

Introduction to  
**Market Failure or Success: The New Debate**  
Forthcoming from Edward Elgar and The Independent Institute  
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## I. Introduction

Market failure remains one of the most influential arguments for government intervention. Throughout the twentieth century, most of the market failure arguments were based on theories of public goods and externalities. These theories suggest that market participants will fail to produce certain mutually beneficial goods and services. To provide a simple example, individuals may not voluntarily contribute towards a protective missile system because they hope to free ride on the contributions of others.

Although aspects of these theories can be traced back to the beginnings of economics, the modern formulations were laid down by Paul Samuelson, James Meade, Francis Bator and others in the 1950s. Since that time, and despite some significant differences (for which see Cowen 1988), a consensus developed that governments should provide at least a few basic public goods, such as national defense, but that markets do the best job of providing most goods and services.

This consensus fell apart in the 1970s and 1980s, as economists constructed new market failure arguments. These new challenges were based on the idea of information and informational imperfections. And in these arguments, more than just a few markets are bound to fail. Rather, if these arguments are correct, we can expect market failure whenever information is imperfect or distributed asymmetrically.

The new wave of market failure ideas included Stiglitz's "efficiency wage" hypothesis, George Akerlof's "market for lemons" model, Oliver Williamson's notion of opportunistic behavior<sup>3</sup>, and network and lock-in effects, stressed by Paul David and others. The first two economists on this list were rewarded with the Nobel Prize in 2001, precisely for their work on market failure and the economics of information.

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<sup>3</sup> Williamson's theory of post-contract opportunism (1976) was directed against Demsetz's 1968 argument that franchise bidding could be used to solve the problem of natural monopoly regulation. In Demsetz's view, a competitive bidding arrangement for the awarding of monopoly privileges in natural monopoly industries would lead to efficient results. Williamson argued that the inevitable incompleteness of contracts would cause the winning companies to shirk on every available margin, leading to undesirable results. Though we have not included this debate in our current volume, readers are encouraged to consult the two seminal papers noted, as well as Zupan's (1989) examination of franchise bidding in the American cable industry. Where Williamson predicts competitive underbidding of franchise contracts in anticipation of chiseling opportunities, Zupan finds no evidence for the phenomenon.

The new market failure economists have pointed to information problems in virtually every sector of the economy. In the Western world, governments account for about forty to sixty percent of gross domestic product, depending on the country. Regulation makes the scope of government intervention even greater, as over the last twenty years most government growth in the United States has come in this form. Virtually all of these expenditures and regulations have been defended with market failure arguments. Critics allege that significant market failures are widespread in the labor market, the health sector, in agriculture, in education, in basic scientific research, in electricity, and in many other sectors. It is hard to think of any area where market failure arguments would not apply. Indeed the work of Joseph Stiglitz suggests that market failure will occur whenever the price system is used.

The "information economy" of course has made the economics of information all the more important. The growth of services relative to manufacturing, the Internet, e-commerce, computer and software networks, and the move away from "mass production" have dramatically changed the American economy. New ideas are more important than ever before and there has been a corresponding interest in how ideas are produced and traded. The advent of new technologies built on standards such as the personal computer, HDTV, wireless telephones and the Internet, had also brought new attention to the fear that markets might lock-in to the wrong standard or technology. When Paul David first used the example of the QWERTY keyboard (see further below) to illustrate this possibility, lock-in seemed like an interesting but esoteric idea of most relevance to economic historians. Lock-in took on new importance in the 1990s when a host of new standards were developed that may be with us for decades to come. The epic antitrust battle between Microsoft and the U.S. Department of Justice, sometimes labeled "the antitrust trial for the new century," also brought home the relevance of David's ideas.

As late as the 1970s, it was a common criticism that neoclassical economics neglected both information and informational asymmetries. In the socialist calculation debate of the 1930s, Friedrich A. Hayek, Ludwig von Mises and others in the "Austrian" tradition stressed imperfect information, and dispersed knowledge as fundamental arguments for the market and a liberal order (Boettke 2000). Most of the economics profession,

however, did not take up the challenge of analyzing decentralized knowledge and information. As late as 1976, Rothschild and Stiglitz were able to argue that “economic theorists traditionally banish discussions of information to footnotes.” This state of affairs, of course, changed rapidly. But the new contributions to economics did not typically follow a Hayekian tack. Instead they emphasized market failure rather than market success.

In essence the new market failure arguments turned Hayek's insights on their head. Information problems were now a cause of market failure, rather than a reason for praising markets.

Hayek and the new market failure theorists focus on different aspects of information. For Hayek, the central problem is to mobilize widely dispersed information to maintain an extended order of sophisticated capitalist production. For the new market failure theorists, however, the key aspect of information is not dispersal but "asymmetry" -- some people have information that others do not. Information dispersal and asymmetry are two sides of the same coin, one must accompany the other. The difference between Hayek and the market failure theorists is that in Hayek's view markets eliminate asymmetry by revealing relevant aspects of information in market prices. The Canadian plumber's knowledge of substitutes for copper piping influences the French electrician's choice of home wiring through its effect on the market price of copper. For the market failure theorists, however, asymmetry cannot be overcome by exchange precisely because the unequal distribution of information interferes with mutually beneficial exchange.

A second difference exists between Hayek and the new theorists. Hayek prefers the word "knowledge" to "information." The term information suggests a well-defined "bit" or datum while the word "knowledge" allows greater scope for practical wisdom, tacit knowledge, and the notion of understanding.

These two visions of markets, and knowledge, stand in tension. Both theories begin with the raw fact that information and knowledge are not centralized, but they reach for different conclusions. Understanding how markets overcome and are overcome by problems of information is perhaps the central problem in economics today. Yet, in the

economics profession the new market failure theorists have taken over the debate. Their perspective has received more attention, and more pages in the journals, than has the Hayekian vision of market success. The purpose of this volume is to remedy this imbalance and to examine the new market failure arguments critically, often from a Hayekian perspective.

We do not seek to dismiss market failure arguments, or to argue that markets always do the best job, amongst competing institutional alternatives. We do, however, believe that the strength of the new market failure arguments has been overstated, and that the new market failure arguments are applied without sufficient discrimination. We are seeking to improve the intellectual debate by collecting and reprinting some of the key articles in the more recent debates on market failure. We believe that these articles, on examination, should produce greater skepticism of market failure claims.

