

**Revisiting the Davis Thesis: Preliminary Evidence of Stock Market Impact on
Industrial Concentration**

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Abstract

Since Lance E. Davis developed his financial thesis, the claim that capital mobility has an inverse relationship to industrial concentration has gone unchallenged. However, evidence exists which suggests that the opposite relationship might be true: capital mobility may lead to a higher incidence of industrial concentration. In this paper, I use Daniel Verdier's conception of capital mobility, which states that mobile capital is reflected by broad and deep securities markets. I argue that even mobile markets will treat large firms and small firms differently. Securities markets accentuate disparities between large and small firms in their ability to access capital, giving large firms the resources to grow relative to their peers. To test this hypothesis, I conduct case studies of the 1920's and 1990's period in the U.S., as well as employ a multivariate panel data regression analysis. The results support my hypothesis that strong securities market performance leads to greater industrial concentration, even when capital is more mobile. These results are at odds with Davis' financial thesis.

Introduction

When Lance E. Davis (1966) developed his famous financial thesis, he pioneered the study of two separate, but related subjects. First, how is capital mobility specified? Capital mobility reflects the free flow of capital between geographic industries and economic sectors. Government policy, banking structure, and security markets all play a significant role in the development of capital mobility. Lance Davis (1963) argued that the U.S. had relatively less mobile capital than England because of the fractured nature of its banking structure, suggesting that metrics for banking structure could be used to specify capital mobility¹. Feldstein and Horioka (1980) developed a method for computing international capital mobility by correlating national savings to domestic investment.² Low correlation would imply a high degree of capital mobility. Lastly, Daniel Verdier (2001) has made the most recent addition to the body of literature on capital mobility specification, arguing that capital mobility is determined by the degree of development of corporate securities markets.³

The second question which Davis' thesis addresses is how capital mobility impacts economic outcomes. In his thesis, Davis argues that industrial concentration and capital mobility are inversely related. This suggests that economic structure will reflect the mobility of capital. Davis' thesis thus argues that the U.S. had relatively large industrial enterprises and more concentrated economic structure relative to England because of its relatively low degree of capital mobility. However, many economists have argued that capital mobility impacts economic

¹ Lance E. Davis "Capital Immobilities and Finance Capitalism: A study of Economic Evolution in the United States." *Explorations in Entrepreneurial History*, Vol. 1, No. 1, (Fall 1963)

² Stefan Sinn "Saving-Investment Correlations and Capital Mobility: On the Evidence from Annual Data" *The Economic Journal*, Vol. 102, No. 414 (Sep., 1992), pp. 1162-1170

³ Daniel Verdier "Capital Mobility and the Origins of Stock Markets." *International Organization*, Vol. 55, No. 2. (Spring, 2001), pp. 327-356.

growth, and this impact may be more salient than impacts on concentration.⁴ Further, there has been work suggesting other determinants to industrial concentration.

This paper attempts to test Davis' financial thesis using current literature to specify capital mobility. The conception of capital mobility developed by Verdier seems to indicate a possible mechanism by which capital mobility may actually lead to greater industrial concentration. Specifically, the development of equity securities markets, an indication of increasing capital mobility, favored large companies relative to small ones and gave them a mechanism for increasing their relative size compared to smaller industry players.

In order to test Davis' thesis, I first look at two case study periods. The first is 1919 - 1929 and the second is 1980 - 1998. In both these periods, banking structure became more conducive to capital mobility. However, evidence indicates that the levels of concentration in industrial activity increased or stagnated. I argue that strong performance in the equity markets which followed increases in capital mobility explains the behavior of concentration. Secondly, I develop a model for industrial concentration using data from over 81 unique SIC industries. The results seem to confirm my hypothesis that stock market performance – for which I assume capital mobility is a prerequisite – causes increased industrial concentration. It is important to note that while capital mobility is a prerequisite, it does not have an impact on stock market performance. When I discuss stock market performance, I refer to the downward or upward movement of stock values over time.

⁴ Verdier, *Capital Mobility*, 331, see also

Peter L. Rousseau and Richard Sylla "Emerging financial markets and early US growth." *Explorations in Economic History*, Vol. 42, Issue 1, (April 2005), pp 1 -26

The Davis Thesis and Specification problems

Lance Davis' thesis states that there is an inverse relationship between financial market development and industrial concentration. In a comparative analysis of the U.S. and U.K., Davis argued that the twofold problem of unit banking laws which restricted branching and limited markets for financial securities severely limited the US's ability to move capital funds between industries and geographic regions. The former made accessing local credit difficult for firms which had large capital needs. Further, it limited the scope in which capital could operate: "the legal prohibitions against branch banking and the distance between economic centres produced as late as 1870 a pattern of small, not very closely connected, short-term capital."⁵ In an environment like this, banks were unable to extend the long term capital needed for the development of many industrial enterprises. However, the market for long term impersonal capital was not very developed either. Davis argued that there were significant information asymmetry problems which took investment bankers many years to overcome before industrial securities could be marketable in U.S. exchanges. The limitations on capital mobility became especially palpable as industrial innovation accelerated in the late 19th century, and there was a need for capital to move out of old slow-growing industries like New England textiles, to new fast growing industries such as Midwest milling or meat-packing. In an environment where opportunities to exploit new technology and gain scale in industry were great, those who could access adequate financing through alternative means thrived while those who could not were driven out of the market or acquired. This phenomenon would cause greater concentration within

⁵ Davis, *Capital Immobilities*, 260

industry. Davis predicted that in an improving capital market, concentration within industry would decline.⁶

Since Davis, many individuals who have studied the relationship between capital mobility and industrial concentration have confirmed Davis' financial thesis. The most significant recent addition to this literature was compiled by Stephen Haber, who conducted a comparative study of capital market efficiency and industrial concentration in the textile industry in the US, Brazil, and Mexico. Using four firm concentration ratios for the textile industry, he concluded that greater capital market efficiency was inversely related to industrial concentration. Therefore, the US, which had the earliest developed and most efficient capital market among the three countries, had the least amount of industrial concentration. Mexico, which was the slowest developing with the least efficient capital market, had the highest rate of concentration.⁷

Given subsequent supporting work by individuals such as Haber, Davis' thesis seems to clearly identify the impact of capital mobility on industrial concentration. The fundamental logic behind the thesis makes sense: if all firms have an equal playing field in terms of accessing financial capital, the *ceteris paribus* impact is that financial lead concentration will be abated. However, Davis and Haber make the mistake of treating capital mobility and capital efficiency as synonymous. While related, they are two distinctly different aspects of finance. Capital mobility is the freedom for capital to go anywhere, whereas capital efficiency is the ability of capital to be put to its best uses. While capital mobility is a prerequisite for capital efficiency, they are not one and the same. In efficient capital markets, *ceteris paribus*, capital will be democratized and industrial concentration will be mitigated, as Haber demonstrates in his

⁶ Davis, *Capital Immobilities* see also

Lance Davis. "The Capital Markets and Industrial Concentration: The U.S. and U.K., a Comparative Study." *The Economic History Review*, Vol. 19, No. 2, pp. 255 – 272

⁷ Stephen H. Haber "Industrial Concentration and the Capital Markets: A Comparative Study of Brazil, Mexico, and the United States, 1830-1930" *Journal of Economic History* 51 no. 3, pp. 571

analysis. However, capital mobility only establishes the conditions on which capital can be deployed efficiently. Because capital mobility is an amorphous concept, it can very easily be confused with capital efficiency. The literature needed a more precise specification for capital mobility, which would be distinct from capital efficiency.

A new conception of Capital Mobility and Davis thesis revisited

In his paper, “Capital Mobility and the Origins of Stock Markets,” Daniel Verdier has two primary goals. First, he establishes a solid conceptual argument that capital mobility is a function of securitization, which he describes as the “transformation of firms’ liabilities into financial instruments of any maturity which can be continually traded in deep, broad, and impersonal markets.”⁸ Secondly, he argues that the extent of the development of securities markets, and thus capital mobility, was a function of the relative power of traditional economic sectors (i.e. non-industrial sectors) and the level of centralization of the state apparatus.

Verdier shows that markets for financial securities best reflect capital mobility. Further, banking structures that are formed in order to support capital markets best allow capital to be mobile. Given a modern financial market, capital can move between sectors and geographic space very easily:

“All it takes is for large investors to modify their relative holdings of stocks in these sectors; the induced change in share values allows the growth sectors to incur more debt while forcing the declining sectors to reimburse past debt. In the presence of a financial market, therefore, capital mobility reflects inter-sectoral changes in expected profitability”⁹

In order for corporate securities markets to develop, it had to be supported by the development of money markets and concentrated banking. For corporate securities to be appealing, viable secondary markets were necessary. However, viable secondary markets needed strong money

⁸ Verdier, *Capital Mobility*, 347

⁹ *Ibid*, 329

markets because short-term lending markets allowed for market players to access the short term funds needed for constant trading which would result in reliable pricing. If banks were to meet the short term borrowing needs of market players, a viable source of short term funds needed to become available. Verdier argues that individual deposits became this source of funding for banks during the 19th century:

“The collection of small deposits from millions of geographically dispersed individuals required the development ... of large, joint – stock banks, headquartered in the financial center, draining deposits from the periphery through networks of local branches”¹⁰

Thus, a unified conception of capital mobility arises out of Verdier’s argument. Specifically, capital mobility reflects the ability of investors to reallocate their portfolio of equity investments. In order for investors to do this, there has to be an active market for the buying and selling of corporate securities. This market will exist if it can access short term funding and the availability of this funding is determined by the ability of the banking system to channel the savings of many dispersed individuals to a central location. Funds move to where they can support market activity when banks are allowed to establish branches and grow in the size of their capital stock.¹¹

Verdier argues that the ability of funds to be channeled rested on the competition between traditional sectors, who did not want to see capital drained away from local banks, and modern industry, which needed large pools of capital to be collected to fund large scale projects. Further, the extent to which government was able to mediate played a substantial role in the results for capital mobility. Verdier argues that when traditional sectors were relatively powerless politically, well-developed financial markets were able to develop free of political constraints. However, when traditional economic sectors were powerful politically and state institutions were decentralized, political constraints hampered the creation of institutions necessary for the

¹⁰ Ibid, 332

¹¹ ibid

development of markets. When traditional sectors were politically powerful, but state power was centralized, financial markets were allowed to develop side by side with state subsidized credit banks.¹²

Understanding Verdier's framework for identifying capital mobility allows for a deeper critique of Davis' financial thesis. Namely, to what extent is the thesis correct to assert that the U.S. capital markets were less mobile than the U.K. in the 19th century? That is, which political groups had the political upper hand during this period and to what extent were the two countries centralized? Secondly, is Davis thesis really a story about capital mobility?

Verdier argues that the U.K. had relatively weak agrarian (traditional economic sector) political influence and a centralized state apparatus. Consequently, the U.K. had strong capital markets and mobile capital by the 19th century. While there was significant tension between the federal and state governments in the U.S. and political opposition from traditional sectors was fierce, victory seemed to have landed on the side of greater capital mobility as well. Sylla and Rousseau (2005) argue that government lead institutional changes allowing for greater financial markets began in the early 19th century. Hamilton's engineering of the financial revolution in the late 18th century and early 19th century in which a Bank of the United States with branches was incorporated with limited liability and in which the federal government took on the debt of states reflected centralized government power and development of financial market friendly institutions. Further, free banking laws in states which allowed for the further growth of banking helped attract capital to banks and solidify their role in mobilizing resources.¹³ Governmental innovations continued in the second half of the 19th century. Most notably, the 1864 National Bank Act created a system which allowed for banks to deposit excess funds to city centers where

¹² Ibid, 335

¹³ Rousseau and Sylla, *Emerging financial markets*, 5

they would be available to support money markets and directly lend to growing and capital needy industrial sectors.

