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PUZZLES OF INFLATION, MONEY, AND DEBT
APPLYING THE FISCAL THEORY OF THE PRICE LEVEL

THOMAS S. COLEMAN,
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AND LAURENCE B. SIEGEL

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ISBN 978-1-952927-22-5

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PUZZLES OF INFLATION, MONEY, AND DEBT

APPLYING THE FISCAL THEORY OF THE PRICE LEVEL

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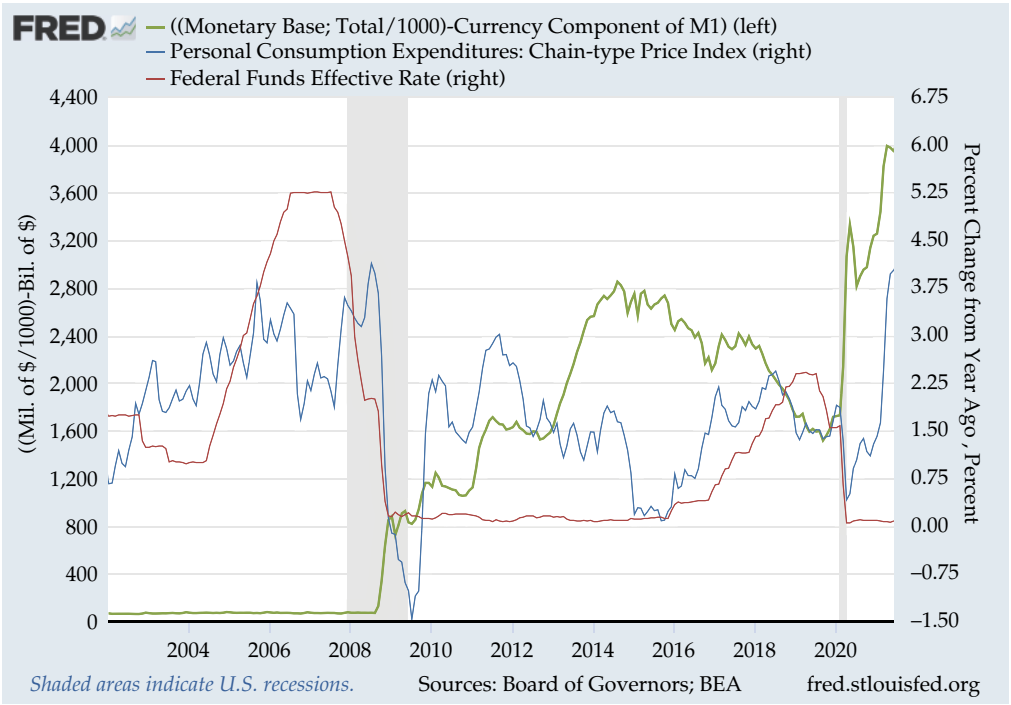
WHY WE NEED A NEW THEORY OF PRICES AND MONEY

We live in tumultuous times—memories of an extraordinary financial crisis are still with us while we experience a once-in-a-century pandemic. Governments around the world are spending money at fabulous rates. These circumstances cause us to ask, What is money and where does it come from? What determines its value, in terms of real economic resources (goods and services)? What determines the price level; what determines inflation? To answer these questions, we need a theory of money and inflation.

Classical monetary theory—originally enunciated by David Ricardo (1817) and John Stuart Mill (1848, for example); developed by Irving Fisher (1928, for example) and John Maynard Keynes (1936, for example); and substantially revised and extended by the neoclassical economists Milton Friedman, Anna Schwartz (see Friedman 1987; Friedman and Schwartz 1963), and many others of the Chicago school—says that prices and inflation are determined by the quantity of money in an economy. This definition served economists well for much of the 20th century. It was superseded, at least among central bank and academic economists, by New Keynesian theories in which central banks control inflation by targeting interest rates.

Neither of these theories fared well after 2008, however. For nearly a decade after the global financial crisis, central banks flooded the banking system with reserves and kept interest rates close to zero, as seen in **Figure 1**. The policy goal was to increase inflation, and yet inflation remained stable and low. Keynesian, New Keynesian, and Friedman's quantity theories

FIGURE 1. BANK RESERVES (PROXY, $ BILLIONS), EFFECTIVE FED FUNDS RATE, AND INFLATION (PERSONAL CONSUMPTION EXPENDITURES DEFLATOR, ANNUAL PERCENTAGE CHANGE), 2002–2021



Note: We use the monetary base minus currency as a rough measure of reserves in the banking system. This metric tracks reasonably closely the "Reserves plus Vault Cash" shown in the Fed's balance sheet, Table L109 of the "Financial Accounts of the United States—Z.1" (2021).

Sources: Board of Governors of the Federal Reserve; US Bureau of Economic Analysis.

predict that pegging the interest rate at zero leads to unstable inflation or spiraling deflation. The quantity theory of money predicts that massive quantitative easing results in large inflation. None of these outcomes happened. Inflation was positive, low, and stable. The past decade's experience with the zero lower bound and low and stable inflation—the divergence between evidence and the Keynesian, New Keynesian, and monetarist predictions—should be recognized as the serious challenge that it is for both academic and central bank economists.

Nor is inflation the only issue. Money itself has evolved beyond the boundaries of traditional theories, so that standard approaches no longer provide a functioning theory of money and inflation. Transactions today often involve electronic bank or brokerage transfers with little or no traditional "money" (either cash or bank deposits). Bonds and money are nearly substitutes, with almost-instantaneous transfers from a bond mutual fund to a credit card payment. Central banks are considering, or have actually introduced, digital money that exists only on

the books of the central bank, without any physical manifestation (cash) or connection to the commercial banking system (demand deposits). Technological innovations such as blockchain and cryptocurrencies have the potential to drastically alter the use and meaning of money.

Such changes in the form of money challenge classic theories of inflation and money in two ways. First, when traditional money disappears from daily life, the foundations of the quantity theory melt away. Transactions that can be accomplished with no traditional money remove the connection between money, on the one side, and prices, on the other, in the quantity equation $MV=PQ$ (i.e., velocity, V, becomes either zero or infinity). Second (saying the same thing from a different perspective), when traditional money is no longer used, we have no way to set the value of a "dollar" relative to other goods. One of the fundamental functions of money is as a unit of account, the accounting unit in which all other goods are denominated. The basic question is, if the time comes when physical dollars no longer exist, how will we even be able to think about the value of a dollar?

We discuss in this brief a new approach that addresses modern issues of inflation and money, a theory that helps explain both low inflation post-2008 and money in the current world of electronic transfers and cryptocurrencies. The theory, called by scholars the "fiscal theory of the price level" (FTPL), is based on neoclassical economics but is updated to reflect today's institutional realities and address today's monetary and inflation puzzles. In particular, it is consistent with a world that differs profoundly from both the gold standard of the 19th century and the paper-currency fiat money world that Milton Friedman sought to understand.

Our work in this brief synthesizes the work of Eric Leeper (1991), John Cochrane (1998, 2021), and many others—plus a few of our own interpretations and applications. We present it for the purposes of teaching and popularization: to increase public understanding of the issues.[1,2]

WHAT IS THE FISCAL THEORY OF THE PRICE LEVEL?

The quantity theory of money says that prices and inflation are determined by money supply and demand: "Inflation is always and everywhere a monetary phenomenon," in Friedman's words (Friedman 1987). The quantity theory applies to unbacked or fiat currencies, the paper money developed in the early part of the 20th century. It has proved powerful, offering insight into inflationary episodes from the German hyperinflation of the 1920s to the great inflation of the 1970s in the United States.

The FTPL, in contrast, says that prices and inflation depend not on money (or not on money alone) but on the overall liabilities of the government—money and bonds. In other words, inflation is always and everywhere a monetary *and fiscal* phenomenon. In one sense, this statement simply says out loud what we all know (or should have known)—namely, government monetary policy will sometimes depend crucially on the government's fiscal behavior.

[1]The historical development of the FTPL may be traced in Leeper's (1991) "Equilibria under 'Active' and 'Passive' Monetary and Fiscal Policies," Christopher Sims's (1994) "A Simple Model for Study of the Determination of the Price Level and the Interaction of Monetary and Fiscal Policy," Michael Woodford's (1994) *Monetary Policy and Price Level Determinacy in a Cash-in-Advance Economy*, and Cochrane's (1998) "A Frictionless View of U.S. Inflation." Cochrane's (2021) book *The Fiscal Theory of the Price Level* is the definitive reference.

[2]We want to strongly emphasize that these ideas have nothing to do with Modern Monetary Theory.

For example, the German hyperinflation in 1923 was, indeed, a monetary phenomenon, but for the genesis of the hyperinflation, we need to look to fiscal policies—the government's unwillingness or inability to meet its obligations through the means of traditional tax and spending and its use of the "inflation tax" to raise revenue. Even more telling is that it is the *interplay of monetary and fiscal reforms* that provides insight into the end of the hyperinflation in November 1923 that is lacking when we focus on money alone.

The essence of the FTPL is simple: The real value of government liabilities must equal the discounted value of future real cash flows the government uses to pay them back. In terms of an equation:

$$\frac{M+B}{P} = EPV\,[\text{future surplus}], \tag{1}$$

where $(M + B)/P$ is the real value of liabilities (i.e., bonds, B, plus money, M, deflated by the price level, P, so that the value of $M + B$ is in real terms) and $EPV(FS)$ is the expected present value of future surpluses (measured in real terms)—that is, the discounted value of future primary surpluses of the government (real revenues minus expenses other than interest on the debt) available to pay back liabilities.

