

# ON THE EIGHT BASIC UNITS OF A DYNAMIC ECONOMY CONTROLLED BY FINANCIAL INSTITUTIONS\*

BY MARTIN SHUBIK  
*Cowles Foundation, Yale University*

The elegant general equilibrium world of Arrow and Debreu has had a considerable mathematical development in the last decade. Underlying this work is an extremely parsimonious model of the economic system. In particular, only one economic actor is distinguished, the consumer who maximizes his welfare (the firm which maximizes profit is an automaton). One class of economic entities is considered. These are goods and services. There is no important operational distinction made between a good, which is durable, and a service, which is not.

It is suggested here that a more fruitful basic economic model needed to achieve a unification of micro and macroeconomic theory needs both more actors and more basic economic units. Specifically, the structure of process in a political-economy is such that even at the level of relatively abstract theory operational differences among consumers, entrepreneurs, administrators, financiers, and politicians should be discernible. Furthermore, several basic economic entities (or "basic particles") must play important discernible roles in an adequate theory. In particular, in the "real sector" physical assets should play a major role, i.e., the distinction between durable goods and consumables or services should be important. The paper sector must also be present with the roles of fiat money, ownership claims and contracts all distinguished. It is argued here that any economy can be characterized in terms of two real and six paper basic units: goods, services and six financial instruments. All other financial instruments can be obtained as mixtures of this basic set.

## 1. THE ACTORS AND UNITS OF TRADE IN A GENERAL EQUILIBRIUM WORLD

In the general equilibrium system several ingenious modelling simplifications were made in order to define a mathematically tractable model which casts some light on production and distribution in a timeless equilibrium.

The actors in the mathematical model are *consumers* and *firms*. At the most abstract level consumers own a vector of resources and any consumer may buy or sell any number of resources. The firms have no institutional content. They are devices which maximize profits and instantaneously flow them through to the consumers who may be deemed to be holding nonvoting common stock in these institutionless mechanisms called firms.

There is no need to distinguish between goods and services because no operational use is made of this distinction.

There is no need for any dynamic mechanism of prediction because by the trick of time dating all future commodities as different commodities which are traded now, all distinctions between spot and future markets are wiped out. By then solving the one period or normalized form of the multiperiod market simultaneously there is no need to consider any evolutionary process or disequilibrium state.

Similarly by expanding the commodity space to include commodities which have not only a time dating but also an existence attached to a contingent event,

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we can formally handle exogeneous statistical uncertainty and still solve the whole system as a one-shot market.

This whole *tour-de-force* is by no means trivial. The proof of the existence of a price system under these conditions is a substantial achievement. But possibly the price paid for the result was too high to be of use when we ask of this model how can it guide us in a world where individuals try to base their actions of today upon predictions of tomorrow. In a world where perfect trust does not exist, where most future markets do not exist and where money and many financial institutions do exist, the general equilibrium model does not come to our aid because it is static. It cannot handle the dynamics or the array of actors, goods, financial paper and institutions needed even to start to reflect the economic process.

General Equilibrium theory gets along with:

one actor	the consumer-trader-owner;
one shadow actor	a mechanism without institutional substance called the firm;
one financial paper	nonvoting stock with no other financial properties beyond the receipt of dividends;
one commodity type	this is a catch-all for goods, services, future and contingent goods and services;
no expectations	because it is static; or if one wishes to try for a dynamic interpretation then all actors have self fulfilling prophecies of the future;
one market	because all of the future including contingencies is collapsed into one period: another interpretation is perfect future markets for everything;
perfect trust	because the only constraint on the system is the budget constraint at the end: cash flow considerations are irrelevant because credit up to the final known budget constraint is always available;
no fiat money	it plays no role;
no financial institutions	they play no role.

## 2. THE DIFFERENT ACTORS NEEDED FOR AN ADEQUATE THEORY OF ECONOMIC PROCESS

It is my belief that as is done in macroeconomic theory the distinction between a consumer and investor is worth making. In particular in a process world where information and evaluation are critical and bureaucracies abound the differentiating characteristics of the following actors need to be developed:

- (1) The Consumer: passive buyer, voter, saver who sells little beyond his services.
- (2) The Businessman: the active investors of private resources.
- (3) The Administrators: the bureaucrats and technicians who are the major carriers of routines and processes.

- (4) The Financiers: the group whose function and tools include information processing, evaluation, brokerage and the control of money and financial papers.
- (5) The Politicians: who are brokers of power and fiduciaries of the public sector coordinating among other factors, public administration finance and business.

A detailed discussion of these suggested categories has been given elsewhere[5]. In this paper my intention is merely to call attention to the possibility that to go from general equilibrium to a useful economic dynamics requires not only that attention be paid to information processing and frictions in the system but these require that we differentiate economic and other actors.

In particular it is my belief that economic dynamics is *financial dynamics*. The financial system is the neural network and dynamic guidance system of the real economy.

### 3. THE EIGHT BASIC UNITS

In a dynamic economy with many frictions and transactions costs, imperfect information, errors, limited trust and aggregated measures, at best there will be some limits to the extension of credit. The magic of the static general equilibrium model is not there. People need bankers, insurance agents, investment bankers and other evaluators of individual, corporate or governmental economic plans.