However, a possible objection to the argument that the U.S. government played a key role in freeing capital during this time period is the extent that regulatory competition between the federal government and state governments fractured banking structure. The active competition between the federal and state government for regulatory control over banking caused the continual relaxation of regulatory controls on banks.¹⁴ In response, the number of commercial banks grew throughout the late 19th century and early 20th century to an all time high of 30, 456 by June 1921.¹⁵ These developments increased the power of small unit bankers, who were bent on keeping capital local. The unit bankers were able to thwart attempts by the federal government to introduce regulation relaxing restrictions on branch banking. The potential for branch banking to channel funds to financial centers would have fostered the movement of capital over geographic ranges and industries and would have increased both capital mobility and capital market efficiency while strengthening the banking system overall, reducing bank risk to localized economies. David Wheelock conducted econometric analysis on determinants of bank structure formation and his results support the belief that unit bankers wanted to suppress geographic capital mobility. Specifically, banks per capita and ratio of state-chartered to federally chartered banks were highest in states with branching restrictions. This implies that the political aversion to branch banking supported by unit bankers lead to a more fractured banking system. Wheelock argues the fact that branching would have allowed banks to re-allocate funds from distressed economic areas to more prosperous areas was the exact reason why branching

¹⁴ Eugene N. White "The Political Economy of Banking Regulation, 1864 – 1933." *Journal of Economic History* 42 no. 1, pp. 33 – 40

¹⁵ Wheelock, David C. "Government Policy and Banking Market Structure in the 1920s." *Journal of Economic History* 53 no. 4, pp. 859

was not politically feasible. He further provides evidence that the high number of banks per capita lead directly to high bank failure rates during the 1920's, showing that the fractured nature of banking structure left the banking system unstable. This failure rate among smaller banks, relaxation in banking restrictions against branching, and relaxation of restrictions against mergers in banking eventually lead to consolidation and strengthened the industry.

This evidence seems to support Davis' own observations. It looks as if the U.S. had more forces of political opposition to its development of financial markets than did the U.K. Paradoxically, the raw data on capital mobility seems to suggest that the U.S. had better developed capital markets than did the U.K. Sylla and Rousseau (2005) argue that the size of U.S. and U.K. equity markets were virtually the same by 1825, despite the fact that U.S. exchanges listed fewer securities and were 100 years behind in terms of experience. The authors argue that the higher implied capitalization per security reflected the U.S.'s support of limited liability corporations, which facilitated the collection of capital and made it easier for larger enterprises to develop. Most interestingly, the authors argued that limited liability allowed for U.S. banks to grow into large corporations with shareholders. However, most English banks, with the exception of the Bank of England, were small partnership and proprietorship enterprises. Therefore, it seems that centralized government forces in the U.S. may have gotten the upper hand in the struggle to create financial institutions, despite the power of local interests. These findings on the extent of capital mobility seem to cast doubt on some of Davis' observations. The incongruities between these facts which indicate that capital was very mobile and Davis' observations are possibly the result of Davis' own misspecification of capital mobility¹⁶

¹⁶ Peter L. Rousseau and Richard Sylla *Emerging financial markets and early US growth*

Verdier's narrowly defined conception of capital mobility indicates that mobile markets are distinct from efficient markets. For capital to be mobile, investors and creditors must be able to reallocate their holdings of securities. Even when investors are able to do this, it does not necessarily mean that their behavior reflects the best use of available knowledge about securities and industries: investors may still be reluctant to place capital in its most efficient uses because of "irrational" market behavior. Therefore, it seems that capital mobility is a necessary, but not a sufficient condition, for unbiased access to capital for business enterprises. Further, capital mobility accentuates differences in ability to access capital across firms, and could thus lead to greater industrial concentration. It is for these reasons that closer scrutiny of Davis' financial thesis is necessary. In this paper, I conduct two qualitative case studies and a quantitative analysis of 81 unique SIC based industries to determine if capital mobility democratizes credit and produces lower levels of industrial concentration, as Lance Davis argued. I find evidence suggesting that Davis' financial thesis is incomplete, and capital mobility may lead to industrial concentration.

Theoretical Argument

Capital mobility, characterized by active markets for financial securities, allows for capital to be moved between enterprises which operate in both different geographic sectors and economic sectors. However, even in deep financial markets, some securities will enjoy more active trading than others. I assume *ceteris paribus*, large firms enjoy more active trading than smaller firms. There are three implications for this assumption which demonstrate why large firms will have an easier time obtaining financing in securities markets than small firms. First, because the securities of large firms are traded more often, the thickness of the trading allows for the firms to have more stable pricing. Second because mobile markets are not always efficient

markets, large firms often receive the upper hand in their ability to raise capital when markets do not act rationally and efficiently. Third, incorporation as limited liability enterprises give firms a tremendous advantage in attracting capital, especially when securities markets are large. Thus, firms which are incorporated will often become more highly capitalized, and therefore larger, than firms which do not. For these reasons, capital mobility may not solve the problem of unequal access to capital. Instead, securities markets may accentuate the problem of unequal access to capital and cause concentration to increase. Simply put, capital efficiency does not automatically follow from capital mobility.

The economic explanation can be understood using corporate finance principals. The theoretical cost of equity capital is determined by the CAPM formula, which computes required return to equity capital (or the cost to firms of raising equity capital):

$$E(R_E) = R_f + \beta(R_m - R_f)$$

R_E = required return on equity capital

R_f = risk free rate of return

R_m = return to the market

β = the risk of a given security

In the CAPM formula, the β risk reflects the variability of stock price performance of an individual security relative to the overall market. Securities which exhibit higher variability relative to the overall market are considered more risky, and the required return on equity capital will be higher to compensate for that risk. Securities of larger and better well known firms, on which information is least costly to gather, will be traded more actively. Because of the “thickness” of the trading in these securities, prices will be less subject to strong movements in valuation, especially those which occur because of investor discounting due to paucity of markets or fear of information asymmetries. The relatively lower variability of larger firms’

securities will give them a lower β value, and the required return on equity capital will be relatively less than that of smaller firms.

One may argue that the above mentioned problem is one which increased capital mobility actually solves. Larger securities markets would imply that all securities are able to command a considerable number of buyers and sellers. However, there are many reasons why larger firms will always command more active buying and selling than smaller firms. One reason may be that with larger capitalizations, there is simply “more” that can be bought and sold. By establishing markets, larger firms are able to command more attention which leads to lower costs of equity capital.

The argument that increased capital mobility will lead to lower variability in stocks is also highly disputed. Specifically, the amount of lending available to participants in the stock market is a direct determinant of capital mobility. If these participants borrow money to speculate as opposed to facilitating market transactions, their actions will actually increase the volatility, and thus the β , of the large firms which receive a disproportionate share of speculators' attention. The academic debate over the question of the impact of security lending on volatility is inconclusive. Notable contributors to this literature include Schwert (1989) and Fortune (2001), who both argue that security lending has no significant impact on stock volatility, and Hardouvelis (1988) who argues that efforts to control margin lending lead to decreased volatility. I do not find this debate to be especially problematic for my assumption for several reasons. The behavior of market speculators reflects yet another method by which capital mobility may make the financial system more inefficient. However, periods of market correction after highly speculative cycles will more likely be less severe for large, heavily monitored firms because information asymmetries will be less.

Further, when markets do not necessarily act according to corporate finance theory, it is often larger firms that benefit from the market irrationality. The connection between the cost of equity capital and the price of a stock is given by:

$$P = \frac{D_1}{R_E - g} \quad \& \quad R_E = \frac{D_1}{P} + g$$

D_1 = dividend payment in the next dividend payment period

g = growth rate of dividend payments (& growth rate in value of stock)

In a rational market, we would expect that this market derived cost of equity capital equals the theoretical determination of the cost of equity reflected in the CAPM formula.

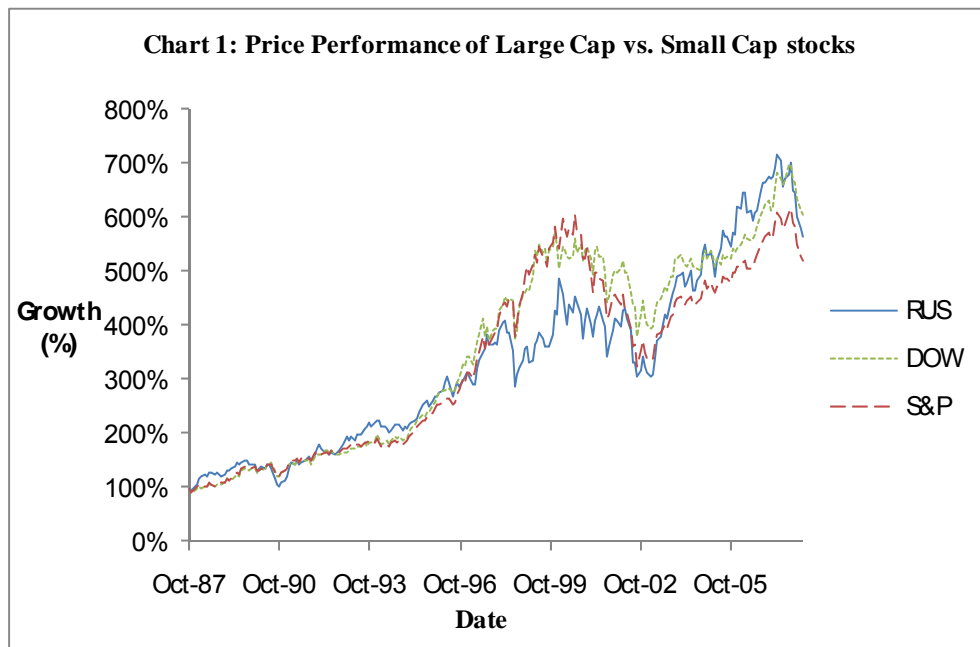
$$R_f + \beta(R_m - R_f) = \frac{D_1}{P} + g$$

This model tells us that price has an inverse relationship to cost of equity capital. Therefore, in an environment where strong demand for equity securities bids up prices, we should expect a corresponding decrease in the cost of equity capital to business firms. One may argue that cost of equity should not change because the relative decrease in $\frac{D_1}{P}$ will be offset by an increase in g .

However, the definition of market exuberance is unrealistic growth figures which never materialize. Given that the fundamentals of the CAPM equation have not changed, there is no reason why R_E should change. In order for R_E to fall, securities must be mispriced. Specifically, prices were bid too high, based on the risk profile of securities in the market. Therefore, many firms do not have to compensate investors for a significant portion of the risk in their securities. I believe larger firms, because they are more conspicuous and more actively traded, benefit more from market irrational exuberance.

Evidence seems to indicate that larger firms benefit in the cases of market irrational exuberance. Chart 1 shows price performance of the Dow Jones Industrial Average (Dow), S&P

500 index (S&P), and Russell 2000 small cap index (Rus). The DJIA represents the 30 largest U.S. stocks, while the S&P 500 is a proxy for entire market performance and the Russell 2000 is a proxy for the performance of the smallest 2000 firms in the market. Because the Russell index was not developed until the late 1980's, comparative time series evidence is limited. However, the chart indicates that the Dow outperformed the Rus during the 1990's stock market climb; a period which many agree was marked by irrational exuberance. Further, the Dow did not fall nearly as much as the Rus during the market correction, supporting my claim that margin speculators increase the variability of small cap firms more so than large cap firms. During the first market climb of this century, when stock market performance reflected the amount of liquidity and money available for investing, we again see that the Dow's performance accelerated faster relative to the Rus in the beginning of the stock market climb. However, there was a period of market correction later in the boom cycle during which the Rus outperformed the Dow, after which they began to move together and with the rest of the overall market.



Source: Data used to create this graph came from finance.yahoo.com

Lastly, securities markets give incorporated firms an advantage to grow relative to unincorporated or private firms. Limited liability and perpetual ownership make the process of attracting capital relatively easy for public firms. However, private firms have unlimited liability and businesses often end or suffer through complicated chain of control processes when the original owner passes away. Many firms choose to stay private because owners do not want to give up ownership or have to adhere to sometimes costly and inflexible regulatory rules for public firms. These firms which decide to stay private will be disadvantaged in their ability to raise capital. While it would be possible for these private firms to enter public markets in order to acquire the capital necessary if rapidly changing economic conditions dictate that they do so, they will still be disadvantaged in raising capital relative to other established public firms, which have had securities floated for a longer period of time and have an active market in which they are traded.

When large firms realize privileged access to capital relative to their peers, they are able to take advantage of this through strategic initiatives which their peers can not match. In particular, when high stock market performance gives larger firms access to capital which is not only cheap relative to their peers, but also cheap overall, the incentive to engage in strategic initiatives meant to improve their performance becomes even stronger. If investments in cost saving technology or capital equipment are not available, larger firms may use their privileged access to capital to increase their market power through mergers. Evidence suggests that positive stock market performance is correlated with higher merger activity.¹⁷ Support for this evidence also exists in both of my case study analysis.

