An Analysis of Transaction Volume and Asset Pricing in a Representative Agent Economy

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Abstract

A parameterized version of a general equilibrium representative agent economy is employed to analyze the joint behavior of the price of capital and transaction volume. Preference shocks motivate agents to buy or sell capital. The model is simulated to determine if there is an interesting pattern of correlations between the transaction volume and the price of capital. Different relationships between the price of capital and transaction volume are analyzed under alternative stochastic processes for the exogenous disturbances. It is shown that when the exogenous shocks are serially correlated, the price of capital and transaction volume to some extent can be predicted by their own past values.

Introduction

This paper employs a parameterized version of a general equilibrium representative agent model to study the behavior of the quantity of assets traded per period. The model is one in which idiosyncratic disturbances motivate agents to buy or sell productive capital. The behavior of agents is characterized by a set of reduced form decision rules for saving and consumption. A measure of the quantity of assets traded consequently can be characterized and studied through simulation methods; it can be seen under which configurations of the physical environment the volume of assets traded will display interesting behavior. This is important because it generally is stated that such representative agent models are reticent on the issue of the transaction volume.

Arguably the most popular general equilibrium model that is capable of exhibiting both dynamic and stochastic features is that of the infinitely-lived representative agent. It has been used to address a wide range of observed phenomena, including issues related to the pricing of assets and the consequent rates of return on assets. This line of research has been both theoretical and

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applied (Lucas, 1978; Hansen and Singleton, 1983). A very strict interpretation of the model of Lucas would be that of many identical agents who face a sequence of one period budget constraints. Because all agents are identical, in equilibrium they all undertake the same actions. Agents in the economy exhibit an uninteresting or trivial form of interaction. This may seem strange, as one can argue that one of the primary goals of the discipline is to study the economic interaction of individuals. It is not necessary for all agents to be identical in such a model. Nevertheless, in such models where they are not identical, the resulting equilibrium may be difficult to analyze and is unlikely to have anything interesting to say regarding the degree of interaction between agents as characterized by the quantity of assets traded in any period.

There has been a large body of literature written to aid understanding of the determinants of the prices and rates of return of assets in various environments. This literature has few, if any, discernable implications regarding the quantity of assets traded. It has been argued elsewhere that asset-pricing models that do not produce an identifiable quantity of assets traded per period may be missing features that are vital to understanding the behavior of markets (Huffman, 1987). Factors that help to produce trade in assets in an environment are also likely to influence the prices of assets (and vice versa). Therefore, models that yield no identifiable implication for transaction volume may be ignoring some of the most interesting features that help to determine the level of prices. There is also another reason for interest in the level of transaction volume. It may be that the distribution of wealth or assets has an important influence on the level of prices and the determination of allocations in an economy. Analyzing the level of transaction volume may yield insights into the determination of the change in the wealth distribution from one period to the next. Explaining the determinants of transaction volume may aid our understanding of the factors that influence allocations as well as that of prices.

It seems obvious that any general equilibrium model in which there is to be any interesting trading also must possess some heterogeneity among the agents; if all agents were identical, there is unlikely to be any trade. This has motivated the work of Huberman (1984), Huffman (1986, 1987), and others who consider the pricing of assets in environments in which the population is heterogeneous. These authors employ the overlapping generations model in one form or another. Nevertheless, it is disturbing that this issue has not been addressed within the context of a representative agent model because the representative agent model appears to be the most popular modelling paradigm for analyzing the pricing of assets.[1] This paper attempts to fill this void by analyzing the ability of a

[1]Scheinkman and Weiss (1986) study an economy populated by infinitely lived agents, which generates an endogenous transaction volume. They do not

particular representative agent model to produce an interesting pattern of asset prices and transaction volume. To the extent that such a model is incapable of mimicking some of the observed regularities for prices and volume, this analysis would be a contribution to the literature that details the failures of the representative agent model (Hansen and Singleton, 1983; Mehra and Prescott, 1985; Shiller, 1981).

It is difficult to arrive at any conclusions concerning the interaction between the quantity of assets traded in a market and other phenomena such as the level or variability of the price of assets. Karpoff (1987) presents an excellent summary of the existing empirical literature on the relationship between transaction volume and price changes. This literature analyzes this relationship for common stocks and bonds over relatively short periods of time.[2] The theoretical models are partial equilibrium analyses or display a wide range of ad hoc assumptions concerning the behavior of agents. According to Karpoff, two empirical relations emerge from the existing literature. First, there is a positive relationship between the transaction volume and the absolute value of the change in price in both equity and futures markets. Second, there is a positive correlation between the transaction volume and the price change in equity markets. Existing representative agent models as yet are far from able to mimic these features. It is hoped that the current analysis will be a step in this direction.