It does not appear to be particularly easy to guess the price system that will exist until the end of an individual's life to work out his total expected future income and to let him allocate his resources constrained only by this budget constraint.

Instead of guidance by the budget constraint the way the world appears to run is by a predominant use of spot markets with trade in money, financial paper and other contracts which permit a limited extension into the future.

The eight basic units which provide a rich enough basis for the development of an adequate microeconomic disequilibrium model of financial control are:

- (1) Services;
- (2) Goods;
- (3) Money;
- (4) Ownership claims;
- (5) Service contracts;
- (6) Futures;
- (7) Promissory notes;
- (8) Calls.

An adequate model of financial control of an economy requires not only a specification of the roles of these basic units, but also a specification of the rules, mechanisms or institutions which control the demand and supply of these items and a description of the motivation of the actors who control the institutions and manipulate the rules. The nature of the actors has been sketched in Section 2. The

institutions are noted in Section 5. Some further comments on the basic units are called for.

(1) *Services*: A service may be regarded as an input which cannot be inventoried, and hence cannot be used as a security against a loan.

(2) *Goods*: For many economic purposes it may be useful to break down the category of goods into consumer, intermediate and capital goods. However, as a first cut, given the time unit under consideration possibly from the point of view of finance the key distinction between a service and a good is that the latter (in varying degrees) provides an asset or a store of value which can be used as a security against which ownership paper or loans may be issued.

(3) *Money*: Money is *the* liquid asset. One might wish to distinguish among commodity money, specie and bank money. In international trade, gold may still play an important role. However, leaving aside commodity money, the distinction among say fiat, deposits and time accounts for most questions is probably less the slight differences in liquidity than the distinction among the mechanisms or institutions generating supply.

(4) *Ownership Claims*: In a world with no uncertainty, perfect divisibility, liquidity and zero transactions costs the sale of ownership claims rather than the sale of an asset might not provide any particular economic advantage. In the world as it is, the existence of various states of indivisibility, uncertainty and ownership transfer costs make the use of ownership claims efficient and important. The main forms of this paper are claims to land, common stock, and titles to buildings and machinery.

(5) *Service Contracts*: Salary and wage contracts are probably the most important form of service contracts, although car rental, apartment rental, building cleaning, payroll processing and so forth provide many other examples. In the case of salaries and wages the only asset backing the service supply is the individual or human capital, and since indentured servitude and slavery are no longer in the rules of the game, that capital asset is of little worth as a backing for a financial instrument.<sup>1</sup> In contrast the fleet of cars, the hotels or the computers of various service firms are excellent items with which to obtain financing.

(6) *Futures*: A futures contract is a financial instrument which guarantees the delivery of a good at some future period. It is possible that the good cannot be delivered at its due date. Hence futures contracts (and for that matter service contracts) must be considered as not fully defined unless a complete specification is given of what happens if the economy evolves to a state where the contract cannot be honored. This involves specifying rules to cover recontracting, bankruptcy, market corners, insolvency and so forth.

(7) *Promissory Notes*: This category encompasses a large array of instruments which involve promises to pay money in the future in return for a money payment now. Thus a government bond involves present money paid by a purchaser in return for a future promise by the government to pay. Care must be taken in defining conditions on these instruments especially when loans are rolled over or perpetuities are issued.

<sup>1</sup>This is not strictly true when information on an individual's integrity exists. A sophisticated lender may feel that an individual with a reputation of integrity is a better risk than one with no reputation but with physical assets.

(8) *Calls*: Calls are financial instruments involving the exchange of money for an option to purchase an ownership certificate at or before some date in the future. Puts, warrants and options are related instruments.

All of the intertemporal financial instruments noted may involve some degree of risk. Thus for example an insurance policy may involve the payment of money now in return for money in the future under a set of contingencies. In a world without uncertainty a call would be a superfluous instrument. Most promissory notes and service contracts are written in a way that presupposes a low risk of contract nonfulfillment. Any change in risk short of disaster is borne by the seller of the contract.

Undoubtedly variations in the conditions of uncertainty, limitations on the length of time over which financial instruments can be issued, changes in physical transactions costs, indivisibility, data transmission and processing all provide the reasons for the production of a continuous blend of financial instruments and the continuous creation and change in financial institutions. However it appears that they can all be built up from the eight basic units. Furthermore one need only consider two time periods "NOW" and "NOW + 1." A transition matrix of the units is given in Table 1.

TABLE 1

NOW	NOW + 1									
	S	G	M	O.C.	S.C.	F	P.N.	C	Nothing	
Services										X
Goods		X								X
Money			X							X*
Ownership Certificates			X	X						X
Service Contracts	X		X							X
Futures Contracts		X	X							X
Promissory Notes		X	X							X
Calls			X	X						X

\*The creation and destruction of money (and for that matter all paper involving future claims) is clearly far more complex than this simple transition matrix indicates, specifically in the sense that they all appear on at least two balance sheets and hence even at the simplest level involve systems properties.

