From *Beyond Price Theory: The Economics of Beliefs, Norms and Contracts* by W. Bentley MacLeod. Not for distribution or quotation.

1 Introduction

This book is about how to use economics to understand complex economic institutions, particularly the design of incentive contracts in the shadow of a legal system. The goal is to present in a unified fashion extensions to price theory that can be used to produce a set of models and hypothesis amenable to empirical exploration. The book is called "Beyond Price Theory" for two reasons. The first is to acknowledge the enormous intellectual impact that modern price theory has had upon how we view and think about economics systems. Second, is to illustrate that modern micro-economics has developed a rich set of tools to study the imperfect economics systems and organizations that we observe in practice that cannot be understood through the lens of price theory.

It is a testament to the success of price theory that today it is difficult to image a world without markets. Yet it was not so long ago when central planning was considered a serious alternative to a market economy. Oskar Lange (1949) published a paper in *Econometrica* arguing that central planning was a big success. Today, after the fall of the Soviet Union, there is now little doubt that markets are an essential ingredient for an effective economy.

But free markets are not a panacea. Even though modern markets are marvels of complexity and sophistication, the 2008 financial crisis in the United States illustrated that free markets are not perfect. A distinctive feature of the 2008 crises, according to the report by the National Commission on the Causes of the Financial and Economic Crisis in the United States (Financial Crisis Inquiry Commission (2011)), is one of poorly designed and implemented incentive systems. For example, they observe: "Compensation systems—designed in an environment of cheap money, intense competition, and light regulation—too often rewarded the quick deal, the short-term gain—without proper consideration of long-term consequences."[1] In addition to several lapses in oversight, the Commission also observed that the ratings agencies who were suppose to provide unbiased estimate of risk, where incentivized not to carry out their job effectively.

The Commission argued that these errors were human made, and hence avoidable. However, as we shall see, the design of effective incentive is very complex. Moreover, there is little evidence to support

1 Page xix, Financial Crisis Inquiry Commission (2011).

the hypothesis that free markets by themselves will solve the problem of effective incentive design. In a classic paper, Steven Kerr (1975) provides many examples of successful, sophisticated firms who implemented poorly designed incentive systems. Unfortunately, this classic paper in the management literature is as relevant today as when he wrote the paper.

Edward Lazear, a very distinguished expert on compensation, studied the Safelight company adopt a performance pay system in the early 1990's. Lazear (2000) shows that subsequently workers put in more effort, consistent with the predictions of the theory. Never the less the company filed for bankruptcy in 1997. Banerjee et al. (2008) document the introduction of an incentive system to address poor performance by nurses in India. After some initial success, about 18 months after the program was introduced it proved to be a failure. Upon the advice of experts, the New York City implemented incentive pay for teachers, that Goodman and Turner (2013) later document was a complete failure.

This evidence is consistent with two hypothesis. The first is that individuals do have well defined goals, and respond in a predictable manner to the rewards that they face in their environment. The second is that the design of effective incentive systems is difficult. In a complex, constantly change world one cannot always anticipate the ultimate consequence of a proposed change in rewards. Rather, incentive design is like any technology - failures are common and improvements are often incremental. The purpose of this book is present an overview of the economic approach to the design of effect incentive mechanisms, and can help us better understand why effective organizational design is so difficult.

As we shall see, effective trade and employment practices consist of several interlocking ingredients. Price theory focuses upon the problem of determining the opportunity cost of decisions, which in turn can lead more efficient outcomes. However, since markets are incomplete, individuals much also rely upon their beliefs regarding how others make choices, which in turn depends upon their behavioral norms and existing contracts. In this book I review the first step - the design of bilateral agreements and institutions, that includes both employment and buy-seller contracts. The goal is to show how the design of effective contracts depends upon the particular features of the commodity being exchanged. The results can help us understand why it is so difficult to ensure efficient exchange in labor, education and health markets. In this introduction

I provide an overview of the terrain. The next section discusses price theory and why it is the dominant tool in economics. This is followed by a discussion of the work that extends price theory. The introduction concludes with a review of the agenda for the book.

1.1 Price Theory

The fundamental theoretical building block of modern economics is general equilibrium theory developed by John Hicks, Kenneth Arrow, and Gerard Debreu (who all won Nobel prizes in economics for their work). The theory, laid out beautifully in Debreu (1959)'s *Theory of Value*, provides a clear definition of an efficient allocation of resources, and the conditions under which such an allocation can be achieved via the price system. The theory is the corner stone of a modern graduate education not because it is "true", but because it provides a precise general framework within which it is possible to define what one means by an efficient allocation of resources.[2] The theory has few normative presumptions beyond requiring that commodities are well defined, and each person has a way to evaluate and rank the allocation of commodities. The power of the model lies in its elegance, and that fact that is provides a framework within which it is possible to study any resource allocation problem (in theory)!

Commodities

The notion of a commodity is defined in Chapter 2 Debreu (1959)'s brilliant book, "A Theory of Value". It can be a good or service. The former is a tangible object, such as food. A service is a commodity that cannot be physically owned, such as the stream of images one views while watching a movie of attending a concert. In this setup, an *asset* would be some physical or intellectual property that provides a stream of services. For example, a pair of shoes is not a good, but an asset that provides services to one's feet as one walks around. The distinction is meaningful because at some future point the service might be used by one's children

2 Here the term *efficient* is always in the sense of Pareto efficiency - there is no other allocation that makes everybody as well off, and some people strictly better off. This is discussed in more details below.

(my son sometimes borrows my shoes). The services provided by asset can be contracted upon and delivered to different individuals over time as a function of future events.