¹⁷ In his work *Merger Movements in American Industry 1895 – 1956*, Ralph Nelson empirically tests the hypothesis that stock market performance predicts merger activity. In his analysis, the correlation between the two variables is extremely strong. Further, when analyzing the 1919–1933 merger movement in banking in *The Merger Movement in Banking, 1919 - 1933*, Eugene

While the argument that stock market activity triggers merger activity may be well supported by the literature on merger activity, this statement may be counter to some aspects of corporate finance theory. Specifically, the pecking order theory of capital developed by Myers (1984) argues that firms access internal financing such as retained earnings before going to external capital markets to obtain funding. Further, when firms do go to external markets, they prefer bonds and debt instruments to equity. While estimates are not conclusive, many guess that external financing makes up less than 20 percent of firms' external financing.¹⁸ I do not believe this is problematic for my analysis for three reasons. First, 20 percent reflects a substantial portion of firms' capital, and the cost of this capital will certainly play a role in decision making about investment projects. Secondly, firms behave opportunistically, thus the lowering of the costs to external financing relative to other periods of time may induce many to take advantage of relatively cheap prices. Lastly, stock values have a strong impact on the overall amount of external financing firms may access, as an increasing equity base will also allow firms to incur more debt.

Because I will test my theoretical conclusions by modeling industrial concentration, it is important to present brief arguments of other determinants of industrial concentration. Davis also acknowledged that there were many other determinants of industrial concentration. I think the most important of these determinants are minimum efficient scale in an industry, entry barriers due to cost of fixed capital, rate of technological innovation, and the political significance of the industry. However, thanks to work conducted by Ralph Nelson in his *Merger Movements in American Industry 1895 – 1956*, there is strong evidence that industrial retardation does not play

White reaches similar conclusion while trying to explain merger activity among banks. In his econometric analysis, stock market performance was found to have a positive impact on merger activity.

¹⁸ S.C. Myers, "Capital structure", *Journal of Economic Perspectives* 15 no. 2 (2001), pp.81-102.

a role in merger activity and by implication industrial concentration. In Nelson's quantitative analysis, the correlation between merger activity and industrial production is weak. Indeed, the increase in merger activity during periods of growth has been perplexing.¹⁹ Therefore, I do not feel it is necessary to address the impact of industrial retardation on mergers and industrial concentration.

Minimum efficient scale is an important determinant of industrial concentration because it constrains the number of firms which can operate in a given market place. An industry where the minimum efficient scale corresponds to 20% of the industry sales will fundamentally have a different structure than one which firms can operate at the minimum efficient scale at 1% of industry sales. Further, the tendency towards concentration will be impacted by changes in the industry's minimum efficient scale.

For similar reasons, both entry barriers and rate of technological innovation are also important theoretical determinants of industrial concentration. Both of these variables become more significant determinants of industrial concentration when capital mobility is low because they represent financial impediments. An entry barrier is often, but not always, a financial barrier to an industry in the form of high fixed capital requirements. This would especially be an issue for US industrial firms, which were always extremely capital intensive. Entry barriers would increase industrial concentration if they are so high that only a few individuals have the access to resources to enter the industry. When capital is mobile and access is democratized, this variable would most likely have less of an impact on concentration. Further, technological innovation creates a requirement for firms to continuously invest in order to remain efficient in an industry. This will require capital. Firms who can not access capital will thus be at a competitive

¹⁹ Davis, *Capital Markets*, 270 and Nelson, *Merger Movements*, 77-78

disadvantage to those which can, and the resulting failure of these firms will lead to greater concentration. This is essentially the logic Davis' employs in arguing his financial thesis, claiming that democratized access to capital will free industrial concentration of its financial determinants.

Lastly, as Carl Eis (1969) indicated by his analysis of anti-trust enforcement on industrial mergers, the extent which industries are scrutinized by governmental regulatory agencies and/or the public may be a large determinant of industrial concentration. Specifically, if an industry is particularly important to consumers or has significant political implications, government regulation may fall more greatly on the industry and impact its structure. Carl Eis' results suggest that public scrutiny in the form of anti-trust enforcement was not an important determinant of merger activity. However, his findings were not conclusive. In U.S. anti-trust regulation history, both the development and enforcement of anti-trust measures seemed to target particular industries. Thus, it seems that public perception and regulatory attention may at least occasionally become a relevant variable. An example of this is the impact of regulatory interest on banking structure in the U.S. described by Eugene White.²⁰

Two Case studies

The tremendous structural changes which took place in the 1920's and the 1980 – 1998 period make a case study of these two periods compelling. This is not to say that there were not significant structural changes in the interim period. The interim period was characterized by the slow relaxation of regulations which had been created in the late 1920's and in the immediate aftermath of the Great Depression. The relaxation of these regulations, including the 1927 McFadden Act which banned interstate branch banking and the 1933 Banking Act which

²⁰ Lawrence J White. "Trends in Aggregate Concentration in the United States," *Journal of Economic Perspectives* 16 no.4 (Fall 2002): pp. 137 – 160

prohibited interest payments on bank deposits, culminated in a period of tremendous change in the structure of the commercial banking industry.²¹ During both periods, bank mergers grew at a tremendous rate and commercial banking assets consolidated into the hands of fewer companies. This consolidation gave money center banks more control over economic resources. Further, branching grew during both periods, and thus the ability for commercial banks to re-allocate capital also grew at a tremendous rate. These similar structural changes make these two periods' excellent case studies. Specifically, it would be interesting if structural changes in both periods have similar impacts on capital mobility and industrial concentration, given the fact that capital markets were significantly more complex towards the end of the century than they were in the 1920's.

A case study of the 1920's

In the 1920's, statistics reflected improving capital market conditions in the U.S. Davis' financial thesis predicts that levels of industrial concentration should decline with improving capital market conditions. However, I find evidence to suggest that levels of industrial concentration actually increased during the 1920s. This increase in concentration seemed to reflect the merger movement during this period, which had been triggered by strong performing stock markets.

The U.S. experienced rapid development in the banking system leading up to and during the 1920s. These developments created a more unified national market for capital. During this period, many small unit banks which restricted capital locally collapsed while new legal regulations allowed other banks to consolidate and develop branch networks.²² Further, a

²¹ Hester, Donald D. "U.S. Banking in the Last Fifty Years: Growth & Adaption," *Wisconsin Madison – Social Systems Working Papers* no. 19 (2002), pp. 19

²² White, *Merger Movement in Banking*, 288

disproportionately large share of state banks failed in comparison to national banks, shifting more banking resources to the national banking system. Increased consolidation in the banking industry allowed for the development of a national money market and a vibrant call loan market. This development in turn supported the expansion of securities markets, allowing for a greater number of firms to access them as a source of capital.

The failure of small unit banks helped move capital into the hands of larger metropolitan banks which were better able to mobilize capital. During the 1920's, no large city banks failed, while 4925 small country banks failed. These country banks made up roughly 17–20 % of total banks and held about \$1.5bn in deposits.²³ This tendency directly helped to offset the power of unit bankers, which had hitherto contributed to fracturing the banking system and creating problems for mobile capital flows. The fact that the overwhelming majority of these bank failures - 4,228 - were state or private banks also played a role in increasing capital mobility, as more funds moved into the national system as a result.

The failure of small banks was simply one aspect in the continuing consolidation of banking resources which helped commercial banks to better mobilize capital. Between 1921 and 1929, Bank deposits increased from \$38.5bn to \$57.9bn. During this period, the number of banks decreased from 30,419 to 25, 113.²⁴ By 1929, 250 metropolitan banks held over \$33bn in resources out of a national total of \$72bn.²⁵ Further, the extent of branching grew significantly. Banks who operated branches numbered 547 in 1921 and made approximately 24% of all loans and investments among commercial banks, and in 1929 these banks numbered 764 and made

²³ Carosso , *Investment Banking in America*, 242

²⁴ Board of Governors of the Federal Reserve System, *Banking and Monetary Statistics* (Washington: National Capital Press, 1943), pg.19

²⁵ Carosso, *Investment Banking in America*,242

approximately 43% of all loans and investments among commercial banks.²⁶ The failure of unit banks discussed above played a substantial role in shifting resources to commercial banks operating branches. However, merger activity also played a significant role. Between 1921 and 1929, 3,290 banks merged with merged assets totaling \$14.7bn. In 1929 alone, the percentage of merged bank assets to total banking assets of the nation was 9.6 percent.²⁷

The impact of the increasing consolidation in banking is that the industry grew more stable and better capable to meet the demands of industrial clients. The comptroller of currency commented on the growing consolidation in commercial banking, stating “Banking is following in the wake of the trend in business in general toward larger operating units with stronger capital funds and more experienced and highly trained management.”²⁸ Eugene White, who conducted a quantitative analysis of the merger movement in banking, comes to much the same conclusion: commercial banks merged, looking to increase their scale and operating performance.²⁹ Further, commercial banks had more funds available to deploy for long term uses. From 1919 to 1929, time deposits as a percentage of total deposits among commercial banks grew from 26.3 percent to 41.1 percent.³⁰ Most importantly, however, these developments allowed commercial banks to play an important role in the development of the securities markets through increased margin lending.

During the 1920’s, the amount of short term lending by commercial banks to stock brokers and market makers increased dramatically. We can see the direct impact of consolidation in the commercial banking industry on the security loan market. Verdier argues that the critical link in developing capital mobility is for brokers and market makers to have access to short term

²⁶ Board of Governors, *Banking and Monetary statistics*, pp. 19 & 297

²⁷ White, *Merger movement in banking*, 286

²⁸ Carosso, *Investment Banking in America*, 242

²⁹ White, *Merger movement in banking*, 291

³⁰ Board of Governors of the Federal Reserve System, *Banking Studies* (Baltimore: Waverly Press Inc, 1941), 436

funds for continuous buying and selling of securities. Between, 1919 and 1929, security loans made by Federal Reserve member banks in the 101 leading cities increased from \$4.7bn to \$8.3bn.³¹ The total size of these loans made up roughly 10 to 20 percent of NYSE value during this period.³²

Commercial banks also became directly involved in developing financial markets through security affiliates they developed during the 1920's. These affiliates not only assisted in developing a viable money market, but played a direct role in buying and selling securities themselves. By 1930, commercial banks originated 44.6% of new securities issues and played a more important role in the investment banking business than the traditional brokerage houses because of their role in distributing securities.³³ Between 1919 and 1929, new corporate issues of securities grew from \$2.7bn to \$9.4bn while volume of shares traded grew from just 317 million shares in 1919 to over 1 billion in 1929.³⁴

All of the factors just mentioned point to the development of a more accessible market. If we compare the above mentioned statistics to Lance Davis' argument for why the US had problems mobilizing capital, we see improvement in all the indicators. Further, this story is consistent with Verdier's argument for how capital mobility leads to deeper and more expansive securities markets. Overall, collection of resources improved, management of banks became more professional, banks grew more familiar with depersonalized finance, commercial banks were better able to make long-term loans, and the securities market expanded in size. Further, the national banking system strengthened, and the extent of branch banking increased, allowing for

³¹Board of Governors, *Banking and Monetary statistics*, pp. 132 - 142

³²Fortune, Peter. "Security Loans at Banks and Nonbanks: Regulation U." *New England Economic Review* (Winter, 2002): pp 22

³³ *ibid*

³⁴ Carosso, *Investment Banking in America*, 244

an increase in mobilization of capital. Lance Davis predicts that in an environment like this, one should expect the extent of concentration to decline.³⁵

However, the data during this period on industrial concentration, while not conclusive, seems to cast serious doubt that the levels of industrial concentration decreased. Economists have come up with varied estimates for industrial concentration. Unfortunately, 4-firm concentration ratios, which have become the standard of measurement, are unavailable for this time period. Nonetheless, available concentration measures for this time period point to the incidence of slightly increased industrial concentration.