In 1988, George Mason University Press, in conjunction with the Cato Institute, published The Theory of Market Failure: A Critical Examination, edited by Tyler Cowen, one of the editors of this collection. (The book was later republished by Transactions Books as Public Goods and Market Failures.) This volume reprinted some of the original articles on public goods and market failures and collected the major rebuttals. The selection of pieces suggested that many observers had overrated the strength of public goods and externalities arguments, both on theoretical and empirical grounds. Due to publication delays, the book, while published in 1988, contained nothing on the new market failure arguments, and thus the need for the present volume. We seek to examine where market failure arguments have headed and how much validity the new market failure arguments hold. More generally, we seek to evaluate the relative efficacies and drawbacks of voluntary exchange, operating under a system of private property and rule of law.

## **II. The new market failure arguments**

The new theoretical arguments for market failure rose to prominence in the 1980s, although their roots can be traced back much earlier, arguably to Adam Smith. They tend to focus on problems of agency, information, and coordination.

Economist Joseph Stiglitz has held a special importance in the new market failure theories. Stiglitz's productivity, brilliance, and expositional talent have made him the leading figure in the new market failure arguments. His stint in government, especially as chief economist at the World Bank, and as Chairman of the Council of Economic Advisors under President Bill Clinton, has extended his influence further. His receipt of the 2001 Nobel Prize in Economics for the economics of information will bring renewed attention to his views.

Stiglitz developed a new way of thinking about market prices. The older view, as found in Hayek, stresses how prices create and communicate information about resource scarcity and help markets economize on information. A price, for Hayek, clears the market and tells distant buyers and sellers about the relative scarcities of differing goods and services. Stiglitz, in contrast, emphasizes how prices are used to solve problems of agency and quality verification. In these models, quality is a function of price. That is, the higher (or lower) the price, the higher the quality of goods and services that buyers can expect to receive. When prices are used to signal or guarantee quality, however, they cannot also clear the market and will not properly measure the relative scarcities of goods and services.

The Stiglitzian worldview is understood best by example. Stiglitz presents credit rationing and efficiency wages -- both based in imperfect information -- as two clear examples of how markets may misfire.

His credit rationing model starts with the claim that the probability of borrower default is related to the rate of interest charged on the loan. Stiglitz argues, for instance, that at high rates of interest the borrowing pool will be composed of an especially high percentage of deadbeats. Note how asymmetric information enters the argument. Stiglitz assumes that borrowers have a better idea of their likelihood of default than do lenders. High rates of interest therefore scare off the good borrowers, who expect to repay the loan. In contrast, high rates of interest do not scare off the deadbeats, who know their chance of having to repay the money is slight in any case. This principle then imposes a

constraint on how high a rate of interest a lender will charge. Many lenders will keep loan rates artificially low, to maintain a higher quality pool of borrowers and to increase their chance of being paid back.

In this setting the rate of interest will not necessarily clear the market for borrowing and lending. Banks keep interest rates down, but at those low rates demand exceeds supply. Lending must then be rationed. Banks will use non-price criteria, such as their estimation of borrower quality, or perhaps simple favoritism, to determine who can borrow how much money.

Stiglitz emphasizes that interest rates are a special kind of price. Most ordinary business firms are happy to sell as much as possible at going prices. No bank, however, wishes to loan as much as possible at posted rates of interest. In fact banks invest a good deal of time and energy into limiting the amount that their customers can borrow.

Whether credit rationing is in fact a market failure remains an open question, as we will see further below. One possibility is that credit rationing is an optimal response to the problem of loan deadbeats and involves no special social costs, other than reflecting a general imperfection of the world. At the very least, however, credit rationing, to the extent it is practiced, shows that prices do not always clear the market. Furthermore the social rate of return on investment will exceed the private rate of interest, which might be used to argue for government investment programs.<sup>4</sup>

Credit rationing models usually rely on a mechanism known as "adverse selection." George Akerlof's "The Market for Lemons", reproduced in this volume, was the first explicit exposition of this mechanism. Akerlof's piece was published in 1970, but it did not attain its full influence until the 1980s and later.

Adverse selection occurs when a voluntary market mechanism tends to attract the "wrong" buyers and sellers, typically for reasons of asymmetric information. Akerlof

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<sup>4</sup> Theories of credit rationing have been around for much longer than the work of Stiglitz, and some individuals have suggested that Stiglitz does not give his precursors (for instance, Barro 1976 and Jaffee 1976) sufficient credit. Stiglitz, however, gives the clearest theoretical account of the mechanism behind credit rationing, and sets it in the broader context of a non-Hayekian theory of prices.

cites the used car market as a possible example of this principle. The model assumes that sellers know the quality of the used car they are selling, but buyers do not know the quality of what they are getting. Buyers, then, will only be willing to pay a price conditioned on the probability of receiving a lemon – a price that will necessarily be lower than the value of a good used car. This makes potential sellers of good used cars more reluctant to offer them for sale, lowering average quality in the marketplace even further. In equilibrium, only the lemons are sold, making it impossible to get a good used car simply by paying a higher price. The potential for adverse selection crops up in insurance markets as well. When a firm offers insurance, for instance, it might expect that only the worst risks will be interested in purchasing the contract. The contract therefore must be structured to pay for these high-risk individuals, which will discourage low-risk individuals from buying insurance even more. Adverse selection models imply that low-risk individuals have a hard time finding fairly priced insurance in the marketplace.

“Efficiency wage” theory concerns labor markets rather than credit markets. Building on suggestions from Adam Smith, Stiglitz notes that higher wages cause individuals to work harder. Asymmetric information is rife in labor markets, as the boss does not always know how hard the employees are working. If we imagine a hypothetical situation where an individual is paid the same wage as he or she could get in the next best job, that individual would tend to shirk rather than to work hard. The worst that could happen is that the individual would be fired, but this would occasion no great loss. The fired individual would move into the next job with no loss in pay.

Employers therefore must pay workers a certain premium if they expect to get good effort. When every employer pays a premium, however, some unemployment will result, due to the higher overall level of wages. In some efficiency wage models the unemployment is itself the disciplining device that induces extra effort (Shapiro and Stiglitz 1984). At the going wage rate, more workers would like to have jobs than can find them. The market price fails to clear the market and to coordinate all buyers and sellers, again contra Hayek.

Note that adverse selection may lie behind efficiency wage arguments as well. Higher wages will attract a higher quality of job applicants in the first place. Offering the market-clearing wage rate may attract only those individuals who don't have jobs, have been fired, or cannot command a high premium for their skills, all of which may serve as examples of labor market "lemons."

