THE PENNSYLVANIA STATE UNIVERSITY SCHREYER HONORS COLLEGE

DEPARTMENT OF ECONOMICS

REWRITING THE MACROECONOMIC TEXTBOOK: IS THE QUANTITY THEORY OF MONEY DEAD?

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ABSTRACT

In this thesis, I examine how changes in macroeconomics in the United States should affect university macroeconomics textbooks, primarily through the lens of the quantity theory of money (QTM). I first investigate the validity of QTM by evaluating the relationship between inflation and money growth in the United States from 1959 to 2019. To test this relationship, several different econometric methods are utilized including standard OLS, Vector Autoregression, Vector Error Correction, and the associated Impulse Response Functions. I then employ these results, which clearly show a breakdown in the relationship between money growth and inflation after 1982, to comment on the current state of university macroeconomic textbooks. Additionally, I examine other issues related to QTM, such as the evolution of the federal funds targeting regime, particularly in the aftermath of the great recession, to further compare to the curriculum that university textbooks teach. Out of the three current textbooks examined, all three were discovered to have woefully out of date models and sections that misinform and inadequately prepare students. The supply-side and demand-side of the textbook industry are briefly investigated to conjecture as to why university macroeconomics textbooks are lagging behind.

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Chapter 1

Introduction

The quantity theory of money (QTM) dates back to the 17th century and states that there is a direct correlation between the quantity of money in the economy and the price level (inflation) of goods and services in the economy. In the 20th century, famous economists, Milton Friedman and Irving Fisher, revitalized the theory and proposed the following equation (Wen, 2006):

(1)

where M is the money supply, V is the velocity of money, P is the average price level, and

MV=PT

T is the volume of transactions of goods and services. Furthermore, QTM is focused on the prediction that "there will be a long-run

proportionate reaction of the price level to an exogenous increase in the nominal money stock." The theory implies that there is a *ceteris paribus* unity relationship between money growth and inflation (McCallum & Nelson, 2010).

This popular macroeconomic theory has been used by central banks and policymakers to meet the mandate of stable prices. In addition, this theory is taught in macroeconomic theory across the world and widely used in academia. The Federal Reserve has a dual mandate of stable prices and full employment (Federal Reserve Bank of Chicago, 2019). To achieve this goal, the Federal Reserve would ideally acquire a policy tool that 1) the Federal Reserve has close and reliable control over and 2) has a strong relationship with the desired goals. In the past, the Federal Reserve used money supply/growth as the tool also known as an intermediate target.

However, it is well known that money supply/growth no longer shares a close and reliable relationship with the Fed's goals nor is money supply/growth under reliable control by the Fed.

As a result, the Federal Reserve began to "deemphasize monetary aggregates" in 1982 and noted that it would not set money supply (M1) targets in February 1987. Roughly 6 years later, former Federal Reserve Chairman Alan Greenspan participated in Congressional testimonies and announced that the Federal Reserve would not "use monetary targets, including M2, as a guide for the conduct of monetary policy" (Mishkin, 2001). Prior to the Great Recession and financial crisis in 2008, the Federal Reserve would conduct monetary policy by influencing reserve supply via open market operations to target the federal funds rate. During and after the crisis, the Federal Reserve utilized large-scale asset purchases and its balance sheet in conjunction with forward guidance (when the central bank uses communication of its own forecasts to influence rate expectations) as its primary monetary policy tools. This change and focus on the Federal Reserve's assets rather than liabilities have led to the price of money being of much greater importance than the quantity theory of money in the economy (Friedman, 2014). Because of this, the popular macroeconomic quantity theory of money should no longer apply to the United States economy and may not apply to other countries around the world.

During the 2013 American Economic Association Conference, a panel, moderated by Janet Yellen, titled "After the Crisis: What Did We Learn, and What Should We Teach, about Monetary Policy?" proposed some significant conclusions. Benjamin Friedman, a leading American political and monetary economist at Harvard University, stated that M (money) should be removed from all economic textbooks. When asked if that meant the quantity theory of money is dead, he replied that yes, except in the very long run (Chuderewicz, 2019). The main point of conducting this analysis is to investigate whether the quantity theory of money should still be included in macroeconomic textbooks in anything but a historical context. Currently, macroeconomic and money and banking textbooks being published and used by universities, such as Penn State, still present the quantity theory of money as a valid and utilized theory. The textbooks in this study will be an introductory macroeconomics text, an intermediate macroeconomics text, and a money and banking text all used by professors at Penn State. These examined textbooks also infer that the Federal Reserve uses open market operations on a daily basis to target the federal funds rate, which is not the case any longer and has not been the case since the Fed made the federal funds rate near zero in December 2008. The goal of my research is to highlight how current monetary policy is conducted and how it differs from the content presented in textbooks used by economics professors, effectively showing that QTM should only be taught in a historical way. The topic will be examined strictly in the context of United States monetary policy since US textbooks focus on the US Federal Reserve policy.

This analysis will contribute to the overall literature of the QTM, by conducting regressions pre and post-financial crisis of 2007-08. In addition, textbooks used at Penn State from a major publisher, Pearson, will be examined to determine the validity of the proposed curriculum in terms of the QTM, money supply, and Federal Reserve policy, including open market operations. This will include the removal of the LM element of the IS/LM model in macroeconomic books that were sampled. Various time series models will be used to conduct a regression analysis on the relationship between inflation and money growth from 1947-2019.

Chapter 2

Literature Review

There have been numerous research studies conducted on the quantity theory of money (QTM). This literature review will highlight findings as they relate to my analysis and regressions.

Thomas Sargent and Paolo Surico (2011) extended the regression coefficients that Lucas (1980) used in the expression of QTM analysis to a longer US dataset. Lucas (1980) used near unit slopes of univariate regressions of moving averages of inflation and interest rates on money growth for the United States for the period 1953–1977. Sargent and Surico attribute the differences in Lucas' regression coefficients that he deduced conclusions from to the differences in the monetary policies across the same timeframes, so they sought to extend the time period to account for changes in monetary policy. Building on Lucas' depictions of the post-World War II break down in QTM, Sargent and Surico find using United States data that the theory additionally breaks down in the period between 1955-75 and 1960-83 within their Dynamic Stochastic General Equilibrium (DSGE) model. The researchers attribute these breakdowns to monetary policy. Due to the complexity of the model, this will not be added to this paper's overall analysis. However, the conclusions are worthwhile to examine, as they indicate that in fact, QTM does break down and the historical record proves this. Moreover, Sargent and Surico attempt to account for monetary policy in their model, while this paper will strictly examine the relationship between inflation and money growth and accepts monetary policy changes as a result of the breakdown of the relationship.