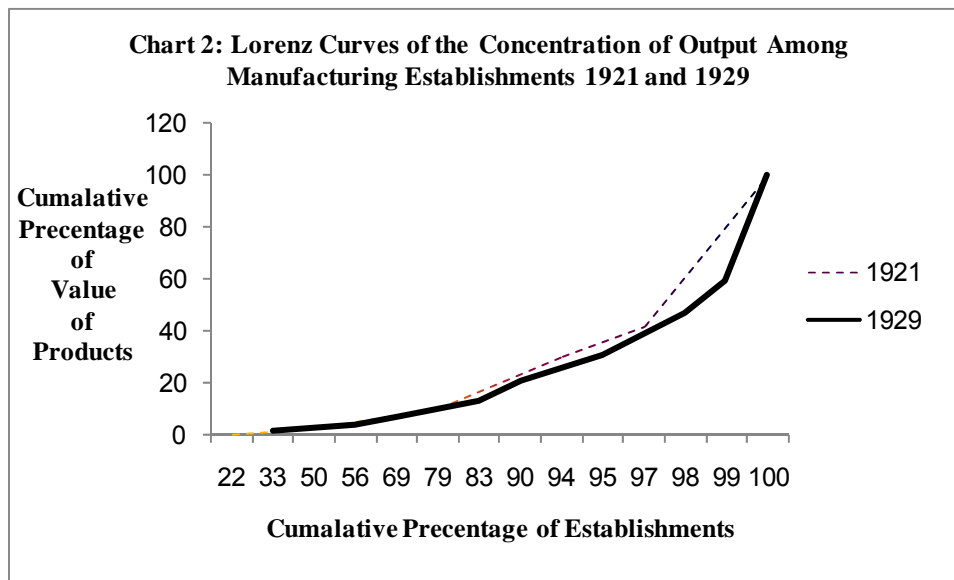
One method for measuring industrial concentration created by the Temporary National Economic Committee is called the TNEC absolute index of concentration of employment. As explained G. Nutter's *The Extent of Enterprise Monopoly in the United States 1899 – 1939*, the index is formed by taking the reciprocal of the percentage change in the number of top establishments, which together employ half the wage-earners in an industry. The index serves as a measure of the number of firms who together employ a fixed fraction of the workforce over time. This index, when computed for the economy overall using 1914 as a base year, grows from 102 in 1921 to 109 in 1929.³⁶ While this is not dramatic, it does point to increasing concentration during a time period where Davis' thesis predicts a decrease in concentration. However, there are many weaknesses in using the TNEC index. The index is highly influenced by how industries are classified as well as by the fact that industries which arise after the base year are not included in the index.³⁷

³⁵ Davis, *Capital Markets*, 271

³⁶ G. Warren Nutter. *The Extent of Enterprise Monopoly in the United States, 1899-1939*. (Chicago: The University of Chicago Press, 1951)

³⁷ *Ibid*, 31

Another measure of concentration is the Lorenz distribution, which shows the cumulative percentages of establishments against the associated cumulative percentage of value of the products produced by the establishments. We would expect that this distribution will bulge outward, creating the shape of an exponential curve, when there is unequal production among firms. Therefore, if we plot Lorenz curves for 1921 and 1929, the extent that each is bowed outward gives us a measure of relative concentration. Figure 2 shows Lorenz curves in 1921 and 1929. The Lorenz curve for 1929 is bowed further outward than that for 1921, signifying that concentration of industry increased during this time period.



Source: data came from concentration figures reported in Nutter's *The Extent of Enterprise Monopoly in the United States, 1899-1939*

However, the most compelling evidence for increased concentration during this time is the magnitude of the merger movement in manufacturing that occurred. While many people debate the time parameters and the exact extent of the merger movement during this period, there is no doubt that the number of mergers increased dramatically. From 1919 – 1930, 3009 manufacturing firms with combined capitalization of \$12.1bn disappeared into mergers. From

1921 – 1929, this numbers totaled 2406 and \$8.8bn, respectively.³⁸ This compares to figures of 1140 and \$4.5bn during the decade from 1911–1920.³⁹ The extent that this merger wave might have influenced industrial concentration is reflected in the tremendous amount of mergers that took the form of horizontal integrations or mergers between competitors. Carl Eis, who conducted a detailed study of the 1919–1930 merger movement in American industry, predicted that approximately 52% of mergers and of merger capitalizations were between competitors.⁴⁰ Further, the merger activity absorbed large parts of many of the nation’s industries. Table 1 gives merger capitalizations as a percentage of total industry capitalizations. We see that in the Steel and Petroleum Refining industries, mergers absorbed over 35 percent of the industries’ capital. In Chemicals and Transportation, the figure is 27.3 and 24.7, respectively. The fact that the merger activity did embrace so much of the merger capitalizations in these industries indicates that their effects lead to industrial concentration, and supports the results obtained from the TNEC absolute concentration index and the Lorenz curve analysis. During the 1920s, concentration in American industry seems to have increased, or at the very least one may surmise that concentration did not decrease in any substantial manner.

³⁸ Carl Eis. “The 1919-1930 Merger Movement in American Industry.” *Journal of law and Economics*, Vol. 12, No. 2, p. 271

³⁹ Ralph L. Nelson *Merger Movements in American Industry, 1895 – 195* (Princeton: Princeton University Press, 1959), 37

⁴⁰ Eis, *The 1919-1930 Merger Movement*, 296

Table 1: Relationship of Merger Values to total 1929 Capital by Industry

Industry Group	1929	1919 - 1930	Col.2
	Capital Million of Dollars	Merger Values \$ Millions	As Per- centage of Col. 1
	<u>1</u>	<u>2</u>	<u>3</u>
Iron, Steel, Non - Ferrous Metals	8420	3045.3	36.2
Peromleum Refining	5745	2211.8	38.5
Food & Kindred Products	7731	1520.3	19.7
Chemicals and Allied Products	3942	1075.5	27.3
Transportation Equipment	3264	806.6	24.7
Nonelectrical Machinery	4319	552.0	12.8
Stone, Clay, & Glass Products	2351	374.1	15.9
Textiles (except clothing)	5929	316.2	5.3
Electrical Machinery	1514	278.8	18.4
Paper, Pulp, & Products	2060	243.4	11.8
Forest Products	3842	179.8	4.7
Rubber Products	1088	119.8	11.0
Printing & Publishing	2622	89.9	3.4
Leather Products	1167	77.2	6.6
Tobacco Products	1150	77.0	6.7
Clothing	1758	20.2	1.1

Source: Eis, Carl. "The 1919-1930 Merger movement in American Industry." *Journal of law and Economics*, Vol. 12, No. 2, p. 278

The results of this natural experiment seem to refute Lance Davis' financial thesis, or at the very least cast serious doubt on it. During a time where capital mobility seemed to be improving, the US does not experience the expected reduction in industrial concentration. Instead, it seems that the more highly active markets paved the way for a rise in the stock market activity which may explain the extent of merger activity during this period. From 1921 to the height of stock market performance before the stock market bust in 1929, the indexed price of common stocks rose from 60.4 to 237.8 while the performance of preferred shares rose from 102.6 to 136.1 over the same time period.⁴¹ The difference between common stocks and preferred shares is that companies are not obligated to pay dividends on common stocks. Therefore, companies could have believed that common stocks offered a relatively cheap form of financing during this period, and may have used it as a currency for acquisitions because of its

⁴¹ Board of Governors, *Banking and Monetary statistics*, 480

relative cheapness and availability. Preliminary data seems to support this hypothesis. While corporate issues of bonds surpass that of stocks over the period from 1921–1929 by a figure of \$26.6bn to \$17bn, issues of stocks saw a much higher growth rate and by 1928 had surpassed the issues of bonds.⁴² Further, issues of common stock surpassed that of preferred stock \$10.5bn to \$6.5bn. Issues of securities to be sold for cash to the public never made up less than 80% of all issues, preferred or common, signifying that public demand for equity securities were strong, which would have increased the price of stocks while lowering the required return.⁴³

Table 2 displays data on percentage of merger activity accounted for by leading firms in several industries during this time period. These figures, compiled by Carl Eis, only take into account horizontal mergers. Eis also separates the firms into the group which were “dominant” in their industry, meaning they commanded a minimum of 40 percent of the market share, and “non-dominant” leaders. A cursory look through the figures reveals that both groups of firms played significant roles in the merger activity within their respective industry groups. All of these firms were publicly traded, and were large enough to benefit from the market exuberance.⁴⁴ Further, we see that leading “non-dominant” firms played larger roles in firm disappearances than did “dominant” firms on average, implying that those firms which had less to fear of anti-trust litigation because of their non-dominant position, used the market conditions to engage in strategic horizontal merger activity.⁴⁵

⁴² Carosso, *Investment Banking in America*, 243

⁴³ Rousseau, Peter L., “Corporate security issues: 1910–1934.” Table Cj831-837 in *Historical Statistics of the United States, Earliest Times to the Present: Millennial Edition*, edited by Susan B. Carter, Scott Sigmund Gartner, Michael R. Haines, Alan L. Olmstead, Richard Sutch, and Gavin Wright. New York: Cambridge University Press, 2006.
<http://dx.doi.org.libproxy.lib.unc.edu/10.1017/ISBN-9780511132971.Cj797-869>

⁴⁴ I referred to Moody’s manual of industrial securities to determine whether or not the firms were publicly traded. All were publicly traded and featured on Moody’s list of most important American corporations in their respective industries.

⁴⁵ Eis, *The 1919-1930 Merger Movement*, 285-287

Table 2 :Percentage of Industry Merger Activity Accounted for by the Leading Firms - Dominant and Non-dominant Firm Industries

Industry or Product	Name of Leading Firm	Total Industry Disappearances	Percentage by Leading Firm (%)	Total Industry Value \$ Millions	Percentage by Leading Firm (%)
<i>Group 1 - Leading Dominant Firms</i>					
Soap & Detergent	Proctor & Gamble	10	50.0	65.4	28.6
Gypsum Production	U.S. Gypsum	10	40.0	35.2	30.1
Biscuits and Crackers	National Biscuit	25	36.0	59.3	56.2
Flat Glass	Pittsburg Plate Glass	21	14.3	50.5	8.1
Industrial Alcohol	U.S. Industrial Alcohol	26	11.5	67.5	11.6
Agricultural Machinery	International Harvester	25	8.0	124.3	5.0
Primary Steel	U.S. Steel	77	0.5	1556	2.7
Tin Containers	American Can	16	—	22.6	—
<i>Group 2 - Leading Non-Dominant Firms</i>					
Flour Milling	General Mills	23	34.8	79.5	45.3
Glass Containers	Owens - Illinois	11	27.3	42.6	54.7
Copper Mining	Anaconda Copper Mining	18	16.7	389.7	54.4
Shoes	International Shoe	17	11.8	45.3	70.0
Refractories	Harbison - Walker Refractories	20	10.0	30.6	7.8
Paper	International Paper	43	9.3	188.3	9.7
Cement	Lehigh Portland Cement	34	3.0	151.1	2.2

Source: Eis, Carl. "The 1919-1930 Merger movement in American Industry." *Journal of law and Economics*, Vol. 12, No. 2, p. 286

Thus, the 1920's indicates a moment in U.S. history which seems to run counter to Lance Davis' financial thesis. Industrial concentration seems to have increased with capital mobility. However, we see that strong stock market performance was the probable cause of this increase. While strong stock market performance is not necessarily caused by capital mobility, the existence of broad securities markets indicated by capital mobility is precisely what allows strong stock market performance to have such a strong impact on firms' abilities to access capital. Thus, it may be argued that stock market lead incentives towards concentration would not have been possible without a mobile capital market: just as efficient markets would not be

possible without a mobile capital market. Though evidence from the 1980 – 1998 period is not as conclusive, the results of capital mobility formation indicate the same results.

