through an "unearned increment," through asset appreciation and compounding interest rather than through earned-income acquisition. According to Watkins, the increasing scale of industrial production and expansion of abstract property undermined small-scale entrepreneurs who directly administered instruments of production and facilitated the growth of large fortunes.

Like Watkins, W.D. Rubinstein (1981:10) employed a classification of economic sectors in his study of elite fortunes. However, his research on the very rich in Britain after the Industrial Revolution was based on probate records, with a focus on all persons leaving half-million to million pound fortunes from 1809-1939. Rubinstein sees "place" in the economy as more important than entrepreneurial effort in the acquisition of great wealth. Skeptical of "self-made" notions of wealth accumulation, he shows that Britain,s wealthy were widely distributed geographically and in terms of socio-economic origins, politics, and religion (1981:100). His analysis of economic sectors suggests that industry has been overemphasized as a source of British wealth; historically, Britain,s largest fortunes were concentrated in commerce and finance rather than in manufacturing, as had been assumed (1981:61).

The work of Watkins and Rubinstein informs our own inquiry on wealth elites. We also adopt the individual or family as the unit of inquiry at the data compilation stage, and use economic sectors as classification and analytic categories. Like Watkins, we rely on popular press rosters of the very rich as a data source.

Data Source

The idea of publicizing a "top 400" roster dates back to Ward McAllister,s 1892 registry of the upper social class in New York society, which actually contained roughly 300 names and only a small share of the richest men of the time (Forbes, October 28, 1985, 83-88; Mills 1956, 54-55). Reincarnations of the idea include "The New 400," a roster of the American "aristocracy of achievement," presented by Igor Cassini in 1953, and the "Metropolitan 400" as described by C. Wright Mills (1956: 47-93) in The Power Elite. In 1982 Forbes launched an annual special edition that profiles the 400 richest individuals, entitled the "Forbes Four Hundred." Forbes appended a supplementary roster of great family fortunes, and in 1987 both Forbes and Fortune magazines introduced annual special editions on world billionaires.

Business press in other countries emulated the "Forbes Four Hundred" model, including a Forbes affiliate in Germany (Forbes von Burda), Business Review Weekly and Australian Business in Australia, the London Sunday Times and Money magazine in Great Britain, and the Financial Post in Canada. These publications provide brief factual and slightly anecdotal profiles of elite wealth holders, with coverage of the size and sector locations of wealth. Data on a wide range of other attributes such as age, sex, personal residence, marital status, and family and business background, are less regularly reported; educational attainment and political, civic, leisure, and religious activities rarely appear.

For this paper we focus on the 1982-99 "Forbes Four Hundred" lists. Both individual and family fortunes appearing in these special editions are eligible for our analyses, including those profiled in an addendum by Forbes as "near misses" (those whose net worth fell just below the minimum threshold for top four hundred status). We exclude cases that Forbes removed because they found substantial errors in an original valuation, but we retain those identified each year as "left behind," "declined," and "deceased."

The most difficult task in cross-year coding of cases to be included in our cumulative database was to ensure against wealth doublecounts or undercounts due to surname changes or to splitting or combining fortunes based on kinship ties. For example, siblings may qualify as individuals one year but subsequently become combined by Forbes into one family-level case; this was an interim status of the H.L. Hunt brothers before they were removed from the roster owing to financially-ruinous speculation in silver futures. We also control for wealth successors when inheritance due to death occurs within the span of the time series. In our cumulative file, for example, we retain only the siblings, spouse, and offspring of Sam Moore Walton, even though he was also listed until his death in 1992. The wealth of his heirs rose dramatically in 1993.

Kinship coding contingencies are best illustrated in the "Forbes Four Hundred" history of the du Ponts family line. Of the six du Pont families and thirty-eight du Pont individuals who have appeared in the 1982-99 Forbes rosters, we retain only three of the families and twenty-six of the individuals, due to complex overlaps of cases across years. The du Ponts trace their American origins to Pierre Samuel du Pont de Nemours (1739-1817), who fled revolutionary France for the new United States in 1800, and to his son Eleuthère Irénée du Pont (1772-1834), who in 1802 founded the gunpowder factory that became the conerstone of the family business fortune. Numerous descendants of Eleuthère now control roughly 15% of the company stock, but not as a cohesive unit, for the family business history is rife with feuds as well as partnerships that affect the distribution of du Pont wealth by particular families and individuals.

Appendix I identifies the years that various du Ponts have appeared in the Forbes rosters, how each is represented in our cumulative database, and whether particular families sided with, remained neutral, or opposed Pierre Samuel II when he presided over a definitive family/firm split in 1915 (in addition to Forbes, see: Colby 1984; Mosley 1980; Chandler and Salsbury 1971).

We give precedence in our aggregate file to latest entries over earlier kinship configurations, with the exception of the 1999 entry for the family of Pierre Samuel II, due to ambiguous data on overlaps with individual du Pont heirs over several years. We tend to use the most recent profile of cases to code net worth, inheritance, and the sector locations of fortunes. For some cases we depart from Forbes coding, especially in regard to underreports of inheritance. Inconsistency in coding of inheritance is evident across years, especially when great wealth transfers within the time series follow death.

Net worth valuation rules used by Forbes, restated in each edition as "Rules of the Chase," vary by sector but appear to be applied consistently; see Canterbery and Nosari (1985: 1076-77) for a detailed description of the original (1982) rules. Estimates for privately-held firms are based on earnings multipliers that prevail for comparably-sized publicly-traded firms in the same sector. Forbes profiles often specify more than one economic sector per case, in order of contribution to net worth, but amounts of holdings by sector are not disaggregated. Accordingly, we assign net worth to the chief sector, even though that poses awkward measurement problems.

Sector Typology

In constructing our typology we grouped Forbes business/asset keywords into sector categories, but our classification strategy was not dictated solely by conventional approaches. Since we are interested in the sector locations and determinants of great wealth, rather than the general shape of the economy, our typology is based on two dimensions of differentiation:

1. economic functions of business enterprise; and
2. attributes of economic capital as generators and stores of wealth.

Table 1 lists the categories of our sector typology, which contains two levels of classification.

Table 1. Categories of Sector Typology	
Finance (Holdings & Services)	**Electronic Technology** (Hardware & Software)
Financial Holdings	Components
Financial Services	Hardware
Property (Holdings & Construction)	Software
Property Holdings	**Trade & Transport** (Commercial Distribution)
Property Construction	Trade
Resources (Non-renewable & Renewable)	Transport
Resource Extraction (Non-renewable)	**Retail Sales** (Consumer Distribution)
Resource Cultivation (Renewable)	Specialized
Capital Goods (Material Conversion)	Diversified
du Pont	**Mass Media** (Print & Electronic)
other Capital Goods	Publishing
Consumer Goods (Non/Semi-Durables)	Broadcasting
Food & Beverages	Telecommunications
Pharmaceuticals	Diversified Media
Clothing	**Services** (Personal & Commercial)
Personal & Household Care	Leisure and Travel Services
Industrial Technology (Hardware/Durables)	Professional & Human Services
Supplies	Business Services
Vehicles	
Equipment	

Main sector heads are distinguished by economic function, for example, capital and consumer goods production versus trade/transport as goods distribution. Within main sector groups we draw distinctions based less on functional specialization than on different attributes of capital that presumably affect economies of scale, cash flow, profit margins, and wealth returns. The notions advanced by Watkins (1907/1971) of "abstract property" and "unearned increments" also figure prominently in our typology as sources of sub-group differentiation.

Our approach draws in part on the seminal tripartite system of primary, secondary, and tertiary production, where economic function is the basis of sector differentiation. Pioneered by Fisher (1939) and Clark (1940), this approach found wide application in the social sciences. Bell (1973), for example, charts the decline after World War II of "goods production" both in absolute terms and relative to the rise of "service production." For Bell, "goods production" encompasses primary and secondary production, business enterprise such as agriculture, mining, construction, and manufacturing, all of which are based in the production of physical capital, the transformation of raw material into component or finished goods. In contrast, "service production" includes tertiary sectors, those based in the distribution of physical capital, notably trade and transportation, or in the provision of financial or human capital, such as finance, insurance, real estate, government, or services per se (personal, professional, or business). Bell (1973: 134, original emphases) shows substantial change not only in the places where people work (employment by sector), but also in the kind of work they do (work tasks and roles), with a reduction in farm and blue-collar work and growth of service and white-collar occupations.

Sector differentiation based on economic function remains a fruitful approach for the study of business enterprise in general, and our typology does distinguish goods producers from goods distributors, and both from service providers. However, further distinctions are required when the object of inquiry is great wealth, where holdings tend to be owned as financial assets and where sector development occurs within rather than between businesses. The wealth of Forbes cases across sectors is owned primarily as abstract property, e.g., articles of incorporation for privately-held firms, publicly-traded securities, and real estate investment vehicles. There are rare exceptions where net worth is dominated by the value of personalty or realty (as personal residential property), rather than of abstract property. Yet even where wealth is based on holdings (notably oil reserves) that do not directly comprise productive enterprise the value of such assets is determined by commodity exchange dynamics of financial markets.