Both credit rationing and efficiency wage theories have had influence on economic policy. Economists at the Department of Labor cited the efficiency wage argument when pushing for an increase in the minimum wage under the Clinton administration. The claim was that in an efficiency wage model a higher real wage would not put as many people out of work as otherwise might be expected. Credit rationing models have been used to justify a number of interventions into credit markets, including usury laws (maximum ceilings on interest rates), fairness in lending regulations, and government investment subsidies. Credit rationing also has been used to argue for a more activist monetary policy, to encourage banks to lend more to customers. Most generally, Stiglitz (1988) has tried to use both efficiency wage and credit rationing theory to restructure the foundations of macroeconomics and the theory of business cycles.

### **III. Critics of credit rationing and adverse selection**

The volume at hand offers several criticisms, both theoretical and empirical in nature, of the new market failure ideas. These critics have argued that the models are not very general but rather rest on very specific assumptions. Other scholars have questioned the empirical relevance of the anti-market mechanisms. It is one thing to argue that credit rationing and efficiency wages are theoretical possibilities, but it is quite another to argue that they are significant phenomena in the real world. Since Stiglitz has never presented empirical work on his basic mechanisms, many economists have been skeptical about the relevance of the research.

The current volume collects two differing critics of credit rationing. Stephen Williamson, in his "Do Information Frictions Justify Federal Credit Programs?" argues that credit rationing is not a market failure that government intervention can improve on in significant fashion.

Williamson addresses credit rationing by building a formal model and then seeing whether government policy, in the form of federal credit lending, will actually improve on the equilibrium. He adds the explicit assumption that government cannot verify the quality of a lender any better than the private sector can. With this assumption, government lending will simply displace private lending, rather than alleviating credit rationing. Some borrowers will be drained from the private markets, and brought into the public sector markets, but the remaining private borrowers will still be rationed. The total amount of lending will not go up. Under some assumptions, "the [government] program lowers the interest rate faced by lenders, raises the interest rate faced by borrowers, and increases the probability that a borrower is rationed." (Williamson, 1994 (525)).

Williamson does show that a sufficiently complex tax and subsidy scheme can improve welfare and alleviate credit rationing to some extent. Nonetheless the informational requirements of such schemes would be daunting, and in any case such schemes do not match current policy. A government that had enough information to implement such a scheme also would be capable of direct central planning, which we know is not the case. In comparative institutional terms, credit rationing may not be a market failure at all.

Credit rationing has come under fire on empirical grounds as well. Berger and Udell (1992) conduct a systematic examination of whether markets do in fact ration credit, looking at over one million commercial bank loans from 1977 to 1988. The authors do find some evidence that commercial loan rates are "sticky," as credit rationing theories would indicate. Nonetheless the data do not support most other implications of credit rationing models.

Berger and Udell note the distinction between loans issued "under commitment" and loans issued without commitments. The former set of borrowers cannot be rationed, since, with the loan, they also receive an option to borrow more. Only lenders who borrow without commitment can be rationed in subsequent time periods. Credit rationing theories typically would predict that when credit markets are tight, a greater percentage of extant loans would result from previous commitments (borrowers without such

commitments presumably would be excluded from the market to some extent, thus raising the percentage of extant loans with commitment). Yet the data show no such relationship, inducing Berger and Udell (1992, p.1047) to conclude: "Overall, the data suggest that equilibrium rationing is not a significant macroeconomic phenomena."

The phenomenon of adverse selection has received empirical attention as well. Eric Bond studies the used car market in "A Direct Test of the "Lemons" Model: The Market for Used Pickup Trucks", and concludes that trucks purchased on the used car market required no more maintenance than other trucks of similar age and mileage. If the used trucks market suffered from Akerlof's lemons problem, truck owners would keep high quality older trucks while selling lemons on the used truck market. Yet data collected by the US Department of Transportation reveal no significant differences in maintenance costs between trucks kept by their original owners and trucks sold on the used car market. In the market used as exemplar by Akerlof, Bond finds no empirical support for the lemons hypothesis.

Keep in mind that the lemons argument, in its most extreme form, predicts that it is impossible to buy a good used car. This prediction is countermanded by the millions of used cars that are bought and sold in the United States each year, frequently to the satisfaction of both buyer and seller.

It has been equally difficult to prove that adverse selection is a serious problem in insurance markets. Cawley and Philipson test the implications of the asymmetric information model in the term life insurance market and find no evidence of market failure. Where asymmetric information predicts increasing unit prices for insurance purchases, quantity-constrained low-risk individuals, and prohibitions on the purchasing of multiple small contracts to prevent arbitrage, Cawley and Philipson find robust evidence for decreasing unit prices, for low-risk individuals holding larger policies than high-risk customers, and for frequent multiple contracting.

The authors suggest that it is cost efficient for insurers to overcome informational asymmetries. Insurers deal with applicant information all the time, both in their role as insurers and as underwriters. It may not be true that the insurance purchasers have

superior information; in fact the company may have better estimates of an individual's health risks than does the individual himself or herself. In Hayekian terms, the knowledge may be so decentralized that individuals themselves do not have easy access to it. The insurance company, however, has a greater ability to process actuarial statistics and hire specialists for advice. Once the underlying informational asymmetry goes away, the adverse selection argument does not get off the ground.

Other researchers find little evidence of adverse selection or asymmetric information in insurance markets, though for reasons of space we have not included their contributions. Chiappori and Salanie (2000) test for asymmetric information in the French market for automobile insurance and echo the conclusions of Cawley and Philipson. Where asymmetric information models predict that, among observationally identical individuals, those with more coverage should have more accidents, Chiappori and Salanie find no correlation between unobserved riskiness and accident frequency. Similarly, Browne and Doeringhaus (1993) find no evidence that risky individuals purchase more medical insurance. They do find that legal obstacles prevent insurers from using all relevant observable information about risk characteristics in setting premiums; that they also find low risk individuals implicitly subsidizing higher risk individuals in a pooling equilibrium then seems unsurprising.