A Case Study from 1980 – 1998

In the 1980's, states began to form reciprocal agreements on interstate banking among themselves.⁴⁶ This trend in liberalizing banking regulation culminated in the Riegle-Neale Interstate Branching Act of 1994, which gave federal approval to nationwide branch banking. These measures lifted constraints on banking which had been in place for over half a century, and lead to a sustained merger wave from 1980 – 1998.⁴⁷ As restrictions on branching fell, the merger wave continued to gain momentum and vigorously accelerated after the 1994 act. During this period, \$2.4 trillion in bank assets were acquired, with half of the acquisitions taking place between 1995 and 1998.⁴⁸

Much of the stimulus for these mergers were not, however, the relaxation of branching regulations. While the relaxation of regulation allowed for the mergers to take place, there were fundamental changes in the business climate for banks which necessitated combinations into larger operating units. Previous to agreements by states on interstate banking, interstate banking structures had been prohibited by the 1927 McFadden Act.⁴⁹ While the trend away from fractured “unit banking” which had begun in the 1920's continued, and many large banking companies were in existence throughout the 20th century, they were effectively limited in their growth by an inability to go beyond state borders in order to collect deposits. Further, after the Banking Act of 1933, commercial banks were restricted in their ability to pay interest on demand deposits. Many believed that bank lending to brokers and market makers was a major cause of

⁴⁶ Hester, *U.S. Banking*, 8 & 19

⁴⁷ Rhoades, *Bank Mergers*, 8

⁴⁸ *Ibid*, 2

⁴⁹ Hester, *U.S. Banking*, 19

stock market speculation during the late 1920's, and there was a desire on the part of government to limit this lending by preventing banks from accessing the funds necessary to make loans for "speculative purposes." Not only did this act prevent money-center banks from being able to attract funds from local banks, but it also prevented them from arranging loans to brokers on behalf of non-banking customers.⁵⁰ Further, these regulations placed binding interest rate limits on time deposits.

In the aftermath of the regulatory changes, the ability of commercial banks to attract funds deteriorated significantly. In particular, commercial clients increasingly pulled their deposits out of banks where they earned no interest and lent directly to other corporate borrowers through the commercial paper market.⁵¹ Financial innovations during the 1960's and 1970 had also made attracting funds more difficult for commercial banks. In particular, investment banks began floating money market mutual funds (MMMFs) which offered short term, low risk, highly liquid interest bearing investments for investors. Further, many mutual savings banks developed negotiable order of withdrawal (NOW) accounts. These accounts were essentially checking accounts, but had the special distinction that they paid interest on these "checking" account deposits, while commercial banks were prohibited from doing so.⁵² Lastly, "Eurodollar" markets for dollar based deposit accounts in foreign countries grew during this time period and became yet another alternative destination for depositors seeking higher returns in banking environments with less regulatory constraints than the U.S. This competition made accessing funds extremely

⁵⁰ Fortune, *Security Loans*, 19

⁵¹ Hester, *U.S. Banking*, 3

⁵² *ibid*, 8

difficult for domestic U.S. commercial banks, and served as a strong impetus to banks to merge in order to limit intra industry competition.⁵³

The extent of the resulting merger movement in banking was dramatic, and ushered many changes to the banking industry. As previously mentioned, \$2.4 trillion in banking assets were consolidated between 1980 and 1998. The extent of this can be appreciated by the fact that this figure represents more than 50 percent of total U.S. commercial banking assets in 1980. Of this figure, states with money centers such as California, New York, and Illinois had acquisition of banking assets totaling \$424bn, \$177bn, and \$180bn, respectively.⁵⁴ These three money centers reflected nearly 1/3 of all acquisitions. Further, the acquisitions were made by large banking enterprises which were becoming larger. Multi-bank holding companies made 64 percent of all acquisitions, while one-bank holding companies only made 27 percent and independent banks only made 9 percent of acquisitions. As a result of these dramatic changes, concentration in the banking industry grew dramatically. Table 3 summarizes changes in concentration among commercial banks. The growth in concentration, displayed by the compounded annual growth rate (CAGR) figure, was impressive and the ending results in terms of concentration are also quite dramatic.

⁵³ *ibid*, 16

⁵⁴ Rhoades, *Bank Mergers*, 3

Table 3: Concentration in Commercial Banking, 1980 - 1998

Year	<i>% of assets accounted for by:</i>			
	<i>Top 10</i>	<i>Top 25</i>	<i>Top 50</i>	<i>Top 100</i>
1980	18.6	29.1	37.1	46.8
1981	17.9	28.7	36.7	46.6
1982	18.1	29.1	37.7	48.1
1983	17.8	28.7	37.9	48.8
1984	17.2	28.3	38.5	50.1
1985	17.0	28.5	40.5	52.6
1986	17.6	29.6	42.4	55.6
1987	18.1	31.1	44.1	57.4
1988	19.2	33.2	47.5	59.9
1989	19.9	34.1	48.1	60.5
1990	20.0	34.9	48.9	61.4
1991	22.7	37.5	49.6	61.3
1992	24.1	39.2	51.7	62.6
1993	25.0	41.0	53.8	64.6
1994	25.2	41.5	54.6	65.9
1995	25.6	43.0	55.8	66.9
1996	29.8	46.8	59.0	68.6
1997	29.9	47.0	59.6	69.1
1998	36.7	51.2	62.6	70.9
CAGR	3.64%	3.02%	2.79%	2.21%

Source: Bank mergers and Banking Structure in the United States, pg. 23 & 24. Author originally obtained the data from NIC database, Federal Reserve Board.

The structural changes ushered by the merger movement in banking allowed for the banking system to become more interconnected geographically, allowing for capital to travel greater distances. 54 percent of commercial bank acquisitions from 1980 – 1998 lead to market extension for the acquiring bank, and this figure remained consistently over 60 percent after the passage of the Riegle-Neale Act.⁵⁵ The increases in market extension lead to growth of bank offices in local markets, while the total number of banks in the U.S. decreased. In 1984, the

⁵⁵ Rhoades, *Bank Mergers*, 19

number of banks stood at 14,381. This number decreased to 8,697 by the end of 1998.

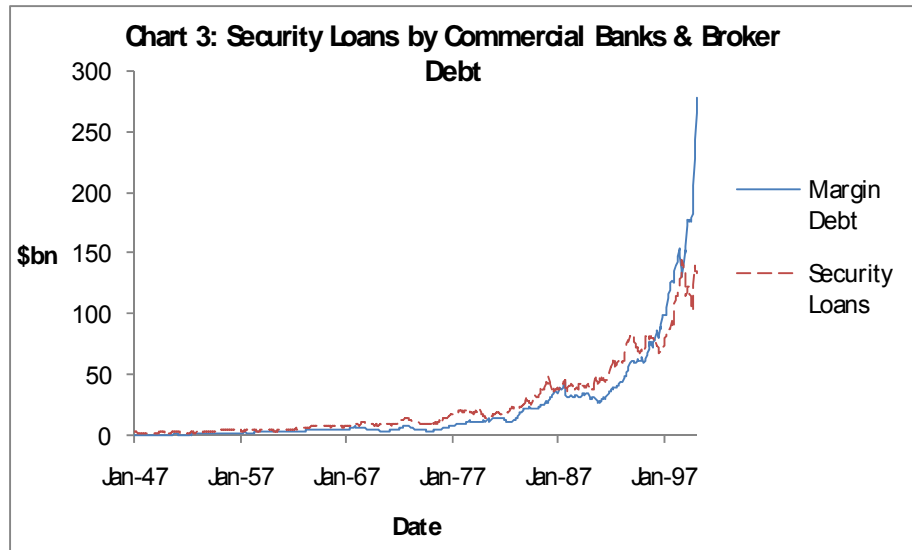
Meanwhile, the number of bank offices grew from 53,000 in 1980 to 71,000 at the end of 1998.⁵⁶

Based on both Verdier and Davis' arguments, we should expect that these developments in the commercial banking industry would increase capital mobility. If we focus on Davis' thesis, we expect that the consolidation of bank assets and the spreading out of branch offices will allow capital to move further away from the sources of savings, in search of the best returns. Verdier's hypothesis is that the consolidation of bank assets, especially in the money centers, creates a ready supply of deposits which can be used for margin lending to brokers. Because this paper focuses primarily on Verdier's conception of capital mobility, looking at the activity in the securities markets will give the most theoretically consistent indication of the trend in capital mobility.

Chart 3 plots the amount of margin loans made by commercial banks against the amount of margin credit available to brokers. These figures stay flat from the 1940's through the 1970's. However, at the end of the 1970's, margin lending by commercial banks and margin debt at brokers both begin to accelerate. This offers tentative support to the hypothesis that commercial banks were better able to attract deposits by consolidating, and this increase in deposits provided more funds for security loans. Chart 4 tracks the growth in deposits versus the growth in securities loans made and debt balances of brokers. The chart offers a compelling example of how deposits and security loans move together. We can see that deposits drove security loans made by commercial banks, and the amount of debt balances of brokers and dealers were essentially the size of their borrowings from commercial banks, until the mid 1990's. Peter Fortune shows that security loans usually made up about 2 percent of all loans made by

⁵⁶ Ibid, 25

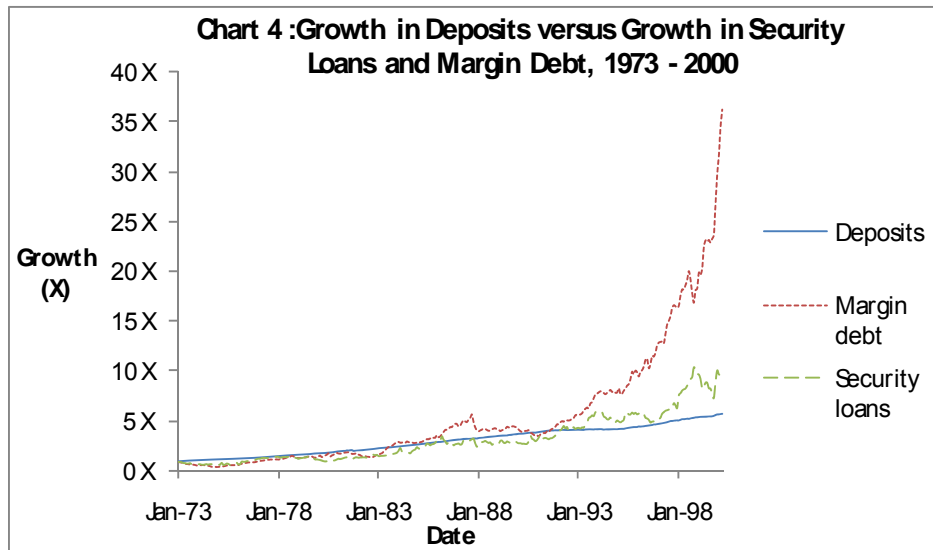
commercial banks and Chart 5 indicates that the security loans as a percentage of loans also stays relatively stable, oscillating between 2% and 4% of deposits. Given these facts, it should not be surprising that the ability of commercial banks to attract greater deposit funds would lead to a greater amount of capital available for security loans. These trends should then have a large impact on the depth of capital markets and capital mobility, reflected by the increase in the exchanges of financial securities. Indeed, the market value of all sales of financial securities went from \$522bn in 1980, to \$6.85tn in 1998.⁵⁷



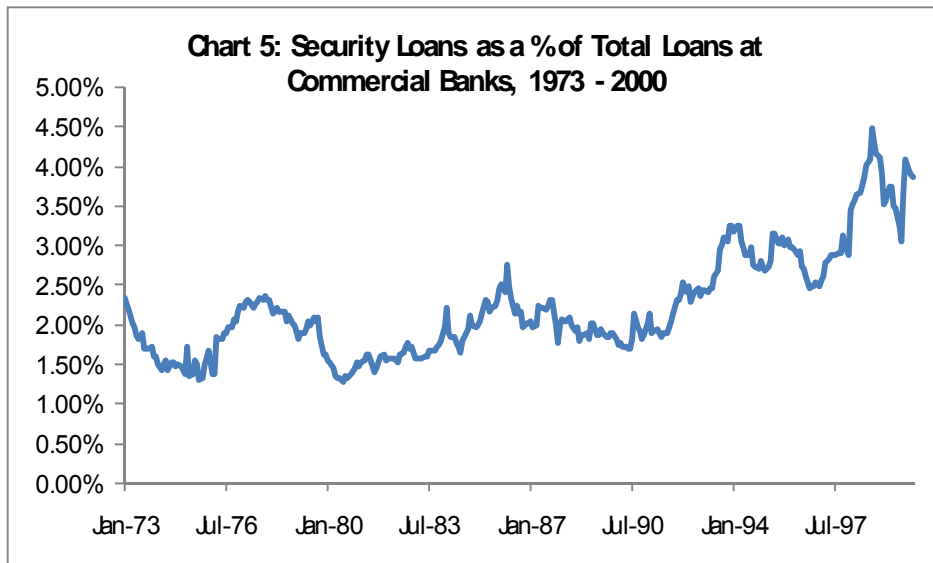
Source: Figures for amount of security loans was found at <http://www.federalreserve.gov/releases/> among the FED's Statistical releases and historical data in data series "Assets and Liabilities of Commercial Banks in the U.S."