The description of a commodity requires specifying the quality of the commodity, as well as the place, and time of consumption. In addition, uncertainty can be introduced by allowing the commodity to be state contingent (Chapter 7 of Debreu (1959)). For example, one might buy a particular type of wheat on the Chicago futures exchange to be delivered next year. In addition to carefully specifying the characteristics of the wheat to be delivered, the contract will also specify what will happen if delivery cannot occur. All these features can be viewed as characteristics of the commodity, with the implication that the same wheat that is delivered under different contingencies, such as different penalties in the even of non-delivery, will be traded at different prices.

The key assumption in general equilibrium theory is the existence of a competitive market (i.e. many buyers and sellers) for *every* commodity. This is clearly impossible - a simple back of the envelope [3]. Rather, actual markets are plagued by market failures. Coase (1937) and Williamson (1971) introduce the idea that the economic institutions we observe, particularly business firms, are the market's solution to the problem of coordinating production due to incomplete markets. Coase did his work before the development of the Arrow-Debreu model of general equilibrium, and uses the term "transactions cost", rather than "incomplete market" to discuss the reasons for moving activity from the market to the firm. The transactions cost perspective implicitly supposes that goods traded in markets are well defined commodities, but the efficient allocation of these commodities is hindered by "transactions costs". Firms are then an efficient response to this problem by moving exchange from the market to a centrally planned firm.

3 There are about 10^{80} atoms in the universe. A contingent commodity needs to be defined for each possible state. Suppose we have $10,000 = 10^4$ new bits of information states each period. This is clearly a large understatement. A state needs to describe the weather, political climate, prices on thousands of stocks and so on, this is much less than we would expect. The point is a complete descritpion of the world, and after one period, for each state in periond 1 we would have 10^4new states, and hence the number of states is 10^8. Thus after T periods there are 10^{4T} states, and hence it takes only $T = 80/4 = 20$ period to exhaust the state space. If data arrives each second, we would exhaust atoms to even describe the full state space by the end of one day!

This mode of analysis used by Coase is grounded in a deep understanding of legal institutions. Oliver Williamson continues in this tradition, and has been very influential in bring economic ideas into thinking about legal rules and institutions.[4] In particular, he notes the sharp difference in law between markets and firms, that he calls the *principle of forebearance.*[5] The point is that contract law applies to transactions in markets, but not inside the firms. Contracts or agreements between parties within a firm are not enforceable in law, and hence must be governed by the policies and norms that characterize a particular firm.

This naturally led to the viewpoint that exchange outside the firm faces a different set of transactions costs compared to exchange within the firm. The result is a very influential and accessible literature that uses transactions costs to explain observed governance structures.[6] However, by focusing upon the transaction, as opposed to the characteristics of the good, one misses on the key ingredients of economic development, namely the process of commodification. Karl Marx (1883), like Adam Smith (1776), was well aware of the fact that economic development is concurrent with increasing commodification of exchange. In Marx's case he identified commodification with the "alienation of labor". Regardless of the normative value of such a view, one of the characteristics of modern economies is the ability to more carefully measure and trade specific types of goods and services.

By focusing upon transactions, rather than commodities, transactions costs economics leads to confusing two rather distinct phenomena. One is the set of classic transactions costs in economics - moral hazard (individuals respond to rewards) and asymmetric information (individuals do not have information regarding product characteristics). The second is the creation of a well defined commodity.

For example, Lisa Bernstein has an important body of work detailing the behavior of parties in specialized communities in this they build relational contracts and develop trading norms.[7] Her work very much follows in the Williamson/Coase tradition of focusing upon the conditions

4 See Williamson (2010) for a nice review of transactions costs economics.

5 *See Williamson (1991),* page 275.

6 For example Williamson (1985)'s book, *The Economic Institutions of Capitalism*, has more than 41,000 Google citations making it one of the most cited works in economics.

7 Bernstein (1992)

that lead parties to opt out of the formal legal system. This approach has the tendency to confuse enforcement problems (making sure that parties do what they promise to do) with allocation problems (determining the efficient agreement). For example, Bernstein (2001) details discusses trading norms within the US cotton industry as a prime example of opting out of a legal system. Yet, the main problem they solve is to create a standardized definition of a "cotton bale" that specifies the size and quality of the product. Solving this problem allows more trade and growth in the cotton industry that is independent of whether or not courts or specialized arbitrators are used to enforce contracts. Similarly, Bernstein (2014) also has a wonderful discussion of a "2 x 4" - the piece of lumber that is not in fact 2 inches by 4 inches, but over time the exact size became standardized. Allen (2012) has a nice historical review of institutions that provides a number of examples of "commodification" in practice over time.

The approach taken in this book is that commodification - the precise definition of the good or service to be exchange - is the distinctive first step of the three step process. The next step is assigning value to different commodities. The final step is to agree upon and enforce trade. Let us now turn to the determination of value.

Value

The next ingredient is a model of human decision making. The model of rational choice is a common target for criticism, however, its power lies in the fact that it is a very simple and elegant model of decision making. It is built upon two assumptions. The first is that individuals have a well defined ranking over commodities. Without loss of generality, one can begin with a finite set of choices, $\{A, B, C, D, ...\}$. The second assumption is that if an individual prefers A over B then she will choose A. A person is considered *irrational* when she knowingly chooses say B, even though she really prefers A.

Debreu (1959) shows that under these assumptions, the choices of a rational person can be represented by assigning a value to each choice, say V_{choice}. By construction choice A will be preferred/chosen to some other choice B if and only if the value of A is greater than the value of B ($V_A > V_B$). The rational choice model is the starting point for what Bandura (2001) calls the *agentic* approach to social cognition - the notion

that individuals have goals and make decisions based upon consequences, and whether these consequence advance their goals.[8]

Once preferences have been defined, then the notion of an *efficient allocation* is defined as a feasible allocation (one that satisfies the resource constraints) with the feature that there is no other allocation that makes a single individual better off without harming any other individual.[9] This notion of efficiency is typically considered to be ethically neutral from the perspective of individual preferences, and most economists would take the normative view that, if possible, one should choose an efficient allocation. Under the standard assumptions for general equilibrium theory, efficient allocations can always be found, though there can be an infinite number of such allocations.