In the next section, a representative agent model is described in which agents are subject to preference shocks. The agent's decision problem is solved in such a way as to lead to closed form decision rules. The equilibrium price of capital is a function of the contemporaneous exogenous disturbances as well as the existing distribution of asset holdings in the economy. The allocations produced by this mechanism are not pareto optimal; consequently, to characterize the resulting equilibrium, the distribution of asset holding will be a state variable for this economy. The decision rules for the agent can be used to produce an endogenous transaction volume. Agents may buy or sell capital due to aggregate effects introduced through the price of capital, such as the impact of individual-specific shocks, or the impact of expected future shocks. It therefore is shown that expected future disturbances can give rise to trade in capital in earlier periods. This research also examines various parameterized versions of the economy. Data are generated from the model, and the statistical relationship between the price of capital and the volume of trade is examined. The relationship between the structural parameters and these correlations also is

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study the behavior of transaction volume, however. There are some similarities between their model and the model described below.

[2]Most of these studies use daily, and sometimes even hourly, data.

explored. It is found that when the exogenous disturbances are independently and identically distributed that the resulting data have difficulty mimicking any of the observed features of volume and price. When the exogenous disturbances are intertemporally positively correlated, then the resulting data can mimic some of the actual observations more easily.

Preferences and Technology

Consider an economy populated by N representative agents with preferences of the form

$$(1)\quad \sum_{t=1}^{\infty} \beta^t[\alpha_t^i \ln(c_t^i)], \qquad i = 1, 2, \ldots, N,$$

where:

α_t^i = preference shock for agent (i) in period (t);
β = constant discount factor; and
c_t^i = consumption of agent (i) in period (t).

The preference shocks α_t^i are observed only by the agent i and are not observable by other agents. This precludes any risk-sharing agreements based on realizations of α_t^i. The disturbances α_t^i are bounded continuous functions of the state variable (s) and occasionally will be written as $\alpha^i(s)$.[3] Additionally, it is assumed that $\beta \in (0, 1)$. The transition probability distribution for the state variable s will be denoted by $F(\cdot \mid \cdot)$, which is defined on $\Omega \times \Omega$ for $\Omega \subset \Re$, so that

[3]Shocks to preferences of this sort are not unusual in the economic literature. Eichenbaum and Singleton (1986) employ them in their econometric analysis of business cycles. They also are used by Diamond and Dybvig (1983) in their analysis of financial institutions. In both cases, they merely serve as sources of risk for agents. Lucas (1980) employs shocks to preferences as the only source of uncertainty in an economy where agents must hold currency from one period to the next.

Although it may be easiest to think of these disturbances as shocks to preferences, it is possible to interpret them as productivity disturbances as well. Suppose the capital produces a dividend in units that are the same every period. The individual must then apply a private production technology to the dividend to convert it into a good that the agent can consume. This latter technology is constant returns to scale in the dividend. If in period (t) agent (i) takes x units of the dividend for consumption, then their effective consumption is (x^{α}). In this way, the disturbance α may be thought to be a private productivity disturbance rather than a preference shock.

$F(s' \mid s) = \text{Prob}\{s_{t+1} \leq s' \mid s_t = s\}.$

In each period an agent (i) is faced with a budget constraint of the form

$$c_t^i + P_t x_{t+1}^i \leq (P_t + d_t) x_t^i,$$

where:

x_t^i = holdings of capital by agent (i) at the end of period t; and
d_t = the dividend yielded by the capital in period t.

It is assumed that realizations of d_t also are bounded strictly away from zero and from above as well. Agents have no other endowment -- all of the consumption good is produced by the capital. In this model all agents are restricted to holding nonnegative quantities of capital in each period ($x_t^i \geq 0$). The number of units of capital is normalized to unity so that the market-clearing condition for capital each period is

$$(2) \quad \sum_{i=1}^{N} x_t^i = 1.$$

This optimization problem then is solved as follows. The objective function (1) is truncated at some date T so the agent is solving a finite horizon programming problem. For this truncated problem, clearly $x_{T+1}^i = 0$ and $x_t^i > 0$ for $t < T$ and for all i. Working recursively, this can be used to reach a solution for capital holdings at date T - 1 and all other prior periods. Then taking the limit as $T \rightarrow \infty$ the decision rules for the agent converge. These decision rules for the infinite horizon problem are as follows

$$(3) \quad P_t x_{t+1}^i = \left(\frac{g(\alpha_t^i)}{\alpha_t^i + g(\alpha_t^i)} \right) (P_t + d_t) x_t^i$$

$$(4)\quad c_t^i = \left(\frac{\alpha_t^i}{\alpha_t^i + g(\alpha_t^i)} \right) (P_t + d_t)x_t^i$$

where

$$(5)\quad g(\alpha^i(s)) = \beta \int_{\Omega} [\alpha^i(s') + g(\alpha^i(s'))]dF(s' \mid s).$$

The function $g(\cdot)$ is well defined because $\beta \in (0, 1)$ and $\alpha^i(s)$ are bounded from above. In the case in which the shocks are distributed independently and identically across agents and periods, the problem is simplified so that

$$g(\alpha^i(s)) = \frac{\beta}{1-\beta} \int_{\Omega} \alpha^i(s')\, dF(s' \mid s)$$

for all $i,s \in \Omega$.

