# THE EFFECT OF TRADING IN FINANCIAL MARKETS ON MONEY DEMAND

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## INTRODUCTION

Empirical models of money demand typically do not include a variable for financial market trading. This exclusion tacitly assumes either that there is no mechanism whereby financial market trading affects money demand or that movements in financial market trading parallel movements of another variable, real GNP, already contained in the model. But the 1980s saw a veritable explosion of trading on financial markets. On the New York Stock Exchange (NYSE) the dollar volume of stocks traded more than quintupled between 1979 and 1986; on futures markets the number of contracts traded annually almost tripled between 1978 and 1985. Similar growth has occurred on options markets, which opened their first official exchange in 1973. If the above assumptions are incorrect, these surges in trading would have caused unexpected surges in money demand, resulting in either over-target money growth without increased inflationary pressure or increased interest rates and economic contraction depending on Fed policy. Two periods of high money growth and low inflation did occur in the 1980s (1982-83 and 1985-86). Both are correlated with large increases in the volume of financial market trading.

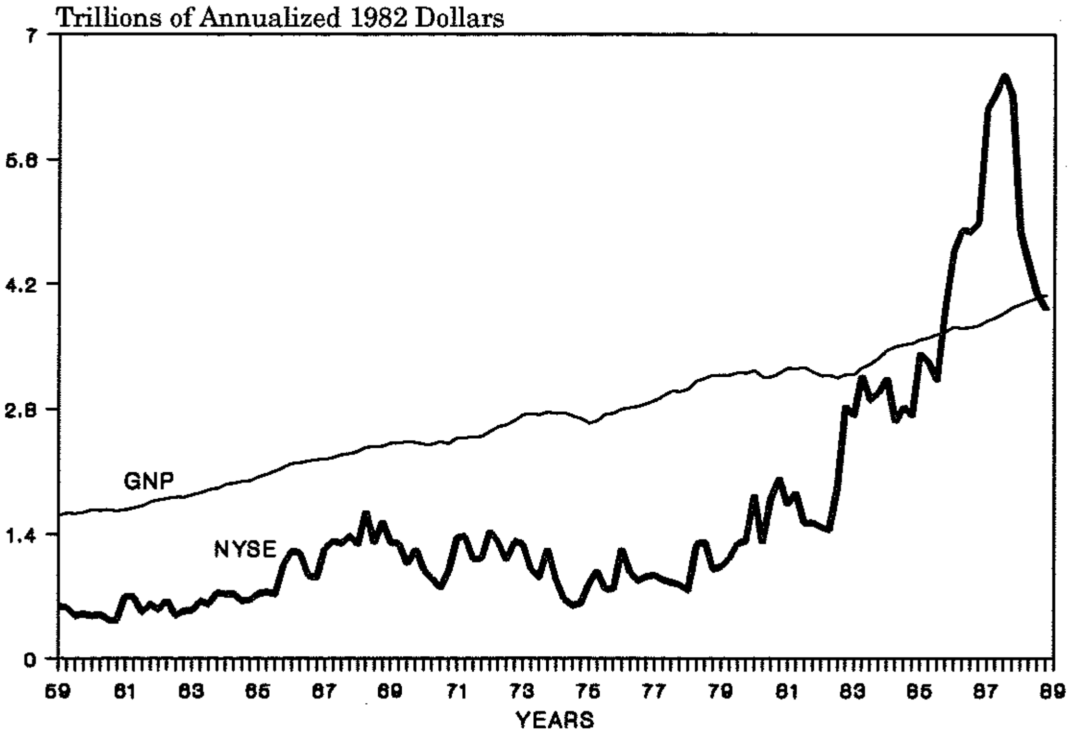
A handful of studies have analyzed the effects of financial transactions on money demand over different time periods with differing conclusions.[1] A. J. Field [1984], in a study of the 1920s, found that an estimate of the dollar volume of trading on the NYSE was both positive and significant. Modigliani, Rasche, and Cooper [1970] added the value of stock exchange trading as a proportion of GNP to an equation with the inverse of velocity as the dependent variable for the period 1955-66. Although the coefficient had the expected positive sign, it was small and insignificant. Radecki and Wenninger [1986] found the dollar volume of NYSE trading to be both positive and significant in estimates of money demand from 1974 to 1984.[2]

The present paper studies whether a long-term relationship exists between transactions demand for money and financial asset trading. The results of testing the hypothesis with data in both levels and first differences from 1960:I through 1988:IV strongly support the hypothesis that such a relationship does exist. Additionally, estimates over shorter time-periods were performed and the resultant coefficients were used to forecast money demand during the periods of large velocity declines, 1982-83 and 1985-86. For both models, forecasts were improved when a proxy for financial market trading was included.