We do not imply, however, that most cases should be classified as "abstract property," which would conflate the form in which assets are expressed and exchanged with the sectors in which wealth is generated and stored. New sector formations also complicate the task of compiling business asset keywords into typology categories. Gershuny (1987), for example, views the reaggregation of occupations within producer services as a partial reversal of the division of labor. The evolution of Sears Roebuck illustrates how vertical integration proceeds

internally rather than through external acquisition. The primary business niche of Sears historically is store-front consumer retail, and while the company "branched out" with manufacturing contracts to offer its own product line, the firm also innovated within to offer mail-order retail, consumer-credit finance, and consumer-service contracts.

In recognition of the limited utility of economic function as a typology dimension, we also examine attributes of business capital as a source of sector differentiation. We view business capital in a broad sense, as either the means or ends of business enterprise, both of which comprise stores of wealth. Means or instruments of production include assets such as land, natural resources, labor, technology, and financial capital. The extent to which particular businesses employ such use values, the degree to which they are resource, labor, technology, or finance intensive, varies by sector. The attributes of capital as ends or objects of production also vary along a variety of familiar continuums, including: renewable/non-renewable, durable/non-durable, and tangible/intangible.

Agriculture and animal husbandry are based in renewable resources, assets that are cultivated and converted for consumption, yet which also can be replenished, while non-renewable resources such as oil and minerals are depleted upon extraction and conversion, at best recyclable. The products of both types of natural resource tend to be highly non-durable, with durables such as hardware components and finished goods, auto parts and automobiles for example, at the other end of the continuum. Finally, all of the above comprise tangible assets, physical capital, whereas financial holdings such as currency, bank accounts, deeds, stocks, and bonds are relatively liquid intangible assets.

Whether wealth is derived from productive or investment is central to the finance sector of our typology. Wealth based in financial holdings capitalizes on unearned increments of compounding interest and asset appreciation. These fortunes are finance-capital intensive by definition, while financial services also comprise labor-intensive productive enterprise driven by earned-income dynamics. We also distinguish "investments" as a subgroup of finance from "diversified" fortunes in other main sectors.

To be coded as investments in the main category of finance, wealth holdings had to be based in more than one other main sector; these fortunes are diversified in the broadest sense. The business activities of the cases that we coded as diversified cross salient sub-sector lines but remain focused on the chief economic function of the main sector, on productive activity rather than on the exchange value of acquired companies. Diversified and specialized retail diverge in the range of consumer goods offered for sale, for example, department stores such as Sears or WalMart versus specialty clothing or fast food shops such as The Gap or McDonalds.

We also distinguish property holdings from construction, which is both labor- and resource-intensive enterprise directed at physical infrastructure development. Qadeer (1981: 174) distinguishes between urban property as a utility good and a commercial good: "these two uses of land, many times, conflict each other. One promotes utility, the other delivers profits." Real estate wealth grows with change in land use through rezoning, property development, and increased yields, and the high concentration of business activity in metropoles and consequent shortage of space is a worldwide phenomenon inevitably leading to escalating property prices. In addition to wealth gains from supply and demand dynamics, unearned increments occur when property rents flow irrespective of capital improvements, or as John Stuart Mill (1848: 365) bemoans, when landlords "·grow richer, as it were, in their sleep, without working, risking, or economizing."

Capital and consumer goods and industrial and electronic technology all comprise manufacturing enterprise, yet whereas consumer goods are purchased primarily by the mass public, capital goods and technology are also consumed extensively by other businesses. Commerce between electronic technology firms and other businesses is among the fastest growing segments of the economy, and logically would lead us to classify electronic technology manufacturing as an industrial sub-sector.

The former adopts the seminal features of industrialism: a mass production process based on specialization and mechanization of labor, which produces goods and services that enable consumers to replace labor with machines. In contrast to industrial technology, the object of mechanization with electronic technology is primarily mental rather than manual labor. As both an object and instrument of production, electronic technology capitalizes on unique physical properties, especially in the case of computer software. Electronic technology enables new mechanisms for expression and exchange of capital. This is exemplified in the evolution of money as a physical asset, with both coinage and paper currency now supplemented by plastic/metalic credit cards that electronically reference or directly encode stores of financial value.

The impact of electronic technology on our typology classifications is evident within the mass media sector,

where we distinguish publishing from broadcasting and telecommunications and from diversified fortunes, which includes both print and electronic enterprise. Technological convergence and corporate consolidation (i.e., takeovers and mergers) are occurring at a rapid pace within the mass media sector. However, lines of divergence can be detected, especially between broadcasting and broadband (wire-based) technology, as in the recent controversy and stock gyrations generated by AT&T,s introduction of a "tracking stock" tied to its wireless business.

Following the logic of economic function as the source of differentiation at our main sector level, we place Internet service providers in the category of telecommunications, in mass media rather than electronic technology, which is a manufacturing sector. Similarly, since we do not want to conflate functions with technologies of exchange, diversified retail includes fortunes derived from tele-retail such as the Home Shopping Network and from web-retail such as Amazon.com.

We hypothesize that independent of inheritance, demographic traits, or social ties, wealth will be most concentrated in:

1. high cash-flow sectors, especially those based on production or distribution of non-durable goods, where earned-income dynamics and economies of scale prevail;
2. abstract-property or finance-intensive sectors such as investments and real estate, where investors can capitalize on "unearned increments" of compounding interest, share price and rent returns, and asset appreciation;
3. technology-intensive sectors, computer software manufacturing and Internet service provision in particular as pioneers of electronic infrastructure development and exchange.

Despite the widely publicized roles of high tech entrepreneurs and companies in current stock market momentum it remains to be seen whether engineers of electronic technology are wealthier in aggregate or on average than specialists in non-durable goods or speculators in abstract property.

RESULTS

First, we show the distribution of wealth by case, social attributes, and economic sector. Next, we examine the results of multivariate models that include both social and sector variables. Finally, we briefly consider change from 1982 to 1999 in the distribution of cases and wealth by sector. Unless otherwise stated, all financial figures are in 1999 constant dollars, with inflation adjustments based on the U.S. Bureau of Labor Statistics August Consumer Price Index.

Table 2 summarizes wealth data on the 400 richest individuals profiled by Forbes (F400), and indicates that even at the apex of the overall distribution inequality increased dramatically over the past two decades, especially in the period 1997-99. Between 1982 and 1999 the minimum and mean/aggregate net worth of the F400 increased by factors of 4.8 and 6.5, respectively, the maximum net worth by a factor of 24.8. F400 mean net worth exceeded $1 billion for the first time in 1995, and F400 aggregate net worth surpassed $1 trillion in 1999.

These data also indicate the impact of the October 1987 stock market crash on great wealth. Note how F400 wealth jumps from 1986 to 1987 but then drops in 1988. There is a recovery and relatively flat slope through the Gulf War recession (1990-91) and three subsequent years, and then sharp increases annually thereafter. This is not surprising, for with notable sector-specific exceptions such as oil and real estate, the bulk of F400 wealth is stored in corporate stock holdings.

Table 2. 1982-99 "Forbes Four Hundred" Individual Fortunes (N=400): Annual Net Worth (in Millions $1999)

Year	$Min	$Max	$Total	$Mean	$SD
1982	126	3,421	158,528	396	373
1983	208	3,669	196,793	492	445
1984	240	6,556	201,473	504	489
1985	232	4,332	207,272	518	415
1986	274	6,855	239,002	598	562
1987	292	12,416	320,695	802	860
1988	316	9,408	310,302	776	774
1989	369	6,974	360,381	901	783
1990	330	13,967	358,537	896	1,007
1991	336	13,578	364,941	912	1,121
1992	314	7,471	358,709	892	994
1993	346	9,607	376,869	942	1,080
1994	348	10,486	392,063	980	1,181
1995	372	16,174	432,053	1,080	1,405
1996	441	19,653	487,352	1,218	1,621
1997	494	41,359	648,333	1,621	2,762
1998	511	59,722	754,808	1,887	3,862
1999	618	85,000	1,035,824	2,590	5,549

Turning to the 1,115 cases (197 families and 918 individuals) represented in our 1982-99 cumulative file (F1115), Table 3 indicates the distribution of cases and wealth by latest year of appearance in the Forbes roster. The 444 fortunes profiled in 1999 represent 40% of all cases, but 77% of aggregate wealth ($1.14 out of $1.48 trillion). The mean wealth of the 1999 cases, over $2.5 billion, is higher by a factor of 3.3 than the 79 cases displaced from the 1998 edition. Note the 97 cases that last appeared in the 1996 edition, with an average net worth of $595 million, which reinforces the view that 1997 is a breakpoint year. However, these data offer only a rough guide to annual turnover in the Forbes rosters, given modest change year-by-year in whether persons with kinship ties are classified by Forbes as individuals or as members of a family fortune.