The equilibrium price of capital can be calculated from equations (2) and (3) as

$$(6)\qquad P_t = \left[\frac{\sum_{i=1}^{N} \left(\frac{x_t^i g(\alpha_t^i)}{\alpha_t^i + g(\alpha_t^i)} \right)}{\sum_{i=1}^{N} \left(\frac{x_t^i \alpha_t^i}{\alpha_t^i + g(\alpha_t^i)} \right)} \right] d_t$$

As a check that the decision rules are solutions to the infinite horizon optimization problem, note that for this problem the intertemporal optimization condition for holdings of capital can be written as

$$\left(\frac{\alpha_t^i P_t}{C_t^i}\right) = \beta E_t \left(\frac{\alpha_{t+1}^i (P_{t+1} + d_{t+1})}{c_{t+1}^i}\right) \tag{7}$$

Substitution of equations (5) and (6) into equation (7) shows that this optimization condition is satisfied.

The fact that markets are incomplete (because of the private information nature of disturbances) causes the resulting allocation to be nonoptimal. This is demonstrated easily by showing that the ratio of marginal utilities of date t consumption for different agents is generally not a constant (i.e., depends upon α_t^i and x_t^i). The consumption decision rule depends upon the distribution of capital among the population, as well as upon the preference shocks, in a nontrivial manner. These features are also present in the overlapping generations model of Huffman (1987). Equation (6) expresses the price of capital as a function of contemporaneous preference shocks and asset holdings. Equation (3) expresses current asset holdings as a function of contemporaneous preference shocks and previous asset holdings. Therefore, repeated substitution of equation (3), divided by P_t, for periods t, t - 1, t - 2, ... , into equation (6) would reveal that the price of capital at any date t is a complicated nonlinear function of all past preference shocks of all agents. Similarly, equation (3) could be used to show that current asset holdings for an agent are functions of all previous preference shocks to all agents. This feature is also present in Huffman (1987).

Because previous preference shocks affect today's distribution of asset holdings, and the distribution of asset holdings affects the volume of assets traded, it is relatively easy to show that even if the preference shocks are distributed independently and identically, the economy's transaction volume nevertheless may be intertemporally correlated. In other words, the conditional probability distribution for the transaction volume of a given period will depend upon the distribution of asset holdings. To illustrate, the probability distribution of the transaction volume generated by agent i in period t, conditional on initial asset holdings $\{x_t^i\}_{i=1}^N$, can be calculated from equations (3) and (6) as

$$\mathrm{Prob}\{\,|x_{t+1}^i - x_t^i| \le v\} =$$

$$\text{Prob}\left\{ \{\alpha_j^i\}_{i=1}^N : -v \le \left[\left(\frac{x_t^i g(\alpha_t^i)}{\alpha_t^i + g(\alpha_t^i)} \right) \cdot \left[\frac{\sum_{i=1}^N \left(\frac{x_t^i \alpha_t^i}{\alpha_t^i + g(\alpha_t^i)} \right)}{\sum_{i=1}^N \left(\frac{x_t^i g(\alpha_t^i)}{\alpha_t^i + g(\alpha_t^i)} \right)} \right] - \left(\frac{x_t^i \alpha_t^i}{\alpha_t^i + g(\alpha_t^i)} \right) \right] \le v \right\}$$

This framework can be used to generate time series data on the price of capital, rate of return on capital, and transaction volume. Figures 1 and 2 illustrate the type of behavior that can be observed. In this case N=2, $\beta = 0.90$, $d_t, = 1 \ \forall \ t$, and the disturbances (α_t^1, α_t^2 are i.i.d., each with a uniform distribution on the unit interval (0,1).

The model also exhibits an attribute that many persons may find to be an important feature that contributes to trade in assets. One may believe that the expectation of future disturbances, not just the disturbances themselves, can lead agents to change their asset holdings. This feature can be shown in the present model. As equations (3) and (6) show, the transaction volume of an agent is influenced by both α_t^i and $g(\alpha_t^i)$. α_t^i is the contemporaneous preference shock, while $g(\alpha_t^i)$ represents the effect of expected future preference shocks. One could construct examples where the values $\{\alpha_t^i\}_{i=1}^N$ are constant for several periods but where $\{g(\alpha_t^i)\}_{i=1}^N$ changes over time. In this instance transaction volume would be generated in periods when there was no change in the preference shocks, but where agents' expectations have changed. Because of the nonlinear structure of the model, computing probability distributions for the endogenous variables or otherwise characterizing the behavior of the model is an onerous task. Therefore, in the next section some statistics are reported from simulations of the model to explain the determinants of the endogenous variables.