The present value relationship closely resembles the dividend discount, or discounted cash flow, equation for stocks or any other security—and this resemblance is no accident. Government liabilities (money plus bonds) are a form of "stock in the government" whose value follows from the government's willingness and ability to extract real resources to repay those liabilities.

The FTPL replaces both the quantity theory and New Keynesian theory (focused on interest rate targeting). In contrast to the quantity theory's focus on money alone, the FTPL formalizes the relationship between fiscal policies and monetary phenomena, thereby laying out the mechanism through which monetary and fiscal policies interact to determine the price level. The FTPL extends classic monetary theory in two important respects. First, it generalizes the concept of "money" to a world of electronic transfers, money market funds, and instantaneous payments, where the classic distinctions between "money" and "bonds" no longer apply. Second, it provides insight into "monetary puzzles" that we would otherwise struggle to understand.

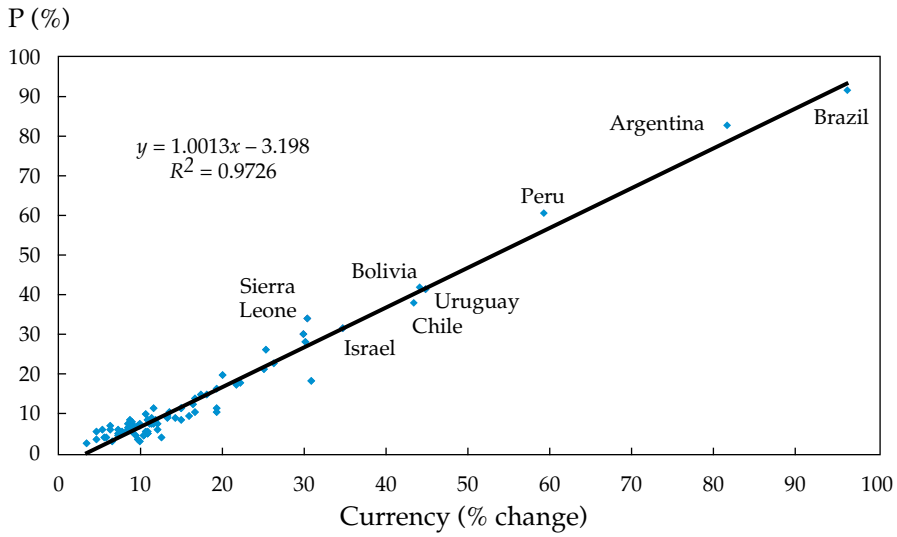
The first and most pressing of the modern monetary puzzles is the subdued inflation following the 2008 financial crisis. In the autumn of 2008, a massive monetary stimulus occurred. The Federal Reserve System injected unprecedented reserves into the banking system under a policy called "quantitative easing," and prices went *down*. Figure 1 shows that reserves jumped whereas prices did not rise and, for a time, actually fell. During the following years, particularly from 2009 through 2015, reserves (and money) continued to grow, the Fed maintained interest rates at (effectively) zero, and inflation remained low.

So, the most expansionary monetary policy in US history—the post-2008 period—did not cause a meaningful increase in the inflation rate. According to alternative theories—quantity theory, old Keynesian, or New Keynesian—this phenomenon is very strange and cries out for explanation. We believe that the FTPL is the most fruitful explanation, and we discuss the post-2008 period in detail in following sections.

Money and Inflation

Low inflation is the monetary puzzle of the 2000s, but the enduring observation regarding inflation is the association between high rates of money growth and high rates of inflation. The

FIGURE 2. RELATIONSHIP BETWEEN INFLATION AND MONEY GROWTH FOR 80 COUNTRIES, 1960–1995



Notes: All growth rates are annual averages for the sample periods, 1960–1995 for most countries.

Sources: Redrawn from a diagram in Barro (1997). Data from the International Monetary Fund's International Financial Statistics database.

nature of money has changed, and although the study of "monetary theory" is not as popular today as it once was, Robert Barro (1997) calls this association "one of the oldest and most reliable conclusions about macroeconomic behavior." According to Friedman (1987, p. 25),

> There is perhaps no empirical regularity among economic phenomena that is based on so much evidence for so wide a range of circumstances as the connection between substantial changes in the quantity of money and in the level of prices.

We will not detail the large volume of such evidence, either in Friedman's work or elsewhere. Instead, we simply provide one figure illustrating that, across a wide range of countries and a wide range of inflation rates, we find over a recent 35-year period a nearly one-to-one connection between growth in money and growth in prices. **Figure 2** shows the average annual inflation rates for 80 countries compared with the average percentage change in currency over the 1960–95 period. The statistical relationship is strong, and the general principle underlying the relationship has been documented over five centuries of history.[3]

This strong relationship between money and inflation is a crucial fact that any theory must reproduce. Evidence that money and prices move together, however, does not prove that money causes inflation: Correlation does not prove causation. What Friedman's quantity

[3]The suggestion that money and prices are related was made as early as 1517 by Copernicus, who wrote that (translated) "money can lose its value also through excessive abundance" (Volckart 1997, p. 435).

theory says is that money does, indeed, cause inflation and that "inflation is always and everywhere a monetary phenomenon." Much of *A Monetary History of the United States* (Friedman and Schwartz 1963) was the marshalling of theory, argument, and evidence to demonstrate that money is the cause of changes in prices (inflation).

The quantity theory aimed to solve an apparent puzzle posed by the rise of fiat currency in the early 20th century: How can such paper money—paper with no backing, no promise of exchange for gold, no intrinsic value—have value? The quantity theory solution is the idea of money demand (and supply) that lies behind the $MV = PQ$ of quantity theory: Fiat money has value because of the benefit it provides when used in trade and in day-to-day business (convenience yield or utility value).

The FTPL overturns quantity theory at its foundations by showing that fiat money is, in fact, backed, by the promise of future surpluses, as shown in Equation 1. Money demand (as a result of the utility value) can be easily incorporated in the FTPL, but money demand (utility value) is not necessary for the FTPL to provide a theory of inflation, prices, and money. The fiscal theory runs counter to quantity theory by positing that prices depend not on the quantity of money but rather on the fiscal backing of the government's liabilities (money and bonds).

In a sense, the fiscal theory is a reversion to a classic view of commodity-backed money, such as a gold-exchange standard, in which the value of money is set by the promise to exchange paper notes for gold. In the fiscal theory, the commodity is not a tangible good but an expectation of future (real) cash flows, such as the cash flow expectation that backs a stock or corporate bond.

The fiscal theory of the price level may remove "money" as the causal factor for inflation, but it does not reject the evidence on money and inflation—given the wealth of such evidence, it could hardly hope to do so. In certain cases, the fiscal theory will generate the same predictions as the quantity theory, particularly a strong association between money and prices. And indeed it should, because the quantity theory has been eminently successful in many circumstances. In this sense, the fiscal theory aims to supplement and extend the quantity theory. It does so by deepening our understanding in circumstances where the quantity theory was successful—by illuminating the true underlying fiscal mechanisms of those seemingly monetary cases—and by accounting for cases where the quantity theory has failed.

We need to emphasize that the FTPL is a "monetary theory," in the sense that it says how the value of a "dollar" is determined. It is not, however, a theory of *money alone* as is the quantity theory. The FTPL applies equally well to a world with bonds alone and no cash or other "money" (by simply setting M to zero in Equation 1). In the FTPL, the value of a dollar is set by denominating bonds in dollars and the promise that the government will repay a dollar of bonds with future surpluses.

We need to mention in passing that, although the FTPL is a monetary theory, New Keynesian macroeconomic theories (used by many academic and central bank economists) are not. In these approaches, the price level (and thus inflation) is set by central bank interest rate policy in the absence of money. The FTPL incorporates money (or bonds, which can be close enough to be the same) and, in this sense, is closer to classical monetary theory.

Policy Regimes and Monetary–Fiscal Coordination

To understand the causes and nature of inflation in the FTPL, we turn to the fundamental relationship given in Equation 1: $(M + B)/P = EPV(FS)$. We need to take into account various circumstances and scenarios. For the first scenario, consider an increase in money (or bonds) with an equal increase in expected (real) future surpluses. This situation would occur when coordination between monetary authorities (responsible for the issuance of money) and fiscal authorities (responsible for taxing and spending) ensures that any increase in money or bonds is matched by an increase in taxes (or reduction in spending) so that both sides balance.

In this case, no change in prices occurs, and no inflation is caused by the increase in money. This outcome stands in contrast to the quantity theory's prediction that an increase in the money supply will cause prices to rise, but it is nonetheless what we observe after 2008 (robust growth in money with subdued inflation) or in the immediate aftermath of the German hyperinflation (substantial growth in money with almost no inflation). The prediction of the FTPL in this situation—increased money (or bonds) and no inflation—depends crucially on the policy regime of monetary–fiscal coordination. The coordination needed for the no-inflation result to occur (in this first scenario) is that fiscal authorities set taxes and spending to whatever is necessary to offset the change in money.

Policy coordination is crucial to using and understanding the fiscal theory. That such policy coordination regimes exist, are durable, and are recognized and believed by the public are crucial auxiliary hypotheses for the fiscal theory. Policy coordination regimes can be implicit rather than formal or legislated, but they must be present for the FTPL to be useful as an economic theory. The concept of a coordination regime may sound feeble and fragile, but regimes turn out to be strong, durable, and long lived. As Cochrane (2021, p. 41) says,

> Good reputations and institutional constraints on inflationary finance are often hard to break. Once people are accustomed to the reputation that Treasury issues, used to finance current deficits, will be paid back in the future by higher surpluses, it is hard to break them of that habit.[4]

The second scenario, the polar opposite, would be for the fiscal authorities to make no change, to leave future surpluses unchanged when money changes.

