Determinants of Asset Prices, Testing For Stock Market Overvaluation, and the Role of Monetary Policy

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Table of Contents:

Introduction

The primary purpose of this paper is to determine if the stock market was overvalued right before it crashed in 1962, 1969, 1973-74, and 1987 using a new technique developed by McGratten and Prescott for estimating fundamental values. The paper first examines traditional methods for estimating fundamental values and the most commonly cited reasons as to why stock prices deviate from their fundamental values. The second section of the paper examines the problems with estimating fundamental values using Gordon Dividend Model, and introduces a new model for estimating fundamental values that was developed by McGratten and Prescott. The third section of this paper explains fundamental value calculations and tests for stock market overvaluation. The remainder of the paper examines problems with McGratten and Prescott's model and the role of monetary policy in asset pricing.

Determinants of Asset Prices

Asset bubbles are of major concern because they are the result of financial imbalances. They arise because of a breakdown in information, and the result is a misallocation of resources that can lead to financial instability. It has been well documented that when a bubble pops it causes serious contractions in real economic activity. Asset bubbles arise when asset prices increase at a rate that is greater than can be explained by market fundamentals (Kindleberger, 1992). Bubbles are also often used to describe events that cannot be explained using standard hypotheses.

There are two components that make up stock prices: the fundamental component and the nonfundamental component. The fundamental value of stock is equal to the present value of future dividends net of taxes plus the expected gain or loss on the

sale/disposal of the stock. This is also equal to the market price of stock in an efficient financial market. Although the hypothesis for efficient financial markets cannot be rejected, many economists and analysts agree that fundamentals alone cannot explain most of the variation in stock prices, particularly over short periods of time.

There are a number of reasons why stock prices may not reflect fundamentals. Some of the most commonly cited reasons as to why stock prices deviate from their fundamental values include:

- Credit expansion/financial liberalization
- Risk-shifting
- Herd behavior
- Overreaction to news
- Irrational behavior

Credit Expansion/Financial Liberalization

Allen and Gale (2003) have identified a sequence of events that occur that result in the onset of a stock market bubble. Initially, some sort of financial liberalization leads to a significant increase in the expansion of credit. This could be the result of dramatic reforms that increase the availability and ease at which firms and households can borrow. Financial liberalization also occurs in developing countries that have permit large capital inflows from abroad. Financial liberalization is usually beneficial unless large amounts are borrowed and invested in assets in fixed supply, such as real estate and corporate stocks (Bernanke and Gertler, 1999). Since the supply of these assets is fixed, investors end up bidding up the prices above their fundamental values. This process continues until an event changes investors' expectations of future payoffs on their assets or the

central bank increases interest rates because of fears of "overheating" and inflation (Allen and Gale, 2003).

In an interesting article by Borio and Lowe (2003), the authors conclude that quickly rising asset prices alone do not necessarily lead to financial distress, but rather it is usually a combination of rising asset prices, rapid credit expansion, and/or above-average capital accumulation. They found that when asset prices increase by 40-50 percent from their trend and credit expansion increase by 4-5 percentage points from its trend, their model predicted approximately 50 percent of all financial distresses with the least amount of error. When the growth rate in investment was 2 percentage points higher than its trend, their model predicted financial distresses fairly well, but there was more error associated with this model.

Risk-Shifting

The composition of market participants has changed dramatically over the past 50 years. During this time there has been substantial growth in the number of institutional investors. In 1952, Goldmith (1971) estimated that 6.5 percent of the value of equities was held by institutional investors, whereas in 1999 that number increased to over 50 percent (Gillan, 2002). Most asset-pricing models assume that investors are using their own wealth when they purchase assets; however, institutional investors are buying stocks with other people's money. This leads to an agency problem, which can lead to a stock market bubble.

Because of the compensation structure for portfolio managers, they have an incentive to engage in riskier behavior because they receive incentive fees in proportion to how well their funds perform. The fee structure is often made of two components: a

base fee and a contingent fee. The contingent fee allows the manager to share in the incremental return. Thus, managers have an incentive to invest in risky stocks that may provide higher returns than less risky stocks that have lower returns. Managers will continue to purchase overvalued stocks as long as there is a probability that they can sell the stock at a higher price at some date in the future. In this case, the portfolio managers' trades are not motivated by changes in information, liquidity shocks, or other changes in fundamentals, but rather because of a speculative profit. The portfolio manager also has limited liability because he or she does not share in the losses when their decisions go belly-up. If the manager continually makes bad investment decisions, the worst that can happen to he or she is that they are fired (Allen and Gorton, 1993).