Hemenway (1990) takes the argument against adverse selection in insurance markets one step further. If individuals are consistent in risk preferences across physical and financial dimensions, then propitious selection ensues: people with higher levels of risk avoidance “are more likely both to buy insurance and to exercise care. Those with low levels, or who are actually risk seeking, will tend to do neither.” While his empirical evidence is less rigorous than that of the other authors cited<sup>5</sup>, it is suggestive. Where adverse selection would lead motorcyclists to purchase more insurance than other drivers, Hemenway argues that motorcyclists admitted to hospital after accidents are more likely than car drivers similarly admitted to have no insurance at all, and that unhelmeted motorcyclists are the least likely to carry any insurance. Automobile associations, which

provide insurance in the form of assistance to member drivers in distress, should be comprised of young risky drivers with unreliable cars but in fact mostly count richer, older drivers as members. While propitious selection does nothing to eliminate the moral hazard problem of insurance markets, it does render far less likely insurance market failures associated with adverse selection.

In retrospect, it may not be surprising that adverse selection fails to hold in many markets. Taking the used car market as an example, let's accept that seller's know more about the value of their car than buyers. We may still ask how much more do they know and how costly is it for buyers to learn? Visual inspection and a test drive will already tell a buyer about many major problems. Services like *Consumer Reports* give buyers ready access to information about the average quality of cars of that year and model.<sup>6</sup> CARFAX, a recent creation of the Internet, allows consumers to find out information about specific cars – information such as odometer readings, major accident and fire histories, types of previous owners - e.g. rental companies, and more (gathered from state title reports, insurance companies, auto rental companies, fire and police stations etc.). A buyer can also pay for a mechanic to examine a car at a price that is usually low relative to the value of the car. Certified used cars, available with a warranty, from car dealers are today a common phenomenon and attract millions of buyers each year.

Not all of these services were available when Akerlof wrote his paper but this only reminds us that markets constantly innovate. In any case, the lesson to be drawn from the above examples is not simply that services exist to alleviate the lemons problem in the used car market. Rather, the lesson is that informational asymmetries (and simple lack of information) create a demand for product assurance that entrepreneurs can profit from by meeting. This is the subject of Daniel Klein's paper.

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<sup>5</sup> Hemenway's evidence consists of various sets of descriptive statistics; a thorough econometric test of propitious selection remains to be conducted but seems a fruitful line of enquiry for an econometrician with an appropriate data set.

<sup>6</sup> Recall that a "lemon" is a specifically bad car not a low quality brand or model (low quality brands, at low prices, are not a market problem). A "lemon" in this sense may be more of a statistical fallacy, a failure to recognize that in any random experiment some cars will turn out to have more problems than others, similar to the "hot hand" in basketball, than a fact. Even if sellers know that their car has a long history of repairs this may say very little, after factoring in information about model and brand, about the future expectation of repair which is what buyer's want to know and what drives the lemons model.

Before turning to Klein, however, it's worth asking one more question about the Akerlof lemons model. Why don't sellers *tell* buyers about the true history of their cars? To an economist, the answer is obvious – sellers don't have an incentive to tell buyers bad news. Yet, in experiments by James Andreoni and others, which we discuss at greater length in the next section, individuals often behave in ways that run against their narrowly defined self-interest. People care about their reputation and their self-image, and for many sellers, honesty is the best policy.

In what is probably the most explicitly Hayekian piece in this volume, Daniel Klein looks for the institutions that have arisen spontaneously in the market system to mitigate problems of information, quality, and certification. In his examination of quality certification, Klein provides some general presumptions against the strength of asymmetric information in markets.

Buyers and sellers are willing to pay to overcome the problems that information asymmetries cause. Buyers wish assurance that purchased products will meet expectations, and sellers know that confidence in product quality generates sales. Several mechanisms have emerged to meet the demand for assurance. At the most basic level, extended dealings and firm reputation, coupled with a low enough discount rate, can engender cooperative transactions and trust. Firms go to considerable expense to foster such extended dealings. The emergence of brand names also makes repeated dealings more frequent and communicates information to consumers about product quality.

Trusted middlemen emerge between buyers and sellers who would otherwise find it too costly to investigate the trustworthiness of each other. Car dealers transform the set of isolated dealings that could otherwise lead to a lemons market into a nexus for repeated transactions. In some cases, the only product provided by the middleman is assurance – the bridging of the information asymmetry that allows trade to take place. *Consumer Reports*, Underwriters Laboratories, CARFAX and a multitude of credit bureaus reduce information asymmetries between buyers and sellers of products and credit. Market failure theory predicts massive deadweight losses accruing from the trades that fail to

take place because of informational asymmetries. In reality, alert entrepreneurs see deadweight losses as potential profits to be earned by removing the impediment to trade.

#### **IV. Critics of efficiency wages**

Like credit rationing, the efficiency wage doctrine has proven the subject of much controversy. H. Lorne Carmichael, in his "Efficiency Wage Models of Unemployment - One View," tries to show that the theoretical case for the efficiency wage phenomenon is weaker than is commonly believed. Efficiency wage arguments require numerous and detailed assumptions, either explicit or implicit, about why markets cannot handle the basic monitoring problem. In Carmichael's view, efficiency wage models explain some facts about labor markets, but do not account for either wage rigidity or persistent involuntary unemployment. They are the exceptional case, rather than the standard account of how labor markets work.

Efficiency wage models make worker productivity a function of wage rates. Firms increase profits by paying a wage higher than the market-clearing rate in order to induce optimal work effort. In the aggregate, these actions create involuntary unemployment by keeping wage rates above those expected in competitive equilibrium. An unemployed worker may offer his or her services for less than the going wage rate, but that prospective worker's marginal product would drop more than proportionately with the decrease in the wage rate, dissuading firms from accepting the offer.

Carmichael examines the various efficiency wage models and finds them less than sound. Some models simply assume that workers wish to return the "gift" of above-market wages with extra effort. Restrictions on worker utility functions, however, do not make for satisfying economic models. Furthermore if efficiency wages do in fact increase worker utility, above and beyond the transfer of additional income (perhaps because of pride), they are all the more likely to be second-best efficient, rather than a market failure.

The mechanisms underlying more complex models also are suspect. Allowing entrance fees and bond posting typically overturns the conclusions of efficiency wage models.

Shirking models posit that firms pay efficiency wages to increase the costs to workers of being fired and thereby reduce shirking. Unemployed workers in such markets should be willing to pay entrance fees in order to get valuable jobs, just as prospective tenants in New York are willing to pay apartment move-in fees for rent-controlled flats. In turnover models firms pay efficiency wages to avoid costly worker quits after the firm has invested in worker training. Again, unemployed workers should be willing to pay an upfront fee to the company to compensate the firm for hiring costs. This would again eliminate involuntary employment within the context of the model. Note that in this context "entrance fees" can take many forms, including a salary structure that penalizes new workers and rewards seniority.