Table 3: F1115 by Latest Year on Roster: Case and Net Worth Distribution					
	Cases		Net Worth in Millions ($1999)		
Year	N	Col%	Col%	$Total	$Mean
1999	444	39.8	77.0	1,140,649	2,569
1998	79	7.1	4.2	61,865	783
1997	41	3.7	2.0	28,894	705
1996	97	8.7	3.9	57,747	595
1995	29	2.6	1.2	18,087	624
1994	42	3.8	1.2	17,916	427
1993	39	3.5	1.2	18,303	469
1992	27	2.4	0.8	11,450	424
1991	35	3.1	1.1	16,716	478
1990	44	3.9	1.3	19,501	443
1989	42	3.8	1.8	26,019	619
1988	26	2.3	0.7	10,324	397
1987	33	3.0	1.0	15,230	462
1986	47	4.2	1.0	15,330	326
1985	17	1.5	0.3	3,952	232
1984	31	2.8	0.6	9,295	300
1983	29	2.6	0.4	6,542	226
1982	13	1.2	0.2	3,109	239
Total	**1,115**	**100.0**	**100.0**	**1,480,928**	**1,328**

We are cautious in how we interpret these data, as the net worth estimates of early cases that do not reappear are probably less reliable. However, cases are displaced from the Forbes rosters not only because they fail to keep pace with a rising minimum threshold for inclusion (an artifact of the "top 400" metric), but also due to real wealth declines. Consider the wealth impact on H.L. Hunt,s "first family" of the financially-ruinous attempt of brothers Lamar, Nelson Bunker, and William Herbert to corner the silver market in 1979-80; they filed for bankruptcy and left the Forbes lists after defaulting in the mid-1980s on a bailout loan arranged by the Federal Reserve. Their siblings, especially full-sisters Caroline and Margaret prudently refused to speculate with their personal shares of the family trust, but instead diversified their assets in conservative enterprise such as real estate and luxury hotels. Along with half-brother Ray Hunt, eldest child and business head of the "second family," the Hunt sisters remained on the Forbes lists through most of the 1990s (in addition to Forbes, see: Hurt 1981).

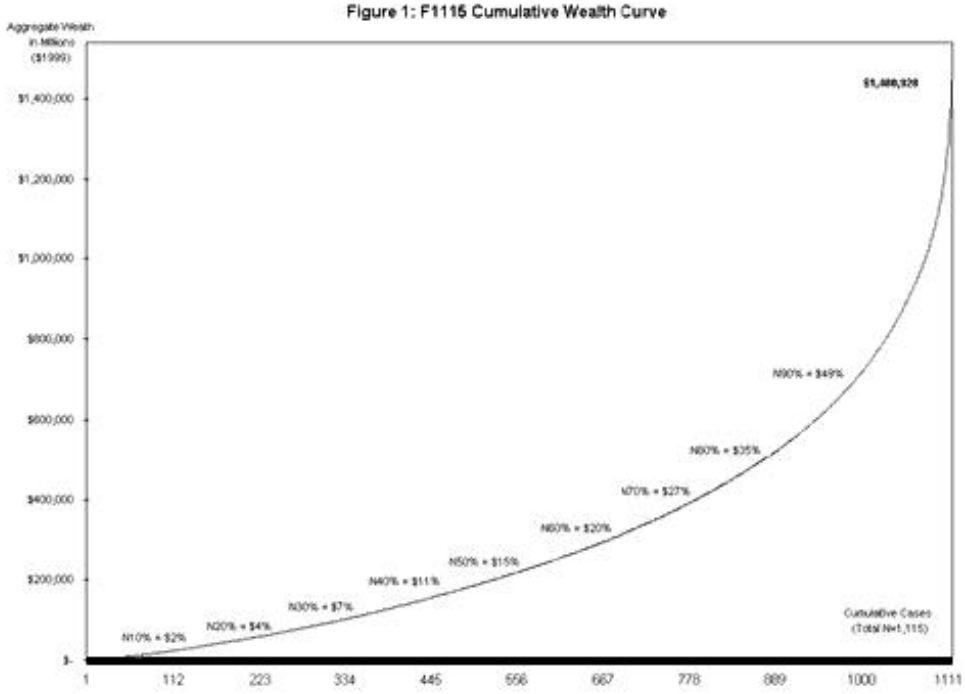
When wealth is heavily concentrated in a single sector it is inevitably vulnerable to external forces. Ross Perot holds the distinction of being the first person to experience a billion dollar one-day loss in paper wealth when his EDS stock collapsed in 1969. One billion is overshadowed in absolute terms by the $12 billion decline of Gates,s fortune when the value of his Microsoft shares cratered in the April, 2000 "Black Friday." However, relative to his net worth Gates suffered a less painful setback.

Table 4 demonstrates wealth discontinuity at the very top of the stratum.

Table 4: F1115 Wealth Distribution by Selected Percentiles				
Cases (Top-Down)		Aggregate Net Worth in Millions ($1999)		
Count	Col%	Col%	$ Total	$Mean
Gates	0.1	5.7	85,000	85,000
11	1.0	20.2	299,000	27,182
56	5.0	39.0	577,971	10,321
112	10.0	50.9	753,675	6,729
168	15.0	58.6	868,095	5,167
224	20.0	64.6	956,202	4,269
279	25.0	69.4	1,028,140	3,685
336	30.0	73.5	1,088,461	3,239
392	35.0	77.0	1,139,856	2,908
448	40.0	80.0	1,185,437	2,646
505	45.0	82.8	1,225,474	2,427
560	50.0	85.2	1,261,808	2,253
616	55.0	87.4	1,294,552	2,102
672	60.0	89.5	1,325,041	1,972
728	65.0	91.4	1,353,167	1,859
785	70.0	93.1	1,378,674	1,756
841	75.0	94.6	1,401,244	1,666
896	80.0	96.0	1,421,602	1,587
952	85.0	97.3	1,440,206	1,513
1,009	90.0	98.4	1,457,169	1,444
1,065	95.0	99.3	1,470,921	1,381
1,115	100.0	100.0	1,480,928	1,328

The $85 billion fortune of Gates in 1999 amounts to 5.7% of the aggregate, and the top 10% of fortunes account for over 50% of total wealth. The extent of inequality is illustrated in Figure 1, where the shape of the F1115 wealth curve is close to the full distribution (cf. Hurst, Luoh, and Stafford 1998: Figure 1).

Figure 1: F1115 Cumulative Wealth Curve



Wealth by Social Attributes

Tables 5-8 present the distribution of wealth by individual versus family holdings (Table 5), by sex for individual fortunes (Table 6), and by kinship ties (Table 7) and inheritance (Table 8) for individual and family fortunes combined. Of the 82% of F1115 fortunes held by individuals, only 12% are by females. Almost one-fourth of the F1115 have a kinship tie to another case, primarily a blood relation rather than through marriage, while almost one-third inherited great wealth. The mean net worth of those related by blood or marriage to another case is 58% higher than those with no such affiliation, and 25% higher for individuals compared to family fortunes. Correlations of these variables (Tables 9-10) also reveal statistically and substantively significant results.

Table 5: FAMILY vs. INDIVIDUAL Fortunes

Family	N		Net Worth in Millions ($1999)		$Mean
Yes	197	18%	216,400	15%	1,098
No	918	82%	1,264,528	85%	1,377
Totals	1,115	100%	1,480,928	100%	1,328

Table 6: SEX of Individual Wealthholders

Sex	N		Net Worth in Millions ($1999)		$Mean
Male	805	88%	1,117,638	88%	1,388
Female	113	12%	146,890	12%	1,300
Totals	918	100%	1,264,528	100%	1,377

Table 7: KINSHIP TIES

Ties	N		Net Worth in Millions ($1999)		$Mean
Yes	255	23%	472,913	32%	1,855
No	860	77%	1,008,016	68%	1,172
Totals	1,115	100%	1,480,928	100%	1,328

Table 8: INHERITANCE

Inheritance	N		Net Worth in Millions ($1999)		$Mean
Yes	349	31%	486,472	33%	1,394
No	766	69%	994,456	67%	1,298
Totals	1,115	100%	1,480,928	100%	1,328

Table 9: F115 Correlations of Family Fortunes, Kinship Ties, and Inheritance (All Cases)

Pearson Correlation Coefficients (Prob > |r| under H0: Rho=0)

Variable	FAMILY FORTUNE	KINSHIP TIES	INHERITANCE
FAMILY FORTUNE (Yes=197)	1.00000	-0.11788 <.0001	0.34147 <.0001
KINSHIP TIES (Yes=255)	-0.11788 <.0001	1.00000	0.44753 <.0001
INHERITANCE (Yes=349)	0.34147 <.0001	0.44753 <.0001	1.00000

Table 10: F1115 Correlations of Kinship Ties, Sex, and Inheritance (Individuals Only, N=918)

Pearson Correlation Coefficients (Prob > |r| under H0: Rho=0)

Variable	KINSHIP TIES	SEX	INHERITANCE
KINSHIP TIES (Yes=231)	1.00000	0.36342 <.0001	0.59182 <.0001
SEX (Female=113)	0.36342 <.0001	1.00000	0.61299 <.0001
INHERITANCE (Yes=220)	0.59182 <.0001	0.61299 <.0001	1.00000

Notable cross-tabulations include:

1. 24% of individuals compared to 65% of families inherited great wealth;
2. of 220 individuals who inherited great wealth, 71% have kinship ties, versus only 16% of families that inherited great wealth; and
3. only 7 of the 113 women are first-generation holders of great wealth.