The purpose of the rational choice model is to provide a simple and coherent representation of how millions of individuals in an economy will respond to changes in their environment. It should also be noted that the model allows for interpersonal judgments. There is nothing in the theory that bars a person from choosing an outcome that is more equitable, even though it may lower her personal income. The theory also allows individuals to change their mind because a good consumed in the future is a different commodity. The strong assumption that is often made is not rationality hypothesis, but the assumption that preferences are *time invariant*, namely if we can observe preferences today, then that will tell us what a person's preferences will be tomorrow. Now only is this assumption difficult to test, it is certainly false - the advertising business is built upon the hypothesis that consumer preferences can be modified over time.

Less well appreciated is the role of the rational choice model in modern behavioral economics. Before the work of Kahneman and Tversky (1979), there had been a great deal of work that attempts to model human decision from the ground up based upon models of human cognition. A good example is the treatise by Newell and Simon (1972). This

8 The term *agentic* is also used in the context of Milgram's theory in which how individuals follow orders are in an agentic state. One might wonder what is the alternative? See Macleod (2016) for a discussion of skill and human capital where choices are pattern based rather than outcome based.

9 The term "Pareto efficient" is more commonly used - there is really no other notion of efficiency that is used in economics, and hence we use the term "efficient". There may be other explicit criteria used to evaluate an allocation - these may or may not be efficient, depending upon the context.

work had little impact in economics, even though it was widely recognized that the standard model needs to be extended. The genius of Kahneman and Tversky (1979) was to use the standard rational choice model as a benchmark against which to measure *deviations* from rational choice. This approach has been enormously influential because the rational choice model provides a good first order representation of behavior, and hence a good way to help organize the many deviations from rational choice that have been observed in the literature (See Camerer et al. (2004) for a collection of seminal articles).

Next we turn to the theory of competitive markets, which, like rational choice theory, has proven to be a good first order model of economic activities.

Markets and the Welfare Theorems of General Equilibrium Theory

General equilibrium theory provides a model of resource allocation when the set of commodities in the economy can be observed and contracted upon. In this case, one can characterize all efficient allocations by giving each commodity in the economy a value per unit or a price.[10] This price is a purely technical construct that follows from the requirement of (Pareto) efficiency.

It turns out that there is a beautiful connection between these prices and the prices in a competitive market. By a competitive market one means a situation for which every commodity can be traded at a price, and that prices are set so that demand is equal to supply. The first welfare theorem demonstrates that every competitive equilibrium is efficient. An obvious concern is that competitive equilibria may be extremely unjust. For example, Sen (1977) pointed out that one of reasons for the Bengali famine was not the lack of food, but the fact that many households did not have the resources to purchase food at the going prices.

These concerns are addressed with the second welfare theorem. Under the appropriate conditions, every efficient allocation can be achieved via a two step procedure. In step one there is a redistribution of initial

10 One good has to be given a numeraire price of 1 against which all the others are measured.

endowments, and in step two parties trade on a competitive market. This is a very powerful idea that can be viewed as consistent with many of the ideas in Friedman (1962). He makes the normative claim that a society with free markets is to be preferred over the alternatives. He recognizes the importance of addressing inequality, and, consistent with the second welfare theorem, advocates for a redistribution of initial endowments (such as vouchers for the provision of school services and a negative income tax system).

Gary Becker (1976) observes that the notion of price used in general equilibrium theory does not correspond to it's everyday use, and certainly does not correspond to "price" as used in a legally binding contract. Price as used in general equilibrium theory represents the value of any constraint upon the set of feasible allocations. When the price of a commodity is zero, then this means that there is more of the commodity than individuals are willing to consume. Similarly, at an efficient allocation, pollution that is associated with a negative price - producing more of the commodity lowers value.

However, this does not imply that markets with free "prices" will achieve an efficient allocation, as claimed by Friedman (1962). The reason is that a prerequisite for efficient trade are *complete markets*. This is the requirement that one can measure and identify *all* commodities in the economy, including commodities that will be created in the future.

To many this discussion may seem a bit pedantic, but general equilibrium theory is the intellectual foundation for modern economics. Even if not explicitly acknowledged, the idea that efficient allocations can be characterized via economic prices is very powerful. In the context of business practices, it shows that in principle, setting standards for goods and services in relationships makes it easier to price these commodities, and hence can potentially increase the value of trade.

Second, it helps explain why so many economists, when acting as advisers, believe that more markets are good. For example, Greenspan (1998) very much supported unregulated over the counter (OTC) trade in derivative securities.[11] He used a perfectly valid argument. The only problem was, as he later admitted (Greenspan (2008)), it was completely

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He stated: "Professional counter-parties to privately negotiated contracts also have demonstrated their ability to protect themselves from losses from fraud

wrong! In an important paper, Oliver Hart (1975) showed that making markets more complete does not necessarily result in increased efficiency, and thus in theory more markets do not necessarily lead to better outcomes.

Finally, one cannot easily escape the power of the second welfare theorem. It implies that given *any* normative claims regarding what is a desirable outcome can be viewed as an outcome supported by some "economic prices". This can tempt economists to use what Paul Krugman (2014) calls a "bait and switch" strategy - namely to go from the true fact that efficient allocations can be supported by some set of "economic prices" to the false claim that free markets are always efficient. To spot this strategy, lets explore a more nuanced notion of "price".