Note that Gary Becker and George Stigler presented the efficiency wage mechanism (1976) before Stiglitz published his work in the area. In their treatment, however, efficiency wages are not necessarily a cause of market failure. Instead efficiency wages (they do not use the term) help motivate market participants to achieve commonly agreed upon ends. Becker and Stigler also note how bonding can serve many of the functions of efficiency wages, and avoid related market failure problems. The treatment of Becker and Stigler received less attention, in part because they pointed out a solution to the problem at the same time they pointed out the problem itself.

Adverse selection models provide a more plausible mechanism for the creation of efficiency wage markets. In these models, firms pay higher wages to attract a more desirable pool of job applicants, as individuals with higher opportunity costs will apply for higher-paying positions. This model, however, like the other models of efficiency wages, does not generate either downward wage rigidity or an unemployment rate that fluctuates across the business cycle in the expected manner.

While efficiency wage models predict above-market wage rates leading to unemployment, they do not predict wage rigidity. First, the model determines the real wage, whereas we usually observe rigidity in nominal terms. More importantly, in such models, the optimal efficiency wage premium will fluctuate pro-cyclically, increasing wage volatility rather than inducing wage rigidity. In gift models, the size of the optimal

“gift” will vary with prevailing wage rates and unemployment levels. When unemployment rises, a smaller wage premium would result in optimal mitigation of both shirking and quitting. A downturn in the business cycle will increase the pool of applicants for open positions, reducing the wage premium necessary to generate the desired number of applicants. In all of these cases, the efficiency wage will fluctuate with the business cycle and efficiency wage models therefore fail as explanations of either nominal or real wage rigidity. Efficiency wage models then lose much of the power that they had claimed in explaining labor markets.

Unfortunately the efficiency wage arguments have not proven easily amenable to more direct empirical tests, and thus we provide no empirical article in this volume on efficiency wages. Krueger and Summers (1988) have argued that strong evidence of the efficiency wage phenomenon exists, but their work is not very convincing. They set up a wage equation and treat the unexplained residual as evidence for the efficiency wage phenomenon. More plausibly, this suggests that an econometric model cannot capture every determinant of the wage rate. Even if we accept this evidence, however, it does not show efficiency wages to be a market failure; it would simply show that the wage structure is one tool that employers use to control shirking. We already have seen that this may be a first- or second-best market response to a serious institutional problem.

Moreover market failure in the labor market would not necessarily imply more government intervention. For example, the basic Shapiro-Stiglitz efficiency wage model (1984) predicts that increases in unemployment benefits will increase unemployment not only by directly reducing the downside risk of shirking but also by increasing the efficiency wage premium that must be paid in order to prevent shirking (p. 439). This might suggest that unemployment benefits should be reduced. While it has been argued that efficiency wages mitigate the employment effects of minimum wage increases, alternative models show that minimum wage increases lead to higher unemployment when the efficiency wage phenomenon is present, because of the required increase in efficiency wage premiums. In any case, efficiency wage models do not provide unequivocal support for government intervention into labor markets.

Some of the more general empirical patterns of business cycles tend to militate against the relevance of the efficiency wage phenomenon. For instance, productivity tends to rise with the business cycle, whereas the efficiency wage model suggests that people will work hardest in depressions, when they are most afraid of losing their jobs. To the extent efficiency wages exist, they are more likely a useful market institution than a fundamental cause of unemployment or economic downturns.

## **V Lock-in**

The lean mathematical models that have characterized the bulk of economic theory since the Second World War necessarily abstracted away from historical context. Paul David brought the notion that “history matters” back to economics in the mid-1980s as a theory of market failure. David combined theories of network effects, path dependence and lock-in to argue for the strong likelihood of market failure in technological markets requiring coordination to a common standard.

The basic argument behind lock-in is simple: collective action problems may cause individuals to end up stuck in a technology that is less than optimal. When compatibility plays a role in determining value, switching from an established standard to a superior standard may become very difficult. The market may fail to abandon the inefficient standard because it has no mechanism to coordinate the move to a new standard. When compatibility effects are strong, the private gains of an individual switch would be lower than the social gains of the switch. Each individual fails to take into account that a successful collective switch would yield significant benefits for others as well. This makes individuals more reluctant to switch than they should be, and the market may become “locked in” to an inefficient standard. Absent a centrally coordinated move, individuals and firms would stay with the old standard.

The QWERTY keyboard is often cited as the classic example of lock-in. According to legend, the QWERTY keys were first laid on the top row of the keyboard to slow typists down, not to help them type faster. Early typewriters sometimes jammed when multiple type bars hit the ribbon in too short a period of time. The QWERTY keyboard, it has been argued, slowed typists down enough to prevent the keys from jamming. This same

QWERTY keyboard, efficient in its day, persists as the dominant technology and now slows down current typists, who obviously do not have to worry about jamming type bars. The critics claim that numerous alternative keyboards, such as Dvorak, in fact allow today's typists to work at a much faster rate.

This story sounds intriguing but in fact it appears to be false. Indeed, the QWERTY keyboard did not slow down early typists at all. Rather, it prevented type bar jamming by separating type bars corresponding to common letter combinations, forcing those type bars to approach the ribbon from different angles and reducing their chances of jamming together. Consequently, Dvorak typists enjoy few or no advantages against their QWERTY-trained counterparts. In Winners, Losers & Microsoft, Stanley Liebowitz and Stephen Margolis examine QWERTY and other cases held as examples of market lock-in and find little evidence for the phenomenon.

Liebowitz and Margolis's "Fable of the Keys"<sup>7</sup> questions whether David succeeded in living up to Cicero's dictum, cited by David in his initial exposition of the QWERTY story, that historians must tell true stories. Where David cites U.S. Navy experiments demonstrating the superiority of the Dvorak keyboard, Liebowitz and Margolis point out the biases in those studies, which had been conducted by Lt. Cmdr. Dvorak himself. They also note a more rigorous examination of the two typewriter layouts performed in 1956 for the U.S. government's General Services Administration which concluded that Dvorak keyboards were no better than the standard QWERTY design and that retraining on Dvorak would never amortize its costs. David concludes his 1985 work by expressing his belief that "there are many more QWERTY worlds lying out there" (1985: 336), but until now we still cannot confirm even the QWERTY keyboard as a market failure.