Under the regime in this second scenario, with no change in expected future surpluses, the right side of Equation 1 does not change, so the left side must remain unchanged even though $M + B$ has changed. The only way to balance is for P to increase (i.e., inflation). This approach sounds much like the quantity theory—predicting that an increase in money causes inflation. But the source and reasons are different. In the FTPL, the money (and bonds) are valuable because of the future resources [the expected future surpluses, $EPV(FS)$]; that is, money is "backed." When money or bonds increase and

[4]The United States, starting with Hamilton's restructuring of the debt in 1790, has developed a long and durable reputation for raising the revenue necessary to pay back debt. See Hall and Sargent (2015), Sargent (2011), Sylla (2010), and Sylla, Wright, and Cowen (2009).

expected future surpluses do not, the result is inflation.[5]

The contrast between these scenarios or regimes offers two takeaways. First, the effect is the same whether money or bonds change. The overall government liability position is the important factor. Second, and a related point, is that switching between bonds and money (with no change in the sum) has no effect on inflation. Both of these takeaways depend on bonds and money being substitutes, which is a pretty good representation of our current world (with electronic transfers making switching between bonds and "money" close to costless and with the Fed paying interest on bank reserves). In other circumstances, we might need to build in costs of switching, but doing so would be a modification rather than a fundamental change in the theory.

These two scenarios show that the relationship between money and inflation depends crucially on the coordination regime—the beliefs and institutional arrangements that determine how changes in money and bonds, on the one hand, are coordinated with future surpluses and expectations, on the other.

Debt as Government Stock and Discounting Primary Surpluses

The right side of the FTPL equation, $EPV(FS)$, is a present value. The overall equation is the exact analog of the dividend discount equation for valuing company stock as the present value of future dividends. The idea of "debt as government stock," together with the analogy of a company issuing shares, helps illuminate the concept of monetary–fiscal coordination. IBM selling new shares will generally *not* dilute the existing shareholders' ownership or cause the share price to fall; instead, it will raise the equity value by the amount of the new cash. Why can IBM sell new shares and bring in new cash without diluting value for existing shareholders? The answer: because (in general) investors anticipate and expect that IBM is selling new shares to exploit profitable opportunities that will raise overall (not per share) earnings and dividends sufficiently to maintain or raise the current market value of the existing shares.

A regime in which future surpluses rise is the parallel in government finance of this type of successful share issue: A rise in debt matched by corresponding higher future surpluses causes no change in prices (no inflation).

A regime in which future surpluses do not rise is the analogue of a dilutive share issue, where a company does not have business opportunities that raise future dividends. In such a regime, investors anticipate that when the government issues debt, future surpluses will not rise sufficiently, and the basic equation, Equation 1, implies that $(M + B)/P$ must remain unchanged—so P must rise to offset the rise in B.

We need to highlight that the surpluses in $EPV(FS)$ are *primary* surpluses, not the surplus as usually reported. The standard surplus is government revenue (taxes) minus spending and interest payments. The primary surplus is revenue minus spending, *excluding interest payments*. Initially, this definition of primary surplus seems counterintuitive, but the analogy with company dividend discount models makes

[5]In the quantity theory, money is intrinsically worthless paper whose value comes from its usefulness in business and day-to-day activity. If the number of pieces of paper goes up, the value (usefulness) of each piece of paper must go down—inflation.

the reason clear. For a company, the free cash flow—income less expenses—is available to pay dividends. Interest expenses are indeed an expense and must be deducted before calculating the cash flow available to owners to be paid as dividends. But for a government, interest payments are really government "dividends"—the analogue of company dividends. In calculating the free cash flow available to pay company owners, fixed spending but not dividends themselves should be deducted. Similarly, to measure the free cash flow available to pay back government bondholders, we must consider the free cash flow—revenue minus spending excluding interest.

FTPL Summary

Equation 1, $(M + B)/P = EPV(FS)$, is the fundamental or guiding equation for the fiscal theory, in the same way that the quantity equation $MV = PQ$ is fundamental for the quantity theory. This equation contains a number of important ideas. First, it is the government's overall liabilities—bonds plus money—that are crucial for understanding inflation. The fiscal theory treats bonds and money as substitutes or near-substitutes, a good approximation to the current world of electronic transfers and low rates. This aspect would require some modification to apply to, say, 1921, when hand-to-hand currency and the idea of gold as money were prevalent.

Second, what determines prices and inflation is the balance between liabilities (money plus bonds) and future surpluses, not the absolute level of money or bonds. If money rises but the expectation is for fiscal balance and future surpluses (as seems to have been the case in 1924 in Germany), prices will not rise. Thus, the fiscal theory is much richer than the quantity theory but also more complex to understand. The policy regime and expectations about current and future monetary–fiscal coordination are central to any predictions. In a regime where fiscal authorities raise future taxes sufficiently to pay off an increase in money—again, what seems to have held in Germany after November 1923 and what Leeper (1991) labeled a passive regime—such an increase in money will *not* be inflationary. In a situation where authorities credibly promise *not* to raise future taxes—for example, in 1933 when Roosevelt abrogated the gold clause, as argued by Jacobson, Leeper, and Preston (2019)—a rise in money or bonds *will* generate inflation.

Policy regimes depend on formal institutional arrangements but also on informal norms and, most importantly, the public's expectations of future government behavior. Defining, delimiting, and understanding the relevant policy regime is difficult but crucial for applying the fiscal theory. It is also valuable because it forces us to be more explicit about the particular context in which the monetary and fiscal authorities operate.

The final, and very important, idea we take from Equation 1 is that the expected present value of future surpluses, being discounted future cash flows, depends also on the real discount rate. If the real rate discounting future (real) surpluses, $EPV(FS)$, goes down with no change in expected surpluses, then the present value rises. If money or bonds do not change, the price level must fall (deflation). Such a scenario could occur during a financial or liquidity crisis when a "flight to quality" takes place—something that we will see when considering the post-2008 experience.

INFLATION AND MONEY POST-2008

The 2008 financial crisis—the largest since the 1930s—led to new central bank policies and dramatic monetary events.[6] The Fed kept short-term policy rates at effectively zero for years. Bank reserves exploded, jumping from $70.7 billion in August 2008 to $882 billion in January 2009—an increase of more than a factor of 10 in just five months. The subsequent years saw continued expansion of the Fed's balance sheet under a variety of unorthodox "quantitative easing" (QE) measures—buying of mortgage securities, large purchases of US Treasury bonds—all in addition to the Fed's zero-interest-rate policy. With such dramatic increases in "money," many commentators predicted high inflation. The Federal Reserve also made higher inflation an explicit goal. And yet, inflation remained subdued.

The COVID-19 pandemic hit the United States in March 2020; the Fed's balance sheet once again expanded dramatically and the Fed lowered rates. At the time of this writing (summer 2021), the low-interest-rate policy and balance sheet expansion are continuing and have again generated fears of loose money engendering unwanted inflation.

According to the quantity theory, the post-2008 and post-pandemic policies should have generated substantial inflation. Instead, prices fell in the immediate aftermath of both 2008 and the 2020 pandemic onset. For the post-2008 decade, inflation remained subdued (long-term inflation for the pandemic era is still an open question). The bottom line is that in spite of sustained efforts by policymakers to generate higher inflation post-2008, inflation was largely subdued.

In this section, we lay out the contours of Fed policy and the changes it has undergone in the past few years. We interpret the experience through theories of money and inflation. The fiscal theory helps us understand why the Fed's balance sheet expansion and zero-interest-rate policies did not lead to runaway inflation after 2008 and why it did not do so during the pandemic's initial stages.

Interpreting these events and their impact on inflation through the lens of the fiscal theory, we argue that traditional quantity theory (and also New Keynesian interest-rate-targeting theories used by academic and central bank economists) cannot account for recent inflation behavior. The success of the fiscal theory and the failure of the quantity theory illustrate the value of the former. Any new theory is particularly valuable when it can serve two purposes: (1) explaining episodes that are puzzles under accepted theory and (2) deepening our understanding of episodes generally thought to be supportive of traditional theories. We believe the FTPL does both.

Two important caveats: First, we focus on the connection between the Fed balance sheet and the price level (inflation), not on wider implications of the growth in Fed assets and intervention in markets. We recognize that the Fed's QE policies have had effects beyond raising (or failing to raise) the overall price level. Buying long-dated Treasuries alters the term structure of interest rates. Buying mortgage bonds alters risk premiums and risk-adjusted rates of return. The zero-interest-rate policy depresses real

[6]The 2008 crisis was global, but we are focusing on monetary events and inflation in the United States. We are also not speculating on either the causes of or the cures for such a crisis.

returns and alters the trade-off between current and future consumption. All of these issues are important but are not our focus here; we leave them for future discussion.

Second, we are absolutely *not* claiming that monetary policy cannot generate inflation. Rather, we simply argue that certain aspects of the post-2008 money expansion set the stage for low inflation. The FTPL does *not* say that fiscal or monetary policy is powerless to cause inflation. It does say that we need to examine more carefully the fiscal foundations of government policy to understand inflation.

Three Approaches to Inflation (and Money)

For the post-2008 period, we want to contrast the approach and predictions of the fiscal theory with alternative theories of money and inflation. We focus primarily on the quantity theory of money but also mention New Keynesian (dynamic stochastic general equilibrium, or DSGE) theories. The fiscal theory makes sense of puzzles that these alternate theories cannot address. Before comparing predictions, however, we must briefly review the models.