The first two findings show that most families profiled by Forbes inherited great wealth and are not otherwise represented by individual cases. As the long history of rigorous academic research on family fortunes also documents (Sorokin 1925; Lundberg 1937, 1968; Allen 1987), the longevity of elite wealth holdings exceeds the life span of particular individuals as progenitors of big business enterprise.

We do not know the incidence of business partnerships among F400 men, but of the seven women who did not inherit great wealth, six built their business fortunes in explicit partnership with others, a husband, siblings, or offspring; Oprah Winfrey appears as an exception. Despite the prevalence of inheritance and family partnerships, F400 women appear as active as F400 men in business enterprise. Both Katherine Graham of The Washington Post and Beverly Kroc of McDonalds were enterprise leaders before and after the deaths of their husbands. Inheritance of great business fortunes built by women is also evident within the time series. Estée Lauder, founder of the cosmetics company that bears her name, appears in the Forbes list and evenly shares her wealth with her two sons and husband (who died subsequently) in 1982, and then with her sons from 1983 through her own death in 1995; with redistribution of family assets the net worth of each son doubled to $2.1 billion (in

$1996). Several other elite family fortunes follow similar interpersonal dynamics, and suggest that women are not weak links in business partnerships. Nevertheless, men in fact as well as stereotypically dominate wealth-generating enterprise.

Big business opportunity and attendant great wealth outcomes in the United States are stratified not only by sex, but also by race, ethnicity, and national origin. Once again Oprah Winfrey is exceptional as an independent player and on racial grounds, as she is only one of five African Americans to appear in the F400. We believe that Table 11 includes all F400 African Americans, but are less confident in our classifications for other demographic groups or national origins, which are based on a systematic but not definitive surname search. The low numbers of non-Caucasians and immigrants are concentrated in few sectors. Mass media and entertainment fortunes predominate among African Americans, and electronic technology among Asians, who except for Japanese American Scott Oki, a former Microsoft officer, are foreign born.

We presume that as with native-born women and racial/ethnic minorities the sector-specific business activity of immigrants reflects a mix of self-selection and limited access. It would be interesting to assess the wealth status of immigrants in the Forbes rosters both before and after they arrived in the United States, with attention to relations between national wealth opportunity, entrepreneurial ambition, and the size and sector locations of business fortunes.

Australian-born Rupert Murdoch, whose personal and family fortunes span three continents, is the ultimate transnational entrepreneur. The evolution and migration of his business operations epitomizes how aspirations can grow and activities expand as resources increase. Murdoch's center of business gravity moved from the Australian periphery to the London core, and finally to the United States supercore (Munster 1985; Korporaal 1987). Without elaborating on his long, complex, and fascinating career, Murdoch,s case epitomizes a path for acquiring great wealth: his multinational media holdings generate large cash flows, use advanced technology, and yield non-durable products, in the form of newspapers and electronic signals.

Table 11: F1115 Race/Ethnicity and Foreign Birth

Cosby, William Henry Jr.	African-American	Entertainment
Gordy, Berry Jr.	African-American	Motown Records
Johnson, John Harold	African-American	Publishing
Lewis, Reginald	African-American	TLC Beatrice
Winfrey, Oprah Gail	African-American	Television
Chan, Ronnie	Chinese Immigrant	Real estate
Hwang, Kupin Phillip	Korean Immigrant	Televideo Systems
Jain, Naveen	Indian Immigrant	Microsoft
Kim, Jeong H.	Korean Immigrant	Yurie Systems (network equipment)
Lee, David L.	Taiwanese Immigrant	Global Crossing (telecommunications)
Oki, Scott	Japanese American	Microsoft
Ono, Yoko	Japanese Immigrant	Music royalties
Sakioka, Katsumasa Roy	Japanese Immigrant	Real estate
Sidhu, Sanjiv	Indian Immigrant	Software
Singh, Rajendra	Indian Immigrant	Teligent (telecommunications services)
Sun, David	Taiwanese Immigrant	Kingston Technology
Tandon, Sirlang Lal	Indian Immigrant	Tandon Corp. (disk drives)
Tu, John	Chinese Immigrant	Kingston Technology
Wang, An	Chinese Immigrant	Wang Laboratories
Wang, Charles B.	Chinese Immigrant	Computer Associates
Yang, Jerry	Taiwanese Immigrant	Yahoo! Inc.
Yuen, Henry C.	Chinese Immigrant	Gemstar
Cayre, family	Syrian Immigrants	Media
Dabah, Morris	Israeli Immigrant	Gitano Group
Ebrahimi, Farhad Fred	American Born	Quark Inc.
Jaharis, Michael Jr.	American Born	Pharmaceuticals
Jamail, Joseph Dahr Jr.	American Born	Lawsuits
Naify, Marshall	son of Lebanese Immigrants	Movie theaters
Naify, Robert Allen	son of Lebanese Immigrants	Movie theaters
Omidyar, Pierre M.	American Born	eBay
Riklis, Meshulam	Turkish Immigrant	Finance
Sarofim, Fayez Shalaby	Egyptian Immigrant	Money management
Zilkha, Ezra Khedouri	Iraqui Immigrant	Investments
Catsimatidis, John Andreas	Greek Immigrant	Supermarkets
Chernick, Aubrey	Canadian Immigrant	Software
Duda family	Czech Immigrant	Agriculture
Ebbers, Bernard J	Canadian Immigrant	Worldcom Inc. (telecommunications)
Fribourg, Michel	European Immigrant	Grain trader
Goizueta, Roberto Crispulo	Cuban Exile	Coca-Cola

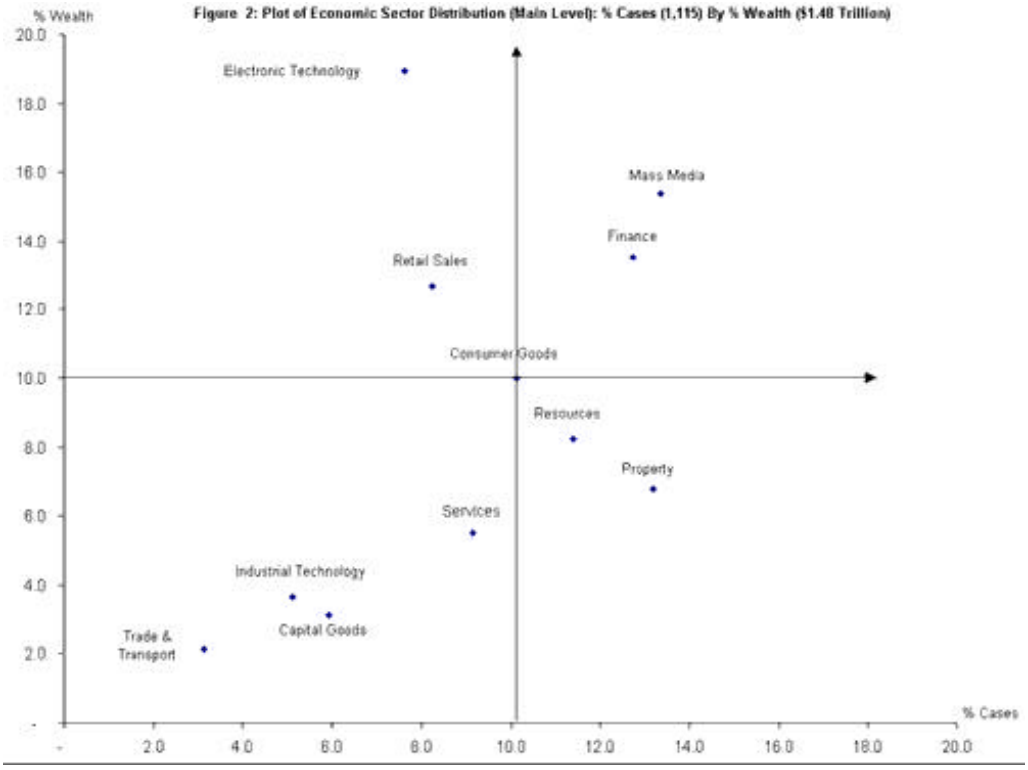
Gonda, Leslie L.	Hungarian Immigrant	International Lease Finance Co.
Gonda, Louis L.	Hungarian Immigrant	International Lease Finance Co.
Murdoch, Keith Rupert	Australian Immigrant	News Corp.
Olenicoff, Igor	Russian Immigrant	Real estate
Simonyi, Charles	Hungarian Immigrant	Microsoft
Soros, George	Hungarian Immigrant	Money management
Taper, Sydney Mark	Polish Immigrant	First Charter Financial Corp.
Udvar-hazy, Steven Ferencz	Hungarian Immigrant	International Lease Finance Co.
Unanue family	Spanish Immigrant	Goya Foods

Table 12: Distribution of F1115 Cases and Wealth by Economic Sector (Main Groups)	Cases		Net Worth in Millions ($1999)		
	N	Col%	$Total	Col%	$Mean
Finance (Holdings & Services)	142	12.7	200,547	13.5	1,412
Property (Holdings & Construction)	147	13.2	100,330	6.8	683
Resources (Non-renewable & Renewable)	127	11.4	122,132	8.2	962
Capital Goods (Materials Conversion)	66	5.9	46,393	3.1	703
Consumer Goods (Non/Semi-Durables)	113	10.1	148,207	10.0	1,312
Industrial Technology (Hardware/Durables)	57	5.1	53,875	3.6	945
Electronic Technology (Hardware & Software)	85	7.6	280,790	19.0	3,303
Trade & Transport (Commercial Distribution)	35	3.1	31,762	2.1	907
Retail Sales (Consumer Distribution)	92	8.3	187,482	12.7	2,038
Mass Media (Print & Electronic)	149	13.4	227,930	15.4	1,530
Services (Personal & Commercial)	102	9.1	81,480	5.5	799
Totals	**1,115**	**100**	**1,480,928**	**100**	**1,328**

Wealth By Economic Sector

In specifying our wealth typology we noted the low utility of gross sector distinctions based on economic function. Table 12 presents raw data and Figure 2 plots wealth differential patterns at the level of main sector groups in our typology. These results demonstrate the analytic value of asset attributes, and substantively we see the configurations of capital that generate the greatest wealth returns.