Table 1 merely shows the main transformation of types and does not specify the actual transformation probabilities that exist in a world of uncertainty. Thus for example a new automobile is a good which transforms into a one year old car of varying quality depending upon the chances of use. It could even be destroyed.

Money may be withdrawn by an issuing agency. A firm can go bankrupt and hence ownership claims can be wiped out, or the owner may obtain some amount of money in the liquidation. The writer of a futures contract or a service contract may fail to meet his obligations in which case the holder is totally or partially wiped out. In the latter case he usually will obtain a money payment and/or a

partial fulfillment of contract such as “all the copper you have, plus a monetary settlement for the remaining futures undelivered.”

When a promissory note is honored a monetary payment will be made. If it is not honored there is a possibility that it becomes valueless. If it is secured by goods the goods may either be appropriated or sold. Not indicated in Table 1 is the possibility that a debtor’s wages may be garnished in which case a claim on the proceeds from the sale of services is established.

### 3.1. *Where Do Taxes and Subsidies Fit?*

In the history of taxation and subsidies these items have been due to or from governmental bodies in the forms of claims on services, goods or money or combinations thereof. Tithes, tariffs, octrois, social security benefits, income taxes, sales taxes, death taxes, levies against wealth and so forth are all claims against goods, services or money and hence can be considered as mixtures of the instruments already noted.

The agencies for the issue and destruction of these claims in the United States include on the order of 70,000 Federal, state and local government bodies with taxing power. The mechanics of the creation and destruction of claims on taxes poses many accounting problems in economies where the nature of some of the claims is contingent upon certain events taking place such as death or the sale of assets.

In the modern world almost all taxes are due in money (or other paper such as certain bonds). The choice of working on the roads, fortifications or in the fields of the lord is no longer available.

### 3.2. *On the Unit of Time.*

How does the usefulness of this classification scheme depend upon the unit of time selected? It is my belief that due to the cyclical aspects of the world, to custom, law and human decisionmaking processes, the year is the natural unit. However from the viewpoint of the development of a theory of finance the classification scheme is not influenced in any conceptually important manner by the choice of time unit.

The major change in extending the size of the unit of time is to lump several of the more short-lived goods together with services. Thus for example if the unit of time were two months as contrasted with two minutes, ripe tomatoes would be classed together with services as items which cannot be stored to the next period. If the period were two minutes then the tomatoes can be stored.

The essential question here however is what the financial implications of the existence of goods with different lives and other properties are. The prime consideration is how suitable they are to be posted as security against the issue of various financial instruments. Ripe tomatoes are not particularly good security.

It is often important to “perform a sensitivity analysis” or to ask if a change in the time unit will have a radical and unnatural effect on the model postulated. If the continuous version of an economic model exhibits properties radically different from the finite time increment model one may suspect that something is

unsatisfactory in the formulation of the problem. Here this does not appear to be the case.

### 3.3. *On Time, Pyramids and Complex Financial Instruments*

By permitting the rollover of short term loans and the issue of long term loans including perpetuities, by permitting the renegotiation of contracts, the delicate tuning of the control structure imposed by the past and present on the future can be achieved. This leads to a considerably different transition matrix than the one shown in Table 1.

Once one starts to consider a multiperiod financial structure which includes the exchange of one form of financial paper or futures contract for another form, it becomes necessary to correctly interpret the paradoxes of infinity such as understanding the implications of servicing but never repaying debts. Furthermore at this point the possibilities for many-tiered financing appear. It becomes possible to create chains of paper backed by paper. These reflect new possibilities for distributing risk of different quality;<sup>2</sup> as well as institutional peculiarities based upon social and historical phenomena.

## 4. THE RELATIVE IMPORTANCE AND TIME STRUCTURE OF THE BASIC UNITS

In this section some comments are given together with a few figures which are at best extremely crude and are meant only to be qualitatively suggestive for the U.S. economy rather than quantitatively meaningful.

Unless otherwise stated the figures quoted are for the year 1970 and are mostly gleaned from the 1971 *Statistical Abstract of the United States*.

Goods and services are what an economic system is about. Steak is still better eating than financial instruments. However even though the goals of an economy are primarily measured in terms of real goods and services, the control mechanism is measured or at least partially described in terms of financial instruments.

(1) *Services*: As an extremely crude approximation we may regard all wages as payments for services. Beyond that we have net income value added from the service sectors. These are shown below, based on [9].

<i>Wages</i>	\$540.1 billion
<i>Net income of service sectors</i>	
Transportation	30.3
Communication	16.3
Finance, Insurance, Real Estate	88.5
Services	104.4
Wholesale, Retail	121.8
	-----
	351.3
	-----
	891.4

<sup>2</sup>I purposely use the somewhat vague word "quality" to emphasize the evaluative aspect to the treatment of financial risk. Probabilities are being assessed but dimensions are also being sought out. "We understand the deal, but what factors have we left out"—hence consultants, evaluators, appraisers, insurance and reinsurance.

This does not count housewives' services but this sector is neither monetized nor accounted for. Nor does it adequately cover rentals.

The stock behind services is human capital plus around half of corporate assets plus housing.