Behavior of Prices and Volume

The nonlinearity of equations (3), (4), and (6) makes the analysis of the endogenous variables problematic. Numerical simulations were employed to generate statistics from the model for different parameter values. The variables that must be specified exogenously are the discount factor (β), the number of agents (N), the stochastic processes governing the preference shocks (α_t^i), and the dividend (d_t).

Throughout all simulations of the model, higher values of the discount factor lead to higher values of the price of capital. This is not surprising, as more patient agents should be willing to pay a higher price for productive capital than will less patient agents. It also appears that average aggregate transaction volume per period is decreasing in the discount factor (β). Loosely speaking, this is a comparative dynamic result that states that there is an inverse relationship between the price of capital (and the discount factor) and the average level of transaction volume. A higher discount factor leads agents to care more about the future and, therefore, produces a higher price of capital. Agents who are subject to idiosyncratic shocks and who will buy or sell capital partially to offset these disturbances will be able to reduce their purchases and sales of capital, but will not necessarily lower the value of these transactions as measured in units of the consumption good because the price of capital is higher.

Changing the number of agents in the economy does not appear to lead to any additional interesting dynamic behavior, so N was set equal to 2 for all remaining simulations. The level of the variables β and N influence the level of the price of capital and volume, but do not appear to change the dynamic correlations of these variables.

Perhaps not surprisingly, specifying different behavior for the preference shocks leads to different behavior for the endogenous variables. Intuitively, a great deal of dispersion in these shocks invariably would lead to a higher level of transaction volume. Additionally, the degree of persistence in these disturbances can be altered to see how the behavior of prices and transaction volume would be affected. It is impossible to describe the joint behavior of prices and volume for all parameter values. Nevertheless, a group of representative results can be studied for this economy. Two different specifications for these disturbances are described in Table 1. Model #1 has two agents who receive purely temporary preference shocks each period. Model #2 has two agents who receive positively correlated preference shocks each period. For each of these specifications of the economy, 500 observations of the economy were simulated, and the resulting data on prices and transaction volume were analyzed. Because it is of interest to see how the behavior of transaction volume is correlated with that of the price of capital, the following regressions (labelled E1 and E2 below) were constructed for each of the models.

Equation

E1 $V_t = \alpha_1 + \beta_1 \Delta P_t + \varepsilon_t^1$

E2 $Vt = \alpha_2 + \beta_2 \left|\Delta P_t\right| + \varepsilon_t^2$

Tables 2 and 3 show the sample estimates for the parameters of equations E1 and E2. The numbers in the fifth column give the probability that the hypothesis $\beta \neq 0.0$ cannot be rejected. For model #1, with temporary preference shocks, there appears to be a negative relationship between the absolute value of the change in the price of capital and the volume of capital traded. There does not appear to be any such relationship between the level of the price change and the amount of transaction volume. For model #2, with persistent preference shocks the opposite appears to be the case. There appears to be a positive relationship between the volume of trade and the change in the price of capital.[4] There does not appear to be any such relationship between the absolute value of the change in the price of capital and the volume of trade. This reveals that an interesting relationship between the price of capital and the contemporaneous volume of trade can arise in this dynamic environment.

The intuition of why the model behaves differently with different stochastic processes for the exogenous disturbances, although not straightforward, may be described as follows. When the disturbances are strongly serially correlated, a high realization of α_t^i in one period implies an expected series of high realizations and, therefore, a high value of $g(\alpha_t^i)$. Hence, the agent will wish to save for these future periods by accumulating more capital. These effects will increase the price of capital and increase the transaction volume. The opposite results hold for low realizations of α_t^i. This would produce the positive relationship between the change in the price of capital and transaction volume. When the shocks α_t^i are i.i.d., as in model #1, the relationship between price change and volume is more complicated. In particular, from equation (5), $g(\alpha_t^i) = \tilde{g}$ for all t. A high realization of α_t^i motivates agents to sell capital to increase current consumption. This fact helps to lower the price of capital. But this lower price for capital motivates the agents to buy more capital, hence mitigating the first effect. There appear to be two opposing forces at work here, resulting in a nebulous relationship between price and transaction volume.

Why model #1 would lead to a negative relationship between the absolute price change and transaction volume remains unexplained. Again, a high realization of α_t^i motivates agents to sell capital, but the resulting fall in the price of capital motivates the agents to buy capital. The smaller is this latter effect (i.e., the lower is $|\Delta P_t|$), the greater will be the transaction volume. The opposite is true for low realizations of α_t^i. Hence a negative relationship can arise between the absolute value of the change in price and transaction volume when the exogenous disturbances are i.i.d.

[4]The fact that the size of the coefficient is small should not be troubling, as a renormalization of the number of available units of capital would result in a rescaling of this coefficient to any desired positive level.