## THEORY

Theoretical discussions posit money demand to be a function of the opportunity cost of holding money, the dollar volume of transactions (scale effect), and an **X** vector of assorted other factors (brokerage fees, cost and probability of being caught illiquid, etc.). Regrettably, all the variables in this **X** vector are essentially unmeasureable and are

**FIGURE 1**
**GNP vs. NYSE Trading**




therefore absent from empirical work which focuses on the effect of opportunity costs and transactions. Most empirical work has used real GNP (RGNP) as a proxy for the number of transactions, although wealth and permanent income also have been used. Transactions requiring money, however, are not limited to the purchase and sale of final goods and services. Only a small portion of debits to demand deposit accounts goes towards the purchase of GNP [Noyes, 1981]. As Figure 1 shows, the movement of real GNP and trading on NYSE are not always closely linked. Therefore, if financial market trading does affect money demand, using GNP as a proxy will lead to an inadequate specification of a money demand function.

The effects of financial market trading are often ignored because very little money ever changes hands at the exchange. A clearing house calculates the net amount of assets and money owed by each participant to the rest of the exchange, and the participant then settles directly with the clearing house using either clearing house or Fed funds. These participants can be broken down into those who trade solely for themselves (members) and those who trade on behalf of others (brokers). Brokers trade for both institutions and individuals.

It is this latter group that generates the increased demand for money.[3] An individual purchasing an asset has five working days to pay the broker. Payment is made either by writing a check or by liquidating funds from a money market fund account at the brokerage. Payment by check increases demand for M1 as funds are either



transferred from other assets into a checkable account[4] or held in a checkable account in anticipation of purchasing financial assets. According to the latest NYSE Public Transactions Study [1980], individual investors account for approximately 20 percent of trading by dollar volume. But what proportion of these transactions are made by check?

A questionnaire sent to the headquarters of 35 of the nation's largest brokerage houses, followed up by a telephone call, produced estimates of the proportion of payments made by check. One in-house study estimated 66 percent of purchases (and 56 percent of sales) by individuals are paid for (paid off) by check. Other "ballpark" estimates suggest checks account for an average of 50 percent of both purchases and sales.[5] Given the volume of financial market trading, and if the pattern exhibited by these respondents is indicative of the industry as a whole, a sizable dollar volume of transactions is paid for by check, which may be large enough to cause a significant quantitative impact on the demand for M1, as demonstrated below.

A rough estimate of the volume of checks written to cover financial market trading in any one year can be obtained as follows: (1) deflate each component of financial market trading[6] to reflect the use of margin purchases; (2) sum the components; (3) multiply the sum by 0.10 assuming 20 percent of transactions are made by individuals and 50 percent of those by check; and (4) double this to reflect the two payments involved in each transaction (one by the buyer and one to the seller). This process yields an estimated $150 billion worth of transactions in 1979. If, in that year, checks took an average of three days to be sent, received, cashed and cleared, then $450 billion, or an average of $1.2 billion per day, would have been needed solely for financial market transactions.

Between 1979 and 1986, the dollar volume of trading more than quintupled. If the same proportion of checks were written and took the same time to clear, then transactional needs would have increased by more than $4.8 billion per day, or roughly 0.7 percent of M1. This increase is similar in magnitude to the underpredictions of money demand by the original Goldfeld model during the periods of "too much money", so named because of the large underpredictions of money demand by forecasts using parameter estimates from the prior period. Forecasts, performed later in this paper, underestimated M1 by 1.5 percent in 1982-83 and by 2.9 percent in 1985-86.