(2) *Goods*: In 1968 assets were evaluated as below, based on [10]:

<i>Structures</i>		
Public nonresidential	\$459.8 billion	
Institutional	55.7	
Other nonresidential	288.7	
Residential	682.7	
Farm	<u>50.0</u>	
		1,536.9
<i>Producer durables</i>		377.0
<i>Consumer durables</i>		233.8
<i>Inventories</i>		
Farm	29.5	
Nonfarm	172.7	
Public	<u>14.0</u>	
		216.2
<i>Land</i>		
Farm	152.6	
Nonfarm	418.6	
Public	<u>144.2</u>	
		<u>715.4</u>
Total		3,079.3 billion

The major part of these assets have ownership paper written against them and serve as an important part of the backing for a credit system.

Unlike financial paper which can be transferred or created and destroyed in a relatively brief time, the real assets give a structure to any economy that can only be modified over time. This is crudely indicated by legal writeoff times:

Land	$\infty$
Buildings	40–60 years
Farm Buildings	25 years
Heavy Machinery	12 years
Office Machinery	10 years

The estimated lives for consumer durables and automobiles vary from around 5 to 11 years.

Obviously in the case of figures on stocks one has to be extremely careful in attaching significance to them, as the fallacy of composition limits their applicability. For example if all, or even a substantial fraction of owners of land tried to sell simultaneously the total worth of land would be far different from the numbers displayed.

Assuming random mass market trading of a sufficiently high level then the stock figures do provide an operationally useful figure to compare with the



amount of financial instruments needed for trade when major correlated disturbances are not present.

We need not only production flows and stocks when we consider financing. We also need a measure of trade among existing stock (i.e. ownership changes in the secondhand markets).

Judging from mortgages the turnover in private real estate is about 10–15 percent of the stock. Trade in automobiles is about 50 percent of the stock, of which somewhat more than half is for new products. Trade in corporate plant appears to be considerably smaller as most exchanges are of financial instruments such as stock. Mere replacement of machinery and plant calls for a trade of the order of magnitude of 10 percent.

When we consider consumer goods, to every final sale there are between 4–6 times the volume of derivative sales. In a nonstrategic world in or near equilibrium this would be of little interest. However in a world where ownership change must be primarily achieved by the use of financial instruments, each stage involves different actors in the control of the process.

Goods and paper are used to back paper. Left out of Table 2 was human capital or the worth of all individuals considered as productive plant. By picking a production function such as the Cobb-Douglas or C.E.S. and by fudging the data one might arrive at a number between \$30,000 to \$60,000 per capita. However the amounts of unsecured loans appear to indicate that human capital is not as directly important as the stock of A.T. and T. or IBM or your house for securing a loan.

Several problems in depreciation and evaluation would have to be solved to get a reasonably accurate estimate of the mortality tables for all goods. Hence instead the legal depreciation lives were used in the estimates above.

Some idea of the faith we can put in legal depreciation rates as a reflection of actual is given by the 1960 housing stock which was approximately 7 million 5 years old or less; 7 million 5–10 years old; 8 million 10–20; 6 million 20–30; and 25 million 30 or older. One then has to adjust these figures for maintenance and repairs.

(3) *Money*: Money is, to the individual in a society with prices, instantaneous liquidity, or a reasonable approximation thereof. In a loosely coupled mass dynamic system with weakly correlated behavior, at any instant of time, money is to the two traders in an exchange approximately a transferable utility in the sense that in a mass market the sale by *A* to *B* of 100 shares of A.T. and T., a used car, or 1,000 bushels of wheat should have virtually no effect on reigning prices. The dynamics of adjustment in a mass monetary economy runs on a fallacy of composition which at or near equilibrium is not present or sufficiently weak that it scarcely matters. When, however, behavior is highly correlated such as in panics, or in reactions to major events which bring a mass change in expectations, then the differences between individual behavior and mass behavior are manifested in the dynamics of mass disequilibrium.

Custom and law determine the instruments of individual liquidity. Thus in a society where gold is a legal means of payment it should be counted in the money supply.

Behind custom and law are the enforcement mechanisms; hence what may be liquid for an individual economic unit may or may not be for a country. Thus international and internal means of payment are not necessarily the same. For example, to the Chilean government, gold is a money vis-a-vis the world, but the Escudo may not be.

In the United States in 1970 the monies, near monies and gold were:

Specie and Currency	\$57.1 billion
Demand Deposits	165.7
Time Deposits	230.4
Gold	10.6

(4) *Ownership Claims*: In a world that is only partially monetized, where conceptual problems concerning the meaning of complex forms of ownership, depreciation, marketability and hosts of different transactions and information costs exist, where barter transactions take place and many services (such as housewives' services) are rendered without going through a market, it is no surprise that accounting is not an exact science.

In particular not all assets are represented by ownership paper. The more likely it is that an asset can be used to secure a loan, or that the asset cannot be easily transferred physically, but the title can be transferred, the more likely it is that ownership paper will be created. Hence there are deeds, titles and stock certificates.

When one buys a washing machine or an automobile on consumer credit the paperwork concerning ownership documents is considerably more precise than when one buys a washing machine for cash. Many of the lesser consumer durables are less desirable as items for consumer financing and many consumers do not even bother to keep serial numbers or ownership papers for items such as wholly owned television sets.