It is also of interest to investigate whether the joint behavior of prices and volume has substantive predictive power for their future levels. Table 4 shows results from running a vector autoregression of the price of capital and transaction volume on five of the lagged values of these variables. The probability statistics after each regression are the probabilities of rejecting the hypothesis that the coefficients on the respective variables are zero. When preference shocks are temporary, the price of capital is not explained to any significant degree by past values or by transaction volume. Alternatively, the level of transaction volume significantly is explained by past values of transaction volume, although it is not predicted by past levels of the price of capital.

Table 5 shows these same statistics for the case of serially correlated preference shocks. In this instance, the price of capital is influenced significantly by its own lagged values, but not influenced by past levels of transaction volume. Alternatively, the volume of capital traded again is influenced significantly by its own past values. The level of volume also is influenced to a moderate degree by past values of the price of capital. Therefore, there is perhaps a more interesting dynamic behavior that arises when these preference shocks exhibit serial correlation. The fact that the price of capital can be predicted to some extent by its own past values does not imply that the markets are not operating efficiently or that agents are not optimizing.

It is of interest to note that model #2 produces a pattern of prices and transaction volume that is predicted much better by past values than is the corresponding pattern for model #1. It appears that serially correlated exogenous disturbances yield a pattern for prices and transaction volume that jointly have predictive power for the future levels of these variables. The reason for this would appear to be as follows. The capital pricing equation (6), and the decision rule (3) induce intertemporal dependence in the price of capital and transaction volume, even when the exogenous disturbances are distributed independently and identically. Nevertheless, this relationship does not appear to be sufficiently strong to produce an interesting relationship, as shown in Table 4. When the exogenous disturbances are strongly serially correlated, this appears to increase these intertemporal links and to make the price and volume more closely related to their past values.

These vector autoregressions, described in Table 5, were used to compute variance decompositions for the transaction volume and the price of capital. These findings are contained in Table 6. The volume of trade does not appear to explain the future changes in the price of capital to any significant degree. Similarly, the price of capital does not appear to explain future changes in volume. Although a naive view of market efficiency may dictate that the price of capital should not be predictable to any significant extent by any lagged variables within the context of this framework, it is surprising that the price and transaction volume could not be forecast to a greater extent. The price of capital, as given by equation (6), is a function of contemporaneous preference shocks and distribution of capital. The distribution of capital is a function of past preference shocks (equation (3)). Hence, the price of capital and the volume of trade are complicated nonlinear functions of past and present preference disturbances. Past levels of these variables contain information about the fundamental unobservable state variables that are of interest: the preference shocks and the distribution of capital. To the extent that past levels of transaction volume and the price of capital contain information about past preference shocks or the distribution of capital, one would expect these variables to have significant predictive power for present levels of these variables. Tables 4 and 5 show that some of this predictive power is present. It is puzzling that the volume of trade does not have more predictive power for the price of capital, and vice versa.

Figures 3 and 4 illustrate the probability densities for transaction volume that can be produced by models #1 and #2 respectively. These densities were calculated by producing 10,000 observations for the economies and using the resulting transaction volume data to calculate a histogram.[5] By noting that the vertical axes of these figures are scaled differently, one can see that the probability density for model #1 is more concentrated near the origin than is the density for model #2. Similarly, the density for model #2 tends to have a fatter tail than does the distribution for model #1.

Throughout these simulations of the model, the dividend (d_t) was held constant. This variable could be stochastic, but this would not change the joint statistical relationship between the price of capital and the volume of trade. The reason for this is that, as shown by equation (6), changes in the dividend have level effects on the price of capital, but do not have distributional effects which cause the transaction volume to change in this framework. Hence, letting the dividend vary in this model would produce interesting implications only to the extent that the dividend also is correlated with other variables such as the preference shocks. Although the results listed in the tables are not exhaustive, they represent what seems to arise for uncorrelated and correlated preference shocks. For example, the results shown in Tables 4 and 5 seem representative. Price and volume seem to be predicted much better by their lagged values when the preference shocks are serially correlated than when they are uncorrelated.

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[5]Because a histogram was calculated, the necessary division of the transaction volume variable into a grid may be the reason for the rather choppy nature of the densities—especially Figure IV. Also, these figures have been truncated. It is interesting to note that the probability density is positive beyond .00015, but of negligible size.