Consumer goods manufacturing sets the standard for comparative analysis of great wealth sector locations: it accounts for 10% of the cases and of wealth, with mean net worth at the overall average of $1.3 billion. Electronic technology and finance-intensive sectors exceed consumer goods, which exceeds industrial technology and resource- and labor-intensive sectors as sites of wealth concentration. Electronic technology manufacturing comprises less than 8% of cases but 19% of aggregate wealth. The finance and mass media sectors, each roughly 13% of cases, have mean wealth marginally higher than the overall average, while retail sales includes 8% of total cases and 13% of aggregate wealth, with mean wealth over $2 billion. Property and natural resources account for 13% and 11% of cases, respectively, yet along with capital goods (6%), industrial technology (5%), trade and transport (3%), and services (9%), have mean wealth less than $1 billion, far below the overall average.



Finer distinctions can be drawn to isolate important properties of sectors as sources of wealth inequality, as shown in Table 13, which details the distribution of F1115 cases and wealth at a sub-sector level. With the exception of natural resources and services, meaningful differences within main sector groups speak directly to our concerns to disentangle the asset attributes that influence wealth accumulation.

Within-sector differentials in mean wealth include the following:

1. financial holdings over services;
2. property construction over holdings;
3. capital goods over du Pont in particular;
4. food/beverages & personal/household care over clothing & pharmaceuticals;
5. industrial supplies and equipment over vehicle manufacturing;
6. computer software over hardware and both over electronic components;
7. trade over transport;
8. diversified over specialized retail; and
9. diversified and electronic media over print media.

Table 13: Distribution of F1115 Cases and Wealth by Economic Sector (Sub-Groups)	Cases		Net Worth in Millions ($1999)		
	N	Col%	$Total	Col%	$Mean
Finance (Holdings & Services)	142	12.7	200,547	13.5	1,412
Financial Holdings	78	7.0	128,227	8.7	1,644
Financial Services	64	5.7	72,320	4.9	1,130
Property (Holdings & Construction)	147	13.2	100,330	6.8	683
Property Holdings	134	12.0	84,454	5.7	630
Property Construction	13	1.2	15,876	1.1	1,221
Resources (Non-renewable & Renewable)	127	11.4	122,132	8.2	962
Resource Extraction (Non-renewable)	105	9.4	102,472	6.9	976
Resource Cultivation (Renewable)	22	2.0	19,660	1.3	894
Capital Goods (Materials Conversion)	66	5.9	46,393	3.1	703
du Pont (chemicals/plastics...)	29	2.6	12,697	0.9	438
other Capital Goods	37	3.3	33,697	2.3	911
Consumer Goods (Non/Semi-Durables)	113	10.1	148,207	10.0	1,312
Food & Beverages	47	4.2	69,820	4.7	1,486
Pharmaceuticals	12	1.1	9,826	0.7	819
Clothing	23	2.1	24,017	1.6	1,044
Personal & Household Care	31	2.8	44,544	3.0	1,437
Industrial Technology (Hardware/Durables)	57	5.1	53,875	3.6	945
Supplies	16	1.4	16,695	1.1	1,043
Vehicles	19	1.7	14,502	1.0	763
Equipment	22	2.0	22,678	1.5	1,031
Electronic Technology (Hardware & Software)	85	7.6	280,790	19.0	3,303
Components	20	1.8	26,505	1.8	1,325
Hardware	26	2.3	59,588	4.0	2,292
Software	39	3.5	194,697	13.1	4,992
Trade & Transport (Commercial Distribution)	35	3.1	31,762	2.1	907
Trade	15	1.3	15,993	1.1	1,066
Transport	20	1.8	15,769	1.1	788
Retail Sales (Consumer Distribution)	92	8.3	187,482	12.7	2,038
Specialized	63	5.7	61,591	4.2	978
Diversified	29	2.6	125,892	8.5	4,341
Mass Media (Print & Electronic)	149	13.4	227,930	15.4	1,530
Publishing	62	5.6	58,339	3.9	941
Broadcasting	32	2.9	49,115	3.3	1,535
Telecommunications (inc., Internet)	27	2.4	45,974	3.1	1,703
Diversified Media	28	2.5	74,501	5.0	2,661
Services (Personal & Commercial)	102	9.1	81,480	5.5	799
Leisure and Travel Services	36	3.2	31,072	2.1	863
Professional & Human Services	36	3.2	25,375	1.7	705
Business Services	30	2.7	25,034	1.7	834
Totals	1,115	100.0	1,480,928	100.0	1,328

Computer software and diversified retail occupy an upper tier of cross-sector wealth differentials, with net worths at almost $5 and $4.3 billion, respectively. In striking contrast, the 29 du Ponts occupy the lowest tier with wealth on average of $438 million. Rather than continuing detailed comparisons through the full sector typology, we turn to multivariate analyses in order to determine whether apparent differences remain statistically significant once we control for individual versus family holdings, kinship ties, and inheritance.

Multivariate Analyses

We tested several ordinary least squares (OLS) regression models with the F1115 data. For social and economic explanatory factors (family fortunes, kinship ties, inheritance, and each sub-sector) we constructed dummy variables (no=0/yes=1), but did not test sex as an independent variable primarily due to its high correlation with inheritance (see Table 10). We express the dependent variable as the natural log of net worth (in millions $1999), following standard practice in linear regression given a non-linear distribution. Outliers include: Warren Buffet and his Berkshire Hathaway colleagues in financial investments, Philip Anschutz in oil, the Bechtels in heavy construction, the founders of Microsoft in computer software, Jeffrey Bezos of Amazon.com in diversified retail, the Cox sisters and Newhouse brothers in diversified media, the Tisch brothers in financial and hospitality services, and members of the Mars family in candy manufacturing, the Haas family in jeans manufacturing (Levi Strauss), the Fisher family in clothing retail (The Gap), and of the Walton family in diversified retail (WalMart).

Table 14 presents results for the most parsimonious of our OLS regression models. We exclude sub-sectors

whose parameter estimates are not statistically significant at $p < .10$, which in aggregate comprise a comparative base for significant sectoral coefficients. With a case count of 1,115, an F value of 14.12, 14 degrees of freedom, and modest level of explained variance (adjusted R-squared = .1416), the overall model is highly significant (Pr > F = .0001).

As indicated above, inheritance does not account for F1115 wealth differentials, but apparently social networks do matter. Kinship ties is one of the strongest parameter estimates in the model, and the family fortune coefficient is also positive and highly significant. Independent of inheritance and economic sector, F1115 families in general and those individuals and families linked by kinship in particular are substantially wealthier on average than those with no such affiliations.

Table 14: F1115 OLS Regression Results at Sub-sector Level of Typology

Dependent Variable: L_n Net Worth ($99) Independent Variables	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	6.40176	0.04238	151.05	<.0001
FAMILTY FORTUNE	1	0.27233	0.07472	3.64	0.0003
KINSHIP TIES	1	0.50308	0.07157	7.03	<.0001
INHERITANCE	1	-0.02275	0.06903	-0.33	0.7418
Financial Holdings	1	0.17284	0.10208	1.69	0.0907
Financial Services	-	-	-	-	-
Property Holdings	1	-0.27630	0.08164	-3.38	0.0007
Property Construction	-	-	-	-	-
Resource Extraction	1	-0.26401	0.09095	-2.90	0.0038
Resource Cultivation	-	-	-	-	-
CAPITAL GOODS	1	-0.47986	0.11259	-4.26	<.0001
Food & Beverages	1	0.25515	0.12931	1.97	0.0487
Pharmaceuticals	-	-	-	-	-
Clothing	-	-	-	-	-
Personal and Household Care	-	-	-	-	-
INDUSTRIAL TECHNOLOGY	-	-	-	-	-
Electronic Tech Components	-	-	-	-	-
Computer Hardware	1	0.49205	0.16873	2.92	0.0036
Computer Software	1	0.61806	0.14018	4.41	<.0001
TRADE & TRANSPORT	-	-	-	-	-
Specialized Retail	-	-	-	-	-
Diversified Retail	1	0.85142	0.16006	5.32	<.0001
Publishing	-	-	-	-	-
Broadcasting	1	0.45904	0.15316	3.00	0.0028
Telecommunications	1	0.69255	0.16603	4.17	<.0001
Diversified Media	1	0.55246	0.16283	3.39	0.0007
SERVICES	-	-	-	-	-
N = 1,115 DF = 14 F Value = 14.12 Prob>F =.0001 Adjusted R-squared = .1416					

It is essential to control for the asset aggregation represented in family fortunes and implied in kinship affiliations. Independent of inheritance and social ties, strong negative coefficients confirm lower-than-average wealth concentration in resource- and land-intensive sectors, including:

1. capital goods, which includes the du Ponts;
2. resource extraction, almost exclusively oil; and
3. property holdings, primarily urban real estate.