Herd Behavior, Overreaction to News, and Irrational Behavior

Herd behavior occurs when people observe the actions of others and make the same decisions as the group because they lack information regarding fundamentals, time constraints, or limitations in their own intelligence on the subject matter. It is not necessarily irrational for investors to follow a herd as long as there is no other source of information for them. Sometimes people follow the decisions of the herd because of social pressures, they may feel incompetent making their own decisions, or they question their own intelligence believing they could not possibly be smarter than the masses.

Studies conducted by Solomon Asch, Morton Deutsch, and Harold Gerard show that group actions are very influential in individual decision-making. In their studies, individuals made the same errors as the herd 84 percent of the time (Deutsch and Gerard, 1955). Based on these behavioral studies, inferences can be made as to how investors react to other market participants. Some market participants are the initial movers. As

others observe the movers' behavior, they question whether or not they have all the relevant information themselves. As a result, you may see other market participants following their lead. Swings in stock prices may be exacerbated as more people hop on the bandwagon, so to speak.

Other reasons why stocks can deviate from their fundamental values include market participants overreacting to news and exhibiting irrational behavior. Shiller (1990) has found that when a news story breaks, the market tends to initially overreact to the news. One starts to see a pendulum effect, whereby the market overshoots fundamentals then undershoots fundamentals, and the process continues until it finally dampens to some equilibrium.

Credit expansion and financial liberalization, agency problems, herd behavior and irrational behavior are just a few of the factors that can cause stock prices to rise above their fundamental value. However, the questions still remain, "How do we know if the market reflects fundamentals, and how do we determine if the stock market is over- or under-valued?" The next section of this paper discusses two methods for estimating fundamental values and how to test for stock market over- and under-valuation.

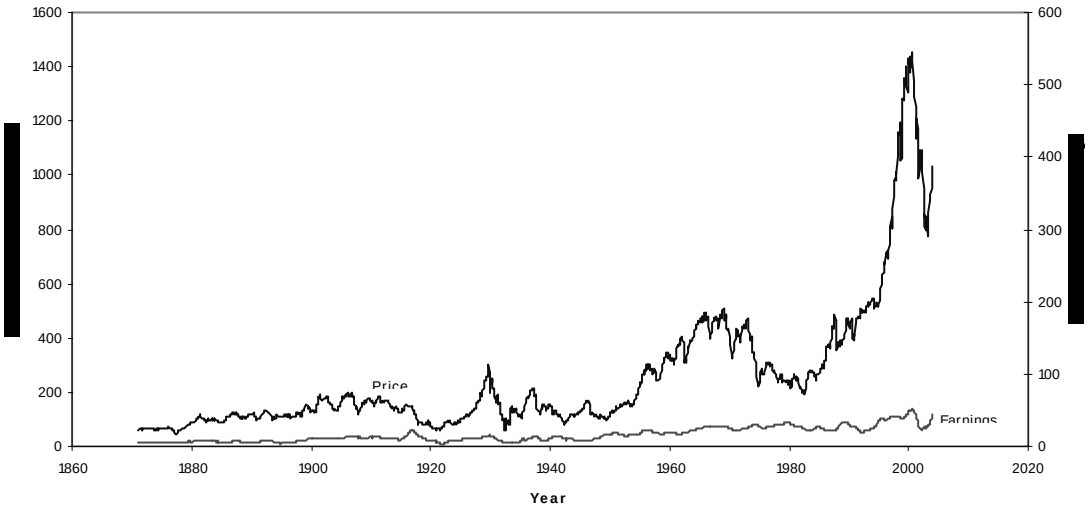
Estimating Fundamental Values

Traditional Approach to Estimating Fundamental Values

Much of the finance literature defines the fundamental value of stock to be equal to the present value of future dividend payments net of taxes plus the expected gain or loss on the sale of the stock. Economists and analysts estimate the fundamental value of stock and then compare this value with the market value of the stock to determine if the asset is correctly valued. The problem with estimating the fundamental value this way

lies in estimating future dividend payments. First, most companies do not pay dividends. Second, the companies that pay dividends base their decisions on current and future earnings and on overall optimism for the future. Shiller (1990) concludes that stock prices can be explained by dividend payments. However, the question that arises is, "Do increases in stock prices result from strong earnings or because of optimism?" In his book *Irrational Exuberance*, Robert Shiller illustrates the relationship between real earnings and the real S&P 500. According to Figure 1, it would appear as though real earnings do little in explaining large movements in stock prices from 1920 to 2000.

Figure 1: Real Earnings Versus Real S&P 500



A New Approach to Estimating Fundamental Values

In the mid-1990s the stock market started to climb to unprecedented levels. In 1996, Federal Reserve Chairman, Alan Greenspan, coined the phrase "Irrational Exuberance" to explain rising stock prices at this time. Robert Shiller, amongst many other economists, reiterated this concern. Despite the problems with identifying asset bubbles, many economists and analysts claim they know one when they see one. Many

financial analysts believed an asset bubble formed during the last part of the 1990s, and many believed that the Federal Reserve should have raised interest rates sooner in an attempt to pop the bubble. While observing Figure 1, there is little doubt that current definitions of fundamental values cannot explain the rapid increases in stock prices during the later part of the 1990s.