The stock market is the clearest example of a relatively low transactions cost market designed primarily for the exchange of second hand ownership certificates for money. Investment bankers and brokers also deal with the distribution and exchange of newly created ownership certificates for money.

The other major markets for ownership claims are in real estate. However these markets are far more imperfect. Furthermore the motivations for operating in them are diverse. Leaving aside tax laws which influence motivation considerably, many individuals and firms who buy real estate ownership claims want to actually use the asset represented by the claim. They live in the houses, or operate the manufacturing plant. The separation of ownership and active management is far less than it is in the stock market. The opportunity to be a passive investor trading real estate paper is still less than it is to trade corporate shares. Institutions such as Real Estate Investment Trusts (REITS) have come into being to enlarge the possibilities of passive investment more disassociated from management of real estate than would otherwise be possible. For common stock, the number of ownership claims in 1970 was 21 billion, in the amount of \$814 billion. Shares are sufficiently visible and frequently traded (velocity around 1/5 per annum in New York) that a money measure of value can be obtained at any time even though the "value" may fluctuate 100 percent or more in a year.

(5) *Service Contracts*: Few service contracts are negotiable instruments. In the case of salary and wage contracts this is probably related to considerations of bondage as the capital asset providing the backing on one side is a person. In general however service contracts are explicitly bilateral and specialized hence can scarcely be thought of as fungible, in contrast with stock where although the individual trade is bilateral it is essentially anonymous with a mass market mechanism designed to process fungible items.

Out of the four basic futures contracts that can exist it must be concluded that with the exception of leases there is no mass market for trade in service contracts. These contracts, especially wage contracts, however, do provide considerable interlinkage between the present and future. The hiring of labor may vary from hourly payments to life tenure. Thus even though there is little if any negotiability the lock-in to the future may be considerable, as anyone who has tried to fire a secretary in a government bureaucracy can soon find out.

(6) *Futures*: The economic purpose of a futures market is to be able to hedge against changes in price of basic commodities or inputs which may be needed in an industrial process. Thus for example well developed futures markets exist for wheat, eggs, copper and several other commodities.

In general futures cannot be purchased more than one or two years into the future. Longer futures take the form of nonnegotiable contracts between specific and frequently large institutions such as a 30 year contract for a coal supply by a power company. Such contracts will usually have renegotiation or other flexible clauses in them.

A futures contract is essentially an insurance policy based upon different price predictions. As such the actual sale of a contract involves the sale of one piece of paper (the futures contract) for other paper (money). Only a minuscule amount of the money required to purchase the actual commodity may be put up until delivery date.

An estimate of the size of trade in the United States in futures contracts in the year ending June 30, 1973 is 47 million contracts, with a value of \$399 billion. Five years previously there were 20 million contracts valued at \$81 billion. In recent years it is estimated that around 300,000 outsiders (i.e. others than professional commodity dealers) have traded in this world of the 10 percent margin.

(7) *Promissory Notes*:

“The Creditors are a superstitious Sect,  
great observers of set days and times.”

Ben Franklin

By far the greatest interconnector between the present and the future is the market for loans. It includes much of insurance as well as bonds and other forms of debt (although mutual insurance companies provide equity rather than debt positions).

The major forms of debt which exist in the United States are Federal Government, State and municipal debts and other obligations; consumer credit,

mortgages, commercial borrowing and bonds. The amounts outstanding in 1970 are given below.

U.S. Government Debt	\$301.3 billion
State and Local	148.1
Corporate	362.9
Mortgages	445.9
Consumer Credit	126.8
Other Business	123.6

Total insurance in force and the assets of the insurance companies were approximately \$1,400 billion and 207 billion.

The time structure of all of this paper is key to understanding the constraints of the past and present on the future. For example the V.A. mortgage issues were 5.3 percent under 25 years; 9.8 percent 25 years; 13.4 percent 26–29 years and 71.5 percent for 30 years; but the *de facto* life of a mortgage is between 5–9 years and the turnover rates for real estate around 5–10 years.

(8) *Calls*: In the classification of the basic units of a financially controlled economy perhaps one area where the distinction is not as clear as it might be concerns individually owned assets as contrasted with assets held under joint ownership and limited responsibility. In general in a mass market for corporate stock the exchanges involve a change in paper holdings, not a change in control, although clearly this is not the case when corporate takeovers take place. When an individual buys an option on the purchase of a piece of land it could become a Jesuitical task to decide whether the option should be described as being on the land, or on the ownership papers representing the land.

If we keep in mind that the purpose of defining the various financial and economic units is to be able to provide the basis for constructing a model of the financial control system then as a good first approximation it is reasonable to consider some options on land as goods futures and others as calls. When a corporation buys an option on a land purchase to locate a new plant, essentially a future is being purchased on land; when a land speculator buys an option on land in a suburban area with the intention of selling the land the trade can best be considered as a call.

Calls (and “Puts”) have been in existence for many years but do not yet figure as major financial instruments. It is as recently as April 1973 that an organized exchange, the Chicago Board Options Exchange was opened to trade this type of paper. The CBOE thus offers a secondary market for this paper which previously was hardly negotiable. For the first eight months of its operation 1.1 million contracts were written.