1.2 Beyond Price Theory

Trade Price

The notion of an economic price for a well defined commodity is quite different from the *trade price.* This corresponds to the everyday concept of a price given by the observed terms of trade at the time of sale. When we speak of the price of milk or housing, it refers to the price we pay at the store - the trade price. The trade price is more of a legal rather than economic concept, in the sense that it defines your obligation to the store should you wish to leave with the milk. The economic price of the milk reflects the *full* cost of leaving home to buy milk and then returning home.

The reason this is important is that while economic price *always* refers to the actual value of a good, the trade price refers to the single market price for a *basket* of different commodities. For example, in his famous "Market for Lemons" paper, Akerlof (1970) considers the market for cars where they are characterized by their age, make and quality. He also supposes that the mechanical quality of the car for sale cannot be

and counter-party insolvencies." and goes on to say "A far more powerful incentive, however, is the fear of loss of the dealer's good reputation, without which it cannot compete effectively, regardless of its financial strength or financial engineering capabilities."

observed by buyers, which in turn implies that high quality cars and low quality "lemons" fetch the same "trade price" in the market, even though they are distinct commodities. In this case, the word "price" in Akerlof corresponds to what I mean by a trade price - the amount one would pay for a car in this market, but whose quality is uncertain. Akerlof showed that the trade price is equal to the average value of low and high quality cars. This in turn creates an incentive for owners of low quality cars to enter the market since their cars are are over valued, while owners of high quality cars exit the market because the trade price is less than the value of the car in their possession. This result is a complete breakdown of the market with all high quality sellers leaving, a phenomena Akerlof calls "adverse selection".

This paper is extremely influential in economics because it illustrates the role that asymmetric information plays in determining the volume of trade. The assumed lack of a contract between parties is consistent with the notion of a *trade price* and with the way the law treats spot exchange (Farnsworth (2004)). Akerlof observes that the presence of adverse selection can explain a number of market institutions, such as a gaining a reputation for quality. As I shall discuss in Part III, there are number of different institutions that arise explicitly to address the problem of adverse selection.

Another good example is the labor market. The competitive labor market model suppose that wages are equal to the economic price. In such a market the employment contract is very simple - the employer hires the employee for a certain number of hours, q, and pays $w \times q$, where w is the wage rate. It is assumed that both employers and employees take the wage signal given, to determine the number of hours, $L^D\left(w, \theta^D\right)$, demanded by the firms, and the hours, $L^S\left(w, \theta^S\right)$, supplied by workers, where θ^S and θ^D are exogenous parameters that changes over time.

In the Hicks-Samuelson model it is assumed that wages adjust to remove the imbalance between supply and demand so that the wage as a function of the exogenous shocks θ^t is given by the formula:

$$L^D\left(w\left(\theta^t\right), \theta^t\right) = L^S\left(w\left(\theta^t\right), \theta^t\right). \tag{1.1}$$

The power of the competitive model lies in its ability to make predictions on wages changes as a function of shocks to supply (θ^S) or demand (θ^D).[12]

Of course, it is well appreciated that this is a highly stylized model of employment, but yet remains one of the most useful approaches to thinking about and organizing evidence regarding secular trends in inequality and the returns to education.[13] It has proven to be much less helpful when trying to understand many aspects of the labor market such as persistent unemployment. By unemployment we mean that at the current market wage rate workers are willing to work, but the firms are not willing to hire them. Such an outcome is not possible within a complete markets framework because if wages are above market clearing, then wages are predicted to fall until supply is equal to demand.

Some unemployment is due to search costs and is part of the normal functioning of the labor market.[14] The puzzle is that job loss typically leads to a permanent lost of earnings rather than a new job with similar earnings to the previous job. [15] Thus many workers should accept a wage cut rather than job lost. While such wages cuts do occur in practice, they are relatively rare.[16] Moreover, workers should only care about real wages, though it seems that nominal wages exhibit some rigidity (Card and Hyslop (1997)). Recent work shows that such "irrational" behavior also occurs in contexts where individuals are very poor, and hence have strong incentives to avoid inefficient behavior (Kaur (2014)).

The traditional approach to these observes is to maintain the conceptual approach of price theory, and try to "patch" the model. Beginning with Keynes, it is common to suppose that wages are downward rigid, and firms set labor demand given the market wage. The problem then is why do unemployment workers refuse to accept lower wages in order to exit unemployment?

To address this problem a number of *patches* to price theory have been suggested. One of the most popular is the class of patches to price

12 See Katz and Autor (1999) for an review of how the supply demand framework can explain the pattern of wage changes in the US.

13 For example, good reviews include Card (2001) on the returns to education and Acemoglu and Autor (2011) for a discussion of inequality and the returns to skill.

14 See Rogerson et al. (2005) for a review.

15 See Gibbons and Katz (1991) and Schmieder and von Wachter (2010).

16 See Blinder and Choi (1990).

theory known as "efficiency wage" models.[17] The basic idea builds upon Leibenstein (1958)'s observation that in a developing context workers have such low incomes that their productivity can be enhanced if the wages is increased above the market clearing rate. The reason is that with a higher income they can eat more, and be physically stronger, and hence the term "efficiency wage".

There are a number of papers that use this idea that increases in worker wages increase the quality of labor. Salop (1979), Calvo (1979) and Weiss (1980) build upon this idea to provide equilibrium market models of unemployment based upon information costs. Subsequent work by Malcomson (1981) and Shapiro and Stiglitz (1984) provides an efficiency wage model based upon the hypothesis that worker performance cannot be formally contracted upon. In these models, the employer uses the threat of dismissal to provide performance incentives, and hence wages have to be above market clearing, which in turn leads to unemployment.