The coefficients for financial holdings and for food/beverage manufacturing are positive but modest in size and only marginally significant ($p < .10$ and $p < .05$, respectively). However, the disproportionate concentration of wealth in sectors based in electronic technology is strongly supported. The parameter estimates for both computer hardware and software manufacturers (but not electronic components producers) and for electronic as opposed to print media, are large, positive, and highly significant. Recall that diversified media fortunes involve both broadcasting and publishing, and that we classify Internet service providers as telecommunications. Diversified retail, which has the largest positive coefficient, appears as an exception. However, this sub-sector includes fortunes based on tele-retail such as the Home Shopping Network and web retail such as Amazon.com. Even wealth derived from WalMart, the largest diversified U.S. retailer, reinforces the importance of electronic media, as the firm deploys an information technology infrastructure with storage capacity second only to the federal government (Forbes October 13, 1997: 163).

Wealth Trends

Table 15 shows change from 1982-99 in the distribution of F400 cases by main sector groups, Table 16 the corresponding time series for F400 wealth. These data indicate substantial shifts over the past two decades in the concentration of great wealth by economic sector. If our analysis had been limited to the 1980s we would have focused on what is in and on the ground, especially oil and urban real estate holdings, which account for the large declines of "resources" and "property" in case and wealth shares through the 1990s. Wealth based in natural resources and property development predominates cross-nationally in early but not more recent business press rosters of world billionaires. Urban real estate in Japan, the landed aristocracy in Great Britain, and oil in the Middle East are country/region-specific exceptions.

Table 15: Change in F400 Case Distribution by Main Sectors (in % of 400)	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999 less 1982
Resources	24	21	21	17	16	11	12	12	12	12	11	10	12	10	9	10	9	8	-16
Property	18	14	16	19	18	18	21	19	17	13	9	9	8	8	7	7	8	7	-11
Capital Goods	10	9	8	10	8	7	5	7	8	8	7	7	6	6	4	4	3	1	-9
Trade & Transport	3	3	4	4	4	4	5	4	4	5	4	4	5	5	5	5	5	3	0
Industrial Technology	3	4	4	2	2	3	3	4	4	4	5	5	6	6	6	4	4	3	0
Consumer Goods	9	9	9	9	11	10	10	10	10	12	14	13	13	13	14	14	13	11	3
Finance	11	13	14	12	14	14	14	14	16	15	17	18	13	15	14	15	16	16	5
Mass Media	14	17	15	16	15	17	18	16	15	14	14	15	14	14	14	14	16	19	5
Retail Sales	4	4	4	5	5	6	5	7	8	9	9	9	10	9	9	8	9	10	6
Services	3	3	3	4	6	6	5	6	4	5	6	7	8	9	9	12	12	11	8
Electronic Technology	3	4	4	3	3	3	3	2	3	4	4	5	6	7	10	8	8	12	9

Table 16: Change in F400 Wealth Distribution by Main Sectors (in column percents)	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1999 less 1982
Resources	32	26	26	21	16	12	13	11	12	11	8	8	11	9	9	9	7	6	-26
Property	14	12	14	16	16	15	18	16	13	8	6	6	6	5	5	5	5	4	-10
Capital Goods	9	6	5	6	5	4	3	4	4	4	4	4	3	3	3	2	2	1	-8
Trade & Transport	4	4	3	3	3	3	3	3	4	4	3	3	3	4	4	3	2	1	-3
Industrial Technology	2	2	2	1	1	2	2	2	2	3	3	3	3	3	4	3	2	2	-1
Consumer Goods	8	9	9	9	11	11	10	10	10	12	14	13	13	13	14	13	11	9	1
Services	3	3	2	3	4	5	4	5	3	4	4	5	4	5	6	6	6	5	2
Mass Media	12	14	14	17	18	20	21	19	16	15	16	18	17	16	15	14	16	17	5
Finance	9	11	12	12	14	15	16	17	20	18	17	19	16	18	17	18	17	15	6
Retail Sales	4	6	6	6	7	9	7	10	11	16	17	14	14	12	11	10	12	15	11
Electronic Technology	3	6	5	4	4	4	3	3	3	6	7	7	9	12	13	19	20	25	22
Total Wealth (in billions, $1999)	159	197	201	207	239	321	310	360	359	365	357	377	392	432	487	648	755	1036	877

In contrast to the 1980s, the F400 average case shares of services, retail sales, and electronic technology doubled in the 1990s, while their respective wealth shares increased marginally, doubled, and tripled. As these data attest, the most substantial growth of electronic technology wealth as a share of total F400 wealth is recent, with 1997 a breakpoint year. If we had confined our analysis to the mid-1980s through mid-1990s we would have highlighted abstract property, especially innovation in financial derivatives and speculation in financial assets. The wealth and case shares of finance fortunes peaked at 20% in 1990 and at 18% in 1993, respectively.

Salient risks are as evident as wealth returns in the creation and manipulation of financial capital during this period, as in the insider-trading scandal and junk-bond market collapse, and removal of Ivan Boesky from the F400 in 1987. Despite large legal bills and federal fines, a brief respite in elite prison accommodations, and a life-long ban on professional investment activity, Michael Milken remained on the Forbes list through 1999. The only other explicit cases of criminally-derived wealth in the F400 are corporate embezzler Robert Vesco (1982-84) and Las Vegas casino mobster Meyer Lansky (1982-83), both of whom were removed by Forbes because the value of hidden assets could not be verified. Examples of corporate negligence and civil-lawsuit bankruptcy are also evident, notably the Dalkon Shield fiasco of A.H. Robins.

Methodological Implications

It is reasonable to contend that trends in F400 data appear in part as an artifact of the Forbes arbitrary cutoff, the "top 400" metric. However, we wonder how far patterns would prevail if Forbes had provided continuous coverage of all individuals ever to appear in the F400, and had set a wealth-amount rather than case- count threshold, which would enable a current database on centimillionaire as well as billionaire fortunes, the minimum thresholds of early versus recent F400 editions. At least we would obtain more reliable measures of changes in the sizes and sector locations of the fortunes already profiled by Forbes, which in conjunction with new cases might reveal how far sector distributions down the wealth strata approximate those at the top.

Closing the data gap between the richest of national surveys and poorest of business rosters is a major methodological dilemma. Using the Survey of Consumer Finances (SCF) as a source of data, Wolff (1996) introduces a promising alternative to post-stratification adjustments of sample weights, with adjustments directly to the data, uniform rescaling of SCF-measured assets and liabilities to match aggregate estimates of the "flow of funds accounts" developed by the Federal Reserve Board. An empirical bridge with less inference and more evidence is sorely lacking. Ideally, despite daunting costs, scientific surveys would measure the full wealth distribution, assess business assets as rigorously as household assets, and enable estimation of the exchange value of business capital. Business press rosters such as the "Forbes Four Hundred," even if augmented in the ways we suggest, could only partially fill this empirical niche. Bridging the empirical gap is a major obstacle to understanding the distribution of great wealth and the shape of the economic order.

DISCUSSION

Our results demonstrate wealth discontinuity at the apex of the distribution. The du Ponts set the threshold for entry into the ranks of the very rich as profiled by Forbes; no other kinship network in the United States even remotely approaches the extension of du Pont wealth across family lines and American history. Consumer goods manufacturers occupy a middle tier of elite wealth concentration, while electronic technology is the common element of the greatest new fortunes, whether based in manufacturing, retail, or mass media sectors.

As with the impact of scientific advances on industrial technology over a century ago, human capital sparks current innovation in electronic technology. Faith in "intellectual property" also drives current stock market momentum. Speculation in the IPOs of Internet start-ups is especially revealing, for often there is neither discernible physical capital nor imminent prospects of cash flow sufficient to generate corporate profit much less great wealth.

The notion of a "new economy" resulting in an emergent "digital divide" raises the question of how far traditional precepts of political economy explain current wealth dynamics and outcomes. Bell (1973) forecast the arrival of a new economy three decades ago, when he concluded that the post-WWII decline of goods production and rise of service production indicate the displacement of "property" by "knowledge" as the fundamental organizing principle of society. However, Landes (1999) emphasizes that the codification of theoretical (as opposed to practical) knowledge, or scientific revolution, preceded the industrial revolution. According to Landes, the relative wealth or poverty of nations depends on culturally-based human capital: an industrious revolution precedes any industrial revolution.

The principles of capital accumulation and wealth inequality that Landes employs for cross-national comparisons are also applicable to cross-sectoral comparisons within nations. His work highlights the importance of cultural as opposed to structural factors in wealth formation, yet deflates any common sense notion of the present period as one of "post-industrial," "knowledge," or "information" revolution. Economic innovation always depends on initiative and inventiveness, on the application of intellect to business enterprise, and our evidence shows that producers of physical capital reap the greatest wealth returns.