McGratten and Prescott (2000) take a new approach to valuing fundamental values. Given the accounting equation:

$$\text{Assets} = \text{Liabilities} + \text{Equity}$$

It follows that the market value of corporate equities should be equal to productive assets less net debt, where net debt is the difference between debt liabilities and debt assets. When net debt is sufficiently low, as it was in the 1990s, then it follows that the market value of corporate equities should be equal to the stock of productive assets in the corporate sector. McGratten and Prescott's formula for the fundamental value of corporate equities is:

$$(1) \qquad V_t = [k_{1m} + (1-\tau)k_{1u}]N + \text{capital of U.S. Foreign Subsidiaries}$$

Where k_{1m} is the stock of tangible capital; τ is the corporate income tax rate; and k_{1u} is the stock of intangible capital in the corporate sector. We are concerned about the after-tax level of intangible capital because expenditures on unmeasured investment are expensed and reduce taxable corporate income.

McGratten and Prescott analyzed two notable time periods where many economists believed assets bubbles were present. They estimated the values of productive assets immediately before the stock market crashed in 1929 and in 2000. In both cases they concluded that stock prices were not overvalued. In fact, they believe

that the stock market was actually undervalued in 1929. In 2000, McGratten and Prescott concluded that the stock market was correctly valued.

McGratten and Prescott's theory as to why the stock market crashed in 1929 is due to the Federal Reserve's reaction to rising stock prices. In an attempt to control rapidly increasing stock prices, the Federal Reserve increased short-term interest rates. The short-term rates that increased the most were those on brokerage loans, which was the result of the Fed's "direct pressure" policy. This policy threatened to deny member banks that made brokerage loans access to the discount window, which was heavily used at this time. When prices started to decline, loan extensions were hard to get. Stock prices fell further as investors had to sell. McGratten and Prescott attribute this stock market crash to an unexpected credit crunch. This raises serious questions about the role of the monetary authority in responding to stock market prices (McGratten and Prescott, 2003a). This topic will be addressed later.

Shortly before the stock market started to crash in 2000, McGratten and Prescott estimated that the value of productive assets in the corporate sector to be 1.84 times gross national product (GNP). According to data that is found in the Flow of Funds Accounts published by the Federal Reserve, the market value of corporate equities at this same time was equal to 1.83 times GNP. This suggests that corporate equities were not overvalued right before the stock market started its descent.

Testing for Stock Market Overvaluation in 1962, 1969, 1973, and 1987

Being able to identify the formation and presence of an asset bubble is important so that policymakers can either take measures to prevent them from occurring or so that they can ameliorate the effects a bursting bubble has on the financial system and

economy. In the sections that follow, McGratten and Prescott's estimate for fundamental values is used to determine if corporate equities were overvalued at the time the stock market crashed in 1962, 1969, 1973, and 1987. Although not all stock market crashes are the result of a bursting asset bubble, when an asset bubble does burst, however, the result is a crash in the stock market.

The Model

McGratten's and Prescott's model includes two sectors: corporate and noncorporate. The noncorporate sector includes the household business sector, the government sector, the noncorporate business sector, and the rest of the world. In their model, the value of corporate equity is equal to the value of the end-of-period stock of capital used in the corporate sector. This value is given by:

(1) $V_t = [k_{1m} + (1-\tau)k_{1u}]N$ + capital of U.S. Foreign Subsidiaries

Where k_{1m} is the stock of tangible capital; τ is the corporate income tax rate; and k_{1u} is the stock of intangible capital in the corporate sector. We are concerned about the after-tax level of intangible capital because expenditures on unmeasured investment are expensed and reduce taxable corporate income. See McGratten and Prescott (2000) for further details.

The U.S. Department of Commerce's Bureau of Economic Analysis (BEA) publishes information in the National Income and Product Accounts (NIPA) tables on the stocks of tangible capital in the corporate sector. The Federal Reserve Board of Governors publishes information in the Flow of Funds Accounts on the stocks of tangible capital in the economy as a whole. However, information does not exist regarding the levels of intangible capital in the corporate sector. This means that it must be estimated.

Table 1 found in the Appendix gives values for the NIPA data for the years 1962, 1969, 1973, and 1987. All of these values are ratios to gross national product. The numbers found in this table are used later in deriving estimates for after-tax rates of return on capital, intangible capital stocks, and the market value of corporate equities.