Each of these models takes the basic framework of price theory, and the shows that a particular form of market incompleteness can generate observed downward rigid wages. In both models the "problem" is that wages are too high, which in turn focuses attention upon wage setting, and finding ways to make the trade price of labor closer to the economic price. For example, OECD (1994) job study explicitly makes the point that wages are an economic price and used as the primary mechanism to connect jobs to workers.[18] Yet, twenty years after this report the employment situation world wide is if anything worst. Using a patch to price theory to think about and model the employment relationship has not provided a useful guide for economic policy making.

As I discuss in detail in Chapter 12, labor markets are very complex institutions, where the value of an employee is a complex function of a number of ingredients. In the case of commodities such as food the fact that the trade price and economic price differ is less consequential than in the case of labor. In order to better understand the employment relationship it is more helpful to think in terms of the *contract price.*

17 See Akerlof and Yellen (1986) for a collection of the important papers in the area.
18 See part 1d.

Contract Price

A typical sales contract entails a seller agreeing to supply a commodity at a future date for a well defined trade price. Contract breach occurs when one or both parties fail to perform as promised. When breach occurs, the harmed party has the right to take the dispute to a court of law. There, as Judge Oliver Wendell Holmes (1897)observes: "The duty to keep a contract at common law means a prediction that you must pay damages if you do not keep it,—and nothing else."[19].

Thus, if the seller chooses a quantity or quality different from the agreement, then the payment she receives will be reduced.[20] Notice that a key feature of such a contract is that the payment to the buyer is state contingent - it varies with the level of performance. The use of such contingent pricing is one of the solutions that Akerlof (1970) argues that markets use to solve the adverse selection problems. This corresponds to warranties for cars in the market for lemons. Another example is documented in Banerjee and Duflo (2000) who observe that suppliers of software services mitigate low quality by providing after the sale services and support - this is the remedy of "cure" that is allowed under UCC 2-508.[21]

By *contract price,* I mean any arrangements in which terms vary after delivery, and for which there is an associated notion of *breach.* The notion of a contract price is best discussed in the context of a simple example. Such examples may lack the richness of a case study, however. the goal is to show that *small* variations in the environment can lead to *significant* variations in predicted contract form.

I consider a number of cases in turn. In each case, the observed trade price is only part of the relationship. In these examples, efficient production and trade relies upon state contingent rewards and punishments that can, if necessary, be backed by the force of the law.

19 Page 462.

20 The common law rule for contract breach is the awarding of "expectation damages" - an amount that ensures the promisee receives the value agreed to by the promisor.

21 UCC refers to the US commercial code that is a default set of legal rules covering trade. All countries have a similar set of rules, though enforcement can vary country to country.

The One Period Contract

Consider the case of a once off exchange with a contract between two agents A and B. We keep the payoffs fixed, but vary the context and information structure to illustrate the impact this has upon the predicted contract form. In some cases A might be a seller, in others a buyer. The stages are as follows:

1. A and B meet and agree upon a contract. If no agreement is reached both parties get zero.
2. Individual A chooses effort $\pi \in \{\pi_b, \pi_g\}$, where $1 > \pi_g > \pi_b > 0$ that represents the probability that there is a good outcome g. In general this effort is not observable, though it might be with sufficient cost. The currency is normalized so that the cost of effort π is π.
3. The state $s \in \{g, b\}$ is realized. If g occurs the value of trade is $v_g = \beta > 1$, if the bad outcome b occurs then trade has no value, $v_b = 0$. The value of trade is assumed to be easily observable by both agents.
4. Parties choose to trade or not as function of the state s, denoted by $q_s \in \{0, 1\}$, and transfers occur under the terms of the contract. The cost of production is c and it is assumed to satisfy $\beta - 1 > c > 0$.

In this model, the only substantive decisions are the level of effort, π, and the trade decision as a function of the state, $\{q_g, q_b\}$. Working backwards we can determine the efficient allocation for this model. If there a bad outcome, since the cost of production is $c > 0$ then no trade is optimal, and hence $q_b^* = 0$. If the outcome is g, then since $\beta > c$, trade is optimal and hence $q_g^* = 1$. Given this the expected value from choosing effort π is

$$W(\pi) = \pi(\beta - c) - \pi = \pi(\beta - (1 + c)) > 0.$$

The net return from effort is positive, and hence gains from trade are maximized effort is high (π_g), and trade occurs if and only if the state is high (g). The next issue is how can parties design contract prices in the shadow of the law that achieves this outcome?

Buyer Liability

Consider a very stylized version of Bernstein (1992)'s diamond market example. Suppose A is a buyer of diamonds and B is a seller. A feature

of this market is that the buyer is often liquidity constrained and hence prefers to pay the seller after he has had an opportunity to cut and sell the diamonds. In that case, the contract would stipulate that the buyer inspect (with effort $\pi \in \{\pi_g, \pi_b\}$), and take delivery. He would be required to pay after a reasonable period, say 60 days. Given that the buyer inspects the goods, the contract assigns all liability regarding the quality of the good with the buyer.

Here we can suppose that β is the value of good, and c is the cost of cutting the diamond. For simplicity, we can suppose that if the buyer makes an error in judgment, then he may later learn that the diamond has no value and should be sold for some other use. Under these assumptions the diamond is sold to the buyer with no warranty at price p, and the buyer has sixty days to pay.

In the absence of a warranty, the payoff for the buyer is:

$$U - buyer(\pi) = \pi(\beta - c - 1) - p.$$

In this case contract *breach* would simply be non-payment of p. Under the standard expectation damages rule for contract, damages would be p. Since $(\beta - c - 1) > 0$ then it immediately follows that it is optimal for the buyer to choose high effort (π_g). Thus, when the buyer is in the best position to evaluate the quality of the good, it is optimal to have a fixed price contract under which the buyer accepts all liability for defects. In this case the role of the law (or diamond merchant association) is to ensure that payment by the buyer occurs.