The quantity theory is straightforward: Increases in the quantity of money cause increases in prices, that is inflation. A central bank can control inflation by controlling the quantity of money. Increase the quantity of money to generate inflation; decrease (or slow the growth of) money to slow inflation.

Two problems arise when applying the quantity theory to the post-2008 period. The first is that no central bank today targets or directly controls the quantity of money. This problem is relatively minor. As we argue in a moment, a central bank may indirectly alter the quantity of money by targeting and controlling interest rates.

The second problem is more fundamental: The quantity theory simply does not fit the facts of the post-2008 era. Reserves exploded. Money grew robustly. And yet, inflation remained subdued. This problem is what the fiscal theory aims to address.

As for interest rate targeting, in today's world, central banks target interest rates with Taylor rules or similar policies.[7] These rules generally dictate that, to counteract a rise in inflation, the monetary authority should raise nominal interest rates—and by more than one-for-one with inflation. Conversely, the monetary authority should *lower* rates if inflation is "too low" and the goal is to generate inflation.

The mechanism by which interest rate changes translate to inflation rates differs between theories. We start with quantity theory. In the standard story, money held by the public consists of currency and commercial bank demand deposits (checking accounts). Bank demand deposits are actually short-term (on-demand) loans that customers make to banks, but banks need to hold some fraction as reserves to redeem deposits on demand. Those reserves are generally borrowed in the market (at the Fed Funds rate) and then deposited as reserves with the Fed.

Higher interest rates increase the cost of holding currency (relative to interest-bearing bonds) and the banks' costs of holding reserves at the Fed. Higher cost will reduce the quantity of money. The standard story is discussed in more detail in the box "Money Creation under the Quantity Theory."

[7]See Taylor (1993).

MONEY CREATION UNDER THE QUANTITY THEORY

Figure 3 illustrates the traditional story of money and money creation prior to 2008. Starting in October 2008, when the Fed began paying interest on reserves, this standard story altered. Instead, the cost of holding reserves (the difference between the zero rate paid on reserves and the cost of reserves—generally, the Fed Funds rate) fell to close to zero.

M1 or "narrow money," so called because it is the most basic or restrictive measure of money, consists of *currency* plus *deposits* (checking deposits). Currency is simple—the pieces of paper printed by and issued by the Fed, amounting to $773.9 billion at the end of 2007. Bank deposits or checking deposits are also widely used as money and considered to be money, but bank deposits are created by banks, not the Fed directly.

The Fed issues currency to a bank in return for a Treasury bill or bond through what are called "open market" operations. You or I will generally acquire our currency through the bank as an intermediary, but the effect is the same as if we bought currency directly from the Fed in return for a bill or bond.

Checking deposits are a little more complicated. A bank deposit is a loan from a bank's customer to the bank. It is a special type of loan, one that can be redeemed upon demand (thus the term "demand deposit"). Because banks promise to pay it back in currency upon demand, customers generally treat a demand deposit as equivalent to currency—as "money."

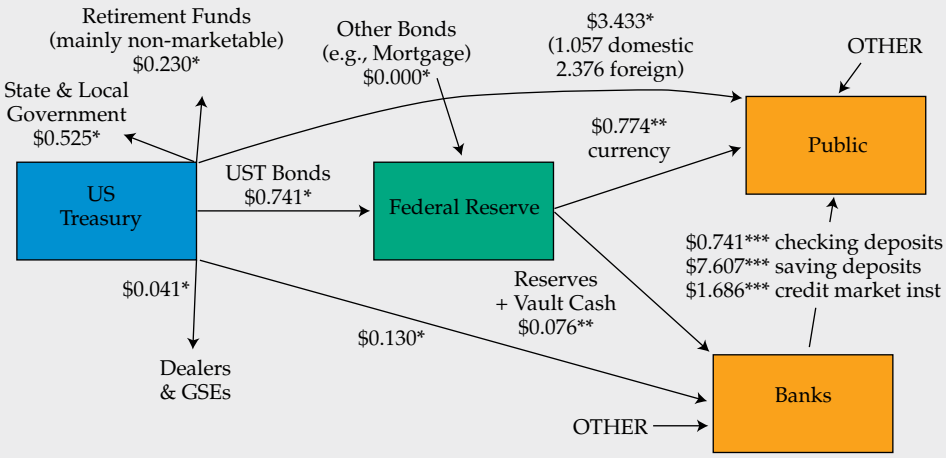
The bank will use the loan from the customer (the demand deposit) in its business of making loans to borrowers, investing in other securities, and so on. But banks need to hold *reserves* against the contingency that some fraction of customers will come in on any day and demand repayment of the loan (demand deposit) in currency.[8]

Vault cash is the obvious reserve to hold but is costly: Cash may be stolen, and it earns no interest sitting in the vault. A more efficient way of holding reserves is to take some of the customer's currency and deposit it at a local Federal Reserve bank as "reserves at the Fed." This reserve is less costly than vault cash (it cannot be stolen), but prior to 2008, it did not itself pay interest—so it would be costly relative to investing in the bank's regular (loan) business.

When a bank does not have enough reserves of its own to deposit at the Fed, it will borrow overnight from another bank in the *Fed Funds* market. The rate in that market (the Fed Funds interest rate) has traditionally been a direct measure of the cost of reserves.

[8]Banks are also required by law to hold some minimum level of reserves, irrespective of the bank's judgment on what level of reserves is needed, to avoid runs.

FIGURE 3. THE FEDERAL RESERVE WITHIN THE US DEBT AND MONETARY ENVIRONMENT, AS OF THE END OF 2007 ($ TRILLIONS)



Notes: Arrows indicate the holding of bonds issued by the US Treasury (for example, such bonds held by the Federal Reserve) or reserves issued by the Fed. Bonds are acquired by transfer of cash or other assets, but those transfers are not shown in the diagram. Inst = instruments.

Source: *Table L209 (and D3), **Table L109, and ***Tables L110–L115 in "Financial Accounts of the United States—Z.1" (2021), Fourth Quarter 2011, released 8 March 2012.

The traditional way the Fed controls money creation and money supply is through control of *high-powered money* (HPM)—the sum of currency plus reserves—also called "the monetary base." The Fed controls HPM through *open market operations* and by setting the Fed Funds rate. Open market operations are buying bonds (issuing dollars) to increase HPM and selling bonds (taking in dollars) to decrease HPM. Reducing HPM will reduce money creation, by either directly drawing currency from the public or by reducing bank reserves and thus banks' ability to create demand deposits (borrowing from customers by creating demand deposits or checking account "money").[9] The Fed could also control bank reserves (prior to October 2008) by changing the Fed Funds rate. A higher rate would make reserves more costly, thus reducing the quantity.

[9]An alternative approach is raising or lowering the Fed Funds rate. Less HPM will make bank reserves more scarce and thus increase demand in the Fed Funds market, raising the Fed Funds rate. Debates are ongoing about whether the Fed does or should target the quantity of HPM or the Fed Funds rate, but in any case, the mechanism is through injecting reserves (buying bonds in open market operations) or draining reserves (selling bonds).

So, to sum up, the traditional story of the Fed's balance sheet, money, and money creation is as follows:

- Money (M1) has two components—currency and demand deposits (bank checking accounts).
  - Currency—$773.9 billion at year-end 2007
  - Checking accounts (bank deposits or demand deposits)—$740.8 billion at year-end 2007
- The important components of the Fed's liabilities are currency and reserves—the sum being HPM, also known as the monetary base.
  - Currency—$773.9 billion at year-end 2007
  - Reserves and vault cash—$75.8 billion at year-end 2007
- Fed assets are (primarily) US Treasury bonds—$740.6 billion at year-end 2007.
- Banks create demand deposits (borrowing from customers) but are constrained in creating deposits by scarcity and cost of reserves.
  - Reserves are expensive and a scarce resource, and demand deposits (bank borrowings) are limited by the cost and availability of reserves.
  - Banks hold roughly $1 of reserves for every $10 of deposits (fractional reserve banking).
- When the Fed increases HPM (either directly through open market operations or indirectly by lowering rates), money supply increases; currency increases directly; and banks use additional reserves to create demand deposits.
- Increased money supply produces inflation, governed by the quantity theory equation $MV = PQ$.

In old Keynesian theories of ISLM aggregate supply and demand, raising rates by more than inflation serves to stabilize inflation expectations (interrupt wage–price spirals) in a world of adaptive expectations.[10] Unfortunately, the rational expectations revolution of the 1970s and 1980s (as much as it is sometimes reviled today) demolished any theoretical foundations of old Keynesian theories based on adaptive expectations. The public is simply not stupid and will adjust its behavior to changing economic reality—you cannot fool all of the people all of the time.

In New Keynesian theories, Taylor-type interest rate policy (raising rates in response to a rise in inflation) looks the same, but the underlying mechanism differs dramatically. As Cochrane (2021) demonstrated, interest rate targeting in New Keynesian models is a mechanism for ensuring that ill-behaved equilibrium solutions are eliminated (see chapters 17, 18, and 19). Under New Keynesian theory, Taylor-type interest rate targets are a threat by central banks to effectively destroy the financial system if a spurious equilibrium threatens to emerge.

[10]ISLM is a Keynesian macroeconomic model of how the market for economic goods (IS) interacts with the loanable funds market (LM) or money market.

TABLE 1. SUMMARY OF FEDERAL RESERVE BALANCE SHEET, 2007 ($ BILLIONS)

Assets		Liabilities	
US Treasury securities	$740.6	Currency	773.9
Agency and GSE securities	0.0	Reserves + vault cash	75.8
Loans to banks	48.6		
Misc. (nonofficial FX)	40.5		
Other	121.6	Other	83.1
Total	951.3	Total	932.8

Note: GSE = government-sponsored enterprises. FX = foreign exchange.