Maria Cristina Marcuzzo (2017) finds that despite increased liquidity in quantitative easing markets, deflation has occurred "due to the liquidity trap environment in which the banking system operated." Marcuzzo notes that the recent money expansion experiments conducted by the Federal Reserve, Bank of Japan, and the European Central Bank, have provided data to test the validity of QTM. While Marcuzzo does not conduct a regression analysis, the conclusions presented in this paper are important as they emphasize the gap that my analysis intends to address. The researcher highlights a study conducted by Michael Graaf (2008) that uses annual datasets from 1991 to 2005 from 105 countries. Graaf concludes that "these analyses leave no doubt that for our sample period, i.e., the years since 1991, the classical proportionality theorem does not hold." The metadata analysis in Marcuzzo's 2017 paper highlights that QTM is not an accurate predictor of inflation. Marcuzzo additionally cites that QTM supporters such as Martin Feldstein have recently commented on the breakdown of the relationship. Feldstein (2015) writes:

The low rate of inflation in the US is a puzzle, especially to economists who focus on the relationship between inflation and changes in the monetary base. To solve it requires understanding the change in the role of the reserves that commercial banks hold at the Federal Reserve.

Furthermore, Hillinger, Süssmuth, and Sunder (2015) perform an analysis of the time series and cross-sectional properties of central variables of the Cambridge-form of the QTM equation of exchange across a global sample of large countries. They examine the equation where:

(2) M = k x Y

Where *M* is money demand, *k* is a parameter that is related to liquidity preference and equal to 1/V where V is velocity, and Y is a country's nominal expenditure (usually identified with nominal Gross Domestic Product (GDP)).

Hillinger, Süssmuth, and Sunder operationalize Y as the nominal GDP in the local currency, M as either M1 or M2, and examine P (price level) while considering the GDP deflator and the CPI measure. The researchers note that the CPI measure is the most suitable between the two price level metrics. They also take the nominal lending interest rate into account for the time series tests. The data is derived from the World Bank's World Development Indicators (WDI) database. Hillinger, Süssmuth, and Sunder primarily focus on the liquidity preference parameter of the equation. Contrary to a variety of existing studies on QTM that utilize longitudinal data on a high number of countries over a long time period, Hillinger, Süssmuth, and Sunder, instead, approach the study by focusing on secular time aggregation of the central variables of the QTM. The researchers do not consider several year averages that are used in other literature on QTM (usually, five-year averages; Grauwe and Polan 2005). While relaxing the constancy assumption of Milton Freidman's equation, Hillinger, Süssmuth, and Sunder conclude that Friedman's assertions about the US are supported by the researcher's use of cross-country analysis.

The 2015 study, finds that "liquidity preference to also internationally grow secularly by about 2 percent p.a. on average." Hillinger, Süssmuth, and Sunder argue that this statement also applies to both high-inflation and low-inflation countries. The researchers note that the key to their conclusions is that while k is not a true constant, it evolves at a "modest pace in the long run" similarly over the countries included in the study. Furthermore, they assert that the equation of exchange could indeed provide some monetary policy guidance for central bank decision-makers in the spirit of Friedman (1956, 1959).

While my analysis will not consider the Cambridge *k*, it was valuable to investigate the option and be knowledgeable of this method because it is a popular model to test QTM. The Cambridge k tests the assumption that velocity is stable to prove or disprove QTM. My analysis is more concerned with testing the relationship between inflation and money growth regardless of velocity. Hillinger, Süssmuth, and Sunder conduct a cross-sectional study across a large number of countries, my analysis will strictly focus on the United States which allows for the use of data that is taken more frequently (as opposed to the researcher's use of annual data). Furthermore, my analysis will be conducted using time series regressions, instead of cross-sectional/panel analysis, since the US is the only country being observed and the goal of my research is to examine how and if QTM has changed over time.

Alexandru Patruti and Alina Tatulescu (2013) regress an inflation metric on money growth in Romania from January 2008 to September 2013. The selected data sets included M2 data made available by the National Bank of Romania and the consumer price index (CPI) information from the Romanian National Institute of Statistics. Similarly, the data sets used in this paper will be provided by the St. Louis Federal Reserve Bank (FRED). The researchers found that in September 2018, the money supply was more than 1.5 times the size as it was represented in January 2008. Additionally, Patruti and Tatulescu conclude that the variation in the CPI in the Romanian economy over the selected period can be explained by the variation in money supply. The researchers argue that the comparatively low inflation that Romania has experienced can be attributed to the National Bank of Romania's policy decisions to keep the supply of money roughly constant. While the variables in this study are stationary, the overall goals and the regression model will be consistent with the setup of this paper's analysis. Özgür Aslan and Levent Korap (2007) use time series data and conduct an OLS regression between price level, output and inflation to examine the validity of the QTM relationship in the Turkish economy. Due to the non-stationary nature of their variables, they utilize co-integration tests for the two variables. Furthermore, the researchers desired to test the neutrality of money. This consisted of testing the I() level of each variable in order to draw conclusions about the exogeneity of money supply. Aslan and Korap find that monetary aggregates "seem to be endogenous for the long-run evolution of prices and real income." Since the researchers wanted to draw conclusions about variables other than inflation and were concerned about neutrality, their regression and methods were more complex and not exactly what this paper intends to use. However, the use of co-integration can be applied to the analysis in this paper. Furthermore, the use of VAR and Vector Error Correction (VEC) will be pertinent in conducting the analysis in this paper.

Chapter 3

Data

I employed historical time series data is to investigate the direct relationship between inflation and money growth in accordance with the QTM. Implicit in my investigation, I assume that the velocity of money is a constant. This is consistent with the standard classical assumption that underlies QTM stating that V is stable (Friedman, 1956). Since V is assumed stable, this analysis will be determining if inflation reacts to money growth in a systematic way. The data collected for this empirical study is sourced from the Federal Reserve Economic Data (FRED) hosted by the Federal Reserve Bank of St. Louis and is publicly available (fred.stlouisfed.org).

Data is monthly with the entire sample consisting of 1959M1 to 2019M7. The time series variable of the price level is the *Personal Consumption Expenditures: Chain-type Price Index* (PCEPI) on FRED. From this series, we generate the inflation variable "INFALL," the one-year percentage change in series (PCEPI). M1 was the chosen monetary aggregate given that the Federal Reserve used to set money supply targets based on M1 (Mishkin, 2001). *M1 Money Stock* (M1SL) from FRED sourced the data for this aggregate. This data was transformed into the variable "M1GROW" by taking the one-year percentage change of M1SL.

Chapter 4

Methodologies

Unit-Root Tests

Since we are working with time series data, I began by testing the stationarity of the variables. By far the most utilized test for stationarity in time series data is the Augmented Dickey-Fuller test (ADF). If a variable is non-stationary, spurious regression problems could arise. According to Granger and Newbold (1974), non-stationary variables will lead to biased standard errors that create correlations where they may not exist. For instance, in a standard OLS regression, a high r-squared value is likely to be present even if the variables are independent of each other. A popular example of a spurious correlation between two variables is what is known as the Super Bowl indicator. This example states that a win by the AFC team likely will result in the stock market going down in the coming year, and a victory by the NFC team indicates a rise in the market for coming the year. Since 1966, the indicator has had an accuracy rate of 80% (Kenton, 2019). Even though a strong relationship exists, it is clear it is spurious as the Super Bowl winner and market performance can surely be thought of as independent events.