Moral Hazard

Next, we consider a very stylized version of Bernstein (2001)'s cotton industry. Suppose that the seller is a cotton farmer whose unobserved effort, π, determines whether the cotton has high quality, with benefit β, or low quality with no value. Suppose the farmer agrees to sell a certain quality of cotton to a firm in the future at a price p, and that the cost of delivery is c. If the contract simply states that the farmer delivers cotton, then her benefit is given by:

$$U - seller = p - c - \pi.$$

Under this contract the seller would choose π_b.

Bernstein (2001) observes that one of the roles of a trade association is to help provide quality standards. If upon receiving the cotton, the firm finds that the cotton does not meet industry standards for quality, then under the expectations damage rule, the court would order the seller to pay β to the buyer in the event of breach. In that case the payoff would be:

$$U - seller = p - c - \pi - \beta(1 - \pi),$$

and the seller will always choose the high effort π_g.

This solution is *not* efficient because it always entails delivery. The optimal solution would have no trade if the good is substandard. Rogerson (1984) shows that if one allows for renegotiation before trade occurs, then we get efficient trade *ex post.* This may or may not give rise to efficient effort incentives. When the bad state occurs, the gain from renegotiation is to save upon the production costs c. The seller is obliged in this case to pay to the buyer β under expectation damages, and thus with renegotiation, the payoff is:

$$\begin{aligned} U - seller &= p - c - \pi - (\beta + c/2)(1 - \pi), \\ &= p - \beta + c/2 + \pi(\beta - 3c/2 - 1). \end{aligned}$$

If $(\beta - 3c/2 - 1) > 0$ then the seller chooses high effort and first best is achieved.

Relationship Specific Investments

Consider now the case of *relationship specific investments,* or what legal scholars have called the *reliance interest* (Fuller and Perdue (1936)).[22] These are post contract investments that increase the gains from trade but have no value outside the relationship. For example, suppose Agent A is the seller, and the investment is into cost reduction that allows her to offer a specialized good to the buyer at a lower price. In this case the effort π is the probability that production costs are low. Let $c_b > c_g > 0$ be high and low production costs respectively. Let V be the value of the

22 In economics, Mincer (1962) discusses the implications of investments that are job specific and have no value on the market. Klein et al. (1978) discuss the implications of relationship specific investments for vertical integration.

good to the buyer, and zero to anybody else. First suppose that it is efficient to trade *ex post* if and only if costs are low since $c_b > V > c_g$. We can map this case into our base example by setting $\beta = c_b - c_g$ and $c = c_b - V$. Suppose that the seller pays the costs and the buyer gets V. Thus when there is trade the net value is $\beta - c$ when β is realized, and $-c$ otherwise.

If trade is always efficient, then under a fixed price contract, the seller would like to minimize costs, which in turn leads to efficient investment. This may no longer be the case when trade is not always efficient because renegotiation may lead to a sharing of the rents from investment with the buyer (see Hart and Moore (1988) for a general analysis of this case). Nöldeke and Schmidt (1998) and Edlin and Hermalin (2000) show that efficiency can be achieved with an *option contract.*

The structure of the contract is as follows. The buyer B offers the seller A the *option* to sell at price p, with no penalty if the seller decides not to sell. Suppose the price is set to satisfy:

$$c_b > V > p > c_b + 1,$$

then the buyer will always be happy to buy at price p. On the seller's side, she will supply the good if and only if she has low costs, and thus her payoff is given by:

$$U - seller = \pi (p - c_b - 1).$$

Since the term in brackets is positive, then she will set $\pi = \pi_g$, and we get efficient investment combined with efficient trade.

In each of these cases, the final efficient allocation is identical. However, the contract price used to implement the efficient allocation varies a great deal. In the first case, enforcement was purely financial - it was up to the buyer to inspect the good and determine quality. In the second case with moral hazard, the seller's effort determined the quality of the good - there is a fixed price combined contract renegotiation which played a crucial role in achieving the efficient outcome. Finally, we considered a case where the seller's effort determines the cost of production. In that case, efficiency is achieved with a fixed price contract that gives the seller the option to sell.

The point here is that one does not need a complex environment to generate a great deal of heterogeneity in contract form - it follows naturally from variations in information structure. Of particular importance

is the allocation of decision rights. In the first case, the buyer has the right not to purchase after inspection of the goods. In the second case, parties jointly renegotiate as a function of the observed quality of the good. In the final case, the seller has the right to sell or not. Thus, a distinguishing feature of contract price relative to a trade price is the allocation of decision rights.

Chakravarty and MacLeod (2009) show that a key feature that forms construction contracts produced by the American Institute of Architects that are used for the management of large and complex construction projects is the careful allocation of decision rights, all of which is done within the shadow of the law. In the case of employment contracts, one of the most contentious areas of public policy are the conditions under which an employee can be dismissed.

Under the legal rule of at will employment, both parties have the right to leave when they wish. This is effectively the rule that the OECD (1994) is advocating. Yet, there exists no legal jurisdiction in the world (including the United States) where the rule of at will employment is the standard. One of the goals is to understand why this is the case, and how we can improve the operation of the labor market. One tool that is used to study the employment relationship is the theory of relational contracts.

Relational Contracts

Even if employment occurs in a spot market, most employment relationships last more than a few periods. For example, day laborers in Los Angeles can be found at the same location each day, where prospective employers can meet employ them on a day to day basis. In such a market both sides learn about the other, so that employment conditions and the trade price can vary with the characteristics of the match, and whether or not there is an expectation of employment again in the future.

By a relational contract one means a model that takes into account the fact that parties will meet again in the future, and take into account the expectation of future trade when setting compensation and choosing the quality of their work. In particular, in situations where an efficient spot transaction is not possible due to say incomplete information, the expectation of future trade may enhance performance. Greenspan (1998)

explicitly made this point when he advised against future regulation of the over the counter market for securities:

"Professional counter-parties to privately negotiated contracts also have demonstrated their ability to protect themselves from losses from fraud and counter-party insolvencies.....A far more powerful incentive, however, is the fear of loss of the dealer's good reputation, without which it cannot compete effectively, regardless of its financial strength or financial engineering capabilities."