Great wealth and building blocks of an industrial infrastructure grew out of smokestack industry, heavy construction, oil and the automobile a century ago. New large fortunes today are concentrated among the engineers of electronic infrastructure. Founders of leading computer hardware and software producers have appeared in the F400 since the 1980s, notably Hewlett and Packard, Steve Jobs and Armas Markkula of Apple, Lawrence Ellison of Oracle, Gordon Moore of Intel, and Bill Gates and Paul Allen of Microsoft. With the advent of the Internet in the late 1990s, the newest members of the F400 include digital network equipment producers such as John Morgridge of Cisco, Jeong Kim of Yurie Systems, Scott Kriens of Juniper Networks, and Henry Nicholas and Henry Samueli of Broadcom.

New objects of production, novel means of distribution, and a sectoral nucleus of innovation in modes of business organization, electronic technology exerts unprecedented effects on business productivity and profits, and on the volume, velocity, volatility, and vulnerability of capital flows. Computer hardware differs from computer software and services as objects of production, and is subject to the same development and exchange principles as industrial technology. Land, raw materials, labor, and technology are deployed with economies of scale to reduce production costs and maximize profit margins. Computer hardware is relatively durable physical capital, and must be distributed and installed by conventional means; at some point interpersonal interaction and human labor are required.

Until recently, computer software followed standard mass production, distribution, and consumption practices, differing from hardware primarily as a relatively non-durable good whose immaterial electronic form enables portability and adaptability for multiple users and purposes. With the advent of the Internet as a commercial service infrastructure, however, software no longer depends on store-front or mail-order retail for distribution, and thereby enters a new realm of economic evolution and impact. An electronic asset exchanged via the web, software is instantaneously acquired and renewed at little or no marginal cost to either producers or consumers. Rather than distributing separate physical copies, one electronic source file can be replicated at the point of consumption. The bottom line: cash flows in as freely as computer software flows out.

A redeployable means of production, electronic technology manufacturers and service providers capitalize on a consumer base whose scope and rate of expansion are unprecedented. But economic benefits derived from deployment of electronic technology as an instrument of business production depend on conventional economic fundamentals. The use of electronic technology can decrease production costs, as it enables increased worker efficiency or replaces labor with technology, and can reduce transaction costs, whether in exchange with resource suppliers or goods and service consumers. To take advantage of new technology businesses must nonetheless incur substantial expense to establish an electronic infrastructure and replace or retrain labor, even with outsourcing as a strategic corporate trend. A synergistic relationship between computer hardware and software progressively increases functionality and capacity. Under this scenario, hardware can cross the traditional non-durability threshold of three years of use value, and even approach the status of a disposable good. What might otherwise comprise a fixed cost--the physical infrastructure of a business--becomes in effect a highly variable cost subject to the vagaries of ever-active technology shifts. This creates a double bind for businesses: constantly upgrade technology and also labor at considerable cost to remain competitive, or save on use value and lose on comparative advantage.

Electronic technology firms are at the forefront of innovation in modes of economic production, the organization of firms internally and of business sectors as a whole. Economic roles are being recast, with owners, managers, workers, even investors and consumers, crossing traditional boundaries. In the traditional division of labor of industrial capitalism business roles became clearly defined and co-existed in an uneasy state of potential conflict due to differentials in power and rewards. However, electronic technology firms are challenging conventional terms of employment. Establishing a "collegiate" corporate culture in a "flat" organization and providing stock options rather than salaries as a main form of compensation reduce role differentials and reinforce employee commitment to the company (granting stock options without reflecting them in the balance sheets of the corporation distorts reports of firm fundamentals, to the disadvantage of outside stock holders). Even operational boundaries between companies and consumers are blurred as software firms rely on consumer feedback to debug faulty early-release products. Once again, Microsoft set the trend, with major corporate players appearing as conspicuous members of the F400. Steve Ballmer joined Gates and Allen in the F400 in 1990, Jon Shirley in 1998, seven other current and former Microsoft officers in 1999 (Jain Naveen, Paul Maritz, Nathan Myhrvold, William Neukom, Scott Oki, Jeffrey Raikes, and Charles Simonyi). This expansive wealth distribution differs from earlier patterns of wealth concentration in which a principle entrepreneur is the chief if not sole beneficiary.

Electronic technology firms are also in the forefront of innovation in modes of corporate growth and sector consolidation. Horizontal integration is aimed at capacity expansion, a combination of companies that fulfill the same economic function (in our view this includes corporate replication, as in franchising in consumer retail and other commercial sectors). In contrast, vertical integration entails acquisition of firms across economic function, an effort to increase efficiency and decrease transaction costs from consolidation of previously separate steps in an economic process. Business enterprise based in electronic technology expands via horizontal and vertical integration, as evident in the exercise of corporate wealth by Microsoft and Cisco as large investors in equity markets. Yet electronic technology producers and service providers also capitalize on and enable for others a variant of functional convergence that we term "virtual integration."

With vertical integration, companies may continue to pursue a functional specialty; firms combined as part of the overall business organization retain unique use-value configurations and remain operationally distinct as separate steps in a production and distribution process. In contrast, "virtual integration" is based in technological rather than organizational convergence; boundaries between economic functions and roles diminish. Transaction costs are not simply reduced; rather, entire employment roles and business sectors are displaced as no longer relevant to economic exchange. Commercial enterprise is especially vulnerable when both the object and means of exchange are electronic. This reverses core organizing and developmental features of the division of labor, both within and between businesses.

In sum, as a new form of capital that impacts both means and modes of economic enterprise, electronic technology effaces traditional sector boundaries. With electronic property as a good and an "information superhighway" as distribution mechanism, economic exchange proceeds at unprecedented speeds over any distance. The net result: profound impacts on the volume, velocity, volatility, and vulnerability of capital flows.

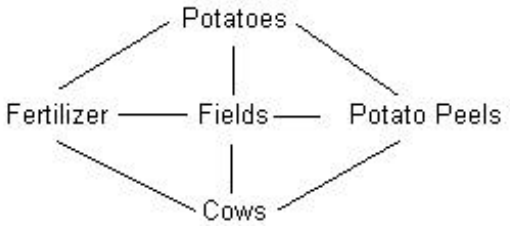
It is instructive to compare the business and wealth careers of John Rockefeller and Gates, emblematic entrepreneurs of the industrial and electronic technology revolutions. As a percentage of GNP the fortune of Gates pales compared to Rockefeller (Klepper and Gunther 1996), yet this distinction primarily reflects the relative sizes of the national economy a century ago and today. A more provocative comparison is the pace or period within which each accumulated great wealth; advantage Gates. The pace of current personal wealth life-cycles is matched by the compression of sector life-cycles. Business sectors typically develop gradually through entrepreneurial, familial, and corporate phases (cf. Useem 1984: 175-179). However, Microsoft quickly lept from emergent corporate entrepreneur to effective control of the operating system market.

The fortunes of software firm founders and of Internet entrepreneurs more recently are exemplars of "new wealth," and perhaps of new wealth accumulation dynamics. An extreme outlier even among the world,s wealthiest individuals, Gates first appeared in the F400 in 1986, the year in which Microsoft stock went public, with a net worth estimate of $480 million. By the next Forbes edition his 40% share of the company was valued at $1.8 billion, and by 1996 Gates had reduced his share of Microsoft to 23.6%, but his stock was valued at $19.6 billion. Asked to comment on his entry into the ranks of the F400, Gates demurred as being "leery of counting paper assets as real wealth" (Forbes October 27, 1986: 173). Indeed, for the continued dramatic growth of his fortune through 1999 illustrates why it is useful where possible to disentangle asset acquisition from asset appreciation as components of wealth formation. Share price increases are unearned increments, like the compounding of interest on financial assets or continuous cash flow of property rents irrespective of capital improvements, such that the same or fewer holdings comprise a higher net worth.

Comparative Sector Advantage

The emergence of electronic technology as a major wealth generator does not imply that other old-fashioned sources of great wealth are moribund. Idaho potato and cattle farmer John Richard Simplot, a master of business expansion through cross-fertilization of economic function, is a stellar example. In the 1950s his company scientists developed a freezing process for the production of french fries, and Simplot,s business fortune rose with growth of his chief client: McDonalds (Forbes, October 13, 1997: 182). The combination of technological and consumer base development with a dash of serendipity is a familiar business synergy. However, as illustrated in Figure 3, Simplot,s most striking organizational innovation is an instance of vertical integration. Use fields to grow potatoes and graze cattle, use potato peels as cattle feed and cow dung as potato fertilizer--a tangible instance of the circulation and consolidation of capital.

Figure 3: Simplot's Farming System



Although we highlight the comparative advantages of electronic technology as both an object and enabler of exchange, we cannot ignore the risks of electronic technology. The main attribute of electronic technology as a business asset, i.e., instantaneous exchangeability, is a chief liability. Unprecedented volatility in financial markets that results from capital being expressed and exchanged electronically is accompanied by extreme vulnerability within wired sectors of the economy and society. The "Melissa" and "I Love You" computer viruses dramatically demonstrate the operational and financial consequences of cyber-assault. Vulnerability is magnified when operating systems are integrated and monopolized.