Liebowitz and Margolis systematically examine other cases held as examples of lock-in to an efficient standard. In each case they fail to find evidence of serious market failure. VHS based videocassette recorders succeeded over Betamax recorders in the consumer market because the VHS standard offered consumers a superior bundle of characteristics, especially longer recording time, rather than because of any initial market dominance. In

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<sup>7</sup> Liebowitz and Margolis (1990), reproduced as Chapter 2 of Winners, Losers and Microsoft.

the professional market, where the ease of editing film is important, Betamax is the standard. The command line interface of Microsoft's DOS system taxed computer system resources less than Apple's graphical user interface in the era when processing speed, memory and hard disc capacity were hard and binding constraints. DOS allowed users to run more powerful programs more quickly, leading consumers to prefer DOS to Apple. Apple's failure to incorporate backward compatibility into system upgrades meant that existing Apple users faced higher costs than Microsoft users in keeping their systems current, ensuring Microsoft's continued popularity when hardware improvements made graphical user interfaces the norm across both platforms.

The popularity of Microsoft's operating system has not, however, translated into the automatic dominance of other Microsoft software packages. Instead, Liebowitz and Margolis point out that Microsoft's market share in a wide range of software product categories seems closely tied to user and reviewer evaluations of the relative quality of Microsoft's products. When Microsoft offers a poor product, as it did with Excel prior to 1992 and Internet Explorer prior to 1996, it has a much lower market share than its competitors. When the Microsoft product improves, so does its market share.

Even the software market provides evidence against the phenomenon of lock-in. WordPerfect dominated the market for word processors from the 1980s through the early 1990s, with a market share rising to almost 50 percent in 1990. WordPerfect users, as many readers will recall, invested significant resources in learning the WordPerfect system's complex array of command keys and functions. WordPerfect would have seemed a likely candidate for market lock-in, but, by 1994, Microsoft Word for Windows had grown to command a larger market share than the DOS and Windows versions of WordPerfect combined. WordPerfect dominated the word processing market only as long as its product beat out its competitors in user evaluations and magazine reviews. When Microsoft produced a better product, Word supplanted WordPerfect as the preferred word processing program. The same story plays out in each of the software markets Liebowitz and Margolis examine: the better product wins, regardless of initial market share.

Given the paucity of identifiable market failures through lock-in, Liebowitz and Margolis adopt a cautious theoretical approach. They present a taxonomy of path dependence based on appropriate policy responses. For instance simple path dependence – when a company’s current production decisions depend in part on capital investment undertaken in previous periods – is of no policy consequence. A more significant form of path dependence results when *ex ante* rational investment decisions are found *ex post* to have been inferior to other previously available options. Liebowitz and Margolis argue, however, that markets may remedy this problem relatively well. Though the *ex ante* decision may be regrettable, it is not inefficient. If the benefits of switching are, *ex post*, high enough, markets can coordinate to new standards. Finally, agents may choose an *ex ante* sub-optimal option. While unlikely, in theory such a situation could emerge from a coordination failure where agents expect the sub-optimal option to become the standard.

David criticizes Liebowitz and Margolis for grounding their analysis too firmly in the world of policy analysis. We argue to the contrary. The theory of market failure must be viewed within a comparative institutional framework; as Harold Demsetz warns us, assertions of failure outside of such a framework slide easily into the Nirvana fallacy. A failure of market mechanisms to deliver as high a level of welfare as other feasible institutions would be a more powerful and relevant critique than simply noting divergences from competitive equilibrium. By focusing on the policies that would be required to remedy the market failures identified by David, Liebowitz and Margolis thrust us back into the world of comparative institutional analysis. Where David argues that lock-in induced failures should pervade technological markets and justify government intervention to slow down the adoption of any technical standard, Liebowitz and Margolis demonstrate the rarity of potentially remediable cases of lock-in, both in theory and, *a fortiori*, in practice.

The mitigation of lock-in induced inefficiencies can take two forms – comprehensive reforms and selective interventions. David proposes comprehensive measures to improve “the informational state in which choices can be made by private parties and governmental agencies” and to delay market commitment to any particular technological standard. Yet the case for such comprehensive measures seems weak. Information

improves the workings of markets, but governments are rarely superior predictors of quality. Comprehensive efforts to delay the adoption of any particular standard will necessarily reduce consumer welfare by the discounted value of the network benefits that would have accrued during the delay period. Furthermore consumers would only enjoy offsetting benefits from the delay when delay prevents them from choosing the inferior standard. But usually we do not know which standard is better until we start experimenting. The fundamental questions about standards often relate to their practical efficacy, rather than their abstract theoretical properties. The market is a discovery process, as Hayek has stressed, and much of this discovery results from learning by doing. Though David argues that static welfare analysis lies at the root of opposition to the concept of path dependence and to the policy consequences he sees as flowing from it, a Hayekian dynamic market process approach to economic analysis makes his case all the more tenuous. It therefore remains to be seen whether David's delay proposals would survive a cost-benefit analysis.

A second form of potential mitigation would take the form of selective government intervention when market failure from lock-in had been identified. In some obvious cases of coordination failure, for example, the government could facilitate standard switching by itself adopting the more efficient standard. Government action would thus coordinate consumer expectations on the best technological standard.

While this sounds good in theory, everyone has their favorite candidate for an inferior standard (e.g., there are still partisans of the Beta format) and what one person regards as an obviously inferior system is, to an aficionado, the best. The case that is supposedly most obvious, QWERTY, turns out to be illusory or at least hard to pin down. More generally government does not do a good job of "picking winners," whether it be backing companies, industrial sectors, or standards. Liebowitz and Margolis note Zinsmeister's (1993) chronicle of the failures of Japan's Ministry of International Trade and Industry (MITI) in picking winners: "[v]ery simply, MITI, which may well have had the best shot of any government agency at steering an economy toward the best bets, was no substitute for the interplay of multitudes of profit-seeking rivals competing with each other to find

the best mousetrap” (1999, p.131). MITI, for instance, originally recommended that Japanese firms abandon both automobiles and consumer electronics.

The failures of politics are often no accident, but rather result from the power of special interest groups. The owner of a winning standard is likely to reap large profits, thus creating an incentive for lobbying, special interest groups, rent-seeking, and other distortions of the political process. For these reasons government intervention could easily make things worse rather than better.