Because of these spurious regression problems in time series data, a standard OLS regression is not suitable given the non-stationarity time series variables. This is why it is paramount to conduct ADF unit root tests in order to determine the stationarity of the variables involved. The augmented Dickey-Fuller unit root test is typically employed to investigate whether time series variables are stationary or not. Below is an example of an ADF test on variable X:

(3)
$$X_t = \alpha + \beta X_{t-1} + \varepsilon_t$$

Subtract Xt-1 both sides of the equation

(4)
$$\Delta X_t = \alpha + (\beta - 1) X_{t-1} + \varepsilon_t$$

Where $\delta = \beta$ -1, the augmented df terms are lags of the dependent variable

(5)
$$\Delta X_{t} = \alpha + \delta X_{t-1} + \psi_{i} \Delta X_{t-i} \varepsilon_{t}$$

The presence of a unit root dictates that $\beta = 1$ which means $\delta = 0$. If an ADF fails to reject the null of a unit root at the 5% level, δ is insignificantly different from zero, and the series X is said to be non-stationary (contains a unit root). If an ADF rejects a unit root at the 5% level, δ is significantly different from zero, the series X is stationary, and the standard error is not biased.

Note that lagged dependent variables, if needed, are added to the right-hand side of the equation to deal with the possible serial correlation issues with the residuals. The null hypothesis of the ADF tests is that the series does contain a unit root - a failure to reject the null hypothesis indicates that the variable is non-stationary. The estimated t-statistic from the unit root test will be compared to the MacKinnon (1996) critical values. For a variable to be stationary, the augmented Dickey-Fuller T-statistic must be larger in absolute value when compared to the 10%, 5% or 1% critical values, depending on the threshold. A maximum of 19 lags was used, and the optimum lag for the test was determined by minimizing the Hannan-Quinn criterion. The results

of the augmented Dickey-Fuller tests for inflation and money growth for the entire sample are given below in Table 1:

Variable Name	t-Statistic	10% Threshold	5% Threshold	1% Threshold
		Value	Value	Value
INFALL	-2.634968	-2.568916	-2.865464	-3.439490
M1GROW	-4.059745	-2.568919	-2.865470	-3.439504

Table 1: Augmented Dickey-Fuller Test on Inflation and M1 Growth

Referring to Table 1, The augmented Dickey-Fuller test rejects the null hypothesis that inflation has a unit root but only at the 10% level. We cannot reject that inflation is nonstationary at the 5% level. Conversely, the test strongly rejects that M1 growth has a unit root at all confidence levels, so we can conclude that M1 growth is stationary for the entire sample.

As cited earlier in the paper, the Federal Reserve began to "deemphasize monetary aggregates" in 1982 (Mishkin, 2001). This will be our designated break date. Because of this break, the dataset has been split in two, and another round of augmented Dickey-Fuller tests must be conducted. Specifically, the dataset has been split into 1959M1-1982M6 and 1982M7-2019M7. The augmented Dickey-Fuller tests are conducted on inflation and M1 growth for each time period for a total of four tests. The ADF results are below in Tables 2:

Table 2: Augmented Dickey-Fuller Test on Inflation and M1 Growth 1982 Split

Variable Name	t-Statistic	10% Threshold	5% Threshold	1% Threshold
		Value	Value	Value
INFALL	-1.594301	-2.572754	-2.872630	-3.455786
(1959M1 -				
1982M6)				

M1GROW	-2.441214	-2.572754	-2.872630	-3.455786
(1959M1 -				
1982M6)				
INFALL	-3.670852	-2.570176	-2.867815	-3.444823
(1982M7 -				
2019M7)				
M1GROW	-2.950130	-2.570168	-2.867801	-3.444790
(1982M7 -				
2019M7)				

Methodology for Period: 1959M1-1982M6

As Table 2 indicates, neither inflation or M1 growth are stationary from the period of 1959M1-1982M6. Since both variables in the regression are I(1) variables, we need to employ something other than standard OLS given the spurious regression problem alluded to earlier if the variables are cointegrated. Given economic theory and basic time series econometrics, the first test we ran was a cointegration test. The concept of cointegration was introduced by Granger (1981) and Engle and Granger (1987). Variables are considered cointegrated if they "share a common stochastic trend such that a linear combination of these variables is stationary" (Kilian & Lütkepohl, 2017). OLS and other conventional regression estimators have difficulties when applied to non-stationary or integrated processes. Granger and Newbold (1974) characterized these difficulties by introducing the concept of spurious relationships. Additional work by Engle and Granger in 1987 noted that two or more integrated and non-stationary time series may be cointegrated. A combination of these series could then be stationary even though each series is not stationary (Baum, 2013). Table 3 provides the results of the Johansen Cointegration Test:

Table 3: Cointegration Tests on Inflation and M1 Growth (1959M1-1982M6)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.058612	19.80903	15.49471	0.0105
At most 1	0.014249	3.803195	3.841466	0.0511

Unrestricted Cointegration Rank Test (Trace)

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted	Cointegration 1	Rank Test	(Maximum	Eigenvalue)
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Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.058612	16.00583	14.26460	0.0263
At most 1	0.014249	3.803195	3.841466	0.0511

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

The results from Table 3 indicate that the two series are cointegrated which is consistent with inflation and money growth sharing a long-run relationship, consistent with the quantity theory of money. Given the cointegration results, the appropriate methodology would be to estimate Vector Error Correction models (VEC). If the variables in a regression are not covariance stationary, but the first differences are, along with the variables being cointegrated (as above), the relationship between the two variables may be modeled utilizing a vector error correction (VEC) model. The cointegration equation is as follows:

(5)
$$INFALL = -3.316769 + (1.519497)M1GROW_{t-i}$$

I obtained the above coefficients from the following output:

Table 4: Cointegration Coefficients on Inflation and M1 Growth (1959M1-1982M6)

Vector Error Correction Es Date: 02/23/20 Time: 16: Sample (adjusted): 1961M Included observations: 25	Vector Error Correction Estimates Date: 02/23/20 Time: 16:47 Sample (adjusted): 1961M02 1982M06 Included observations: 257 after adjustments		
Standard errors in () & t-s	tatistics in []		
Cointegrating Eq:	CointEq1		

Cointegrating Eq:	CointEq1	
INFALL(-1)	1.000000	
M1GROW(-1)	-1.519497 (0.27606) [-5.50418]	
С	3.316769	

Methodology for Period: 1982M7-2019M7

As Table 2 indicates, both inflation and M1 growth are stationary from the period of 1982M7-2019M7. Since both variables in the regression are I(0) variables, we can employ standard OLS given there are no spurious regression problems alluded to earlier. In addition, a vector autoregression (VAR) can be utilized and is especially useful for stationary time series data. For instance, VARs, introduced by Christopher A. Sims in 1980, suggested that VARs are "useful statistical devices for evaluating alternative macroeconomic models" (Parker, 2013). Over three decades later, VARs still play a role in the evaluation of alternative models. Sims outlined three purposes that VARs may be useful including for including: "(1) forecasting economic time series; (2) designing and evaluating economic models; (3) evaluating the consequences of alternative policy actions" (Christiano, 2012). The expressions of the VAR that will be utilized in this analysis is as follows:

(6)
$$INFALL = \beta_i INFALL_{t-i} + \delta_i M 1 GROW_{t-i}$$

(7) $M1GROW = \alpha_i INFALL_{t-i} + \psi_i M1GROW_{t-i}$

It is argued that VARs are one of the easiest to use and flexible models for multivariate economic and financial time series analysis (Zivot & Wang, 2006). Additionally, VARs are useful for forecasting and examining the dynamic behavior of time series data. Forecasts from VAR are flexible because they can often be made conditional on potential paths of the variables in the model. VARs are also helpful for structural and policy analysis (Zivot & Wang, 2006). Estimating the equations of a VAR does not require strong identification assumptions. However, some of the most useful applications do require these assumptions, including calculating impulse response functions and variance decomposition (Parker, 2013) The application of VARs in financial data are given in papers by Hamilton (1994), Mills (1999), and Tsay (2001) (Zivot & Wang, 2006)

Chapter 5

Results

Results for Period: 1959M1-1982M6

Impulse-response functions (IRFs) "describe the evolution of the variable of interest along a specified time horizon given exogenous shocks of either variable" (Alloza, 2017). Our interest in employing the QTM is to investigate the reaction to inflation, given an exogenous shock to money growth. In short, IRFs track the impact of specific variables on the others (Lin, 2006). The graphic below depicts the IRF's from our estimated 2 variable VEC. We are particularly interested in the upper righthand graphic that depicts the response of inflation to a one standard deviation (positive) shock to M1GROW. As you can see from the graphic, inflation responds to money growth which is consistent with QTM assuming that V is stable i.e., "inflation is always and everywhere a monetary phenomenon" (Friedman, 1970).



Figure 1: VEC Impulse Response Function of Inflation and M1 Growth (1959M1-1982M6)

Results for Period: 1982M7-2019M7

Moving onto the second time period in which the variables are stationary, we can employ a standard OLS regression. Again, in accordance with QTM, we are interested in the relationship between M1 growth (independent variable) and inflation (dependent variable). Twelve onemonth lags were used to account for the lag between the two variables' relationship. The coefficient and t-statistic on M1GROW can be viewed below in Table 5:

 Table 5: OLS Regression of Inflation on M1 Growth (1982M7-2019M8)

Variable Name	Coefficient	Standard Error	t-Statistic	Probability
M1GROW(-12)	0.004027	.010558	.381451	.7031

Constant (C)	2.320645	.086182	26.92717	0.0000

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As we can see, the coefficient on M1GROW is extremely small and is not statistically different from zero. In addition, the t-statistic for M1GROW is not close to significant. This is consistent with a breakdown in QTM over the latter time period. Inflation no longer increases significantly to an increase in money supply. Another observation of note is that there may be possible serial correlation with the residuals. In order to remedy this, lagged dependent variables are added to the right-hand side of the regression equation, and the OLS regression is updated. The number of lagged dependent variables added to the OLS equation was determined by minimizing the Schwarz and Akaike Criterions. The results are below in Table 6:

Table 6: OLS Regression of Inflation on M1 Growth with Lagged Inflation(1982M7-2019M7)

Variable Name	Coefficient	Standard Error	t-Statistic	Probability
M1GROW(-12)	0.001041	0.002163	0.481128	0.6307
INFALL(-1)	1.341284	0.043884	30.56410	0.0000
INFALL(-2)	-0.381324	0.043595	-8.747014	0.0000
Constant (C)	0.081492	0.028808	2.828785	0.0049

The data once again shows a breakdown in the QTM relationship between inflation and money growth. The coefficient on M1GROW is even smaller than in Table 5 and is almost zero. The t-statistic on M1GROW is, again, not close to significant. The dependent variable, INFALL, was lagged twice in order to eliminate serial correlation in the error term.

If the error term is serially correlated, the estimated OLS standard errors are invalid and the estimated coefficients will be biased and inconsistent due to the presence of a lagged dependent variable on the right-hand side. The Durbin-Watson statistic is not appropriate as a test for serial correlation in this case since there are lagged dependent variables on the right-hand side of the equation. To remedy this, we ran a Breusch–Godfrey Serial Correlation LM test to determine if serial correlation was present in the residuals. As evidenced by Table 7, none of the lags are significant, so we fail to reject the null hypothesis that there is no serial correlation up to lag order 2.

Variable Name	t-Statistic	Probability
RESID(-1)	0.228489	0.8194
RESID(-2)	0.019595	0.9844
RESID(-3)	-0.602411	0.5472
RESID(-4)	1.310596	0.1907
RESID(-5)	-0.417176	0.6768
RESID(-6)	0.464055	0.6428
RESID(-7)	0.330920	0.7409
RESID(-8)	-1.113281	0.2662
RESID(-9)	1.469310	0.1425
RESID(-10)	1.517345	0.1299

Table 7: Breusch–Godfrey Serial Correlation LM Test

Finally, by employing a 2 variable VAR for inflation and M1 growth displayed in equations (6) and (7), an IRF can be generated. Once again, we are interested in the upper righthand graphic that depicts the response of inflation to a one standard deviation (positive) shock to M1GROW. As you can see from the graphic, inflation does not significantly respond to the shock (95% confidence intervals in red). This is inconsistent with QTM but consistent with our OLS results for this time period.



Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

Figure 2: VAR Impulse Response Function of Inflation and M1 Growth (1982M7-2019M7)

Chapter 6

Discussion

Implications on Textbook Content

In the introduction of this paper, I discussed how a leading political economist at Harvard stated that "M should be removed from all textbooks." That is because money means next to nothing when it comes to Federal Reserve policy and the macroeconomy. Unfortunately, textbooks still include money and teach outdated models to students. To illustrate this point, I have examined three textbooks: an introductory macroeconomics textbook, an intermediate macroeconomics textbook, and a money and banking textbook. All three of these textbooks are used for corresponding courses at Penn State and are all published by a leader in the industry, Pearson. Furthermore, I have included images directly from these three textbooks within this section to accurately depict what these texts teach. Nothing exemplifies how outdated these textbooks are more than their inclusion of the IS/LM Model and the implied role of money in the economy. I will then examine how the reserve market and the federal funds market is treated in Mishkin's 2020 Money and Banking textbook. Finally, I will discuss some of the possible economic reasons for this inertia in terms of updating these textbooks at the end of this section.

IS/LM Model

The "investment-savings" (IS) and "liquidity preference-money supply" (LM) Keynesian macroeconomic model, otherwise known as the Hicks–Hansen model, demonstrates both the real

and the financial parts of the economy. The IS curve represents equilibrium in product markets and slopes downwards due to the notion that higher interest rates reduce spending and therefore lowers the level of output where demand equals supply (The Economist, 2005). Moreover, the LM curve represents equilibrium in the money market and slopes upwards because increased income raises money demand, thus raising the interest rate where money supply and money demand are equal (The Economist, 2005).