After-Tax Rate of Return on Capital

To estimate the stock of intangible capital, the after-tax rate of return on capital needs to be estimated first. McGratten and Prescott assume that the after-tax rate of return on tangible capital in the noncorporate sector is equal to the after-tax rate of return on intangible capital in the corporate sector. This is because unless one sector is riskier than the other, competition and mobile capital ensures that the after-tax rates of return are equal. Using data from the NIPA accounts we can estimate the after-tax rate of return on capital in the noncorporate sector using the following equation:

(2) $$i = \frac{\text{Accounting Returns + Imputed Returns}}{\text{Noncorporate Capital + Capital of Foreign Subsidiaries}}$$

The NIPA data requires some adjustments. Part of the net interest in the noncorporate sector consists of intermediate financial services; the other portion of net interest needs to be added to noncorporate profits. The intermediate financial services portion of net interest mainly consists of services implicitly purchased by homeowners with mortgages. It is the difference in interest paid by people with mortgages and the interest received by households lending to those financial institutions issuing mortgages. McGratten and Prescott estimate that intermediate financial services are a little more than half of net interest. In 1962, 1969, 1973, and 1987 it is estimated that intermediate financial services amount to 0.009, 0.003, 0.014, and 0.027 times GNP, respectively. Substituting values into the above equation for 1962 yields an after-tax rate of return on capital equal to:

(3) $i = [0.07164 + (0.709 + 0.329)i] / (2.342)$

➔ $i = 0.0549$

Where 0.07164 of GNP is equal to noncorporate profits plus net interest less intermediate financial services; 0.709 is the net stock of government capital; 0.329 is the net stock of consumer durables; and 2.342 is the sum of stocks of government capital, consumer durables, and noncorporate business. In 1962, the term for capital of foreign subsidiaries was excluded because that value relative to GNP is approximately zero. Hence, according to the above equation, the after-tax rate of return on capital is equal to 0.0549.

For the years 1969, 1973, and 1987 the only thing that changes in the above equation is the addition of a term for capital of foreign subsidiaries. The estimated after-tax rates of return on intangible capital in the corporate sector for the years 1969, 1973, and 1987 are given by:

(4) 1969:

$i = [0.0764 + (0.69 + 0.306)i] / [2.208 + (0.006/i)]$

➔ $i = 0.058$

(4) 1973:

$i = [0.064 + (0.698 + 0.302)i] / [2.204 + (0.007/i)]$

➔ $i = 0.047$

(5) 1987:

$i = [0.064 + (0.592 + 0.287)i] / [2.37 + (0.01/i)]$

➔ $i = 0.036$

Intangible Capital

The BEA reports values for tangible capital. However, this value does not include values for inventories and land. These components need to be added to arrive at the total amount of corporate tangible capital. The NIPA data reports the value of inventories, but it does not estimate the value of land. McGratten and Prescott estimated the value of land in two ways. First, they obtained data on the market values of real estate from the Federal Reserve. Using this method they estimated land to be 0.06 times GNP in 2000. However, the problem with this estimate is that the Federal Reserve does not separate land from the total real estate value. The second way they estimated the value of land is by using data that was published by the Internal Revenue Service. Using this method they estimated the value of land to range from 0.03 to 0.04 of GNP in 2000. The problem with these estimates is that the values the IRS publishes are book values rather than market values. In correspondence with Ellen McGratten, she believes that land valued at 0.045 times GNP is a reasonable estimate from 1960 to 1990.

Using the estimates for the after-tax rate of return on corporate tangible capital and the adjustments to the NIPA data, intangible capital can be estimated. From McGratten and Prescott (2000), the estimate for intangible capital is given by the following equation:

$$(6) \qquad i = (1 - \tau_1)\{\text{NIPA Profits} + [(1 + \gamma)(1 + \eta) - 1]k_{1u} - ik_{1u}\} / k_{1m}$$

Where τ_1 is the corporate income tax rate; η is the growth rate in the population; γ is the growth rate in technology; k_{1u} is the stock of corporate intangible capital; and k_{1m} is the

stock of corporate tangible capital (this includes the values for land and inventories). Substituting values into equation (6) and solving for k_{1u} gives estimates of intangible capital for the years 1962, 1969, 1973, and 1987, as follows:

(7) 1962:

$$0.0549 = [1 - (0.047/0.097)] * [0.097 + 0.0282k_{1u} - 0.0549\ k_{1u}\ ] / 1.101$$

$$\rightarrow\ k_{1u} = -0.754$$

(8) 1969:

$$0.058 = [1 - (0.042/0.100)] * [0.1 + 0.0353\ k_{1u} - 0.058\ k_{1u}\ ] / 1.006$$

$$\rightarrow\ k_{1u} = -0.023$$

(9) 1973:

$$0.047 = [1 - (0.039/0.093)] * [0.093 + 0.0292\ k_{1u} - 0.047\ k_{1u}\ ] / 0.994$$

$$\rightarrow\ k_{1u} = 0.709$$

(10) 1987:

$$0.036 = [1 - (0.027/0.066)] * [0.066 + 0.0262\ k_{1u} - 0.036\ k_{1u}\ ] / 1.148$$

$$\rightarrow\ k_{1u} = -0.397$$

Value of U.S. Corporate Equity

Recall that our model states that the market value of U.S. corporate equities is equal to the sum of corporate tangible capital, corporate intangible capital, and capital of U.S. foreign subsidiaries. By substituting the appropriate values into equation (1), the market value of corporate equities for the years 1962, 1969, 1973, and 1987 is as follows:

(11) 1962:

$$V = [1.101 + (0.515)(-0.754)]N$$

$$\rightarrow\ V = 0.71 \text{ of GNP}$$

(12) 1969:

$V = [1.006 + (0.58)(-0.023)]N + (0.006/0.058)N$

➔ $V = 1.12$ of GNP

(13) 1973:

$V = [0.994 + (0.581)(0.709)]N + (0.007/0.047)N$

➔ $V = 1.56$ of GNP

(14) 1987:

$V = [1.148 + (0.591)(-.397)]N + (0.01/0.036)N$

➔ $V = 1.19$ of GNP

Recall that when net debt is sufficiently low, the market value of U.S. corporate equities should be approximately equal to the value of productive assets in the corporate sector. Unlike the 1990s when net debt was very low, from 1962 to 1987 net debt was considerably higher. This was especially the case from the mid-1970s to the early 1990s. So net debt in the corporate sector must be included in order to determine whether stock prices were under- or overvalued. When the stock market is correctly valued, one would expect to see actual market values of corporate equities plus corporate net debt to equal the estimate for productive assets.

Net Debt

Corporate net debt is equal to debt liabilities less debt assets. It includes all financial claims except for corporate equities, the equity portion of mutual funds, life insurance reserves, pension reserves, and the equity portion of miscellaneous claims. Net debt is calculated using data from the Flow of Funds Accounts, and it includes all domestic sectors issuing corporate equities. These sectors include:

- nonfinancial corporate business
- commercial banking

- life insurance companies
- other insurance companies
- closed-end and exchange-end traded funds
- real estate investment trusts
- security brokers and dealers

Mutual fund holdings can be divided into two sections: the equity portion and the debt portion. In order to estimate the amount that is equity, McGratten and Prescott use the ratio of net assets in equity mutual funds to total industry net assets from the Investment Company Institute. Hybrid funds are then split equally between debt and equity. McGratten and Prescott also make adjustments for life insurance and pension fund reserves. See McGratten and Prescott (2003b) for deriving these estimates.

The final adjustment that needs to be made is separating miscellaneous assets and miscellaneous liabilities into debt and equity claims. Miscellaneous assets that are listed in the Flow of Funds Accounts that are included in debt assets include:

- 1/10 of corporate direct investment abroad
- 1/2 of bank holding companies investment in subsidiaries
- nonfinancial corporate investment in finance company subsidiaries
- nonfinancial corporate policy payables
- brokers and dealers securities borrowed
- deferred and unpaid life insurance premiums
- unidentified corporate assets.

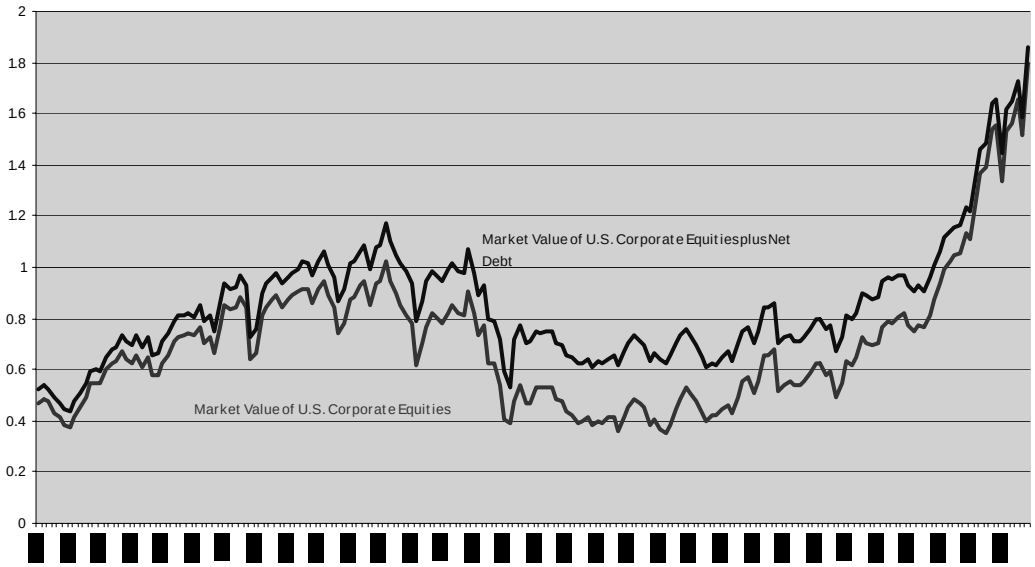
Miscellaneous liabilities that are listed in the Flow of Funds Accounts that are included with debt liabilities include:

- 1/4 corporate foreign direct investment in the United States
- 1/2 of bank holding companies investment in subsidiaries
- liabilities of other insurance company payables
- nonfinancial corporation pension fund contributions payable
- unidentified corporate liabilities

For derivations on the separation of debt and equity portions of assets and liabilities, see McGratten and Prescott (2003b). One problem with using the Flow of Funds Accounts for measuring net debt is that it is based on book values rather than market values. Hall (2001) makes an adjustment in his data for this difference. This amount is very small, and its value does not change any interpretations of the data.

Figure 2 plots the market value of U.S. corporate equities and the market value of corporate equities plus net debt. It is evident from this graph that net debt should, indeed, be taken into consideration when valuing stock prices.

Figure 2: Value of U.S. Corporations, 1952-1999



Testing for Overvaluation

To determine whether or not the stock market is overvalued, the estimates for productive assets are compared with the actual market value of U.S. corporate equities plus net debt. In 1962, productive assets in the corporate sector were estimated to be 0.71 of GNP. Looking at Figure 2, one can see that the market value of corporate equities plus net debt was equal to 0.93 times GNP in the first quarter, 0.73 times GNP in the second quarter, 0.75 times GNP in the third quarter, and 0.90 times GNP in the fourth quarter of the year 1962. It would appear as though the stock market was overvalued right before it crashed in 1962. The stock market then bottomed out and was approximately equal to the estimate of 0.71. However, it may appear as though this estimate is too low because within less than a year, the stock market climbed to pre-crash levels.

In 1969, productive assets in the corporate sector were estimated to be 1.12 times GNP. According to Figure 2, the market started to decline in 1969 and fell sharply by mid-1970. In the first quarter of 1969 the market value of corporations was equal to 1.098 times GNP. In the three quarters that followed, market values fell to 1.05 times GNP, 1.01 times GNP, and 0.98 times GNP. By June 1970, the market bottomed out and the Dow Jones declined 30.6 percent in value (Mishkin and White, 2003). The market value of corporations fell to 0.79 times GNP in June of 1970. Hence, stock prices were not overvalued when the stock market crashed in 1969-1970.

In 1973, productive assets in the corporate sector were estimated to be 1.56 times GNP. According to Figure 2, the market value of corporations peaked in the last quarter of 1972 with a market value of 1.07 of GNP. At the start of 1973, the stock market

started to plunge and within 12 months the value of the Dow Jones declined by 30.4 percent, and the value of the S&P 500 declined by 36.8 percent (Mishkin and White, 2003). By the end of 1974 the market value of corporations was equal to 0.53 of GNP. According to McGratten and Prescott's model, it would appear as though stock prices were not overvalued right before the stock market crashed in 1973. In fact, one could even say that they were undervalued according to the model. However, right around this time the economy was experiencing high inflation and high oil prices. It is possible that the model does not reflect the level of uncertainty that surrounded this time period.

In 1987, productive assets in the corporate sector were estimated to be 1.19 times GNP. In Figure 2 one can see that the market value of corporations in the first, second, third, and fourth quarters of 1987 equaled 0.84, 0.84, 0.86. 0.70, respectively. The crash in October 1987 had the largest one-day decline in stock market values in U.S. history. On October 19, the Dow Jones fell 22.6 percent. The S&P 500 fell 12.1 percent in October and 12.5 percent in November (Mishkin and White, 2003). Once again, according to the model, it would appear as though corporate equities were undervalued.

Model Weaknesses

McGratten and Prescott's model provides us with some striking results. One of the biggest strengths of this model is that we no longer have to measure the expectations of future dividends. However, other problems arise in this model that need to be addressed. One of the problems with using data published by the BEA and the Federal Reserve is that their measures of capital stock are imprecisely measured (Filardo, 2003). The other problem with this model is that it is highly sensitive to very small changes in fundamentals.

McGratten and Prescott estimate the after-tax rate of return on intangible capital by assuming that it is equal to the after-tax rate of return on noncorporate tangible capital. There are two problems with this assumption. First, real rates of return are not observable over this period of time. McGratten and Prescott felt comfortable about their estimated after-tax rate of return on intangible capital in the 1990s because their estimated return was very close to the average values of the risk-free rate on five-year inflation-protected bonds issued by the U.S. Treasury. However, prior to the 1990s, there was no similar measure by which to gauge these estimated rates of return against.