Biotechnology is a foreseeable source of new great wealth, but commercialized biotechnology poses severe constraints and risks. Vast research and development costs and the long lead time needed to market safe and beneficial products enter the risk-reward equation. With advanced technology and public and private funding already in the mix, when and how will biotechnology payoff? Furthermore, who will benefit most financially: the research innovators and their universities and governmental agencies whose discoveries enable the treatment of disease and genetic disorders, the officials of pharmaceutical companies that organize testing and marketing of products, or venture capitalists who can afford a long-term view? All the players have their stakes, often conflicting stakes. We are witness to technological and scientific change taking place on a playing field in which many institutions, both governmental and commercial, are fully committed. The problems and conflicting systems are too diverse to permit monopolistic practices. Biotechnology entrepreneurs eventually will find their place in future editions of the "Forbes Four Hundred," but their paths to the richest 400 are less than clear when wealth formation precedents are not instructive.

REFERENCES

Allen, M. Patrick. 1987. The Founding Fortunes: a New Anatomy of the Corporate-Rich Families in America. New York: E.P. Dutton.

Bell, Daniel. 1973. The Coming of Post-Industrial Society: A Venture in Social Forecasting. New York: Basic Books.

Canterbery, E. Ray and E. Joe Nosari. 1985. "The Forbes Four Hundred: The Determinants of Super Wealth." Southern Economics Journal, v. 51 (April): Pp. 1073-83.

Chandler, Alfred Jr., and Stephen Salsbury.1971. Pierre S. du Pont and the Making of the Modern Corporation. New York: Harper & Row.

Clark, Colin. 1940. The Conditions of Economic Progress. London: Macmillan.

Colby, Gerard. 1984. Du Pont Dynasty: Behind the Nylon Curtain. Secaucus, N.J.: Lyle Stuart.

Curtin, Richard, F. Thomas Juster, and James Morgan. 1989. "Survey Estimates of Wealth: an Assessment of Quality." in The Measurement of Saving, Investment, and Wealth, R.E. Lipsey and Helen S. Tice (eds.), Chicago: The University of Chicago Press.

Fisher, A. 1939. "Primary, Secondary, and Tertiary Production." Economic Record (June).

Gershuny, Jonathan I. 1987. "The Future of Service Employment." in The Emerging Service Economy, Orio Giarini (ed.), Pergamon Press.

Hurst, Erik, Ming Ching Luoh, and Frank Stafford.1998. "The Wealth Dynamics of American Families, 1984-94."

Brookings Papers on Economic Activity 1: 1998: 267-337.

Hurt, Harry III. 1981. Texas Rich: the Hunt Dynasty from the Early Oil Days through the Silver Crash. New York: W.W. Norton.

Klepper, Michael, and Robert Gunther. 1996. The Wealthy 100: A Ranking of the Richest Americans, Past and Present. Secaucus, N. J.: Citadel Press.

Korporaal, Glenda. 1987. Afterword to Rupert Murdoch. Ringwood, Australia: Penguin Books.

Lundberg, Ferdinand .1937. America,s 60 Families. New York: Vanguard Press.

------1968. The Rich and the Super-Rich, A Study in the Power of Money Today. New York: Lyle Stuart.

Mill, John Stuart. 1848. Principles of Political Economy. Boston: Charles C. Little & James Brown (Volume II).

Mills, C. Wright. 1956. The Power Elite. New York: Oxford University Press.

Mosley, Leonard 1980. Blood Relations: the Rise and Fall of the du Ponts of Delaware. New York: Antheum.

Munster, George. 1985. Rupert Murdoch: A Paper Prince. New York: Viking.

Oliver, Melvin L., and Thomas M. Shapiro. 1995. Black Wealth/White Wealth: A New Perspective on Racial Inequality. New York: Routledge.

Qadeer, M.A. 1981. "The Nature of Urban Land." The American Journal of Economics and Sociology, 40: 2: 165-182.

Rubinstein, W.D. 1981. Men of Property. London: Croom Helm.

Sorokin, Pitirim. 1925. "American Millionaires and Multi-Millionaires: a Comparative Statistical Study." Social Forces (May) III: 4: 627-40.

Useem, Michael. 1984. The Inner Circle: Large Corporations and the Rise of Business Political Activity in the U.S. and U.K. N.Y.: Oxford University Press.

Watkins, G.P. 1907/71. The Growth of Large Fortunes. New York: A.M. Kelly.

Wolff, Edward N. 1995. Top Heavy: A Study of the Increasing Inequality of Wealth in America. New York: The Twentieth Century Fund Press.

------1996. "International Comparisons of Wealth Inequality." Review of Income and Wealth. Series 42, No. 4 (December): 433-451.

APPENDIX I.a: du Pont Descendants Profiled in "Forbes 400" (1982-99)	Years in Roster (Inc., "Near Misses")	Cumulative File:
(A) du Pont Family	1982-86	Dropped
(B) Pierre Samuel du Pont (Grandchildren/Great Grandchildren of...)		
Pierre Samuel II Family (Pierre childless, distributed fortune to siblings/nephew in Wilmington Trust/Christiana Securities.)	1982-84, 1987-99	Dropped
Henry du Pont		
Siblings		
1 Edward Bradford du Pont	1982-86	Retained
2 Joan Wheeler du Pont	1985-86	Retained
3 Margaret Lewis du Pont Smith	1982-86	Retained
Irenee du Pont Sr.		
Siblings		
4 Irenee du Pont Jr.	1982-87, 1989-98	Retained
5 Octavia Mary du Pont Bredin	1982-87, 1989-98	Retained
6 Constance Simons du Pont Darden	1982-87, 1989-98	Retained
7 Lucile Evelina du Pont Flint	1982-87, 1989-95	Retained
8 Margaretta Lammot du Pont Greenewalt	1982-87, 1989-90	Retained
9 Irene Sophie du Pont May	1982-87, 1989-97	Retained
10 Mariana du Pont Silliman	1982-87, 1989-93	Retained
11 Eleanor Francis du Pont Rust	1982-87, 1989-93	Retained
Isabella du Pont Sharp		
Sharp Family	1986	Dropped
Siblings		
12 Bayard Sharp	1982-85, 1990, 1993-95	Retained
Hugh Rodney Jr.	1982-85	Dropped
Son of Hugh Jr.		
13 Hugh Rodney Sharp III	1994-99	Retained
Lammot du Pont		
Siblings		
14 Willis Harrington du Pont	1982-87, 1989-96	Retained
15 Pierre Samuel du Pont III	1982-87	Retained
16 Mary Belin du Pont Faulkner	1982-86	Retained
17 Edith du Pont Pearson	1982-87, 1989-96	Retained
18 Esther Driver du Pont Thouron	1982-83	Retained
Louisa du Pont (Married Charles Copeland, business associate/ally of Pierre)		
19 Copeland Family	1986	Retained
Lammot du Pont Copeland Sr.	1983	Dropped
Pamela Cunningham Copeland (Wife of Lammot)	1985	Dropped
Siblings		
Lammot du Pont Copeland Jr. (Child of Pamela)	1982, 1985	Dropped
Gerret van Sweringen Copeland (Child of Pamela)	1985	Dropped
Louisa Copeland Duemling (Child of Pamela)	1985	Dropped
Margaretta du Pont		
Siblings		
20 Robert Ruliph Carpenter Jr.	1982-88	Retained
21 William Kemble Carpenter	1982-86	Retained
22 Irene Carpenter Draper	1982-88, 1990	Retained
Mary Alleta du Pont (Married William Winder Laird)		
23 Laird Family (Descendants of Mary Alleta du Pont)	1982-1986	Retained
William Kembel du Pont		
24 Wilhelmina du Pont Ross	1982-86	Retained

APPENDIX II.b: du Pont Descendants Profiled in "Forbes 400" (1982-99)	Years in Roster (Inc., "Near Misses")	Cumulative File:
(C) Philip du Pont (Child of...)		
(Philip independent, increased small share of family fortune by own efforts.)		
25 Mary Jane du Pont Lunger	1982-90	Retained
(D) A. Felix du Pont (Grandchildren of cousin of Pierre...)		
(Sided with Pierre in 1915 family split, thus stakes in Wilmington Trust/Christiana Securities).		
Siblings		
26 Alexis Felix Jr.	1982-97	Retained
27 Alice Francis du Pont Mills	1982-98	Retained
28 Helena Allaire Crozer du Pont	1984-88	Retained
(E) William du Pont (Children/Grandchildren of cousin of Pierre....)		
(Against Pierre in 1915 family split, founded Delaware Trust).		
29 William du Pont Family	1986-90	Retained
Marion du Pont Scott (sister of William du Pont Jr.)	1982	Dropped
Siblings		
Evelyn Rebecca du Pont Donaldson	1982-87	Dropped
John Eleuthere du Pont	1982-87	Dropped
William du Pont III	1982-84	Dropped
Henry Eleuthere Irenee du Pont	1985-87	Dropped
Jean Ellen du Pont Sheehan	1982-87	Dropped