Figures for margin debt balances were obtained from "Financial Markets Center" <http://www.fmcenter.org/site/pp.asp?c=8fLGJTOyHpE&b=24639>. The original data came from various government publications.

⁵⁷ Rousseau, *Sales of stocks and bonds*, Table Cj839-856



Source: See chart 3 for margin debt and security loans. Figures for deposits were also obtained from the FED's Statistical releases and historical data.



Source: Total loans and security loans at commercial banks were both obtained from the FED's Statistical releases and historical data.

While it is not directly related to Verdier's capital mobility hypothesis, the trend by commercial banks of securitizing and redistributing their loans should be noted for its potential impact on capital mobility. Many banks desired to reduce the risk in their business by making fee earnings a more fundamental part of their business, as opposed to holding loans on their books. This reflected the growing trend towards disintermediation, and this period saw the continued

growth of commercial banks sponsoring the issuers of asset-backed securities, which securitized banks assets in order to facilitate their removal from the bank's balance sheet.⁵⁸ This development is synonymous to the growth of securities affiliates to commercial banks during the 1920's. By assisting the development of more markets for depersonalized investments, this trend in disintermediation adds to the argument that capital was becoming more mobile during this period. According to Davis' thesis, we should expect a corresponding decline in industrial concentration.

While concentration data for this latter period is almost as difficult to find as it is for the 1920s, available evidence detailed by Lawrence J. White (2002) indicates that overall concentration decreased slightly in the 1980's and early 1990's, and increased slightly in the late 1990's. Overall, the movement in concentration was not dramatic. White used a number of data sources to paint an accurate description of the trends on concentration during the 1980's and 1990's. The most important data sources were the Census of Manufacturers data on largest firms in the U.S. based on long term value added, Bureau of the Census data on employment and payroll, and Forbes data on concentration measured by corporate profits and employment. Tables of this data can be found in the Appendix. The value-added data reveals a slight decreasing trend in overall concentration. As a point of example, share of value-added by the largest 200 firms decreased from 44% in 1977 to 40% 1997.⁵⁹ However, a reversal towards more concentration from 1997 to 2002 after 20 years of level or decreasing concentration is conspicuous. Share of value-added by the largest 200 firms increased from 40% in 1997 to 42.7% in 2002.⁶⁰ I will discuss what I believe to be the significance of this below. Because my paper focuses primarily

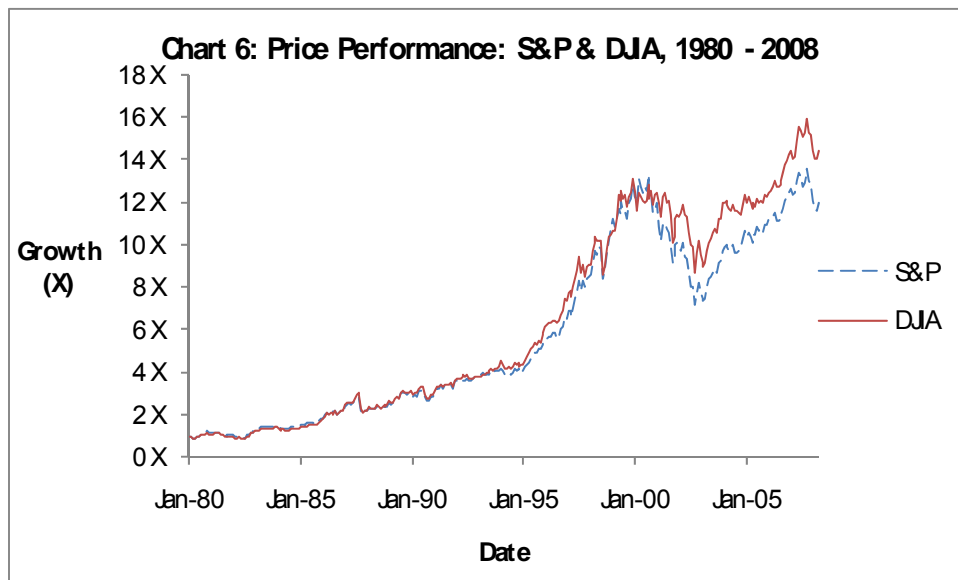
⁵⁸ Hester, *U.S. Banking*, 22

⁵⁹ White, *Trends in Aggregate Concentration*, 144

⁶⁰ White, *Trends in Aggregate Concentration*, 144 & U.S. Bureau of the Census. "Economic Census: Concentration Ratios, 2002." <http://www.census.gov/epcd/www/concentration.html> (accessed April 8, 2008)

on manufacturing industries, and does not control for the nuances of other types of industries, it may be sufficient to stop here. However, White provides a wealth of relevant detail about economy wide concentration. Specifically, he uses Bureau of the Census data to show that private sector employment as a whole experienced a decreasing trend which, similar to the manufacturing industry, reversed itself in the late 1990's. Likewise, the Forbes data reveals the same trends. Lastly, the Census of Manufacturers data reveals that the firms which have been able to greatly increase their concentration relative to other groups have been the relatively large, but not largest firms.⁶¹

The concentration evidence from this period seems to contrast sharply with what we would expect from casual observations of stock market activity and merger activity. As Chart 6 demonstrates, equities markets had witnessed sustained long term growth during this period. Both the S&P 500 and Dow Jones Industrial Average have grown over 10-fold in the past 27 years.



Source: data was obtained from finance.yahoo.com

⁶¹ White, *Trends in Aggregate Concentration*, 149

Alongside this growth in stock market performance, this period witnessed tremendous growth in the size and scope of mergers and acquisitions. Table 4 details the data from *mergerstat* magazine. In the 1980's, yearly merger activity reached into the hundreds of billions, and by the late 1990's these figures were in the trillions. However, despite this tremendous wave of mergers, concentration did not increase substantially over the entire period. This period behooves, and seems to suggest that the diminishing impact on concentration one might expect from increased capital mobility may have been offset by the merger movement, which is often triggered by the availability of cheap credit, especially relative to peers. This explanation offers causal support for my hypothesis, but looking more closely at the latter period of this case study is even more illustrative.

Table 4: Merger Values, 1980 - 1999

	<i>Total Dollar</i>	<i>Net</i>	<i>Average</i>	<i>Median</i>	<i>Transaction Value</i>	
	<i>Value Offered</i>		<i>Price</i>	<i>Price</i>	<i>\$100mm</i>	<i>\$1000mm</i>
	<i>(\$mm)</i>	<i>Announcements</i>	<i>(\$mm)</i>	<i>(\$mm)</i>	<i>or More</i>	<i>or More</i>
1980	\$44,345.70	1,889	\$49.80	\$9.30	94	4
1981	82,617.60	2,395	73.40	9.00	113	12
1982	53,754.50	2,346	57.80	10.50	116	6
1983	73,080.50	2,533	67.90	16.50	138	11
1984	122,223.70	2,543	112.80	20.10	200	18
1985	179,767.50	3,001	136.20	21.10	270	36
1986	173,136.90	3,336	117.90	24.90	346	27
1987	163,686.30	2,032	168.40	51.30	301	36
1988	246,875.10	2,258	215.10	56.90	369	45
1989	221,085.10	2,366	202.50	36.60	328	35
1990	108,151.70	2,074	126.40	21.00	181	21
1991	71,163.80	1,877	98.60	22.70	150	13
1992	96,688.30	2,574	101.80	22.50	200	18
1993	176,399.60	2,663	163.20	26.00	242	27
1994	226,670.80	2,997	168.20	33.00	383	51
1995	356,016.40	3,510	205.20	30.50	462	74
1996	494,962.10	5,848	186.70	25.30	640	94
1997	657,062.60	7,800	218.10	30.00	873	120
1998	1,191,861.10	7,809	385.60	33.50	906	158
1999	1,425,884.80	9,278	421.40	39.60	1,097	195

Source: Mergerstat Reveiw. Purchase Price 1980 – 1998. May 12, 2000. From LexisNexis Academic.

http://www.lexisnexis.com/us/lnacademic/results/docview/docview.do?risb=21_T3473106310&treeMax=true&sort=BOOLEAN&docNo=128&format=GNBFULL&startDocNo=126&treeWidth=0&nodeDisplayName=&cisb=22_T3473106316&reloadPage=false

In the last half of the 1990's, the changes in banking structure which were already in place accelerated at a dramatic rate; however, concentration increased during this period. As I stated previously, half of the \$2.4 trillion in bank assets which were consolidated from 1980 – 1998 occurred after the Riegle – Neale Act of 1994. As banking firms became more consolidated, they were able to attract increasing amounts of deposits, which allowed for banks to increase their security loans in support of stock market activity. After 1995, however, the actual size of margin debt balances accelerates at a much higher rate than the growth in commercial bank deposits. This is demonstrated quite dramatically in charts 3 & 4 above. The apparent cause of this divergence seems to be the passage of the National Security Market Improvement Act of 1996 which repealed substantial portions of the 1934 Banking Act, including a provision which had prohibited broker-dealers from borrowing from lenders who were not Federal Reserve Bank members or approved nonmembers. As Fortune stated, “this allowed nonbank lenders to lend to broker-dealers and market makers, a previously prohibited activity.”⁶² Chart 3 demonstrates the immediate impact of this regulatory change. It is difficult to state definitively if this dramatic increase in margin debt caused the strong stock market rise of the late 1990's, or simply reflects a response by lenders to demand for more funds to take advantage of growing stock markets. Given that the sharp increase in stock market performance occurred before the 1996 Act, the latter explanation seems more plausible. However, the availability of margin credit supports Verdier's claim that loan markets provide market players with an ability to buy and sell securities more often and creates a “dense” trading or “liquidity” which supports capital mobility.

⁶² Fortune, *Security Loans*, 28

Despite improving capital mobility during this period, all available data on concentration indicate that there was a systematic, economy wide increase in concentration. As stated previously, one can find the different tables of concentration figures originally compiled by Lawrence J. White in the Appendix. The Census of manufacturer's data shows this was the case in the industrial sector of the economy, and the Bureau of the Census data on employment and profits along with the Forbes data indicate this trend for the economy overall. The very obvious culprit of this activity seems to be the unprecedented levels of mergers and acquisitions which were buoyed by an irrationally exuberant stock market. During this time period, equity markets exhibited unprecedented growth. At the end of 1994, the value of the S&P 500 index and the DJIA stood at 459 and 3834, respectively. Five short years latter, these indices had each approximately tripled in value, standing at 1469 and 11497, respectively. The strength of the merger wave seemed to mirror that of the stock market. In 1995, the value of mergers and acquisitions transactions stood at approximately \$356bn. This number grew dramatically and in 1999, the value of mergers and acquisitions transactions was equal to \$1.5tn, a compounded annual growth rate of approximately 32 percent. Further, average acquisition price of mergers grew from \$205mm to \$421mm while the number of transactions for more than \$100mm doubled to 1097 from 462 and the number of transactions for more than \$1bn grew from 74 to 195. This indicates that the larger firms were getting an increasing share of the merger action during this period. These trends lead to the increases in concentration. While the trends in banking structure, margin debt, stock market performance, and merger activity were significant during the entire period of 1980 – 1998, the period from 1995 – 1998 and through 1999 was marked by being distinctively large scale.

The fact that concentration increases in the face of the dramatic changes to commercial banking structure which should have lead to decreased concentration supports my hypothesis, but also uncovers some interesting nuances which were not originally considered. Firstly, margin debt balances exploded upwards due to the lending activity of nonbank lenders, not commercial banks. This, along with the fact that security loans continue to make up such a small portion of commercial banks' loan portfolios indicates that commercial banks play a continually less important role in the call loan markets. This observation suggests that banking structure will continually become a less important indicator of capital mobility, based on Verdier's conception. Currently, it appears that a diverse group of nonbank actors (as well as many foreign commercial banks) are providing the liquidity for equity markets.⁶³ Secondly, call loans do not seem to act simply as providers of necessary short term liquidity. Instead, as their rise subsequent to stock market growth seems to imply, they can be used as instruments of speculation. This, however, is not problematic for Verdier's conception of capital mobility because speculative interest brings many more buyers and sellers into the market place, giving it even more "density." The problem of speculation, where the valuations of securities are not reliable, is more of a problem for capital efficiency than it is for capital mobility. Further, I argued in my theoretical passage that it is this type of behavior by irrational stock market participants which lead to preferential access to capital for large firms, despite the incidence of greater capital mobility. Also, as I discussed in my theoretical passage, knowledge of how margin credit impacts stock market performance and stock market volatility is limited, but much of the data seems to conclude that there is no significant relationship.