## MODEL

A Goldfeld-like [1973] partial adjustment model is used to test the hypothesis with real GNP serving as the scale variable and the 3-month T-bill rate as the opportunity cost variable.[7] The partial adjustment model (1) assumes that individuals gradually adjust their real money balances towards the desired or long-run level, $m^*$ (2), where $\lambda$ represents the speed of adjustment.

$$m - m_{-1} = \lambda(m^* - m_{-1}) \quad (1)$$

$$m^* = \alpha_0 + \alpha_1 y + \alpha_2 TB + e \quad (2)$$

Rearranging (1) and substituting (2) for $m^*$ we obtain the Goldfeld model, which was estimated from 1960:I through 1988:IV.

$$m = \lambda\alpha_0 + \lambda\alpha_1 y + \lambda\alpha_2 TB + (1 - \lambda)m_{-1} + e \quad (3)$$

**TABLE 1**
**Levels Model**

| c | m(t-1) | RGNP | T-Bill | NYSE | Int. Dum. 1974:III | RGNP Sl. Dum 1982:II on | ROE | Adjusted R2 |
|---|---|---|---|---|---|---|---|---|
| -.015 | .879 | .079 | - .024 | -- | - .019 | .005 | .163 | .9919 |
| (-.57) | (44.66) | (5.74) | (-6.03) | | (-4.92) | (5.51) | (1.73) | |
| -.010 | .883 | .052 | - .024 | .011 | - .013 | .002 | .129 | .9925 |
| (-.40) | (48.42) | (3.42) | (-6.28) | (3.20) | (-3.32) | (2.15) | (1.37) | |

Durban *h* statistics of 0.05 and 0.14 respectively.
*t* statistics are in parentheses.

A problem with time series estimates is that over time the effects of one or more independent variables may change due to an alteration in institutional structure or other event. Such a problem is indicated by the onset of inconsistent parameter estimates when the model is estimated recursively. This problem can often be reduced or eliminated by using either an intercept dummy, which allows the constant to change and/or a slope dummy, which allows the coefficient on an independent variable to change. The years 1960 to 1988 contain two episodes of parameter inconsistency: the period of "missing money", so named because of large overpredictions of money demand in 1974 and afterwards by forecasts using parameter estimates from the prior period; and the period of "too much money", discussed previously. An intercept dummy, which takes on the value of 0 before 1974:II and 1 otherwise, is used to reduce parameter inconsistency during the period of "missing money".[8] A slope dummy on RGNP, starting in 1982:IV, eliminates these problems in the later period.[9]

In addition, spurious correlation problems sometimes accompany time series estimations, because some or all of the variables grow simultaneously with the economy. This type of error can be greatly reduced if the variables can be made stationary, normally accomplished by differencing. Therefore, to eliminate possible problems from non-stationarity, all variables were first-differenced and the model was reestimated.[10] However, differencing did not eliminate parameter inconsistency, which emerged with a different pattern.[11] This problem was nearly eliminated with an intercept dummy for 1974:III, a slope dummy for the 3-month T-bill rate from 1980:II through 1982:III, and slope dummies for the lagged dependent variable from 1980:III through 1982:III and from 1985:I through 1986:IV.

## PROXY

The real dollar volume of trading on the NYSE is used to proxy financial market trading. A composite proxy for financial market trading using all stocks traded on domestic exchanges, over-the-counter (OTC) stocks, corporate bonds, options and futures, used previously in an unpublished dissertation [Furey, 1987], produced approximately the same results as those using the more readily available NYSE proxy. The NYSE variable, which is the same as or similar to variables used by Modigliani, Rasche, and Cooper [1970], Field [1984], and Radecki and Wenninger [1986], was chosen to proxy all financial market trading.



**TABLE 2**
**First Difference Model**

| c | m(t-1) | RGNP | T-Bill | NYSE | Int.Dum. 1974:III | TB Sl. Dum 1980:II-1982:III | m(t-1) Sl. Dum. 1980:II-1982:III | m(t-1) Sl. Dum. 1985:I-1986:IV | Adjusted R2 |
|---|---|---|---|---|---|---|---|---|---|
| - .001 | .502 | .227 | - .017 | -- | - .014 | .048 | -1.14 | .549 | .5617 |
| (-1.27) | (5.71) | (2.77) | (- 2.27) | | (-1.76) | (3.17) | (-6.15) | (3.61) | |
| - .001 | .507 | .178 | - .011 | .011 | - .013 | .040 | -1.07 | .537 | .5832 |
| (-1.13) | (5.92) | (2.17) | (-1.40) | (2.54) | (-1.75) | (2.66) | (-5.87) | (3.62) | |

Durban *h* statistics of -1.61 and -1.34 respectively.
*t* statistics are in parentheses.