Note also that private market participants can settle on their own standards, and change standards, without government intervention. Railroad gauges became mutually compatible in the interests of commerce. The railroads even succeeded in introducing standard time zones across the United States, a particularly interesting example because government did not make the zones official until, after three decades of evolution, the market had decisively locked-in - the precise opposite of the process that David recommends.<sup>8</sup> The MP3 format has become commonplace in digitally distributed music, without government assistance. Yet if the major music companies come up with something better, they will have every opportunity to market it to their consumers. These same companies are also using consortia (SDMI, Secure Digital Music Initiative) to introduce new standards for encrypted music that cannot be distributed over Napster-like services. The companies may not beat the hackers, but there is no doubt that they have worked together to introduce new standards. Similarly, we see Hollywood moving towards digital filming of movies, and away from the previous medium of celluloid film.

Lock-in theories have influenced real world economic policy, most notably in the realm of antitrust. Antitrust lawyers argue that network effects give incumbent firms too large an advantage over their competitors or potential competitors. Liebowitz and Margolis point out that, to the contrary, multiple standards are common in many markets. While competition within a proprietary standard is negligible, competition among standards can be fierce and need not lead to “winner-take-all” dominance. Apple remains a strong

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<sup>8</sup> The contra-David process in which governments officially sanction a standard that the market has chosen has not been well studied but is not uncommon. In law, for example, governments and private bodies such

player in the computer market, especially among those involved in graphic design, despite its smaller market share than Microsoft. VHS dominates consumer videocassette markets while Betamax is the choice of those involved in film production and editing, though DVD technology may yet supersede both formats. Suppliers that rest on their laurels usually receive a comeuppance at the hands of a very dynamic marketplace. Microsoft must constantly improve its product or lose market share to another fierce competitor.

How, then, can the debate over QWERTY-nomics be resolved? Evidence for the phenomenon seems weak, but the existence of the phenomena cannot be ruled out on aprioristic grounds. QWERTY was a plausible story when first told and continues to hold influence despite the criticisms of Liebowitz and Margolis. David argues that, because his theory predicts pervasive inefficient market lock-in, the burden of proof must lie on Liebowitz and Margolis to show that lock-in does not exist. Liebowitz and Margolis, in turn, contend that David's theory isn't strong enough for him to assert that market failure in this context is the null hypothesis; consequently, he must provide sufficient proof of its empirical significance.<sup>9</sup>

Harold Demsetz, in his 1969 classic "Information and Efficiency: Another Viewpoint," offers clues as to how we might resolve such disputes. Demsetz reminds us of the dangers of moving from the identification of an imperfection to the belief that government can usefully improve matters. Attempting to remedy all observed imperfections is dangerous and costly, both in terms of efficiency and liberty. The burden of proof should therefore lie on those who assert market failure, and they have failed to make a convincing case in the areas cited above.

Demsetz argues that economic analysis cannot consist of simply pointing out that the real world fails to conform to a theoretical ideal, which he calls the nirvana approach to economics. Reducing economic analysis to nirvana theorizing leaves great scope for political mischief. Absent a comparative institutional framework, simple identification of

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as the American Law Institute periodically restate and codify law that is developed in a decentralized manner.

<sup>9</sup> See Peter Lewin (2001) for an extended discussion of these issues.

inefficiency amounts to a cry that “Something must be done!” – a call that politicians and regulators are only too ready to respond to, with an armory of “somethings” always at the ready. Comparative institutional analysis moves beyond the identification of discrepancies between the ideal and the real, examining instead the relative merits of feasible alternative institutional arrangements for dealing with identified economic problems.

Though Demsetz’s critique of nirvana theorizing was directed at earlier market failure theories advanced by Kenneth Arrow, it applies just as strongly against the information-based market failure theories currently popular. Demsetz lays out three fallacies that are commonly found in public policy discourse. “The grass is always greener fallacy” arises when it is simply assumed that government can improve on free enterprise. Far more pages in economic journals have been devoted to technical expositions of why markets might fail than have been used to explain why we might expect better results from government interventions. Echoes of the fallacy can be heard in David’s calls for government delays of technological standard adoption. If public choice theory teaches us anything, it is that we have reasons to believe that the grass may be less lush when watered by a government bureaucracy.

Similarly, inefficiency claims flowing from Stiglitz’s efficiency wage theory arguably rest upon two additional fallacies identified by Demsetz: the “free lunch” fallacy and the “people could be different” fallacy. If we assume for the moment that efficiency wages are a common phenomenon and that they are a result of firms mitigating shirking (both contentious claims) we must remember that we cannot eliminate the desire to shirk and that we cannot do away with efficiency wages without incurring the resulting reduction in work effort. The alternative to existing market structures is not some theoretical ideal achieved by sleight of hand and good intentions, it is some other institution whose feasibility and efficiency require careful examination. Demsetz's points are simple, and his targets obvious, but these remain some of the most important, and underappreciated, contributions of the economic way of thinking.

In lieu of these fallacies, Demsetz proposes that economists conduct comparative institutional analysis. That is, we should consider which real world alternatives actually do a better job at solving problems. While the economics profession has moved a long way towards Demsetz's perspective, there is still a long way to go.

## **VI. Experimental investigations of public goods theory**

The market failure literature has evolved methodologically as well as theoretically. In the last twenty years we have seen a spate of articles testing market failure and game-theoretic propositions using the method of experimental economics. While the experimental method has offered varied results, the thrust of the literature has been to revise some of our previous beliefs. In particular economists now see voluntary cooperation as more likely than before.

The experimental revolution has been one of the most important developments in recent economics. In this approach the economist adopts some of the methods of the natural scientist. He or she creates a controlled experiment using actual subjects and real dollar prizes. The economist designs "rules of the game" and communicates those rules to the participants. Individuals then play the game, knowing they can keep their winnings. Variations in the experiment then allow us to better see how markets work, how individuals make decisions, and how institutions matter.

Elizabeth Hoffman, in her "Public Choice Experiments," surveys the contributions of the experimental method to issues of public goods and politics. The first and most basic result was to establish that free-riding behavior is not universal. When individuals are given the opportunity to free ride in experiments, many of them cooperate or contribute to the production of a public good. Individuals are also more likely to contribute when they see others contributing as well. This suggests that ongoing reciprocity is possible, even when a prisoners' dilemma might otherwise appear to hold. Individuals follow "rules of thumb" that allow both small and large groups to sometimes reach cooperative solutions. Casual empiricism had already led us to suspect this result, but it is welcome to see it confirmed repeatedly in a laboratory setting.

Hoffman also surveys the literature on bargaining experiments. When individuals are put in isolated, stylized settings and allowed to strike bargains, they tend to strike good bargains. More specifically, they tend to strike the bargain that maximizes joint profits. This is consonant with a belief in the power of markets to encourage value-maximizing outcomes.