The second problem with assuming that the after-tax rate of return on intangible capital is equal to the after-tax rate of return on noncorporate tangible capital is the two types of assets can have very different economic depreciation. McGratten and Prescott's model assumes a constant rate of depreciation. Depreciation rates on tangible capital can vary considerably, especially during periods of rapid technological advancement. Tangible assets can depreciate quickly not necessarily because of deterioration but because of obsolescence. Intangible assets are bets on tastes and technology in the future, and their values can change quickly because of increased market competition. It only takes one company to come along and offer a suitable substitute to affect the value of a company's stock of intangible assets.

The assumptions that we make to estimate the after-tax rate of return on intangible capital can have serious implications on the model and how we interpret it. The model is highly sensitive to very small changes in our after-tax rate of return on intangible capital. For instance, in 1987 it was estimated that the value of productive assets in the U.S. economy was equal to 1.19 times GNP. However, if the real rate of

return were a quarter of a percent higher than we estimated, then the value of productive assets would be 1.01 times GNP. If the real rate of return were a quarter of a percent less than we estimated, then the value of productive assets would be 1.50 times GNP. This is quite a large range for the estimate of productive assets.

This also raises serious questions about the role of monetary policy in reacting to asset prices. Many analysts in the late-1990s believed that the Federal Reserve should have increased interest rates sooner in order to pop what many thought was an asset bubble in the stock market. If the stock market was overvalued, then it is true that raising interest rates may have brought asset prices back down to their fundamental values without too much disruption to the real economy. However, if stock prices were correctly valued or even undervalued and inflation was low, then the Federal Reserve could have unnecessarily contracted the economy. Many economists, including McGratten and Prescott, believe that the Great Depression was a result of the Federal Reserve bungling of interest rates.

The Role of Monetary Policy

Arguments in Favor of Reacting to Asset Prices

There are reasons why some economists and analysts believe that the Federal Reserve should consider asset prices when conducting monetary policy. Mussa (2003) points out that equities, bonds, real estate, and foreign exchange are important macroeconomic variables, and their behavior has implications concerning price stability and financial stability. Some believe that considering asset prices is in line with the goal of price stability because when asset prices increase, eventually through the wealth effect you start to see increases in consumption and investment. By adjusting interest rates

accordingly, it is believed that the Fed can reduce the likelihood of an asset bubble forming, and thus reduce the risk of boom-bust investment cycles (Cecchetti, Genberg, Wadhwani, 2003).

It should be noted that those who believe the monetary authority should consider asset prices when conducting policy believe that the monetary authority should *react* to asset prices, not target them. They believe that the Federal Reserve should not abandon its overriding goal of price stability. What they merely suggest is that after price stability and the output gap have been taken into account, then it is appropriate to consider asset prices. They do not suggest that the central bank should automatically react to all changes, but rather to evaluate each situation separately and act accordingly. Whether or not the Fed reacts to asset prices would be based on the discretion of monetary policymakers.

Those who are in favor of the central bank reacting to asset prices realize that there are times when doing so can be counterproductive. This occurs when the central bank reacts to real shocks, which are pure demand shocks unrelated to disturbances in income or the real interest rate, instead of financial shocks. Thus, it is important that the Fed be able to determine the source of the shock. When problems arise with differentiating between types of shocks, most agree that it is probably best if the central bank does not react. However, if the central bank can differentiate between the types of shocks on the economy, a "leaning against the wind" policy is advisable. This is a policy whereby the Federal Reserve would increase interest rates when stock prices are higher than warranted or decrease interest rates when stock prices are lower than warranted. It is

argued this type of policy would create more stability ((Cecchetti, Genberg, Wadhwani, 2003).

Arguments Against Reacting to Asset Prices

One of the strongest arguments against reacting to asset prices is it is extremely difficult to determine whether or not an asset bubble existed, let alone to be able to recognize one in real time. It is also difficult to determine if rapidly increasing asset prices are the result of permanent increases in productivity or are the result of an asset bubble. In 1996 when Alan Greenspan explained rapidly increasing asset prices as the result of irrational exuberance, the Dow Jones was valued at 6500. However, changes in fundamentals must have also been occurring because even with the uncertainty that surrounded the terrorist attacks and the Iraq war, the Dow never fell below 7200. If the Federal Reserve had increased interest rates at that time to prick the "bubble," it is possible that the economy could have slipped into an unnecessary recession.

Another reason some argue against the Federal Reserve reacting to asset prices is because it may jeopardize its credibility. Central banks rely heavily on credibility and reputation, both of which can be jeopardized if the Fed's reaction is inappropriate, unnecessary, or poorly executed. If the Fed should lose credibility because of poor decisions regarding asset prices, then it will find it more difficult to maintain price stability. Also, even if the Federal Reserve did choose the correct policy that resulted in increased interest rates, such a policy is not a popular one with the public. The public is willing to accept higher interest rates to curb future inflation, but they would be less likely to support higher interest rates that would decrease the value of the assets that they hold.