#### 4.1. *On Trust and Finance*

The amount of unsecured loans to individuals in our economy appears to be relatively small. It seems as if the financial structure involving the interchange of paper claims backed by physical goods and the law is designed to optimize the availability of credit for a given level of trust and security. If your bank loan is

covered several times by the market value of your A.T. and T. stock the bank does not need a large dossier on your personal history.

This paper is devoted to sketching the preliminary factors needed prior to mathematical model building, hence it is several steps from "theorem proving." Nevertheless even at this level of informality it can be seen that:

For a given level of trust, all other things being equal an economy with more real goods which can be posted as security will have a financial structure as close or closer to optimum than an economy with fewer real assets.

## 5. THE INSTITUTIONS OR ACTORS WHO CREATE AND DESTROY THE BASIC UNITS

In this section several basic problems in modeling are noted. Few solutions are given beyond suggesting that isolating promising problems is the first step towards obtaining useful solutions.

(1) and (2) *Goods and Services*: Much of microeconomic theory has been devoted to discussing this aspect of the economy. In the United States approximately 1,500,000 corporations, 900,000 partnerships and 9,200,000 proprietorships provide the major sources for the production of goods and services.

Except for the inevitable accounting errors and difficulties in measuring the organizational and informational inputs, on the whole the technocratic-engineering-microeconomic view of goods and services provides a reasonable first approximation, at least in comparison with the microeconomic view (or lack of view) of the financial structure.

(3) *Money*: Among the institutions which participate in the creation of money are the Federal Reserve System, the Treasury and the public in general. A simple picture of causality is not possible. Different groupings may have different potentials for money creation. Active and passive money creation must be distinguished. The system is by no means necessarily linear or reversible. An apt analogy concerning the relationship between active and passive roles in money creation is with an elastic band. If the band has an expansion capacity an outside force can bring about its expansion and maintain it.

The accurate description of the monetary expansion possibilities in an economy cannot be given by merely describing the individual financial units. It has been said that "it takes two to tango," in some instances it may take two or more to create new money<sup>3</sup>. The description of how money can be created or destroyed calls for the specification of the rules of the money game. Morgenstern has made this point elsewhere [2]. The minimum list of institutional actors whose role must be described are:

The Federal Reserve System,  
the Treasury,  
the tax authorities, and  
the banking system.

<sup>3</sup>This extremely important point is discussed further in the Appendix. A *key* distinction must be made between instruments involving only one party and those involving two or more. Concepts such as "neutral banking" depend delicately on this distinction.

(4) *Ownership Claims*: It is frequently forgotten that the stock market is primarily a second-hand market for negotiable paper. The creation and destruction of ownership paper may frequently involve the use of the stock market but the market itself is a brokerage arrangement, not a creator or destroyer of ownership paper *per se*.

The creation of new stock comes through flotations by new or existing firms. In 1970 for example the new issues of common and preferred stock were approximately \$9,213 million. Retirements were estimated at \$2,411 million. The changes represented around 39,000 new issues and 9,000 retirements. These should be compared with a market value of sales on the exchanges of \$131 billion with a turnover of less than 20 percent.

Stock ownership paper is wiped out by failure, merger refinancing or confiscation. It is created by groups who have the power to be believed. To quote from the great example of South Sea Bubble financing:

A company for carrying out an undertaking of great advantage, but nobody to know what it is.<sup>4</sup>

Leaving aside corporations, paper of varying levels of negotiability is constantly being created and destroyed by the changing patterns of real estate holdings and development.

As economies are increasingly monetized and accounting practices and reporting improves we may expect the amount of ownership paper to increase. For example a state or city pawnbroker such as the Dorotheum in Vienna creates tickets which are the owners' ownership claims against property which previously may have even been unrecorded. The ticket is a compound instrument combining an ownership claim with a futures contract.

Among the goods of sufficient importance to merit separate discussion are houses, automobiles and major consumer durables. In economies where decentralized markets are used as the means for the distribution of these items the creation of this paper involves four parties, the producers, consumers, the specialized financial institutions and governmental agencies.

(5) *Service Contracts*: The major parties to the creation of service contracts are individual suppliers of labor, unions, small and large private firms and institutions and governmental bodies. The security aspect of a civil service post or a university tenure does to some extent provide extra borrowing power or creditworthiness, but the labor service contract in general, as has already been noted, is not negotiable paper.

It is my guess that commercial service contracts such as leases, rent rolls, franchises, time sharing and other communications contracts may well be among the most important class for the growth of new negotiable instruments. This is evinced by the sale leaseback activity, the growth of REITS (real estate investment trusts) and the possibility of the computer utility.

(6) *Futures*: The major parties to the creation and destruction of futures are primary producers and industrial users. The trading stories of the few professional

<sup>4</sup>MacKay[1] reports that £500,000 was to be raised by selling 5,000 shares of £100 each. 1,000 subscriptions were sold at £2 each, the £98 to be paid one month later. At this point the promoter disappeared.

brokers and arbitrageurs make good light reading for those who prefer financial detective stories to real detective stories, but that is not really where the action is. A little light comedy is also provided by distinguished mathematical economists or econometricians losing their “grub stakes” or making fortunes.<sup>5</sup>

(7) *Promissory Notes*: The creation of promissory notes, bonds, loans, mortgages, insurance claims and so forth is a major subject by itself. Only one small, but in my opinion extremely important, point is made here concerning loans.