The importance of reputations has been illustrated in a number of contexts. Greif (1989) shows that social groups in medieval times play a crucial role in contract enforcement, while Greif et al. (1994)'s work on the law merchant provides historical examples of exchange that is enforced in the absence of formal law. More recent work includes McMillan and Woodruff (1999) who point out the important of informal contracts in Vietnam, while Johnson et al. (2002) highlight the complementarities between informal enforcement and courts.

The theory of relational contracts builds upon the research that applies the prisoner's dilemma game to social interactions. Beginning with the work of Axelrod (1981, 1984), there is a literature that suppose life can be viewed as a repeated game between two individuals who much choose each period between trusting each other or cheating/opportunism. The basic idea is that trust is sustainable if parties are in a social environment where others can observe their behavior. This simple idea has been very fruitful and widely applied to a variety of questions, such as Kranton (1996)'s work on sustaining reciprocal trade relationships, and more recently Dixit (2003)'s work on explaining the rise of private governance relationships.

The literature on relational contracts begins with Telser (1980) who adds contract prices to a version of the prisoner's dilemma game. MacLeod and Malcomson (1989) incorporates the work of Abreu (1988) into this model to provide a complete characterization of the set of feasible relational contracts. The key ingredient of the model is the assumption that every period there is a future surplus V^* that is larger than what they would get if they did not trade. In the event of a breakdown in the relationship, it is assumed that the firm gets U_F^0 and the worker gets U_W^0. The threat of breakdown of the relationship is a substitute to seeking relief in court. MacLeod and Malcomson (1989) show that if this

surplus is sufficiently large, then there are a wide variety of contracts that can divide the gain from trade in an arbitrary way.

More precisely, a relational contract is an agreement between the worker and the firm in which there is legally enforceable payment w to the worker. The worker agrees to select effort π_g. In exchange, the firm agrees to pay a bonus b if the worker chooses π_g. If the worker does not choose the high effort, then the firm will view the worker in breach of their agreement and will terminate the relationship.

Similarly, if the firm does not pay the bonus, then the worker will view the firm in breach of contract, and terminate the relationship. What makes the contract relational is that rather than ask the court for relief, the parties threaten to leave the relationship - this may be their only option if effort is not observable outside the relationship. If termination occurs, then the surplus, $S*$, from future trade is destroyed:

$$S^* = V^* - \left(U_F^0 + U_W^0\right) > 0.$$

If neither party breaches the agreement, then they continue to trade. As part of their agreement, the worker gets a share $\alpha \in [0,1]$ of the surplus. In practice the allocation of the future share can be achieved via a set of trade prices. However, we adopt this formulation in order to focus upon the important role that the allocation of future rents plays in relational contract theory.

Consider first the firm. If no party breaches the agreement, the firm has payoff:

$$U_F^* = \pi_g\beta - w - b + (1-\alpha)\,V^* = CurrentProfit + FutureProfit \tag{1.2}$$

After the worker has chosen effort, the firm might be tempted to cheat upon the agreement and not pay the bonus. Thus a necessary condition for this contract to be self-enforcing is:

$$U_F^* \geq \pi_g\beta - p + U_F^0 = DefectProfit + OutsideOptionProfit. \tag{1.3}$$

Notice that this implies that following incentive constraint for the firm:

$$FurturePrfit - OutsideOptionProfit \geq Bonus \tag{1.4}$$

A similar situation for the worker holds:

$$U_W^* = w + b - \pi_g + \alpha V^*.$$

If the worker shirks, then the firm will not pay the bonus and fires the worker. Thus, for the relational contract to be self-enforcing we have:

$$U_W^* = p + b - \pi_g + \alpha V^* \geq p - \pi_b + U_W^0.$$

This implies the following incentive constraint:

$$FutureUtility - OutsideOptionWorker \geq IncentiveToCheat - Bonus. \tag{1.5}$$

These expressions illustrate that there is a connection between the division of the rents and contract form. If the firm has a greater share of the surplus, then it can credibly commit to a larger bonus, which in turn reduces the rent that it must leave to the worker to provide incentives.

Consider the two polar cases. Suppose that the market for the firm is perfectly competitive - by this we mean that the future rent for the firm is equal to its outside option. Thus equation (1.4) implies that $0 \geq bonus$, or there is no bonus pay. This implies that in equation (1.5) we have:

$$FutureUtility - OutsideOptionWorker \geq IncentiveToCheat > 0.$$

In other words, the worker must receive a rent or she will shirk. This case corresponds to the well known efficiency wage model of Shapiro and Stiglitz (1984) where workers are paid a high wage, and then fired if they are caught shirking. The rent needed to enforce the contract is generated by equilibrium unemployment. Klein and Leffler (1981) have a similar model, though in their case they argue that firms with good reputation dissipate rents with wasteful advertising.

A robust prediction of the theory is that efficiency of the relationship is related to the size of the rent and does *not* depend upon contract form. If we add constraints 1.4 and 1.5 we get that the future value of a relationship must be greater than the sum of the outside options by at least the size of the temptation to cheat:

$$GainsFromTrade - OutsideOptions \geq IncentiveToCheat\,(\pi_g - \pi_b)\,.$$

MacLeod and Malcomson (1989) show that this condition is not only necessary, but sufficient for the existence of self-enforcing relational contracts. That is, if it is satisfied, then there exist relational contracts that

implement the efficient allocation. The form of the contract (the size of the bonus) is a function of how the surplus from the relationship is divided between the two parties.