Source: Table L109 ("Assets and Liabilities of the Monetary Authority") of "Financial Accounts of the United States—Z.1," Fourth Quarter 2011, released 8 March 2012.

If this approach sounds unrealistic, it is: New Keynesian theories are not truly monetary theories.

The Federal Reserve Balance Sheet and US Monetary Structure

We devote a fair amount of attention to money and the Federal Reserve balance sheet.[11] The increase in Fed liabilities has been a major concern for many during the post-2008 period. Although the Fed manages interest rates, not the quantity of money directly, the result is changes in Fed assets and liabilities. To understand the fiscal theory—and how and why changes in the money supply and the Fed balance sheet (and interest rate policies) have not generated inflation—we need to be clear about the Fed's balance sheet.

Table 1 summarizes the Federal Reserve balance sheet as of year-end 2007. The summary highlights the important items we will be concerned with—on the asset side, bonds (Treasuries and securities of agencies and government-sponsored enterprises) and loans to banks; on the liability side, currency and reserves. Remaining items are lumped together in "Other."

Figure 3, in the box "Money Creation under the Quantity Theory," shows the Fed in the context of the overall monetary structure of the United States in 2007, particularly debt issued by the US government (a major source of Fed assets) and the users of Fed liabilities (banks and the public). In 2007, most of the Fed's assets (78%) were US Treasury bonds. Liabilities were mostly currency issued to the public, one of the major components of "money." "Reserves and vault cash" were small but crucially important because reserves form the foundation for checking deposits, the other major component of money.[12]

[11]The main source for the Fed balance sheet data and figures is the Federal Reserve, "Financial Accounts of the United States—Z.1" for various years.

[12]Note that arrows in Figure 3 represent the holdings of assets, not flows. The $0.741 trillion arrow from "US

TABLE 2. FEDERAL RESERVE BALANCE SHEET ITEMS, SELECTED YEAR-ENDS ($ BILLIONS)

	2007	2008	2009	2014	2019	2020
Assets	**951.3**	**2,270.6**	**2,267.2**	**4,555.4**	**4,379.1**	**7,599.5**
Bonds	**740.6**	**495.6**	**1,844.9**	**4,236.9**	**4,011.8**	**7,365.5**
US Treasury bonds	740.6	475.9	776.6	2,461.4	2,540.7	5,217.9
Agency and GSE-backed holdings	0.0	19.7	1,068.3	1,775.5	1,471.1	2,147.8
Loans to banks + misc.	**89.1**	**1,619.9**	**172.5**	**235.6**	**25.4**	**145.8**
Liabilities	**932.8**	**2,249.6**	**2,241.6**	**4,526.8**	**4,216.6**	**7,299.8**
Monetary base (high-powered money)	**849.7**	**1,749.9**	**1,905.2**	**3,721.0**	**3,356.4**	**5,084.1**
Currency	773.9	832.2	873.3	1,267.3	1,724.2	1,989.9
Reserves + vault cash	75.8	917.7	1,031.9	2,453.7	1,632.2	3,094.2
Repos + other (gov't) deposits	**62.2**	**476.6**	**307.1**	**759.0**	**819.5**	**2,171.9**
Other data						
Bank checking deposits	740.8	814.6	952.6	2,021.2	2,635.7	5,184.0
Deposit-to-reserves ratio	9.77	0.89	0.92	0.82	1.61	1.68

Source: "Financial Accounts of the United States—Z.1," various years.

Chronology of Inflation since 2008: Explosive Growth in Money, Zero Rates, and Low Inflation

Stress in the financial system was apparent in the summer and autumn of 2008, but it was in September that the crisis erupted. Financial markets and banking services, particularly overnight financing, started to freeze up. The Federal Reserve took extraordinary measures—flooding the banking system with reserves, which grew by more than 10 times from December 2007 to December 2008 (see the row "Reserves + vault cash" in **Table 2**). The Fed's balance sheet grew in an unprecedented manner, in both size and form. Money growth accelerated dramatically. By December, the Fed Funds rate was effectively zero and would remain at zero for years.

Both the interest-rate-targeting theory and standard quantity theory would predict substantial inflation. And yet, inflation was subdued. Over many years, the Fed attempted, largely without success, to generate higher inflation.

Growth in the Fed's balance sheet since 2008 was given the name "quantitative easing," and it had various stages—QE1, QE2, and so on—but the essence was short-term rates maintained at zero for years, together with balance sheet expansion that occurred in three phases. Recently, we have

Treasury" to "Federal Reserve" shows that at the end of 2007, the Fed held $0.741 trillion of bonds issued by the Treasury.

seen a fourth phase of expansion in response to the coronavirus pandemic in 2020–2021.

The phases of balance sheet expansion have been as follows:

- Immediate 2008 response: autumn 2008 with an unprecedented increase in reserves
- Normalization of QE: purchase of bonds (US Treasury and mortgage bonds) during 2009
- Continued QE expansion: normal operation of QE during 2009–2014 with continued expansion of the Fed balance sheet
- Initial pandemic response: dramatic expansion of Fed balance sheet in 2020

Each of these phases should have produced substantial inflation, according to the standard quantity theory of money.

Figure 1 shows the increase in reserves after the September 2008 crisis in the financial markets and the Fed response; the monetary base less the currency component of M1 is a rough measure of bank reserves. Reserves jumped from $70.7 billion in August 2008 to $882 billion in January 2009.

Table 2 shows the change in the Fed's assets and liabilities from year-end 2007 to year-end 2008. Liabilities increased by a factor of 2.4 (140%) entirely as a result of increased reserves, which were up by a factor of 12 (1,100%). The asset categories that increased were both loans to banks (through the traditional route of the discount window and also through nontraditional mechanisms) and "nonofficial foreign currencies" through swap lines with foreign central banks.

During 2009, the Fed rearranged the balance sheet with holdings of bonds—particularly, agency and GSE-backed (mortgage) bonds—replacing the loans to banks and foreign central bank swap lines. On the liability side, currency and reserves increased somewhat (by, respectively, 5% and 12%), but the overall level of assets and liabilities changed little. The purchase of agency- and GSE-backed securities was both unorthodox and controversial, and it will be a point of discussion in the next section.

During the five years subsequent to 2014, the balance sheet grew robustly; assets and liabilities each grew at a compound rate of roughly 15% per year in nominal terms, or roughly 13% in real terms. This rate was substantially faster than prior to the financial crisis: For the three years 2004–2007, assets and liabilities grew by 4% annually. During the five years 2009–2014, holdings of US Treasury bonds grew faster than other assets and became a larger fraction of the Fed's balance sheet than in 2009. We will discuss the increase in Treasury holdings in the next section.

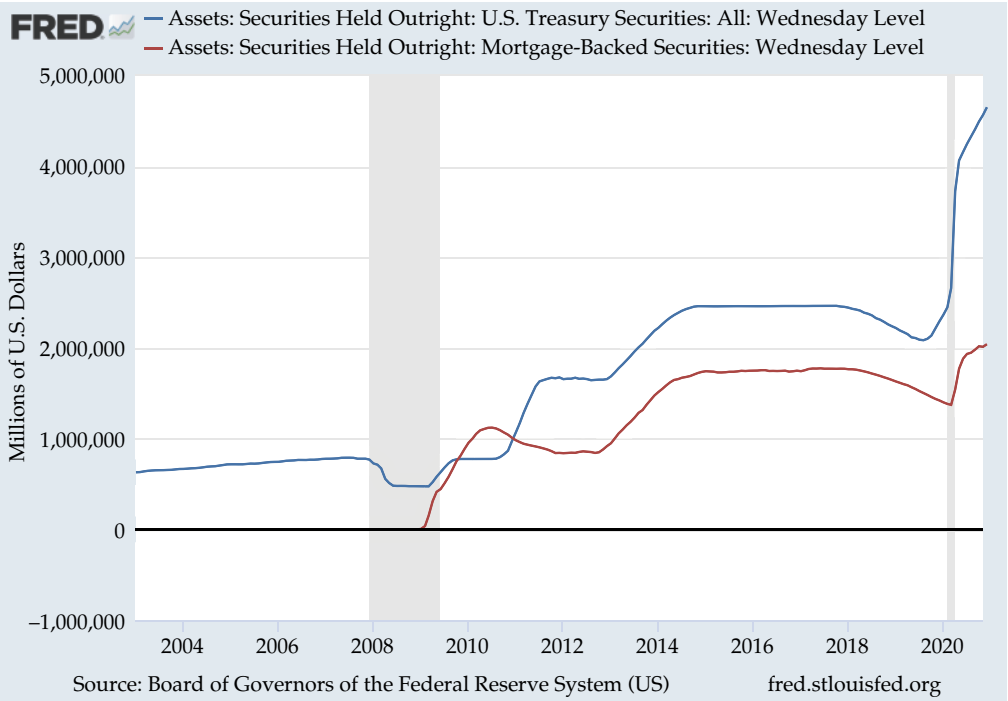
Figure 4 shows the time series for holdings of US Treasuries and mortgage-backed securities.[13] Mortgage securities increased dramatically during 2009, and both Treasuries and mortgage-backed bonds increased during 2009–2014, the period of QE.

The 2015–19 period was relatively quiet as far as the Fed's balance sheet is concerned. Assets and liabilities in real terms decreased by roughly 2% per year (also decreasing in nominal terms). Holdings of bonds were relatively stable (see Figure 4 and Table 2), and reserves fell (see Figure 1 and Table 2).