An unfortunate drawback of this analysis is that the preferences employed are unduly restrictive; it would be of interest to know how the economy would behave with a more general preference structure. The decision rules in the present case are independent of the future price of capital (equation (3)). If, hypothetically, an agent were given some information about a future event (such as another agent's preference shock or the future dividend), it would not influence the decision rule of that agent. This would not necessarily be true in more general environments. Removing this feature would complicate the analysis substantially. If the realizations of the present and future preference shocks of other agents directly influenced the contemporaneous behavior of an agent, then the agent would be forced to attempt to uncover the preference parameters of other agents from the aggregate statistics such as the price of capital or the level of aggregate transaction volume if the latter statistic is publicly available. This presents complicated feedback effects from the equilibrium value of the endogenous variables to the individual decision rules which, in turn, determine the former. The agent's decision rules would become sensitive to the information he or she receives concerning the behavior of other agents. Characterizing such an equilibrium would require a technical tour de force. This is related to the issues discussed by Grossman and Stiglitz (1980).[6]

The model described does not exhibit features that would lead one to conclude that the volume of trade should be correlated with the level of the price or the change in the price of capital. Agents in the model gain nothing by observing aggregate transaction volume in any period. To a statistician who is observing the aggregates generated by this economy, however, the volume of trade may be of interest. Because both the price of capital and transaction volume are functions of the dividend, contemporaneous preference shocks, and initial asset holdings, observing the price of capital yields information on these underlying state variables. If the statistician observes the aggregate transaction volume as well as the price, this would yield even more information on the underlying state variables than if he or she observed the price alone. To the extent that one would wish to predict the future price of capital, for example, observing the volume of trade in the market may help because this variable contains useful information. For an economy composed of many agents ($N >> 1$), there is a great leap between observing the price and volume of trade in a period and unravelling the underlying state variables from this information.

[6]Huffman (1990) develops another approach to addressing this issue within a model in which it is shown that there is a relationship between the transaction volume, the change in the price of capital, and the information conveyed by the change in the price.

Conclusion

It has been shown that a general equilibrium representative agent model can be employed to analyze the behavior of transaction volume. The model presented in this paper has the beneficial characteristic that, in the steady state, the decision rules and the aggregate transaction volume exhibit an interesting type of behavior relative to the exogenous disturbances in the model. The distribution of assets was shown to be an important feature in determining the price of capital (and hence its rate of return), as well as the level of transaction volume. Contemporaneous preference shocks affect the price of capital and volume of trade in the present period and, through the distribution of assets, also affect future levels of prices and the volume of trade. The degree to which the price of capital and the level of volume have predictive power for the future levels of these same variables, however, depends critically on exogenous patterns of correlations for the exogenous variables. The stochastic process for the exogenous disturbances could be configured in such a manner as to produce patterns of correlations between price and volume that seem roughly consistent with some of the observed patterns for these variables. The model, however, will not produce a pattern of correlation between volume and the price of capital that is consistent with all the observed correlations for these variables. To the extent that the model fails to account simultaneously for all the observed patterns of correlations, the present paper is a contribution to the growing literature that documents the apparent failure of versions of the representative agent construct (Hansen and Singleton, 1983; Mehra and Prescott, 1985; Shiller, 1981). Future research that attempts to account for all these various correlations simultaneously likely will be forced to resort to another paradigm.

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Table 1
Configuration of Parameters for Model #1 and #2

	Model #1	Model #2
β	.90	.90
N	2	2
d_t	1.0	1.0
α_t^i	$\sim$ U (0, 1)	(.90) $\alpha_{t-1}^i = \eta_t^i$
η_t^i		$\sim$ U(0, 1)

Table 2
Regression Results for Model #1*

Equation	α	β	R^2	Probability
E1	.011 (.00042)	-.000009 (.00002)	.00004	.35
E2	0.12 (.00049)	-.00005 (.00002)	.012	.99

*Standard errors are in parentheses

Table 3
Regression Results for Model #2*

Equation	α	β	R^2	Probability
E1	.0018 (.00006)	.00059 (.00025)	.011	.98
E2	.0019 (.00011)	-.00036 (.00043)	.001	.60

*Standard errors are in parentheses

Table 4
Regression Results for Model #1*

$$P = \underset{(2.36)}{15.9099} - \underset{(.04540)}{.0223}\,P_{-1} + \underset{(.04546)}{.0193}\,P_{-2} + \underset{(.04547)}{.0109}\,P_{-3} + \underset{(.04526)}{.0125}\,P_{-4} + \underset{(.04521)}{.0404}\,P_{-5}$$

$$+ \underset{(79.7160)}{64.0736}\,V_{-1} - \underset{(79.1286)}{92.0722}\,V_{-2} - \underset{(77.6989)}{81.8982}\,V_{-3} - \underset{(79.4174)}{23.6450}\,V_{-4} - \underset{(79.3468)}{123.1097}\,V_{-5}$$

$R^2 = .018$

Variable	Probability
Price	.07
Volume	.78

$$V = \underset{(.0013)}{.0061} - \underset{(.00003)}{.00001}\,P_{-1} - \underset{(.00003)}{.00002}\,P_{-2} - \underset{(.00003)}{.00002}\,P_{-3} - \underset{(.00003)}{.00001}\,P_{-4} + \underset{(.00003)}{.00001}\,P_{-5}$$

$$+ \underset{(.0452)}{.0575}\,V_{-1} + \underset{(.0449)}{.0383}\,V_{-2} + \underset{(.0441)}{.2064}\,V_{-3} + \underset{(.0450)}{.0840}\,V_{-4} + \underset{(.0450)}{.1182}\,V_{-5}$$