To understand the IS/LM model, it is first necessary to understand that the entirety of the model relies on the assumption that the Federal Reserve utilizes its control over nominal money supply (M) to target the federal funds rate. The Federal Reserve exercises this control through open market operations. For example, the figure above, from Hubbard's 2019 introductory macroeconomics textbook, shows that an increase in M results in an increase in the real supply

of money and shifts the MS curve to the right to MS₂. For a constant level of output (Y), the real interest rate that clears the market falls from 4% to 3%.



Figure 4: Abel, Bernanke, & Croushore, 2020, p. 336.

Now we can examine how an increase in the M affects the LM curve according to the model. Figure 4 above is from Bernanke's et al (2020) intermediate macroeconomics book. The graph on the left again demonstrates an increase in MS and is identical to Figure 3 except that all is in real terms. Nominal money supply M is replaced with real money supply (M/P). Nominal money demand is now real money demand and nominal interest rates (i) are now real interest rates (r). The graph on the right is the effect of this increase in the real money supply on the LM curve. For any level of output, the increase in the real money supply causes the real interest rate that clears the money market to fall, so the LM curve shifts down and to the right from LM(M/P=100) to LM(M/P=1200). The book adds that "because the real money supply equals

M/P, it will increase whenever nominal money supply, M, which is controlled by the central bank, grows more quickly than the price level" (Abel, Bernanke, & Croushore, 2020, p. 337).



Figure 5: Abel, Bernanke, & Croushore, 2020, p. 345.

Both textbooks address what the ultimate result is on price level when the Federal Reserve increases the money supply. The intermediate text adds the IS curve to the LM curve to complete the model and to show the final result. This can be seen in Figure 5. In the graph on the left, with price level fixed, a 10% increase in M by the Federal Reserve, increases MS and shifts the LM curve down and to the right to LM₂, and the real interest rate has fallen to 3% (point F). Since the real interest rate has fallen, the aggregate demand (AD) for goods increases which increases firm output resulting in an increased Y. In the graph to the right, AD exceeds fullemployment (point F), so firms raise prices. A price increase of 10% is required to offset the 10% increase in M to restore MS to its original position and shift the LM curve back to LM₁. The economy is back at point E where output is at the full-employment level of 1000, but the price level has risen 10% from 100 to 110. In conclusion, according to this model, when M increases by 10%, prices/inflation rise by 10%, which is exactly what QTM states.



Figure 6: Hubbard & O'Brien, 2017, p. 523

Figure 6 above from the introductory macroeconomics text comes to a similar conclusion. Price level is on the left axis, and the graph represents expansionary monetary policy. Output is stimulated by lower interest rates caused by expansionary monetary policy as defined as an increase in the money supply. The increase in money supply is represented as an increase in aggregate demand (AD) and thus an increase in the general price level (inflation). Hence, it is argued that increases in money supply are associated with an increase in the general price level aka QTM.

As exemplified above, it should be clear that the IS/LM model is predicated, in part, on the quantity theory of money. If M is increased, P will increase. This paper has already demonstrated with various econometric techniques that QTM is no longer valid in the United States and broke down after the Federal Reserve deemphasized monetary aggregates in 1982. The regressions in this paper proved that inflation does not significantly react to increases in the money supply in the short or long-run. The picture below from FRED further emphasizes this point by illustrating that inflation has stayed relatively constant while M1 has had major fluctuations in recent years. In fact, the average growth rate in the money supply (M1) from September 2008 to January 2020 was 9.5%, and the average inflation rate during the same time period is 1.4%, which is clearly not consistent with the textbooks alluded to above.



Figure 7: Federal Reserve Economic Data: FRED: St. Louis Fed

To repeat, the intermediate textbook (in 2020) states that a 10% increase in M will result in a proportional 10% increase in inflation. In 2020, teaching a model with that conclusion is detrimental to students and is grossly incorrect. The Federal Reserve at one time utilized money supply as its intermediate target to pursue the dual mandate, but the Federal Reserve no longer has close and reliable control over money supply due to the instability of MD, and MS no longer has a strong relationship with the desired dual mandate due to the breakdown of QTM. That is why money aggregates were deemphasized all the way back in 1982 and why Benjamin Friedman suggested that it should be removed from textbooks. Furthermore, it is well known that the Federal Reserve has been undershooting its inflation target of 2% consistently over the past decade (at least). Even with three rounds of quantitative easing, inflation remained and remains muted. If there was a relationship between money growth and inflation, the Fed surely would have fixed the problem by now.

Additionally, in order to have any control over M and MS, the Federal Reserve would have to conduct open market operations. The IS/LM is under this assumption too, but open market operations are a relic of the past. When the Federal Reserve obtained the authority to pay interest on reserves in October of 2008 and hit the subsequent zero-bound in December of 2008, the conduct of monetary policy transitioned to a floor and ceiling method to control the policy rate, the federal funds rate. This method of conducting monetary policy is not, in any shape or form, connected to changes in money supply or reserves via open market operations. This idea will be further explored next when a money and banking textbook is examined.

Reserves and the Federal Funds Rate

Along with all the issues and problems in macroeconomics textbooks regarding QTM and the role of money in the economy, there are serious errors in the treatment as to how the Fed currently targets the federal funds rate. Since the Federal Reserve deemphasized the role of monetary targets in the early 1980s, the Fed has been focused on targeting the federal funds rate via reserve supply and reserve demand in the market for reserves. Every business day, the Fed (FRBNY and the monetary affairs division of the Federal Reserve Board of Governors) would

predict reserve demand and supply the necessary reserves, via open market operations, to

achieve the target for the federal funds rate set by the FOMC. For example, in Miskin's most

recent money and banking textbook from 2019, there is a box titled "Inside the Fed: A day at the

trading desk."

Inside the Fed A Day at the Trading Desk

The manager of domestic open market operations supervises the analysts and traders who execute the purchases and sales of securities in the drive to hit the federal funds rate target. To get a grip on what might happen in the federal funds market that day, the manager's workday starts early in the morning, around 7:30 a.m., when her staff presents a review of developments in the federal funds market the previous day and an update on the actual amount of reserves in the banking system the day before. Then the staff produces updated reports that contain detailed forecasts of what will be happening to some of the short-term factors affecting the supply and demand of reserves (discussed in Chapter 14). For example, if float is predicted to decrease because good weather throughout the country is speeding up check delivery, the manager of domestic open market operations knows that she will have to conduct a defensive open market operation (in this case, a purchase of securities) to offset the expected decline in reserves and the monetary base from the decreased float. However, if Treasury deposits with the Fed are predicted to fall, a defensive open market sale would be needed to offset the expected increase in reserves. The report also predicts the change in the public's holding of currency. If currency holdings are expected to rise, then, as we saw in Chapter 14, reserves will fall, and an open market purchase is needed to raise reserves back up again.

This information helps the manager of domestic open market operations and her staff decide how large a change in nonborrowed reserves is needed to reach the federal funds rate target. If the amount of reserves in the banking system is too large, many banks will have excess reserves to lend that other banks may have little desire to hold, and the federal funds rate will fall. If the level of reserves is too low, banks seeking to borrow reserves from the few banks that have excess reserves to lend may push the funds rate higher than the desired level. Also during the morning, the staff will monitor the behavior of the federal funds rate and contact some of the major participants in the market for reserves, which may provide independent information about whether a change in reserves is needed to achieve the desired level of the federal funds rate.