In early 2020, the coronavirus pandemic hit, and the Fed's balance sheet once again exploded. Table 2 shows the expansion from the fourth quarter of 2019 to the fourth quarter of 2020: Assets and liabilities grew by roughly 70% over the 12 months.

[13]The "Agency and GSE-backed holdings" in Table 2 are primarily mortgage-backed securities—80% at the end of 2009.

FIGURE 4. FED HOLDINGS OF US TREASURY SECURITIES AND MORTGAGE-BACKED SECURITIES, 2003–2021



Source: Board of Governors of the Federal Reserve.

Assets grew mainly as a result of the purchase of bonds, primarily Treasuries, as seen in **Figure 5**. On the liability side, bank reserves and security repos (Fed lending in the repurchase market) grew at rates of 90% and 165%.

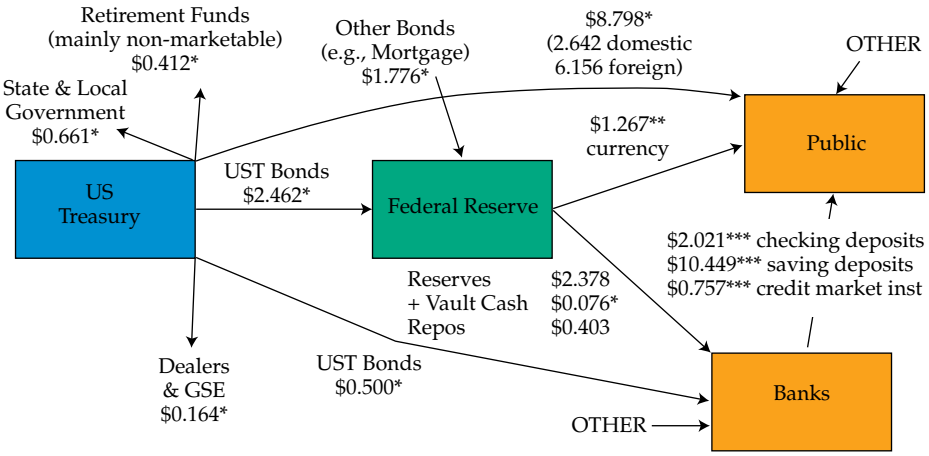
Next we turn to the interpretation of the Fed's actions (balance sheet expansion and interest rate targeting) in the context of the fiscal theory.

Phase 1 (2008): Liquidity Crisis, Unprecedented Bank Reserve Expansion, and Low Inflation

The standard quantity theory story for money creation and inflation (outlined previously) is that money is created either as *currency* (directly by the Fed) or as *demand deposits* (by banks using reserves supplied by the Fed). Reserves are a scarce and costly resource for banks, so the Fed's control of reserves (generally, prior to 2008, through interest rate policy and control of the Fed Funds rate) provides control over money growth. The quantity theory posits that money supply and prices are related through the equation $MV = PQ$. If money supply increases sharply in the short run (so that the level of economic activity or output, Q, is relatively constant), then the quantity theory posits that prices should increase sharply: inflation.

According to this story, the massive increase in reserves in late 2008 seen in Table 2 and Figure 1 should have produced a surge in inflation. In fact,

FIGURE 5. US DEBT AND MONETARY HOLDINGS, END 2014 ($ TRILLIONS)



Note: See the notes to Figure 3.

Source: *Table L210 (and D3), **Table L109, and ***Table L110 in "Financial Accounts of the United States—Z.1," First Quarter 2015, released 11 June 2015.

as can be seen in Figure 1 and **Figure 6**, prices *fell* in the immediate aftermath of 2008, and inflation remained moderate throughout the period.

The quantity theory is able to accommodate low inflation or even falling prices in the presence of rising reserves *during* a liquidity crisis such as 2008; so is the fiscal theory. The explanation for low inflation following the massive increase in reserves consists of two parts. The first involves fundamental quantity theory: Liquidity crises tend to produce low inflation. The second is a specific change in Fed procedures: The Fed started paying interest on reserves in 2008.

To understand why prices tend to go down during a liquidity crisis, it is critical to understand what is the "price of money." A widespread belief is that the interest rate is the price of money, and the tendency is to associate "low rates" with "cheap money." This belief is simply wrong. The (inverse of the) overall price level—say, the US Consumer Price Index or the Personal Consumption Expenditures Price Index—is the price of money. According to Friedman (1987, p. 15):

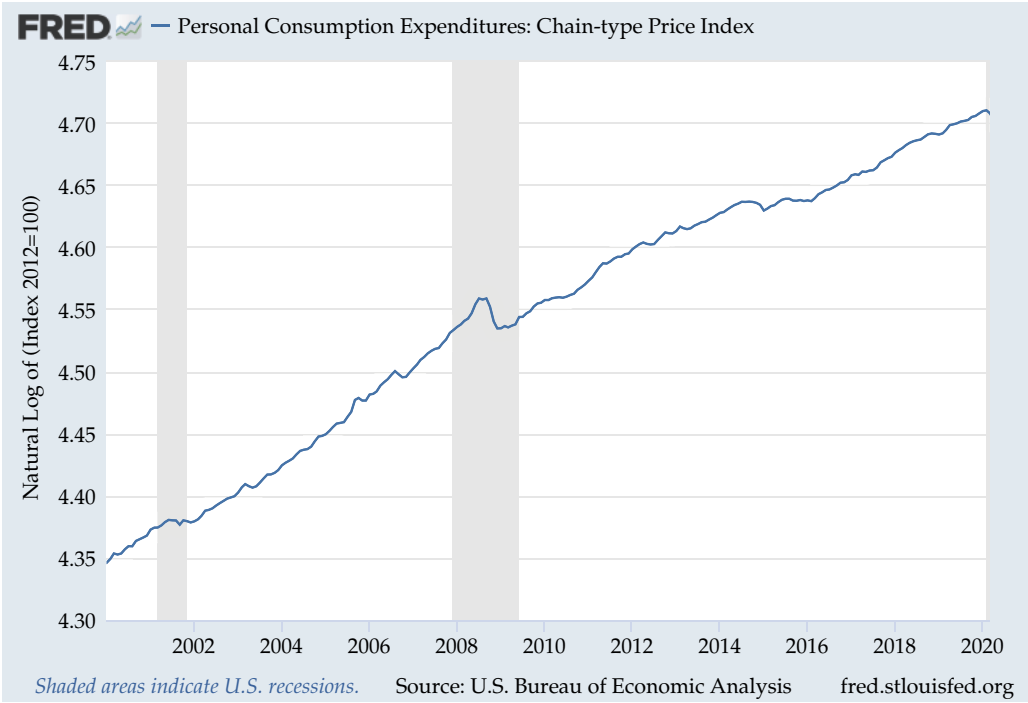
> The "price" of money is the quantity of goods and services that must be given up to acquire a unit of money [a dollar bill].

Because the quantity theory is a theory of the supply and demand for money, thinking clearly about the price of money is absolutely crucial. Friedman continued:

> [The "price" of money is thus] the inverse of the price level. This is the price that is analogous to the price of land or of copper or of haircuts. The "price" of money is not the interest rate, which is the "price" of credit.

Confusion over the price of money has acted and continues to act as a substantial hurdle to the correct understanding of monetary theory.

FIGURE 6. PRICES MEASURED BY THE PERSONAL CONSUMPTION EXPENDITURE DEFLATOR, 2000–2021



Source: US Bureau of Economic Analysis.

A liquidity crisis is almost by definition a dramatic increase in demand for liquidity, or money. Demand by the public for money increases, and banks become more risk averse and increase their demand for reserves. The particular focus here is banks' increased demand for reserves. If banks desired a deposits-to-reserves ratio of 10-to-1 before the liquidity crisis (roughly the level in 2007), then they will generally desire a ratio *less* than 10-to-1 during and after a liquidity crisis. To decrease the ratio, banks must either hold more reserves or hold less in deposits.

The lesson from the historical crises of 1893, 1907, and the 1930s is that if the supply of currency and reserves (high-powered money) are not increased during a crisis, price deflation (and often severe recession) follows. The Fed was founded in 1913, in the wake of the 1907 crisis, specifically to provide an institution and mechanism for increasing high-powered money during a crisis. Friedman and Schwartz (1963) argued persuasively in *A Monetary History of the United States* that the Fed's failure to increase high-powered money in 1929–1931 was a major contributor to the severity and length of the Great Depression. Ben Bernanke (2002), as a member of the Board of Governors of the Federal Reserve, told Friedman and Schwartz,

> Regarding the Great Depression. You're right, we did it [by failing to provide liquidity when needed].

> We're very sorry. But thanks to you, we won't do it again.

During a liquidity crisis such as 2008, banks' preference for reserves, and consequently their demand for such, increases sharply. Banks willingly hold more reserves with a higher ratio of reserves-to-deposits relative to precrisis levels. During the 2008 crisis, banks did dramatically change their reserves-to-deposit ratio—from roughly 10-to-1 before the crisis to roughly 1-to-1 by the end of 2008—by increasing their holdings of reserves.