Some of the research surveyed by Hoffman reveals the limitations of many experimental studies. The constructed experiment does not exactly match any set of real world institutions. The experimental subjects sometimes know they are being 'watched.' The "prizes" are often smaller than real world rewards. Yet the experimentalists have, over time, responded to many of their critics with effectiveness. Experiments have been set up where individuals sit at a computer terminal and play anonymously. Many results are robust to the size of the prizes, or even become stronger as the prizes become more valuable. Experiments have moved closer and closer to reflecting some institutional structure. The robustness of many experimental results -- including the finding of cooperative behavior -- is a central reason why the experimental method has become increasingly popular and influential (see Kurzaban, McCabe, Smith, and Wilson, forthcoming, as well as Smith, 1992 and 2000).

The other experimental pieces in this section look at how cooperative behavior varies under various assumptions and experimental designs. Gordon Tullock, in his "Non-prisoner's dilemma," allows the experimental participants to communicate, and he allows them to "fire" their partners if they find the person insufficiently cooperative. Under these assumptions individuals cooperate with a much higher degree of frequency than most other experiments have found. Tullock's experiment is a very simple one, but also a powerful one. His design comes closer to real world institutions than do many other experiments about cooperation, and he finds that those changes bring more cooperation. Tullock (p.456) notes that: "...most of our normal dealings do not meet the rather stringent conditions of the prisoner's dilemma."

Isaac, Walker, and Williams, in their "Group Size and the Voluntary Provision of Public Goods," vary yet another aspect of experimental design. They look at how the extent of cooperation changes as the number of players in a game changes.

Under the standard market failure story, small groups might manage to cooperate successfully, but large groups almost certainly will not. When the group is small, the contribution of any single person still affects the overall outcome. Furthermore it would appear that small groups use norms, sanctions, and informal codes of behavior more easily than can large groups, due to the lesser degree of anonymity in small groups. This also would militate in favor of more cooperation in small groups than in large ones.

While these kinds of stories have long commanded assent from many economists, they do not necessarily fit the data. The authors of this paper, for instance, found that groups of 4 and 10 persons provide public goods less effectively than do groups of 40 and 100. This is directly contrary to what standard theory would have led us to expect.

It remains an interesting question why the experiments indicate that large groups cooperate more successfully than do small ones. The authors suggest several reasons why people cooperate at all, but they make little attempt to explain their result of more cooperation with greater numbers of people. It appears clear that people reject the "backwards induction" reasoning of the Nash equilibrium concept in game theory. (Backwards induction suggests that people see they will not cooperate in the last period of some game, and thus do not cooperate at all, once they see the breakdown in cooperation coming.) Yet why should they reject backwards induction even more when the number of players is large?

The answer to this question is likely to await further experimental work. The authors (p.23) hint at one possibility but without exploring it. They suggest that individuals may cooperate to signal their trustworthiness to others. The value of this signal may be larger, the greater the number of people playing the game. There is yet another hypothesis, not considered by the authors. Cooperation may bring feelings of belonging and group solidarity, almost like that of a fan club or mass movement. Again, the value of these benefits may be greater, the larger the number of individuals playing the game.

James Andreoni, in the final experimental piece in our book, looks at why individuals tend to cooperate more than standard theory had predicted they would. Andreoni distinguishes two hypotheses (though more hypotheses may be relevant): an "error" hypothesis, and a "warm glow" hypothesis. The error hypothesis states that people cooperate because they do not really understand the nature of the game. The implication is that learning the nature of the game, and extended play, will bring less cooperation over time. The "warm glow" hypothesis is that people simply enjoy cooperating, helping others, or being kind.

Andreoni's experiment reveals that at least half of all observed cooperative behavior comes from the warm glow hypothesis. That is, individuals persist in this behavior, even once they understand that they might do financially better by free-riding. Again, this suggests that cooperation is relatively robust, more robust than traditional models would indicate. Cooperation is not just a matter of making a mistake.

## **VII Concluding remarks**

Our world is a highly imperfect one, and these imperfections include the workings of markets. Nonetheless, while being vigilant about what we will learn in the future, we conclude that the "new theories" of market failure overstate their case and exaggerate the relative imperfections of the market economy. In some cases, the theoretical foundations of the market failure arguments are weak. In other cases, the evidence does not support what the abstract models suggest. Rarely is analysis done in a comparative institutional framework.

The term "market failure" is prejudicial – we can't know whether markets fail before we actually examine them, yet most of market failure theory is just theory. Alexander Tabarrok (2002) suggests that "market challenge theory" might be a better term. Market challenge theory alerts us to areas where markets might fail and encourages us to seek out evidence. In testing these theories, we may find market failure or we may find that markets are more robust than we had previously believed. Indeed, the lasting contribution of the new market failure theorists may be in encouraging empirical research that broadens and deepens our understanding of markets.

We believe that the market failure or success debate will become more fruitful as it turns more to Hayekian themes and empirical and experimental methods. Above, we noted that extant models were long on "information" -- which can be encapsulated into unambiguous, articulable bits -- and short on the broader category of "knowledge," as we find in Hayek. Yet most of the critical economic problems involve at least as much knowledge as information. Employers, for instance, have knowledge of how to overcome shirking problems, even when they do not have explicit information about how hard their employees are working. Many market failures are avoided to the extent we mobilize dispersed knowledge successfully.

It is no accident that the new market failure theorists have focused on information to the exclusion of knowledge. Information is easier to model, whereas knowledge is not, and the economics profession has been oriented towards models. Explicitly modeling knowledge may remain impossible for the immediate future, which suggests a greater role for history, case studies, cognitive science, and the methods of experimental economics.

We think in particular of the experimental revolution in economics as a way of understanding and addressing Hayek's insights on markets and knowledge; Vernon Smith, arguably the father of modern experimental economics, frequently makes this connection explicit. Experimental economics forces the practitioner to deal with the kinds of knowledge and behavior patterns that individuals possess in the real world, rather than what the theorist writes into an abstract model. The experiment then tells us how the original "endowments" might translate into real world outcomes. Since we are using real world agents, these endowments can include Hayekian knowledge and not just narrower categories of information.

Experimental results also tend to suggest Hayekian conclusions. When institutions and "rules of the game" are set up correctly, decentralized knowledge has enormous power. Prices and incentives are extremely potent. The collective result of a market process contains a wisdom that the theorist could not have replicated with pencil and paper alone.

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