⁶³ Fortune, *Security Loans*, 31

Evidence from both case studies indicate that mobile capital markets can and often do lead to greater industrial concentration. This observation seems to run counter to Davis' thesis, which suggests that mobile capital markets will lead to diminished concentration. However, the case study analysis found commercial banks may continue to be less important in the development of capital mobility, as the process of disintermediation continues and many more nonbank sources of credit continue to arise and give liquidity to stock markets. Evidence from 1947 – 2002 on 81 SIC based industries lead to similar conclusions about the Davis thesis.

Evidence from 81 SIC industries: 1947-2002

The case study indicates that capital mobility may lead to greater industrial concentration. Using 4,8,20,50 – firm concentration ratio data and stock market performance indices, I will now formally test the hypothesis that capital mobility may have a positive affect on industrial concentration. I believe that capital mobility may help to produce greater concentration by supporting securities markets, which favor large firms relative to small firms.

Data and Model selection

Measuring industrial concentration using published data was relatively straight forward. While there are several methods by which researchers can measure industrial concentration, the standard used by the U.S. Government in its economic census reports is the 4-firm, 8-firm, 20 - firm, and 50-firm ratios. These ratios simply measure the value of shipments, or sales, accounted for by the 4, 8, 20, and 50 largest firms in an industry. The Government has taken these measurements in every year which there has been an economic census, a total of 14 times between the years of 1947 and 2002. This measurement falls in line with the intuitive understanding of concentration and is the metric most often used by much of the experts who study concentration. Further, this metric should very accurately reflect my theoretical analysis. I

claim stock market performance makes the largest companies larger relative to the size of the industry. These concentration ratios capture the extent to which the largest companies in an industry are growing relative to the industry, and thus make the best metrics which can be used to measure concentration. It should be noted that my observables were 4 digit SIC industries. However, the US Government began classifying industries based on a new North American Industrial Classification System (NACIS) in 1992. This conversion greatly limited the number of observations which I was able to obtain because I was only able to use those industries whose components stayed the same when their classification changed from SIC to NACIS.

Stock market performance data was also easy to identify. I was able to retrieve this information the Global Financial Database. From this database, I selected sector indices compiled by S&P which I believed would best reflect the stock performance of each of the 81 industries. I used my subjective judgment in this exercise because neither the S&P indices nor the governmental data allowed me to apprehend the particular firms which went into the respective metrics. I matched industries with stock indices based on their names and descriptions of the stocks included in them. Some of these matches were fairly easy to make. For example, the S&P 500 Tobacco index, which reflects the performance of companies in the business of manufacturing tobacco products, was matched with SIC industry 2111 (NACIS – 312221) Cigarette manufacturing. Other matches reflected industries which the connection may not have been as readily apparent, such as the S&P 500 Chemicals index with SIC industry 2873 (NACIS – 325311) Nitrogenous fertilizer manufacturing. However, I believe I erred on the side of being conservative in creating these matches, and all matches had to have a compelling basis based on their title or their description which indicated that they referred to the same or very similar subset of firms. There were many SIC industries which I dropped from my dataset because I did not

believe there was a stock index which would appropriately reflect their industries stock performance.

Daniel Verdier's work lead me to believe that data reflecting the extent of stock market activity would best reflect the still somewhat abstract and hard to specify concept of "capital mobility." I obtained figures for the total sales of equity securities, as well as total equity and bond sales, in financial markets from *Historical Statistics of the United States of America*, a collection of quantitative historical statistics of the United States. Ultimately, the sources of the figures found in this collection are public documents created by various government agencies (particularly the SEC in the latter portion of the century) and the bureau of the census. Total stock sales reflect how large of a market for buying and selling securities existed in the U.S., and reflects Verdier's assertion that capital mobility reflects the existence of broad markets for financial securities. Based on these figures, there is a strong indication that capital mobility has increased over time. However, other methods used by economist to measure capital mobility do not necessarily reach the same conclusions. Specifically, the Fieldston-Horioka saving-investment correlation method for estimating capital mobility indicates that international capital mobility has not increased substantially in the latter half of the 20th century.⁶⁴ While, this method is most often used when measuring the degree of international capital mobility, it can easily be applied to domestic capital mobility by breaking a country down in terms of regions or states. The method presupposes that if capital is truly mobile, then there should be no correlation between investment and savings within a prescribed geographic space. Therefore, capital is said to be mobile where the correlation coefficient on investment and saving is low (i.e. domestic savings is not a good predictor of domestic investment), and immobile when this correlation is

⁶⁴ Imad A. Moosa "A Note on Capital Mobility" *Southern Economic Journal*, Vol. 63, No. 1. (Jul., 1996), pp. 248-254.
Stable URL: <http://links.jstor.org/sici?sici=0038-4038%28199607%2963%3A1%3C248%3AANOCM%3E2.0.CO%3B2-3>

high. While this method has been criticized by many researchers on this topic, i.e. see Sinn (1992), this metric is often looked at when discussing capital mobility. However, the extent of securities markets is the conception which best reflects both Verdier and Davis' notions of capital mobility. My analysis seeks to test claims made about this particular type of capital mobility. Further, even if I wanted to conduct regressions using this specification as a point of comparison to total securities issues, data on savings and investment broken down by state over the time period from 1947 to 2002 does not seem to be available, and thus it is not possible for me to use this method of measuring capital mobility.

Lastly, the National Bureau of Economic Research (NBER)'s database had a dataset on manufacturing productivity which contained data which I could use to measure minimum efficient scale, entry barriers, technological change, and regulatory attention. The database was a joint effort on the part of senior economist at the Bureau of the Census and members of NBER.⁶⁵ The data base had information from 1958 – 1991 on SIC based industries. I obtained a preliminary version of the updated database which goes through 2002 from the creators of the database. While the data from 1992 – 2002 is not finalized, the data is consistent with the SIC codes and variables in the 1958 – 1991 data set and the authors assured me that my analysis would not be compromised by the updated version of the database. From the database, I computed the value of shipments per firms as a proxy for minimum efficient scale. My rationale is simply that minimum efficient scale reflects an effective limit to the amount of firms which can operate in an industry, as large levels of production to reach efficient scale will tend to reduce the number of firms that can operate in an industry, and vice-a-versa for low levels of

⁶⁵ The author gives special thanks to Wayne Gray at Clark University and Randy Becker at the Center for Economic Studies (U.S. Bureau of the Census) for their willingness to share the unpublished update to this series with me and answering all of my questions. This project could not have completed in the time without their help.

production. Value of shipments per firm gives us an indication of the necessary level of production per firm to reach efficient scale. Further, movements in this figure may reflect firms entering or leaving this industry, or technological changes, in response to the industry participants attempting to arrive at minimum efficient scale. This metric is one which I have developed for my purposes, and I am unaware of others' who have used this metric. Thus, I critically examine this figure in my regression and study the results of its coefficient to ensure that bias had not been intruded into my model. I used capital stock per firm as a proxy for entry barriers, though I realize that it could be used as a proxy for both entry barriers and minimum efficient scale. My desire to control for both of these two theoretical determinants forced me to seek out two distinct proxy variables. The concepts are related, and the correlation between the proxy figures is relatively significant at .23. However, it does not appear that their coefficients became problematically imprecise in the regression. In order to model technological change, I use total factor productivity figures from the database. Total factory productivity is a measure of productivity caused by technological shocks. Therefore, this statistic is a good measure of technology changes. Lastly, I use total value of shipments as a proxy for regulatory attention on an industry. This decision is grounded on the assumption that larger industries, on average, will attract more attention than small industries because of their perceived importance to the overall economy. Admittedly, this thought comes from a causal observation of U.S. history, and a certain aversion to "largeness" and concentration of control which comes out of periodical literature during development and carrying out of anti-trust regulation. A summary of theoretical variables, my predicted relationship, and the corresponding proxy data are listed in Table 3:

Table 5: Theoretical Variables

<i>Theoretical Variables</i>	<i>Predicted Coefficient</i>	<i>Proxy Variables</i>
Concentration	--	4,8,20,50 firm ratios
Stock market Performance	+	S&P industry indices
Capital Mobility	-	Value of securities sold in financial markets
Minimum efficient Scale	+	Value of shipments - per firm
Entry Barriers	+	Fixed capital - per firm
Technological Change	+	(1)TFP (2) New Investment Spending
Regulatory Attention	-	Value of shipments - by industry

Lastly, the problems of reverse causality and unobserved heterogeneity which I will discuss further in my model necessitated the use of instrumental variables to predict stock market growth. The instruments used included S&P 500 index, a capitalization weighted index which reflects the performance of the entire stock market. The other instruments I used were material costs of the industry and energy costs of the industry. Changes in materials cost or energy costs would immediately reflect the financial performance of the firms in the industry and impact their stock market valuations. Tests for weak instruments revealed correlation coefficients between stock market performance and S&P 500, material costs, and energy costs of .56, .29, and .07, respectively. This suggested that energy cost is a relatively weak instrument. Further, tests for over-specification, in which I regress the error in the model with the instruments to check for their correlation, revealed that energy costs were significant with a P-value of .011, suggesting that energy costs are endogenous. Therefore, I dropped the energy cost variable as an instrument for stock market performance.

I conduct the empirical test of this hypothesis using basic panel data regression analysis. In order to best model industrial concentration, I employed a panel data model taking cross sectional data on specific industries. This method would allow for the measurement of the impact

of changes in the relevant variables which impact industrial concentration, while using a broad array of industries. A pooled OLS statistical method would be inappropriate because of correlation between relevant explanatory variables and unobserved heterogeneity in the error term. The likelihood that some unobservable industry specific variable will be correlated with stock market return is extremely high. The metrics used for valuing companies within different industries is often idiosyncratic to the industry, and the returns of the industry will reflect these methodologies. Further, because a pooled OLS statistical method is inappropriate, a random effects estimation technique will also be inappropriate.

Similarly, a fixed effect estimator is inappropriate because strict exogeneity is most likely violated in this model. This model suffers from reverse causality. Namely, while stock market performance will impact industrial concentration, there is a compelling basis to make the claim that industrial concentration impacts stock performance. As I mentioned in my theoretical discussion, larger firms will benefit disproportionately during periods of equity market exuberance. Larger firms will more likely perform well in securities markets when an industry is relatively concentrated, so the firm's size allows it to have strong market performance which helps further increase concentration. Secondly, the fact that a firm has market power is a compelling reason to invest in the firm, as cash flows will more likely be stable. Thus, more concentrated firms may earn a premium valuation and a lower required return on their equity. Because unobservable variables in the error term do impact concentration, and concentration may also impact stock performance, strict exogeneity of explanatory variables and error terms over time is broken. Thus, fixed effects estimation will lead to biased results.

I use a first difference estimation technique for this model because the criterion of sequential exogeneity is not violated. In the model, there is no basis to conclude that unobservable

variables in the present have any relation to past explanatory variables. Therefore first difference estimations will be unbiased. However, we must use an instrument for stock market performance. Therefore, our estimation technique will take the form of a two stage least squares multiple regression employing variables which have been transformed to reflect first differences. The final empirical model includes the two explanatory variables of interest, capital mobility and stock market performance, along with variables that reflect other theoretically relevant variables. The form is:

$$\Delta concentration_{it} = \beta_0 + \beta_1 \Delta stockperformance_{it} + \beta_2 \Delta efficient scale_{it} + \beta_3 \Delta entrybarriers_{it} + \beta_4 \Delta technologicalchange_{it} - \beta_5 \Delta capitalmobility_{it} - \beta_6 \Delta regulatoryattention_{it} + c_{it} + \varepsilon_{it}$$

I should note that when undergoing the regression, it was unnecessary to transform the stock market performance and concentration data into first differences because their growth was my variable of interest. Because growth is a form of taking differences, taking the difference of growth would have amounted to taking differences of differences, or second differences. The variables naturally lend themselves to first difference analysis, so there was no need to take differences on these variables.