## ESTIMATES

The models are estimated with quarterly data from 1960:I through 1988:IV. The levels model uses iterated Cochrane-Orcutt to correct for serial correlation,[12] while the first-difference model is estimated using ordinary least squares (OLS). For each model, money demand is estimated twice, once with and once without the NYSE variable. The measure of real money balances used in each is the quarterly average of seasonally adjusted monthly M1 divided by the GNP deflator. Quarterly values for trading on the NYSE are obtained by summing the monthly values and dividing by the GNP deflator. All variables are in log form.

## EMPIRICAL RESULTS

Results of both models are given in Tables 1 and 2. In both, the dollar volume of trading on the NYSE is significant at the 98 percent level. Results of estimating the levels model before addition of NYSE (Table 1) are similar to other estimates of this equation: the speed of adjustment is slow (12.1 percent per quarter);[13] the T-bill rate is significant, with a short-run coefficient of -0.024 (-0.20 in the long run); and RGNP is significant with a short-run coefficient of 0.079 (0.65 in the long-run).

When NYSE is added, its short-run coefficient, 0.011, is significant (with a long-run coefficient of 0.09), and adjusted $R^2$ increases from .9919 to .9925. The coefficients on the lagged dependent variable and the T-bill rate are essentially unchanged, while the coefficient on RGNP declines from 0.079 to 0.052 but stays significant.

In the first-difference model (Table 2) all three explanatory variables are significant. When the NYSE variable is added, it enters significantly with a coefficient of 0.011, and the adjusted $R^2$ increases from .5617 to .5832. The effects of NYSE on the the lagged dependent variable and RGNP are the same as in the level estimations. However, the coefficient on the T-bill rate declines from -0.017 to -0.011 and becomes insignificant. This result is certainly unexpected; however, recursive regression of the model without

**TABLE 3**
**Out of Sample Forecasts**

| Model | 1982:III-1983:IV Absolute Mean Error[a] (Billions of dollars) | % of m1 | 1985:I-1986:IV Absolute Mean Error (Billions of dollars) | % of m1 |
|---|---|---|---|---|
| Levels | | | | |
| Without NYSE | 7.49 | 1.56 | 18.16 | 2.90 |
| With NYSE | 4.95 | 1.03 | 9.90 | 1.58 |
| First Difference | | | | |
| Without NYSE | 5.81 (4.75) | | 8.69 | |
| With NYSE | 5.41 (4.36) | | 8.29 | |

[a] Where the Mean Error differs from the Absolute Mean Error the value is put in parenthesis. Mean Error is defined as Observed - Predicted.

the NYSE variable shows the 3-month T-bill rate to be insignificant until 1982:IV and significant thereafter. Beginning in 1982:IV, several sizeable jumps in the level of financial market trading occurred. It is entirely possible that the T-bill rate only becomes significant because it is picking up the effect of the missing variable — financial market trading. The real puzzle is why this opportunity-cost variable is insignificant over the more than two decades prior to 1982:IV.

## FORECASTING

In a further attempt to test the hypothesis and its implication that financial market trading might help explain the periods of "too much money", I used the NYSE variable to forecast M1. Estimates of the two models were repeated for the sample periods 1960:I through 1982:II (and 1984:IV). The coefficients (and ρ for the levels model) from these regressions were then used to forecast the values of money demand (M1) in the periods 1982:III through 1983:IV and 1985:I through 1986:IV. The results of these forecasts are reported in Table 3, which gives the mean absolute error and, where different, the mean error in parentheses.[14] The levels model underpredicts money demand by an average of $7.49 billion (approximately 1.5 percent of M1) during the 1982-83 period and by an average of $18.16 billion (approximately 2.9 percent of M1) during 1985-86. This underprediction is reduced to $4.95 billion and $9.90 billion (by 34 and 45 percent) respectively when the NYSE variable is added. Such magnitudes certainly warrant the attention of economic forecasters and policy makers. Improvements in the first-difference model were much more modest with reductions in prediction error of 7 percent during 1982-83 and 5 percent during 1985-86.