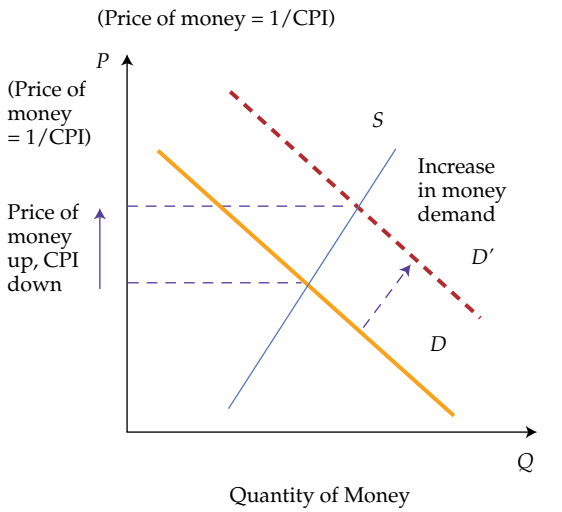
The second factor behind the rise in reserves was the Fed's new policy in late 2008 of paying interest on reserves. The traditional story presumes that reserves pay no interest and are costly relative to alternative uses of those funds. With reserves earning interest, the cost is substantially reduced (and possibly eliminated), and banks may hold more reserves because the lower costs may increase their willingness to hold reserves.

Both of these factors—the increase in demand during a liquidity crisis and the payment of interest on reserves—imply a large shift *outward* in the demand for money. We can display this shift as in **Figure 7**. The shift outward in money demand in the absence of any change in supply leads to a fall in the price level.

In fact, the supply of high-powered money—reserves, in particular—did shift out considerably, as shown in Figure 1 and Table 2. The argument here is that this outward shift in supply was offset by an outward shift in the demand curve, implying that the sharp rise in reserves in late 2008 seen in Figure 1 and Table 2 could be consistent with stable or lower inflation.

The fiscal theory provides the same prediction—prices may fall even in the presence of the large increase in reserves—but by a fundamentally

FIGURE 7. SUPPLY AND DEMAND FOR MONEY ACCORDING TO THE QUANTITY THEORY: INCREASE IN MONEY DEMAND (OUTWARD SHIFT IN DEMAND CURVE)



Note: *S* denotes supply; *D* denotes demand; CPI is the US Consumer Price Index.

Source: Authors.

different mechanism. First, note that the increase in Fed liabilities in autumn 2008 produced what we might call "naked" (that is, unbacked) liabilities. Table 2 shows that from year-end 2007 to year-end 2008, the increase in liabilities was primarily bank reserves. The matching asset was largely loans to banks. Although "loans to banks" are recorded as an asset on the balance sheet, they are essentially an unbacked promise to repay. The newly issued reserves were essentially a newly created liability of the government.[14]

[14]As the reader will see shortly, the situation in 2009–2014 was quite different. The increase in liabilities (reserves)

Recall that the basic equation of the FTPL is $(M + B)/P = EPV(FS)$—that is, present liabilities equal expected discounted future surpluses. When liabilities increase and the discounted future surpluses do not, the price level must adjust upward—meaning inflation. We have no reason to think the public's expectations of future surpluses rose in late 2008. But we have every reason—in fact, good evidence—that the real discount rate fell substantially in a massive flight to quality. A fall in the discount rate implies a rise, of course, in the present value, even with no change in future cash flows. Under the FTPL, in other words, we expect that prices could fall (as the present value of future surpluses rise) even in the presence of rising current liabilities.

In New Keynesian interest rate targeting, the decline in prices in 2008–2009 presents a puzzle. The Fed lowered rates aggressively during late 2008, which should have raised inflation.

Phase 2 (2009): Unorthodox Assets on the Balance Sheet, Low Inflation

From the end of 2008 to the end of 2009, the *level* of the Fed balance sheet experienced no substantial change, but a change did occur in the balance sheet's *structure*. And this change was important. At the end of 2008, Fed assets were dominated by loans to banks and swap lines with foreign central banks, as shown in Table 2. These assets were, as argued previously, essentially new liabilities of the government created by the Fed.

In 2009, these loans to banks were replaced with holdings of bonds. This change effectively converted the "unbacked" reserves issued in autumn 2008 into reserves backed by bonds, either government or mortgage bonds. This second action had the effect of reducing net government liabilities. Although the level of liabilities on the Fed balance sheet did not change, the alteration in the composition, according to the FTPL, was potentially deflationary.

Examining the balance sheet in Table 2 more closely between 2009 and 2014, note that the purchases of US Treasury bonds increased, which took the holdings back roughly to the level at the end of 2007. More importantly, the Fed took the unprecedented step of purchasing large holdings of agency- and GSE-backed bonds, particularly mortgage-backed bonds. Table 2 shows that these holdings went from zero in 2007 to $1,000 billion at the end of 2009, and Figure 4 shows the time path of those purchases.

The purchase of mortgage bonds was explicit government policy to support the home mortgage market after 2008. Widespread concern arose that the unorthodox purchase of mortgage bonds would seriously undermine the integrity of the Fed's balance sheet because, unlike Treasury bonds, mortgage bonds are potentially risky and private sector intervention by the Fed may not be unambiguously in the public interest. Furthermore, the size of the Fed's liabilities remained a worry.

We should distinguish two related but separate concerns. The first is the unorthodox nature of the assets (mortgage bonds) added to the Fed's balance sheet. The second is bond purchases (whether Treasury or agency) and the size of the balance sheet. We are interested in the potential inflationary impact of these bond purchases, the impact of the switch from "loans to banks" to "bonds" on the asset side. The FTPL argues

was matched by an increase in assets in the form of bonds. In essence, the increase in reserves in 2009–2014 was the switch of one government liability (bonds) for another (reserves), not the creation of new liabilities.

that the switch could be neutral rather than inflationary.

Viewed through the lens of FTPL, however, neither concern—neither the unorthodox makeup of the balance sheet nor the size of the balance sheet—was warranted. The FTPL pushes us to look beyond narrow definitions of money and the Fed's balance sheet to consider the government's underlying fiscal position.

The switch of Fed assets from loans to banks to mortgage bonds replaced an unbacked asset with real assets, in that the bonds were largely backed by home mortgages. These bonds were not guaranteed but were of high quality and were expected to generate future private sector cash flows. According to the FTPL—Equation 1, $(M + B)/P = EPV$ [future surplus]—what matters is the future revenue (expected primary surplus) on the right side of the equation and the balance between that revenue and current liabilities (money and bonds). Adding the private mortgage bonds to the Fed balance sheet increased expected future government revenue without increasing liabilities, a potentially deflationary action.

Had the Fed replaced the loans to banks with Treasuries instead of mortgage bonds, the effect would have been largely the same but for a different reason. Recall that in the FTPL basic equation, replacing with mortgage bonds has the effect of increasing future revenues. Replacing with Treasuries would be taking Treasuries out of the hands of the public and thus, effectively, reducing the liabilities on the left side of the equation (reducing the sum $M + B$). Either increasing the PV on the right or decreasing the nominal liabilities on the left would tend to be deflationary.

For future reference, we point out that when the Fed purchases Treasury bonds and issues money (open market operations) the effect will be, at least approximately, neutral with respect to inflation. This action is a "maturity transformation"—namely, selling short-term assets (money) and buying long-term assets (Treasury bonds) without changing the backing.[15,16] The overall liabilities ($M + B$) do not change.

Another issue regarding the Fed's purchase of mortgage bonds is the explicit policy intervention in support of the home mortgage market. Questions can be raised about whether a central bank should undertake such policy goals, supporting one sector of the economy at the expense of others, but those questions are separate from whether, if a central bank does buy such mortgage bonds, the effect will be inflationary or not. In this brief we are concerned only with the inflationary effect (if any) of such buying.

Phase 3 (2009–2014): More Bonds, More Money, and Low Inflation

Over the period 2009–2014, the balance sheet continued to expand at a robust pace of roughly 15% per year in nominal terms (13% in real terms). On the asset side, US Treasury

[15]A *maturity transformation* is what both commercial banks and central banks do as a matter of course. A maturity transformation rearranges risk between the affected securities but does not change their total value.

[16]This kind of (noninflationary) money issuance backed by assets seems to have been the rule in the aftermath of the hyperinflations of Germany, Austria, Hungary, and Poland in the 1920s, discussed by Sargent (1982). For Germany, the currency stabilized in November and December 1923. From December 1923 to December 1924, prices rose by only 3.4% (Sargent, Table 3) while notes in circulation grew by 291% (Sargent, Table 4). As Sargent comments, "The post inflation increase in notes was no longer backed by government debt. Instead, in the German case, it was largely backed by discounted commercial bills."

holdings grew substantially faster than agency and GSE bonds. On the liability side, high-powered money grew at slightly over 14% per year. Narrow money (M1) grew at almost 12% per year. Under the quantity theory, such rapid growth in any and all measures of the quantity of money should generate similarly strong inflation. And yet, inflation was low—only 1.6% per year—and stable, never rising above 3% year over year.

This phase of the post-2008 recovery provides a substantial challenge to the quantity theory (and also to New Keynesian interest rate targeting, as discussed at the end of this section). The fiscal theory provides a reasonable explanation that accords with the observations of rapid monetary expansion, low nominal rates, and low and stable inflation.

Focus, for now, on the growth in government bonds, the largest component of the balance sheet growth. When the Fed buys a bond, it prints new money to buy the bond. During this period, there was substantial concern that the new money printed to buy the bonds would generate inflation.

According to the standard quantity theory, it is the *public*'s holding of currency and checking deposits, M1, that is money in the quantity equation. Or maybe money also includes savings deposits—considerable debate surrounds what actually constitutes "money." But certainly, government bonds are not part of money. In Figure 5, money is the holdings (incoming arrows) of "Currency" from the Fed and "Checking Deposits" from banks.

The fiscal theory of the price level provides a different perspective. It says that we should look through the "veil" of money and the Fed's balance sheet to the underlying fiscal position of the government. We must consider the balance of liabilities versus future cash flows that repay those liabilities. Figure 5 lays out the structure of the US debt and monetary environment as of the end of 2014 (updating Figure 3) and provides the framework for thinking in this direction.