Members of the manager's staff also contact several representatives of the primary dealers with whom the open market desk trades. Her staff finds out how the dealers view market conditions to get a feel for what may happen to the prices of the securities they trade in over the course of the day. They also call the Treasury to get updated information on the expected level of Treasury balances at the Fed to refine their estimates of the supply of reserves.

Members of the Monetary Affairs Division at the Board of Governors are then contacted, and the New York Fed's forecasts of reserve supply and demand are compared with the Board's. On the basis of these projections and the observed behavior of the federal funds market, the desk formulates and proposes a course of action to be taken that day, which may involve plans to add reserves to or drain reserves from the banking system through open market operations. If an operation is contemplated, the type, size, and maturity will be discussed.

At about 9 a.m., a daily conference call takes place, linking the desk with the Office of the Director of Monetary Affairs at the Board of Governors and with one of the four voting Reserve Bank presidents outside New York. During the call, a member of the open market operations unit outlines the desk's proposed reserve management strategy for the day. After the plan is approved, it is announced to the markets at 9:30 a.m., and the desk is instructed to execute immediately any temporary open market operations that are planned for that day.

At times, the desk may see the need to address a persistent reserve shortage or surplus and may wish to arrange an operation that will have a more permanent impact on the supply of reserves. These operations, referred to as *outright operations*, involve a straightforward purchase or sale of securities that is not self-reversing, and they are traditionally executed later in the day, when temporary operations are not being conducted. Even when outright operations are not being conducted, the manager of domestic open market operations and her staff do not sit idle for the rest of the day. They are continually monitoring the markets and bank reserves to plan for the next day's operations.

Figure 8: Mishkin, 2019, p.352

Mishkin states that the manager of domestic operations and her staff begin the day with a review of developments in the federal funds market the previous day with an update on the actual amount of reserves in the banking system the day before. This information will help the manager and her staff decide how large a change in non-borrowed reserves is needed to reach the federal funds target. If the amount of reserves in the banking system is too large, many banks will have excess reserves to lend that other banks may have little desire to hold, and the federal funds rate will fall. If the level of reserves is too low, banks seeking to borrow reserves from the few banks that have excess reserves to lend may push the funds rate higher than the desired level.

Mishkin describes this process accurately, and this how the process functioned until September – December of 2008. Since the end of 2008, the Fed has utilized a floor and ceiling system to target a range for the federal funds rate that is in no way shape or form consistent with Mishkin's 'Inside the Fed' box. This change occurred when the Fed received the authority to pay interest on reserves (October 2008), and total reserves in the system went from \$46 Billion in August of 2008 to \$821 Billion in December of 2008 (FRED). September of 2008 was arguably the height of the financial crisis as Lehman Brothers went bankrupt, and Bank of America purchased Merrill Lynch on September 15th. The Fed started injecting reserves on a massive scale. Naturally, the old system of predicting reserve demand and supplying the necessary reserves to hit the funds rate target would not work anymore given the tremendous increase in reserve supply. The Wall Street Journal explains that "since the Fed has pumped \$2.5 trillion into the economy by purchasing bonds, **the old system won't work unless the central bank pulls much of this money out**" (McGrane & Hilsenrath, 2013). Instead, the Fed will be "offering investors and banks interest on their funds" (McGrane & Hilsenrath, 2013). Before moving on to how exactly the new system works, let us examine how Mishkin, in his money and banking textbook, treats the reserve market given that the Fed has the authority to pay interest on reserves. Consider the figure below from Mishkin (2019):



Figure 9: Mishkin, 2019, p. 346

Mishkin argues that the interest rate on reserves serves as the lower bound for the federal funds rate and that the discount rate serves as the upper bound. When the Fed increases reserve supply through open market purchases (left-hand panel), like in the old system, the federal funds rate will fall. The only difference is that the Fed has more control over the federal funds rate. It is often difficult to predict reserve demand, and if the predicted reserve demand is significantly different than actual reserve demand, the funds rate will not be at target. Consider the figure below during the Russian financial crisis (1998):



Figure 10: Federal Reserve Economic Data: FRED: St. Louis Fed

For example, during the Russian Financial crisis, money markets became volatile, and it was very difficult to predict reserve demand and thus, very difficult to hit the federal funds rate target. Consider September 30, 1998, when the target for the federal funds rate was 5.25%, but the actual funds rate was 6.14%, a miss of 89 basis points (.89%) on the upside. Then on October 7, the target was still 5.25%, but the actual funds rate was 4.57%, a miss of 68 basis points (.68%) on the downside. Given this reality, the original reason why the Fed desired the authority to pay interest on reserves (IOR) was to have better control of the federal funds rate. For example, the system presented by Figure 9 from the Mishkin textbook would address the problem from Figure 10 above. In that case, the funds rate will never fall below the interest rate on reserves because if it did, member banks will borrow reserves in the federal funds market and hold them with the Fed at the higher IOR. The funds rate will never go above the discount rate since banks would presumably borrow from the discount rate rather than borrow at the higher

funds rate. However, this system totally breaks down in a world with significant excess reserves (i.e. since September of 2008).

How the System Works Now

Given the abundance of excess reserves, the system is still a ceiling-floor system similar to above. The big difference is that the IOR serves as the upper bound, not the lower bound, and the rate on reverse repos (IRRP) serves as the lower bound. The Fed created the reverse repo facility to give participants in the federal funds market a place to park their cash, namely government-sponsored enterprises or GSEs (federal home loan banks). The Fed also provided access to over 100 money market mutual funds to put an interest rate floor on the all-important repo market. Member banks or primary dealers have access to the IOR, but GSEs do not. The GSEs have cash looking for a return, and given that they have access to the reverse repo facility, the worst-case scenario is to accept the IRRP. But member banks, having access to the IOR, would be willing to pay more than the IRRP if the IOR is greater than the IRRP, which it is, by design. In the very beginning, during the zero-lower bound period, the IOR was set at 25 basis points and IRRP was set at 5 basis points. See the figure below:



Figure 11: Federal Reserve Economic Data: FRED: St. Louis Fed

The difference between the IOR and the funds rate is the cost of arbitrage. The member banks borrow from the GSE's at the lower federal funds rate and hold the proceeds earning the higher IOR. This activity is not costless. Gagnon and Sack (2014) explain the above process as follows:

This pattern reflects the fact that some large lenders in the federal funds market are not eligible to receive interest on reserves (mainly government-sponsored enterprises, or GSEs). Banks are willing to borrow from these entities and hold the proceeds as reserves, performing the arbitrage noted above, but they require a yield spread to do so because they view the associated increases in their balance sheets as costly in terms of required regulatory capital and internal oversight. In addition, banks have to pay a fee to the Federal Deposit Insurance Corporation (FDIC) related to the size of their balance sheets, which directly reduces the return on this activity by 10 to 15 basis points on average.