Whenever a loan is created there are at least two identifiable directly active parties (and frequently more). There is almost always an indirectly involved, but important third party—some governmental agency controlling and frequently changing rules. And there are at least two basic types of paper, several subspecies or mixed instruments involved.

When an individual borrows from his bank he usually takes his loan in some mixture of money (or liquidity or “now money”) such as cash and a bank deposit. He exchanges this for a piece of paper he, the borrower creates (albeit with the consent of the bank, and in conformity to various regulations and legal requirements). Depending upon the nature of the securing of the loan other paper such as stock or other ownership claims are pledged. But the fundamental feature is that when a loan is made, regardless of the type of money the lender supplies, it is the borrower who is the prime creator of a new type of paper which is the promissory note (the I.O.U. or a future delivery contract for money). If the lender does not control or limit the promises of the borrower, disaster can result. If you as the lender lend me \$100, I as the borrower, by several strokes of the pen could write out an I.O.U. note promising to pay you \$1,000,000,000 next year in return for your \$100. If there were no usury laws or other limitations the contract might be legally correct but the chances of fulfillment would be slight.

When a lender permits a borrower to promise more than he can probably pay he increases the chances for insolvency. This however is directly related to the supply of promissory notes of varying quality and not the supply of money for loans.

Money and promissory notes are different financial instruments and their direct creators are different institutions and individuals. Because a banking system plays an important risk evaluation role in an enterprise economy it is reasonable to expect that it will apply rules not only to its lending but to what it will permit a borrower to offer. Only with relatively shady banking groups in deals of dubious legality will the offer by the borrower to pay 10 times the prime rate improve his chances of getting a loan.

(8) *Calls*: The individual owner of a claim can become the writer of a put or call. The leverage is large and the number of players in this game is few. Puts and calls are instruments for magnifying the gains or losses to be made from fine differences in perception and hence are magnifiers of a dynamic adjustment (or disequilibrium?) process. In a complex world with capital gains taxes and lots of fine print the real and stated purpose of a calls market may be different.

<sup>5</sup>My (possibly incomplete) statistics on this point indicate the former but not the latter.

## 6. A THEORY OF MONEY AND FINANCIAL INSTITUTIONS

It is my contention that there exists a theoretical basis which can be used to reconcile micro and macroeconomic theory. It involves viewing the processes of financial control of an economy as a mass market noncooperative “money game”[7].

The general equilibrium model of the economy is an extremely limited and not fully defined special case of this particular game. It applies only when the system is in an equilibrium state and the need for and purpose of most financial instruments has disappeared. When one tries to view the general equilibrium theory in a disequilibrium state the difficulties appear. It is not possible to do so without considerable further modeling to describe the adjustment processes.

As a first cut one can try for an arcane noninstitutional array of adjustment processes involving excess supply and demand. This can be tied in with a tatonnement involving “virtual trades” rather than actual trades. However as such a system has so little dynamic structure and totally ignores the intervening financial variables it should come as a surprise to no one if all that is discovered is a set of essentially negative results, i.e. systems behavior which may be globally unstable even if there were a unique state equilibrium[4].

The general equilibrium theory is not congenial to being modified for information conditions. In particular the very concept of the system also does not allow for models where there is an intermixture of mass behavior and oligopolistic or large unit behavior. Yet there is not a country in the world where this is even a good first order approximation. Governmental units, utilities, public services and major investment agencies are by the very nature of things large with respect to trade in vegetables.

It may be that trade in markets with mass suppliers and purchasers can be usefully approximated by a low information content dynamic non-historical process. Trade and major investment by large units involves historical and information rich processes. These processes are highly dependent on detailed institutional and behavioral facts. One must recognize the asset structure of the industry, the level of organization, the quality of management, the age structure of the real assets and the financial paper. They provide the framework for the dynamics.

A little known feature of the formal theory of games is that when one tries to extend the concept of a static noncooperative equilibrium to multiperiod models it becomes necessary to distinguish between equilibria which are obtained from state strategies and those obtained from historical strategies.<sup>6</sup> Attempts to derive an adequate dynamic theory of dynamic noncooperative games lead to the creation of models which melt imperceptibly into behavioral models.<sup>7</sup>

At this point the true believer in general equilibrium might say, “So what, why do we need to bother with a game theoretic formulation if all it is going to do is to lead us to behavior equations? We can easily cut our own out of the whole cloth!”

<sup>6</sup>This point is explained in detail elsewhere[8].

<sup>7</sup>See for example the thesis of A. Sanghvi [3].



The point is that the methodology and the model building power of the game theory provides a natural framework which forces the individual to model sufficient detail to well define a system not merely for its equilibrium states (if they exist), but for every attainable state of the system. In doing so information conditions must be specified in detail and rules of the game such as bankruptcy laws, conditions on how money is issued or financial claims are traded emerge from the need to well-define the model.