Results and Analysis

The results of the regression analysis given in table 4 provide evidence that capital mobility did not have a large impact on industrial concentration, while stock market performance had a substantial and positive impact on concentration. Preliminary analysis indicated that my specification for capital mobility was appropriate. It captured capital mobility in a theoretical sense and exhibited a low correlation with stock market performance of .069. This is important because I wanted to separate the notion capital mobility, which is prerequisite for a viable stock market, from its actual performance, which should be determined by investor behavior and

analysis and not capital mobility. Further, I used total securities sales to reflect capital mobility because Verdier's analysis indicated that deep overall security markets, and not simply equity markets, reflect capital mobility. To determine if my use of overall sales would be problematic, I correlated the change in equity sales against change in total security sales. The correlation .9978, indicating that the two pieces of data introduce almost identical information into the regression. Further, when total security sales replace total stock sales in the regression, there is no significant change in the coefficients. Table 4 summarizes results of the regression.

Table 6: Regression results

<i>Independent Variables</i>	<i>Dependent Variable</i>			
	Δ 4-firm concentration (1)	Δ 8-firm concentration (2)	Δ 20 - firm concentration (3)	Δ 50 - firm Concentration (4)
Δ Stock Performance	0.092 (0.000)	0.055 (0.000)	0.011 (0.207)	0.002 (0.734)
Δ Total Securities Sales	0.002 (0.822)	-0.004 (0.561)	-0.004 (0.308)	-0.002 (0.657)
Δ Value of Shipments	-0.102 (0.022)	-0.082 (0.010)	-0.069 (0.000)	-0.057 (0.000)
Δ Value of Shipments per firm	-0.095 (0.069)	-0.025 (0.504)	0.045 (0.032)	0.056 (0.000)
Δ Investment Spending	0.01 (0.350)	0.008 (0.316)	0.002 (0.732)	0.002 (0.523)
Δ Capital Stock per firm	0.167 (0.000)	0.112 (0.001)	0.041 (0.026)	0.01 (0.389)
Δ Total factor Productivity	0.26 (0.002)	0.126 (0.031)	0.034 (0.302)	0.009 (0.657)
_Constant	-0.008 (0.367)	0.002 (0.714)	0.009 (0.006)	0.009 (0.000)

Notes: First differences estimation technique using the S&P market index and materials costs as instruments for stock performance. The cells report the observed coefficient with p-values in parenthesis. The number of unique observations is 81. However, some SIC industries appear in the panel data twice, as there were multiple stock indexes which could reflect the industries stock performance. Overall, there are 93 unique SIC industry/stock index combinations.

Regressions 1 & 2, which model the change in 4-firm and 8-firm concentration ratios, indicate that stock market performance has a positive impact on industrial concentration while

capital mobility does not have any impact. Further, stock market impact becomes weaker when attempting to model 20-firm and 50-firm concentration ratios. This reflects the fact that the stock market mechanics I discussed earlier impact the very largest companies in an industry, and allow them preferential access to capital which their peers do not receive. The percentage of an industry controlled by the 4 largest firms will reveal this fact better than the percentage of an industry controlled by the 20 or 50 largest firms. Simply put, I expect less variance in 50-firm ratios than I would in 4 and 8 firm ratios.

In the regressions, securities sales are never statistically significant. As mentioned earlier, this supports the hypothesis that capital mobility may not in itself lead to decreased concentration. Further, while the sign on the coefficient for capital mobility was negative in three of the four regressions, it is hard to find this meaningful because of the large p-values on the coefficients as well as the lack of economic significance of the figures. In regression 2, the $-.004$ coefficient indicates that a 10% increase in securities sales (capital mobility) will yield a decrease of $.04\%$ in concentration. This is less than a tenth of 1 percent, and does not make a compelling basis to argue for the importance of capital mobility.

The most interesting result of this regression seems to be that stock market performance has the weakest impact on concentration among all significant explanatory variables. This is consistent in the first two regressions. Total factor productivity seems to have the largest positive impact on concentration with a coefficient of $.26$, indicating that a 10% increase in productivity results in a 2.6% increase in concentration. However, a 10% increase in stock market performance would result in a $.9\%$ increase in concentration. The difference in these coefficients may be explained by the fact that rapid technological change may give firms an incentive to operate on larger scales over and above the results of firms' ability to simply obtain the new

technologies. It is important to note that these coefficients are significant from an economic standpoint. Productivity growth in the U.S. is strong and continuous, and it is not outside of reason to expect 10% productivity growth within a decade. Further, stock market performance has a continuous upward growth trend in the U.S. In fact, the economic significance of stock performance may be greater due to the greater dynamism of stock prices relative to productivity growth or growth in capital stock. These results indicate a natural trend towards greater concentration over time.

Value of shipments and total fixed capital are significant and reflect their predicted theoretical relationship to capital mobility. Specifically, growth in an industry's product seems to be correlated with less concentration while large fixed capital requirements seem to insulate and bolster the position of large firms. However, the results on value of shipments per firm seem a bit perplexing. In particular, the coefficient is negative and statistically insignificant in regressions 1 & 2, but is positive and statistically significant in regression 3 & 4. The results of the later regressions support theoretical conclusions, as higher minimum efficient scales would lead to greater concentration. Thus, an explanation for the incidence of negative coefficients on 4-firm concentration ratios is that actions intended to increase scale by the largest firms in an industry may attract unwanted regulatory attention, which hinders the growth of these very largest firms relative to the industry. Testing this hypothesis is beyond the scope of this paper, and may not be crucial, as even the statistically significant coefficients of .045 & .056 are of dubious economic significance.

Investment spending does not seem to be significant in any of the regressions. This result does not seem to be problematic, as it implies that no relationship exists between concentration and investment spending at a theoretical level, or that the variables are misspecified. Further,

total factor productivity already appears to capture the rate of technological change. The presence of the investment spending statistic may be unnecessary. However, it is not problematic because the correlation between Δ investment spending and Δ total factor productivity is only .093, suggesting that collinearity is not an issue.

Lastly, variables are only weakly significant or not significant in the 3rd and 4th regressions. As discussed above, I believe this reflects the fact that most determinants of industrial concentration impact the share of control of the largest companies within an industry. Thus, these determinants will be much weaker predictors of concentration as the analysis tries to capture the activity of a larger group of firms in an industry.

Conclusion

The results of my case study analysis and regression analysis give tentative and preliminary indications that capital mobility, marked by the presence of a meaningful market for securities, does not impact industrial concentration, while inefficient markets where capital is mobile may actually increase concentration. The two case studies which I conducted, along with my regression analysis, made a strong case for these conclusions.

However, findings should remain tentative until more case studies of the topic are conducted which draw on experiences of other periods of U.S. history. Specifically, I did not do any in depth analysis of periods where capital mobility was increasing, but stock market performance did not move dramatically in any direction. It would be illustrative if one found decreasing concentration during this period, as it would support Davis' thesis. However, if one found increasing concentration during this period, it may cast doubt on my belief that strong stock market performance is a driver of concentration. The regression analysis attempts to answer these questions by looking at data over a 50 year period. However, measurement using

first-differences technique with instrumental variables produces inefficient results. Therefore, the insignificance of stock sales (“capital mobility”) in predicting concentration may need to be scrutinized more carefully. More case study analysis may be necessary to understand the dynamics of the different periods, and come to more conclusive findings on the impact of capital mobility.

Further, the results do not give any indication of a “stock market led” or “technology led” increase in concentration. The figures only establish correlation, and there might be deeper problems of heterogeneity and reverse causality which are masked by the results. An implementation of a Vector Autoregression (VAR) model might have helped to bolster the results of the regression analysis. Specifically, the implementation of the granger causality method to this panel data model would have helped bolster the validity of results while better treating issues of heterogeneity. Hurlin and Venet (2003) developed a theoretical procedure for applying the granger causality method to panel data, and argue that granger tests with panel data yield more efficient results than conducting this technique with cross-sectional data.⁶⁶ Unfortunately, granger causality is very difficult to conduct in STATA software. Further, a standard VAR regression would not properly control for the heterogeneity between panel data observations.

Therefore, the results of this study give a strong indication of the impact of capital mobility and stock market performance on industrial concentration. These results do not support Davis’ financial thesis, and suggests that policy makers should not only work to create institutions which allow for capital to be mobile, but that also reduce information asymmetries and other determinants of capital inefficiency. Thus, before this analysis can be put to any sort of

⁶⁶ Christophe Hurlin, and Baptiste Venet “Granger Causality Tests in Panel Data Models with Fixed Coefficients”, *Mimeo*, University Paris IX, 2003

productive use, it will be necessary for individuals to better understand what determines capital efficiency.

A. Census of Manufacturers Data

Aggregate Concentration in Manufacturing, as Measured by Value Added, 1947 - 2002

Year	Largest 50 Cos.	Largest 100 Cos.	Largest 150 Cos.	Largest 200 Cos.
1947	17%	23%	27%	30%
1954	23	30	34	37
1958	23	30	35	38
1962	24	32	36	35
1963	25	33	37	41
1966	25	33	38	42
1967	25	33	38	42
1970	24	33	39	43
1972	25	33	39	43
1976	24	33	39	44
1977	24	33	39	44
1982	25	33	39	43
1987	27	33	39	43
1992	24	32	38	42
1997	24	32	37	40
2002*	25.3	33.7	38.7	42.7

Note: I retrieved data for 2002 directly from the *Census of Manufactures* myself

Appendix

B. Bureau of the Census data

Aggregate Concentration in the Entire Private Sector, as measured by
Employment and Payroll, 1988 - 1999

Year	Largest 100 Cos.	Largest 500 Cos.	Largest 1,000 Cos.
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Panel A: Share of Total Private Sector Employment

1988	11.3%	21.9%	27.1%
1989	11.1	21.5	26.6
1990	11	21.4	26.6
1991	11.1	21.6	26.8
1992	10.9	21.3	26.6
1993	10.7	20.8	26.1
1994	10.6	20.7	26.1
1995	10.5	20.7	26.1
1996	10.6	20.9	26.5
1997	10.9	21.2	26.7
1998	10.8	21.5	27.1
1999	11.2	21.8	27.4

Panel B: Share of Total Private Sector Payroll

1988	13.8%	26.3%	32.4%
1989	13.6	25.6	31.2
1990	13.2	25.3	31.5
1991	13.2	25.4	31.6
1992	12.9	24.9	31.3
1993	12	24.1	30.5
1994	11.8	23.6	29.9
1995	11.7	23.6	29.8
1996	11.2	23.3	30
1997	11.4	23.4	30
1998	10.9	23.4	30.5
1999	11.5	23.9	31.1

C. Forbes Data

Aggregate Concentration in the Entire Private Sector, as Measured by Corporate Profits and by Employment, 1980 - 2000

Year	Forbes Data		Private Sector Totals		Largest Co. Shares of Total	
	Profits of Largest 500 Cos. (\$billions)	Employment (millions)	Corporate Profits (\$billions)	Employment (millions)	Profits	Employment
1980	119	22.6	167	74.2	71.3%	21.1%
1981	124	22.4	157	75.2	79.0	20.9
1982	112	21.6	109	73.7	102.8	20.5
1983	132	21.9	136	74.3	97.1	20.7
1984	140	21.2	171	78.4	81.9	19.2
1985	133	21.1	179	81	74.3	18.5
1986	141	20.6	198	82.7	71.2	17.8
1987	156	20.5	244	84.9	63.9	17.2
1988	167	19.9	321	87.8	52.0	16.2
1989	182	20.3	293	90.1	62.1	16.2
1990	171	20.6	275	91.1	62.2	16.1
1991	155	20.8	252	89.8	61.5	16.4
1992	179	20.4	300	90	59.7	16.0
1993	204	20.2	375	91.9	54.4	15.6
1994	250	20.2	441	95	56.7	15.2
1995	285	20.4	558	97.9	51.1	14.9
1996	325	20.9	635	100.2	51.2	15.0
1997	356	21.9	731	103.1	48.7	15.4
1998	364	22.9	909	106	40.0	15.7
1999	451	23.9	773	108.6	58.3	16.0
2000	496	24.9	870	111.1	57.0	16.3

* All tables came from White, Lawrence J. "Trends in Aggregate Concentration in the United States," Journal of Economic Perspectives 16 no.4 (Fall 2002): pp. 137 – 160 . His data sources varied, and are indicated in the title of each table.

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