In summary, the federal funds rate is determined by the IOR minus the cost of arbitrage. The determination of the federal funds rate has absolutely nothing to do with changes in reserve supply or open market operations as Mishkin argues, and the IOR is certainly not the floor, it is the ceiling. If we understand all of this, the rest of the story is simple: to raise the target for the federal funds rate, raise the IOR and IRRP; to lower the range, lower the IOR and the IRRP- it is that simple. The Fed is no longer predicting reserve demand and has not been conducting open market operations, as we once knew it, to influence the federal funds rate. The Fed has been injecting reserves into the market since September 2019 for the purposes of providing liquidity to the \$3 trillion repo market given the imbalances between the treasuries used as collateral for repos and the amount of liquidity needed to satisfy those repos.

The Role of the Reverse Repo Rate (IRRP) and the Reverse Repo Facility

The reverse repo facility was created for the GSE's and money market funds a place to park their cash. Naturally, these institutions are seeking to obtain the highest return on their funds. The reverse repo facility became very important when the Fed got off of the zero bound in December of 2015. There was a multitude of discussions as to how large to make the facility and what institutions would have access to it. The Fed went 'all in' in December of 2015. Consider the excerpts from the implementation note below from the Federal Reserve from December 17, 2015, the day the Fed got off the zero bound:

The Board of Governors of the Federal Reserve System voted unanimously to raise the **interest rate paid on required and excess reserve balances to 0.50 percent**, effective December 17, 2015.

Effective December 17, 2015, the Federal Open Market Committee directs the Desk to undertake open market operations as necessary to maintain **the federal funds rate in a target range of 1/4 to 1/2 percent**, including: (1) **overnight reverse repurchase operations (and reverse repurchase operations with maturities of more than one day when necessary to accommodate weekend, holiday, or similar trading conventions) at an offering rate of 0.25 percent**, in amounts limited only by the value of Treasury securities held outright in the System Open Market Account that are available for such operations and by a per-counterparty limit of \$30 billion per day; and (2) term reverse repurchase operations to the extent approved in the resolution on term RRP operations approved by the Committee at its March 17-18, 2015, meeting.

In a related action, the Board of Governors of the Federal Reserve System voted unanimously to **approve a 1/4 percentage point increase in the discount rate (the primary credit rate) to 1.00 percent, effective December 17, 2015.**

As evidenced by the implementation note, there are three distinct rates set by the Fed: the IOR that serves as the upper bound for the federal funds rate, the IRRP which serves as a lower bound for the funds rate and the repo rate (money market funds), and the discount rate which is almost meaningless. We now consider the final figure below:



Figure 12: Federal Reserve Economic Data: FRED: St. Louis Fed

Note the evolution of the federal funds rate. The IOR is the upper bound and the IRRP is the lower bound. The difference between the IOR and the funds rate is the cost of arbitrage. As you can see from the graphic, the lower bound or IRRP serves effectively as the floor for the federal funds rate. There are no open market operations to consider except for injecting cash to alleviate pressure in the all-important \$3 trillion repo market. For instance, according to the WSJ, on September 26, 2019, "the Federal Reserve Bank of New York added \$110.1 billion to the financial system... using the market for repurchase agreements, or repo, to relieve funding pressure in money markets. The actions marked the first time since the financial crisis that the Fed had taken such actions" (Kruger & Sebastian, 2019). The final line is of the utmost importance for this paper: "the actions marked the first time since the financial crisis that the Fed had taken such actions." On March 15, 2020, the Fed surprised financial markets by lowering the target range for the federal funds rate to the zero bound – a range from 0 to .25% (FRED). What are the mechanics of such a move? The Fed lowered the rate on reserves, the ceiling, to .10% and lower the rate on reverse repos to .00%. For the first week of April 2020, the federal funds rate averaged .05%, right in the middle of the floor and ceiling (FRED). This is how the Fed conducts expansionary policy, manipulating the floor and the ceiling, not open market operations that for some reason, textbooks still cling to.

This prompts the million-dollar question: why hasn't Mishkin updated his money and banking textbook to take the new regime into account? Reflect on how incorrect Mishkin's text is: the IOR serves as the upper bound not the lower bound, the IRRP serves as the lower bound, the discount rate means next to nothing in terms of targeting the funds rate, and the Federal Reserve went approximately 11 years (excluding QE 1, 2, and 3) without conducting open market operations, and these open market operations (purchases) have much less to do with targeting the federal funds rate and much more to do with alleviating pressures in the allimportant \$3 trillion repo market in which Mishkin basically ignores throughout his entire textbook.

Why Textbooks Are Not Current

It is difficult to exactly explain why macroeconomic textbooks, including money and banking textbooks, like those above, do not update information even when that information has not applied to the United States for over a decade. Textbook authors, such as Mishkin and Bernanke, are certainly more than adequately knowledgeable about the economy, so it is not for a lack of expertise that these textbooks remain incorrect or incomplete. I propose that it boils down to two key elements of the textbook industry.

Firstly, the university textbook market lacks competition. Consolidation has been a theme in the industry over the past 25 years. For instance, five companies (Pearson, Cengage, McGraw-Hill, Macmillan, and Wiley) control more than 80% of the market, and a merger between Cengage and McGraw-Hill is currently in the works (US PIRG, 2019). The resulting merged company would be so large that its only other meaningful competitor would be Pearson, further reducing competition (US PIRG, 2019). If so few firms control so much market share, there is arguably less incentive for these publishers to continuously update their books or to innovate.

One may propose that new editions of textbooks are expensive to produce and explains why books are not up to date. This argument would be incorrect. In reality, we see publishers producing new edition textbooks faster than ever before in order to increase profits and hinder secondary (used textbook) market sales. For example, publishers have increased the frequency of new edition textbooks from every five years to every 3.5 years (Student PIRGs, 2004). Additionally, the rise of e-books reduces publishing and editing costs. Pearson has adopted a policy of digital first and will make any revisions of content in the digital version first (Wan, 2019).

Unfortunately, these "new" editions rarely change anything substantial since the turnaround time from writing to distribution has been reduced. In a survey, 76% of faculty respondents said that the new editions they use are justified half the time or less, and over 50% said that the new editions they use are rarely to never justified (Student PIRGs, 2004). It appears that publishers are releasing new editions for reasons other than with the primary intent of updating content so that it is accurate and relevant. The decreased time in between new editions

also provides authors less time to make substantial edits to their texts. Authors earn a royalty on every book sold regardless of information, so they are also lacking the incentives to tell publishers to slow down as long as textbooks are selling. The higher education textbook industry clearly has high barriers to entry and could be described as an oligopoly. These companies and authors are attempting to maximize profits, and some would argue that this is independent of the content of the books as long as the contents are similar to competitors. You may be asking 'what about the demand-side of this market?' Here lies the second underlying reason why textbook content is not updated.