Monetary policy may be inappropriate considering it is a blunt instrument being used on a narrowly defined asset group. Monetary policy may also be inappropriate because it assumes the Federal Reserve has more information than market participants. If we are to assume that stock prices reflect all available information, then why should one believe that the Federal Reserve has an information advantage? It is, therefore, unlikely that the Fed would be able to recognize the formation of an asset bubble and the appropriate time to prick the bubble.

Lastly, although we are interested in asset bubbles because of their potential impact on the real economy and financial stability, the bursting of an asset bubble or a stock market crash does not necessarily lead to financial instability. In Mishkin and White (2003), the authors examined stock market crashes from 1903 to 2000 and found that not all major crashes resulted in financial instability. In fact, as seen in 1903, 1940, 1946, 1962, and 2000 the stock market can crash without causing any stress on the financial system. Crashes that resulted in severe financial distress included crashes in 1907, 1930-33, 1937, 1973-1974 because of poor balance sheets, a weak banking system, breakdowns in information, and tight monetary policy.

Instead of the Fed implementing some sort of reaction function to asset prices, policies can be put in place that can prevent asset bubble formation and add to the overall health of the financial system. It is imperative that depositories and other intermediaries maintain adequate collateral and margin requirements. Capital ratios need to be high enough that intermediaries can remain viable even under extremely adverse conditions. Intermediaries must also routinely perform stress tests. In addition, policies that improve transparency, particularly as they relate to corporate financial disclosure should be

embraced. The mispricing of assets is less likely to occur when better information is provided to investors, corporate officers are more accountable, and when a stronger, more independent audit system is in place. If and when these measures fail, a central bank can still inject large amounts of liquidity into the economy through open market operations, lending freely at the discount window, and provide technical expertise (Reinhart, 2003).

Conclusion

Although economists continue to develop better techniques for identifying price misalignments, it is evident that there is still much to be learned. In this paper explained various reasons why stock prices deviate from their fundamental values. The paper also explained the problems with estimating fundamental values using both the Gordon Dividend Model and using McGratten and Prescott's model. McGratten and Prescott's model has the potential of being a powerful tool, but better information regarding stocks of tangible assets is needed, and economists need to increase their understanding of how to value intangible assets. Depending on the model that is chosen and the assumptions that are made, an infinite number of results will occur.

Because of the sensitivity of the model to very small changes in fundamentals, I am hesitant to accept that the stock market was either correctly or undervalued right before it crashed in 1969, 1973, and 1987. For this same reason I am also hesitant to believe that the stock market was overvalued in 1962, particularly because of the rapid rebound it made. There is no doubt that economists and the original authors will continue to build and improve upon this model.

The inability of this model, amongst many others, to accurately identify the presence of an asset bubble raises serious questions as to the role of monetary policy in

reacting to large changes in stock prices. Although a bursting bubble will lead to a stock market crash, Mishkin and White have shown that a stock market crash does not have to result in financial instability. Instead of focusing our efforts on identifying asset bubbles and reacting to them, a more desirable solution would be to ensure the proper policies are in place that add to the overall health of the financial system.

Appendix:

Table 1:

National Income and Product Account Data (NIPA)

NIPA Concept	1987	1973	1969	1962
Product Relative to GNP:				
Private Consumption	0.548	0.527	0.531	0.537
Government Consumption	0.168	0.175	0.170	0.165
Corporate Investment	0.102	0.083	0.079	0.070
Noncorporate Investment	0.182	0.215	0.220	0.228
Total Product (GNP)	1.00	1.00	1.00	1.00
Income:				
Corporate Sector:				
Corporate Compensation	0.389	0.037	0.362	0.352
Indirect Business Tax	0.054	0.058	0.056	0.053
Capital Consumption	0.065	0.045	0.045	0.045
Profits	0.066	0.093	0.100	0.097
After Tax Profits	0.039	0.054	0.058	0.050
Profits Tax	0.027	0.039	0.042	0.047
Net Interest	0.017	0.004	0.001	-0.001
Value Added	*0.591*	*0.571*	*0.564*	*0.546*
Noncorporate Sector:				
Noncorporate Compensation	0.238	0.266	0.27	0.284
Indirect Business Tax	0.023	0.03	0.03	0.028
Capital Consumption	0.057	0.055	0.057	0.061
Profits	0.040	0.051	0.074	0.063
Net Interest	0.051	0.027	0.005	0.018
Value Added	*0.409*	*0.429*	*0.436*	*0.454*
Total Income	1.00	1.00	1.00	1.00

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