$R^2 = .018$

Variable	Probability
Price	.14
Volume	1.00

*Standard errors are in parentheses

Table 5
Regression Results for Model #2*

$$P = \underset{(.2420)}{1.2755} + \underset{(.0464)}{.9124}\,P_{-1} - \underset{(.0627)}{.0070}\,P_{-2} + \underset{(.0627)}{.0116}\,P_{-3} - \underset{(.0624)}{.0958}\,P_{-4} + \underset{(.0462)}{.0442}\,P_{-5}$$

$$+ \underset{(12.9298)}{18.8193}\,V_{-1} - \underset{(16.3389)}{11.9877}\,V_{-2} - \underset{(16.2748)}{9.3459}\,V_{-3} + \underset{(16.3310)}{13.1701}\,V_{-4} - \underset{(12.9222)}{3.0223}\,V_{-5}$$

$R^2 = .778$

Variable	Probability
Price	1.00
Volume	.29

$$V = \underset{(.0009)}{.0013} + \underset{(.0002)}{.00005}\,P_{-1} + \underset{(.0002)}{.0001}\,P_{-2} + \underset{(.0002)}{.0001}\,P_{-3} + \underset{(.0002)}{.0003}\,P_{-4} - \underset{(.0002)}{.0005}\,P_{-5}$$

$$+ \underset{(.0460)}{.7864}\,V_{-1} - \underset{(.0582)}{.0316}\,V_{-2} - \underset{(.0579)}{.0986}\,V_{-3} + \underset{(.0581)}{0.919}\,V_{-4} + \underset{(.0460)}{.0709}\,V_{-5}$$