## CONCLUSION

Evidence provided by regression estimates and forecasts strongly suggests that fluctuations in the dollar volume of financial market trading significantly affects money demand. This indicates that empirical estimates which use only measured income (permanent income or wealth) as a scale variable are misspecified, and monetary policy based on estimates is therefore flawed.



This study also supplies an explanation for at least part of the underprediction of money demand during the periods of "too much money". As shown in Figure 1, these periods coincided with a major surge in the dollar volume of financial market trading. This suggests that these unexpected increases in money demand may have been due, in part, to accelerated trading in financial markets.

## NOTES

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1. In addition, a few studies [Lieberman, 1977; Judd and Scadding, 1982; and Radecki and Wenninger, 1986] have attempted to capture the effect of all transactions by using bank debits to demand deposit accounts as a proxy. In general, estimations using this variable have outperformed those using only real GNP (RGNP) as the transactions variable.
2. However, Radecki and Wenninger seemed unimpressed with this result and concluded, based on other information, that "Even though stronger-than-expected M1 growth has occurred during a period of rapid growth in the volume of financial transactions, longer-relationships do not confirm that there is a strong linkage between the two" [1986, 29]. It should be noted that Radecki and Wenninger's "financial transaction" includes a broader range of transactions than just the trading of financial assets.
3. Institutional transactions are often for large dollar amounts with payments generally made via clearing house or Fed funds.
4. It appears, at least in part, that these funds come from the non-transactional segment of M2. In estimates of money demand using non-M1 M2 minus money market mutual fund accounts as the dependent variable, the coefficient on the proxy for financial market trading (explained later in the paper) is both negative and significant. This indicates that as financial market trading increases, funds flow out of the non-transactional segment of M2.
5. The results of the in-house study were provided by Kidder Peabody. Estimates of purchases and sales by check were A.G. Edwards & Sons, 60 percent; Dain Bosworth Inc., 50 percent; Edward D. Jones & Company, 40 percent.
6. The volume of financial market trading is defined as the sum of all components for which data is available. This includes stocks traded on the New York Stock Exchange, stocks traded on all other domestic stock exchanges, over-the-counter stocks, corporate bonds traded on the NYSE, options, and futures. To this an estimate of over-the-counter corporate bonds and municipal bonds is added, which together are assumed to have the same dollar volume of trading as stocks on domestic stock exchanges.
7. The hypothesis was also tested in the permanent income, wealth, rachet, gradual price adjustment, nominal price adjustment, and lagged explanatory variable models [Furey, 1987]. All exhibited essentially the same results.
8. A full set of slope and intercept dummies was tested. Some of the options, including a slope dummy on RGNP and the T-bill rate as suggested by Goldfeld and Sichel [1987], reduced parameter inconsistency and model instability during the period of "missing money" by a greater extent than did the simple intercept dummy. However, all of these options created parameter inconsistency and model instability during later periods where none had occurred previously and where none occurs with the intercept dummy. In addition, the statistical significance of these dummies disappeared after the period of "missing money". Therefore, I decided to use the simple intercept dummy; however, the choice of which dummy variable option to use does not affect the significance of the financial market trading variable.
9. The presence of the financial market trading variable itself markedly reduced parameter inconsistency and model instability during this period. Without this variable in the equation there were six model breaks (based on Chow tests) between 1982:III and 1986:IV; with it there were only three. Between those two dates the standard sample error (SSE) increased a total of 77 percent when the financial trading variable was absent, and only 32 percent when it was present.
10. Based on Dickey-Fuller tests all variables were found to be stationary after first-differencing.

11. The major contributor to parameter inconsistency was the period of money targeting, while the period of "missing money" had only a minor effect.
12. The Cochrane-Orcutt procedure was corrected for the presence of a lagged dependent variable.
13. Equation (3), which appears in the section entitled "Model", shows the speed of adjustment ($\lambda$) is obtained by subtracting the estimated coefficient on the lagged dependent variable from one. Long-run coefficients are then obtained by dividing the estimated short-run coefficients by the speed of adjustment.
14. Mean error is measured as actual M1 minus forecasted M1.

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