The college textbook market is a strange one because it is one in which the consumer, who cares most about the product, is not the one choosing the product. When it comes to university textbooks, faculty, not students, ultimately decide which texts are utilized in the curriculum. As a student paying for education, we prefer to learn the most current information that is most applicable to understanding the real-world. Knowing how monetary policy is currently conducted is very useful in interviews and graduate school applications. If a student was asked how the Federal Reserve sets the federal funds rate in an interview with one of the Federal Reserve banks, and s/he responded with the Fed sets a range with the discount rate as the upper bound and interest on reserves as the lower bound or talked about a day at the Fed trading desk, he/she will most likely not obtain the position. Learning outdated information is a significant cost for students.

Professors/faculty pass off that cost to students by teaching that outdated information from their chosen text. In order for professors to demand updated textbooks, they would have to be willing to incur the cost by changing their curriculum, notes, and learning the new material. That requires effort and time, so more often than not, they pass this cost to students by teaching them a curriculum that has not significantly changed in years. In addition, how can they learn the new, updated, and relevant material if it's not in the current editions of the textbooks? The incentives for professors to demand up to date books are not present. To be clear, I am not accusing professors of doing this consciously but often, people procrastinate, are averse to change, and minimize 'needless' work to maximize utility. Many, if not most, of the lecturers/professors, may not even know that what they are teaching is obsolete and in many cases, entirely incorrect, so there is an almost nonexistent chance that they will demand the current and updated information in texts.

From my point of view, it would be necessary to eliminate the 'opt-in' cost for professors. For example, currently, if professors want to teach information not in textbooks, they have to find supplemental materials and redesign the curriculum. In other words, professors must be aware of this choice and its costs and 'opt-in' in order to teach the most accurate information. This 'opt-in' cost has worsened recently as more and more digital programs are sold as companions with textbooks. Professors have the option to use these digital programs as homework for students, which is very attractive since professors no longer have to create problems or be responsible for grading homework. Unfortunately, these digital programs mirror whatever the (possibly outdated) textbook teaches. If suppliers updated textbooks with nonobsolete information, professors would already be 'opted in' as they would no longer have to find supplemental materials and would be forced to change curriculum if they want to use the text and accompanying digital programs. As already explained, suppliers have little incentive to update textbooks except for profit motivation (i.e. kill the used-book market). Without demand from professors and institutions, who are not even the primary consumer of the texts, we are stuck in a bad equilibrium. Currently, Bernanke's and Mishkin's textbooks cost \$299.99 each on

Pearson's website, a very high price to pay for outdated and obsolete material. The well-known phrase: 'if it's not broken, don't fix it' does not apply here. Conversely, what applies is that 'if it is broken, don't fix it.'

Chapter 7

Concluding Remarks

At the beginning of this paper, I set out to investigate whether the quantity theory of money (QTM) should still be included in macroeconomic textbooks in anything but a historical context. I utilized various econometric techniques to test the relationship between inflation and money growth in the United States since 1959, assuming velocity is stable per QTM. The results concluded that the QTM relationship between inflation and money growth broke down from mid-1982 to the present. Because of this conclusion, which is well accepted by the economics profession and the Federal Reserve, it is my belief that QTM and related models should only be included for historical context in textbooks and not included to explain or teach how the economy and US monetary policy function in reality.

As a student at the Pennsylvania State University, I examined three textbooks (principles of macroeconomics, intermediate macroeconomics, and money and banking) utilized by professors at the University and from Pearson, a major publisher. I established that these textbooks currently teach outdated models, partially predicated on QTM, such as the IS/LM model. I also discovered a gross misteaching of the reserve market and how the Fed currently conducts monetary policy, which can be partly retraced back to assumptions underlying QTM. It is my conclusion that macroeconomic textbooks are not being updated due to supply and demand limitations revolving around a deficit of compatible incentives for those involved. This is to the detriment of the students, and I believe that there should be a major change in the industry.

It is worthwhile to note that the microeconomics field is obviously more stable than macroeconomics. For upcoming microeconomic fields, such as climate change and environmental economics, they are still in the learning stage, so textbooks are expected to incorporate new material and discoveries. Contrarily, macroeconomics was hit with shocks that are permanent like how money has become obsolete and how the Great Recession has changed the way the Fed conducts policy forever. Further research on the state of microeconomic textbooks would be worthwhile especially in comparison to macroeconomic books.

On the positive side, some books are catching up and are admitting that the moneyinflation relationship is invalid in the short-run. One book, Mishkin's intermediate macroeconomics text, has eliminated the LM curve altogether and replaced it with a Taylor rulelike monetary reaction function, which I view as overly welcome. Both of these examples indicate progress, but there is still much to fix as evidenced by this paper. A suggestion that may be of value is to allow other professors and central bankers to rate books on their accuracy to the real world. This would serve as a type of peer review. For example, if Janet Yellen or Jerome Powell would seriously review Bernanke's and Mishkin's books, they would deem them less than stellar which would theoretically prompt the authors to update their texts. The logistics of this solution are not entirely clear, and other possible solutions most likely exist, but both matters could be explored in further research.

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ACADEMIC VITA Evan S. Toomey

EDUCATION

The Pennsylvania State University, University Park B.S. in Economics & B.S. in Finance

Schreyers Honors College Paterno Fellows Program

PROFESSIONAL EXPERIENCE

Vanguard - Fund Financial Services (Malvern, Pa)

- FFS Global Fund Accounting Intern
- Developed a deep conceptual knowledge of and managed the dividend reinvestment process for all Vanguard institutional products
- Implemented 3 process improvements to reduce training time by 2 hours overall due to the upcoming 2020 transition
- Built 3 Excel macros to reduce risk and to decrease process time by 40 hours annually
- Created and led a presentation given to 15 colleagues, including 5 managers, on process improvement and feedback
- Trained 2 team members on dividend-related duties and provided insight and answers to questions
- · Participated in various corporate service events including All Cans on Deck and a departmental diversity event

Emerald Asset Management (Lancaster, Pa)

Research Intern

- Assisted Research and Investment teams in coalescing information about existing and potential portfolio assets
- Built and completed financial models of companies including multiple IPOs
- Conducted field research on companies by phone and onsite visitations
- Acquired knowledge of the inner workings of companies by attending and participating in meetings and conferencing

LEADERSHIP

PSU Economics Association

President

- Preside over 5 other members on the Executive Board and their committees to run association effectively
- Lead weekly meetings of 60 attending members as well as plan and organize treks to NYC and D.C.

2nd Annual Central PA Event (The E Foundation (Non-profit); Lancaster, Pa) May 2018-July 2018 **Project Manager**

- Led team of 5 other volunteers to plan event that raised over \$6,000 for a local after-school program
- Built relationships with 11 different local restaurants and food trucks through multiple visits, calls, and emails
- Marketed event through several media channels to attract over 200 attendees
- Oversaw and participated in event operations on the day of the fest

EXTRACURRICULAR ACTIVITIES

Teaching Assistant and Grader (Intermediate Macroeconomics & Advanced International Trade) The Pennsylvania State University, Department of Economics August 2017–May 2020

- · Grade homework and exams for professor along with a Graduate TA
- · Meet strict deadlines and followed precise directions competently

Graduation Date: May 2020

May 2018-August 2018

May 2019-August 2019

December2018-May 2020