These observations illustrate that the move from economic price to relational contract provides an economic model of many phenomena that appear to be "non-economic". For example, Akerlof (1980) introduces a theory of social norms to explain why wages are downward rigid. It turns out that when relational contracts are modeled as a repeated game then the existence of a social norm with these features is a *necessary* condition for the existence of a relational contract. This provides a way to integrate the theory of norms with efficiency wage theory.

A second, if not more important issue, is to understand the limits of the theory and when things can go wrong. Above we have a quotation from Greenspan (1998) claiming that reputation effects (and hence relational contracts) are sufficient to ensure good behavior in financial markets. Ten years later, after the 2008 financial crises, Greenspan (2008) states:

"As I wrote last March: those of us who have looked to the self-interest of lending institutions to protect shareholder's equity (myself especially) are in a state of shocked disbelief. Such counter-party surveillance is a central pillar of our financial markets' state of balance."

1.3 The Agenda

The agenda of this book is to review research that extends price theory to provide ways to model and explore questions such as the extent to which contracts and reputations can ensure efficient exchange. Like the law itself, the theory I outline in this book is complex and builds upon a number of interlocking elements. The book is divided into four parts.

Part I includes this chapter, and a chapter on the relationship between theory and evidence. The concern here is not one of econometric practice - but rather the role that theory plays in the evaluation of socio-economic evidence. Economic systems, like biological systems, are very complex and non-linear. It is unlikely that economics will every achieve the precision that physics has achieved regarding fundamental processes in nature. The question then is how does one evaluate the empirical validity of a theory, and how are such theories applied to practical questions?

In Chapter 2 I highlight two distinct goals for economic theory. The first is to provide a way to measure and synthesis evidence. With the advent of the internet and cloud computing we now have access to very large amounts of data. This has resulted in the new field of "data science" in which practitioners use learning algorithms to model and estimate structures in data that are hoped to have some temporal stability (aka make predictions). Like the brain, these models have thousands of parameters that are estimated, and, like human decision making, one can systematically evaluate the quality of these data mining exercises where there are well defined performance measures, such has machine translation, voice recognition or games such as chess or go.

In contrast to a machine learning algorithm, the purpose of an economic model, is to build what Savage (1954) calls a "small model" of the world. Such a model is a tool to organize evidence and systematically evaluate the consequences of different choices. The unprovable assumption is that the use of a imperfect model makes imperfect decision making more perfect! As Robert Solow (1956) comments at the beginning of his classic paper on economic growth:

> All theory depends on assumptions which are not quite true. That is what makes it theory. The art of successful theorizing is to make the inevitable simplifying assumptions in such a way that the final results are not very sensitive. A "crucial" assumption is one on which the conclusions do depend sensitively, and it is important that crucial assumptions be reasonably realistic. When the results of a theory seem to flow specifically from a special crucial assumption, then if the assumption is dubious, the results are suspect.

Since Solow wrote those words we now have a much better understanding of how to do credible empirical work. We do not yet have a firm understanding of the empirical relevance of many, if not most, of the work I discuss in this book. The purpose of Chapter 2 is provide a brief introduction to the potential outcomes framework of Rubin and Holland (Holland (1986)) that forms the foundation for much of modern empirical research in economics. As readers go through the book it is a useful exercise to think about how to use the potential outcomes framework to derive testable implications from the theory.

Part II, Beliefs and Decision Theory, provides a brief review of decision theory as it is used in contract and institution design. This is material that is traditionally part of a first year graduate training in economics. The perspective used in Part II builds upon the influential work of Savage (1954). Savage emphasized the point that it is impossible to build a truly

objective model of the world. Rather, all that is possible is to be objective relative to some imperfect world view, a viewpoint that I shall show is consistent with the way contract law works.[23]

A core ingredient for the Savage model are the subjective beliefs that individuals have regarding the future. Savage realized that in many, if not most real world decision making problem it is impossible to have an accurate assessment of future events, yet one mush never the less make a decision. This is particularly evident in law where in order to finish a case, the judge or jury must make a decision. They do not have the luxury of waiting a century or so as the science is worked out. Savage's approach is perfect for such situations because he allows/requires individuals to build a model of the future and then decide using that model. When the science is uncertain one builds the best mode one can.

The advance of data science makes Savage's approach more rather than less useful. In environments where there is enough data with some temporal stability and clear, measurable performance criteria then we can simply let a machine decide. There remains many, important decisions where there needs to be a discussion of the possible future events, and how today's actions will affect them.

In social situations one of the essential ingredients is a model of how others will behave. Chapter 5 provides a brief review of game theory. The goal of this theory is to extended decision theory to model belief formation, and then make predictions regarding how individuals will select actions.[24] An important area of application to contract theory is bargaining. Chapter 5 reviews symmetric information bargaining theory.

Part III introduces Agency Theory - that class of models that build upon three ingredients. The first is that is a temporal separation between action and payments. Second, parties are assumed to understand the relationship between their actions and outcomes, and to correctly anticipate how their counter party will respond to contract terms and conditions. Finally, parties are assumed to have imperfect information, but use events during trade to appropriately update beliefs. The goal is to explore in more details the contracting examples discussed above using the tools of decision theory and game theory.

23 See Currie and MacLeod (2014) for an application of Savage's model to tort law.

24 See Kreps and Wilson (1982) for of model that integrates Savage's model of decision making into game theory.

The goal of Part IV is to put these models to work with some applications. Chapter 10 (written with Lewis Kornhauser) reviews the basics of contract law, and the role of economics in understanding the form of the law. Chapter 11 explores the theory of relational contracts that provide an (imperfect) substitute for law. In particular, it discusses how one can tease empirical implications from the theory. The final chapter discusses employment law, and address the question of why there is so much intervention into these markets.

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