The general equilibrium model is not inconsistent with the noncooperative game model; it is merely insufficiently defined to provide an adequate dynamic model of the economy. It can however be regarded as an extremely limited and somewhat misleading special case of a much more general, relevant and interesting class of models.

That it may be regarded as a special case of a more general set of models is in my opinion an indication of both its value and its limitations. It provided an important abstract means to examine relationships between production and consumption over an important range of economic problems. But it provided no insights whatsoever into the problems of economic control.

The general equilibrium theory is simultaneously not mathematically general enough to provide the tools to model information conditions or oligopolistic or strategic behavior. And it is not sufficiently institutionally oriented that it is not possible to extend it in a way to model the mechanisms which govern and transmit strategic behavior.

### 6.1. *On International Finance*

In this paper no mention has been made previously of international finance. I believe that international finance involves no basically new instruments; however, it does involve new agencies for their creation and destruction.

The essence of a financial system is that it is a control system which has as its neural network "paper" or claims and information flows. In parallel with the real goods and services are the ownership papers which can be alienated from them and hence a continuum of ownership and control relations can be created.

In the resulting loosely coupled system where mass markets exist together with powerful central agencies the individual units which make up the economic mass of a single national society may be controlled or predicted at least to a reasonable first order approximation. When we move to an international context the strategic and control conditions are essentially different. To talk of financial and monetary international control without talking of international law enforcement has about as much operational significance as writing for the Sunday supplements.

### 6.2. *On Mathematical Institutional Economics*

In a preface to the discussion of information and dynamic economic models I suggested, some time ago, the title "Mathematical Institutional Economics"[6] as the appropriate title for the type of approach needed to specify the economic process. In particular the qualifier "mathematical" refers to the formal specification of the economic models as mathematical structures with the behavior of the

individuals described by mathematical operators such as maximization. The qualifier “institutional” refers to the “rules of the game”: the laws, the institutions and the details in any society which act as the *carriers of process*. In a truly dynamic economy no magic auctioneer or tatonnement guide exists. Supply and demand are not equalized by a magic noninstitutional matching and rematching of tentative bids and offers. When you blunder, you blunder and you pay for your education in a world where information is expensive, perceptions poor and decisionmaking expensive in many dimensions.

This essay has not been meant as an institutional attack on the true church of microeconomic theory. On the contrary it is an attack from within the church.

Institutional economics, macroeconomics and behavioral models of economic process are *not* alternatives to microeconomic analysis. They are the natural extensions that are implicit in the appropriate formulation of the microeconomic models.

This appropriate formulation requires an abandonment of attempts to patch up the general equilibrium system in a manner not unlike the efforts to patch up the Ptolemeic system in astronomy.

The general equilibrium system was modeled as a tightly coupled essentially static construct with, to say the least, a grotesquely oversimplified view (or nonview) of ownership and control, and perception and information processing.

The model needed calls for a loosely coupled system with money and financial institutions providing the loose coupling and the control mechanism. It has to permit easy modifications to information conditions. It must allow for a mixture of mass markets and large economic units. And lastly, both for scientific and theological purposes it should yield the general equilibrium analysis as a special case. It is my belief that the class of models which satisfies these requirements can be broadly described as dynamic noncooperative “money games.” They can be solved in three different ways—for equilibrium state strategies, for historical strategies or for behavioral descriptions of the choices of agents.

The equilibrium state strategies provide the direct linkage to the simplistic assumptions of general equilibrium theory.

### 6.3. *A Postscript on Economic Theory*

Before the proof comes the theorem; before the theorem comes the conjecture and an insight as to why the theorem is worth proving. Before the conjecture, or at least with it, comes the model. Before the model comes a need to look at the economic world as it is, not merely as it is told to us in the story books. Books, theories and other *dicta* are great helps to enable us to interpret the economic world around us. But they are secondary, not primary, sources. In spite of the elegance of the general equilibrium system, the world does not look like that—even as a crude approximation for many questions we want to answer. If this is the case we need a different world or possibly a different theory.

## APPENDIX

Of the eight instruments suggested, two are real and six are paper. Of the six paper instruments, two are not contracts except possibly in the broadest sense, but four are clearly contracts. Fiat money and ownership paper are basically one party paper. An attempt to "cash" a \$1 bill will merely yield another \$1 bill.

All four instruments which link two time periods, service contracts, futures contracts, debt instruments, and calls are also between two (or more) parties. For example, if  $i$  borrows \$100 from  $j$  now on the condition that he will pay back \$105 next period, this can be described by the pair  $(100_{t^i}^i, 105_{t+1}^{ij})$  where the first number is  $j$ 's contractual promise to  $i$  and the second is  $i$ 's promise to  $j$ . Any time a contract is created essentially two commitments are made,  $i$  to  $j$  and  $j$  to  $i$ . Once this is fully understood then a concept such as neutral banking can be mathematically specified. If  $j$  is the bank, it may be possible to state a fixed strategy for the bank, much in the same way as the dealer at a Blackjack table must follow a fixed strategy; this means that the power to borrow or not lies with  $i$ . If he meets the requirements, then  $j$  must, by the rules of the game, lend to him.

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