$R^2 = .623$

Variable	Probability
Price	.91
Volume	1.00

*Standard errors are in parentheses

Table 6
Decomposition of Variance of Price for Model #2

Step	Price	Volume
1	100.00	0.00
10	99.29	.71
20	98.98	1.02

Table 7
Decomposition of Variance of Volume for Model #2

Step	Price	Volume
1	0.00	100.00
10	1.41	98.59
20	3.10	96.90

Figure 1
Sample Path for Volume and Price

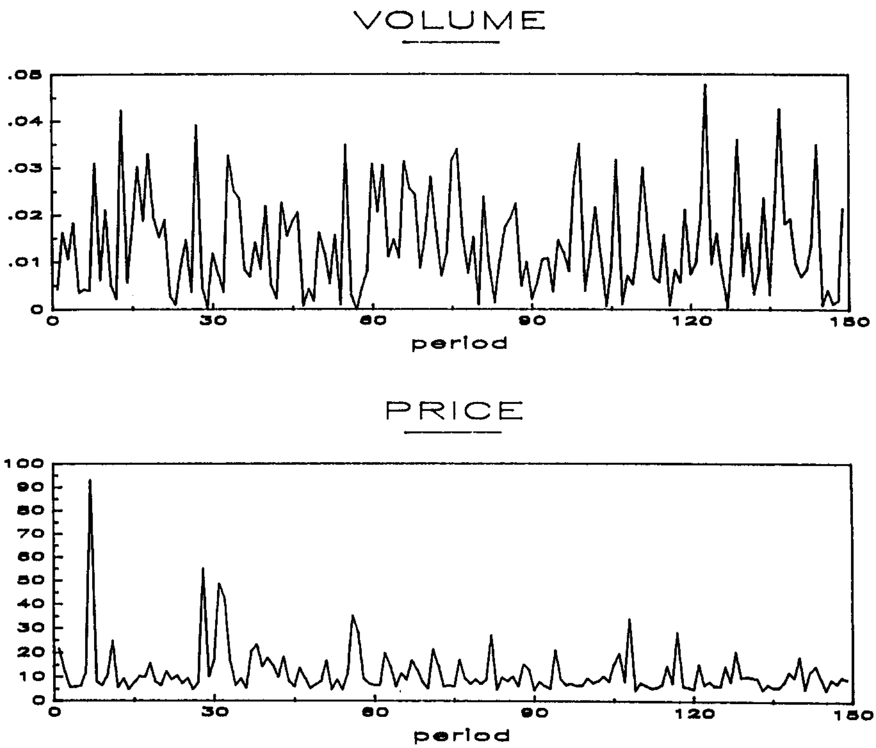

Figure 2
Sample Path for Volume and Price Change

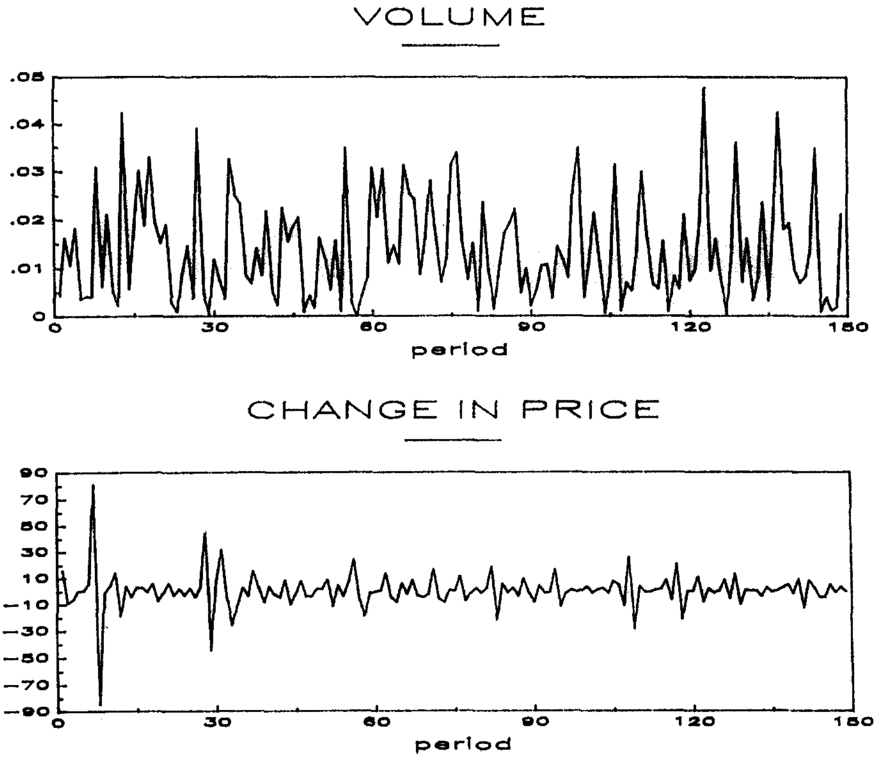

Figure 3
Probability Density of Volume
Model #1

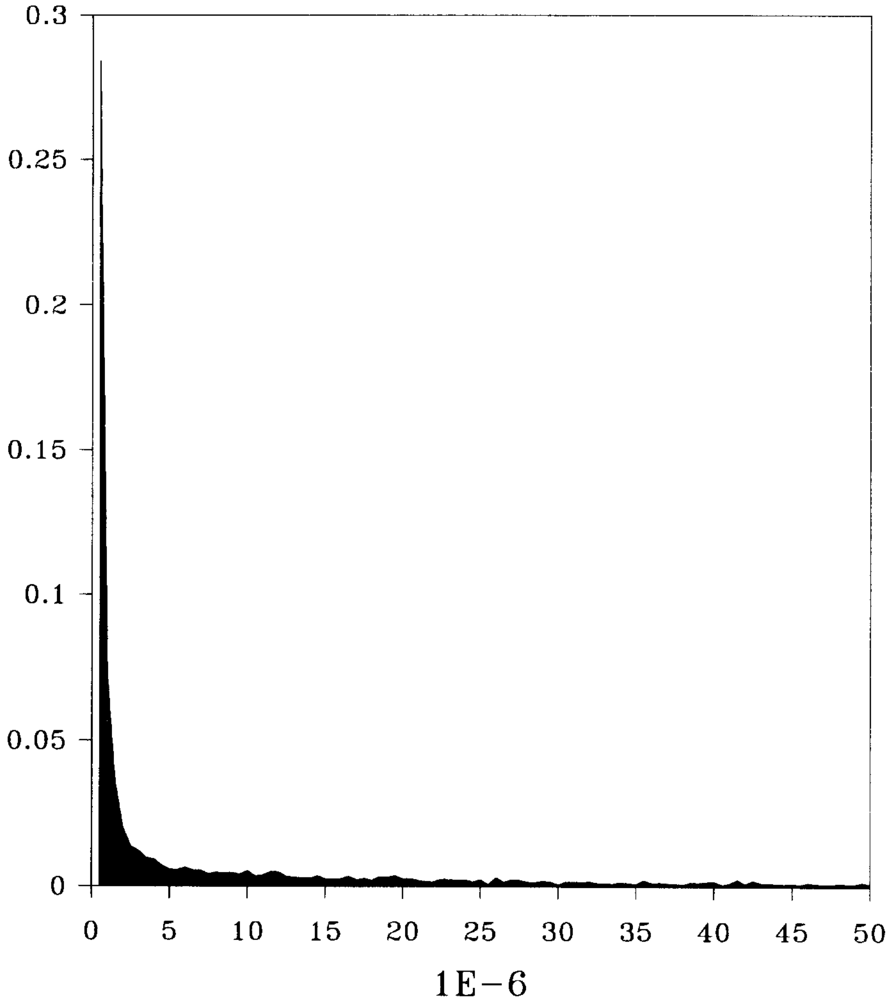

Figure 4
Probability Density of Volume
Model #2