The FTPL says that, although currency is *one* obligation of the government (a liability of the central bank, the Fed in the United States), what matters are the government's *overall* obligations. We need to consider the Fed's monetary obligations in the context of the government's overall fiscal position. Money and government bonds are in many respects fungible, and the public is to some extent indifferent to substituting money and bonds—holding more money and less bonds (or the reverse). Under the FTPL, the incoming arrows of "Currency" *and* "US Treasury Bonds" for the public or banks (representing the balances held) are relevant for Equation 1.

From the FTPL perspective, the mere exchange of Treasury bonds for money under quantitative easing should be approximately neutral with respect to inflation. Yes, the Fed is increasing money, but the Fed issues money in return for buying bonds, so the process is largely a portfolio rearrangement—switching one government liability (bonds) for a different liability (currency)—rather than the creation of an additional government liability.[17] The FTPL focuses, first, on the overall liability position and focuses only secondarily on the split between money and bonds. The academic literature refers to this approach as the coordination between monetary and fiscal authorities, a coordination that sets the balance between liabilities and future revenue.

When the issuance of money increases the net liabilities of the government, the effect will be

[17]This switch is the act of maturity transformation discussed earlier.

inflationary. In contrast, when the issuance of money simply reflects the conversion of one form of government liability into another, the effect is (approximately) neutral. During the 2009–14 period, the Fed undertook a large (and explicit) maturity transformation of government liabilities from long-term debt into money. The Fed's actions were not, in themselves, fiscal actions and thus, in themselves, were neutral regarding inflation. As Cochrane (2021) states, "The Fed must always buy something in return for issuing cash or reserves. … They can lend, not give."

The bottom line is that if the public willingly exchanges bonds for currency, the observed quantity of "money" (measured by currency plus deposits) might increase with no effect on inflation. We conclude, based on the FTPL, that during the 2009–14 period, money increased, but it was a result of portfolio rearrangement between money and bonds—and not an increase in government liabilities (either money or bonds)—that would have caused inflation to rise.

We emphasize that we are focusing on the inflationary impact of an increase in the Fed's balance sheet. The FTPL argues that when bond purchases leave the government's overall liabilities unaltered, such purchases should be (approximately) neutral with respect to inflation. We are *not* arguing that Fed bond purchases are neutral with respect to other issues—say market-based term premiums (the term structure of interest rates) or risk premiums.

Nor are we claiming that increasing *overall* government liabilities will be neutral with respect to inflation. Some have argued that the government can print money at will with no effect on inflation, but the FTPL argues the opposite. Equation 1 explicitly links overall liabilities with the price level: An increase in liabilities ($M + B$) with *no* offsetting increase in future surpluses (FS) *will* generate inflation (rising P).

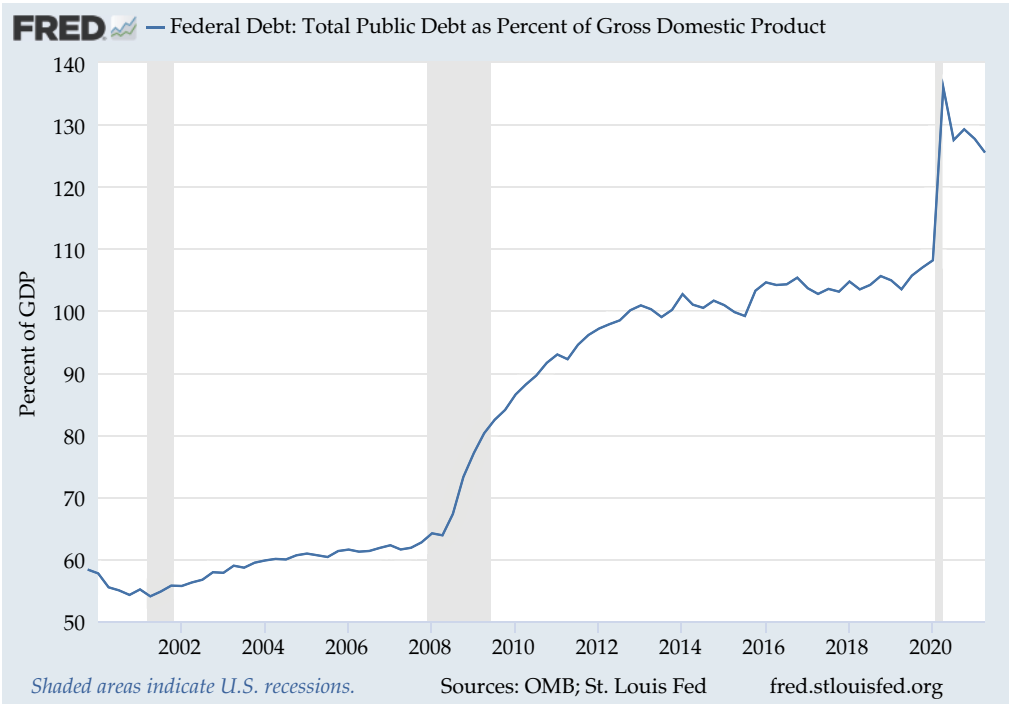
Turning from the narrow perspective of the Fed balance sheet to the wider perspective of overall government liabilities, note that the 2009–14 period does raise questions about inflation. Government debt, measured by the debt-to-GDP ratio, rose from roughly 65% in 2008 to 100% by 2014, as shown in **Figure 8**. The surplus plunged (deficit rose) in 2008 and remained negative during this period, as shown in **Figure 9**. In other words, the overall liabilities ($M + B$) on the left side of the FTPL equation rose, which (in the absence of a rise in expected future surpluses) would imply inflation.

The puzzle of 2009–2014, then, is not the expanding Fed balance sheet itself but the rising overall liabilities of the government. Remember, however, that inflation depends on the balance of rising liabilities with expected future surpluses. And the current expectation of future surpluses depends on future government behavior together with the public's beliefs about that behavior—the monetary–fiscal coordination discussed previously.

The United States seems to have built, over a long period, a durable regime in which surpluses are (eventually) generated to offset rising debt issuance, which allows for low inflation in the presence of rising current debt. We can argue that rising debt during this period was offset by expectations of higher future surpluses, resulting in low inflation.

However, producing direct evidence for the hypothesis that expectations of future surpluses rose during 2009–2014, or testing that hypothesis, is difficult. We can, nevertheless, provide circumstantial evidence. There was political pressure during this time toward fiscal tightening to reduce the deficit (increase the surplus). The deficit did fall during this period (the surplus moved upward toward zero) as seen in Figure 9. New nominal debt was issued without causing

FIGURE 8. US FEDERAL GOVERNMENT DEBT-TO-GDP RATIO, 2000–2021



Sources: US Office of Management and Budget (OMB); St. Louis Federal Reserve Bank.

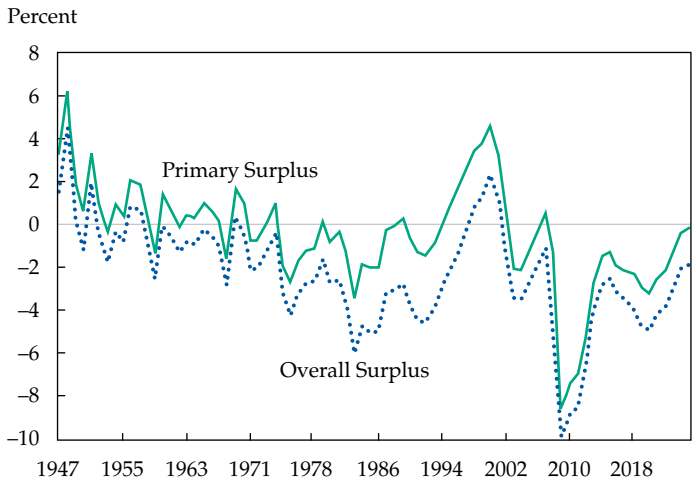
additional inflation or rising interest rates, so that real debt increased. All of these phenomena reflect the public's expectations that new debt would be (eventually) offset by higher surpluses.

We also note that the common narrative—that the US government is chronically in deficit—is not justified when considering the primary surplus. Figure 9 depicts the year-by-year history of US budget surpluses.[18] For the period 1947–2007 (excluding, for now, the post-2008 era), the average deficit was 1.6% of GDP, which is consistent with the standard story—but the average *primary* surplus was +0.3% of GDP and was positive in more than half the years. The 2008–19 period is, indeed, one of large deficits (and primary deficits), but the 2008 financial crisis and, recently, the coronavirus pandemic are extraordinary events.

The 2009–14 period presents a substantial challenge to the quantity theory. Rapid growth in the Fed's balance sheet and in wider measures of money should have led to higher inflation. The fiscal theory argues that mere maturity transformation—from money to bonds—should be (approximately) neutral with respect to inflation. The fiscal theory pushes us to look beyond a narrow conception of money to consider overall government liabilities.

[18]Figures 8 and 9 are from the Office of Management and Budget, Tables 1.1 (Receipts, Outlays, Surplus), 6.1 (Net Interest to Calculate Primary Surplus), and 10.1 (GDP). Numbers quoted in the text include actual data through 2019 and projections for 2020–2025: https://www.whitehouse.gov/omb/historical-tables/, accessed December 2020.

FIGURE 9. OVERALL SURPLUS AND PRIMARY SURPLUS FOR THE UNITED STATES AS A PERCENTAGE OF GDP: ACTUAL 1947–2019 AND PROJECTED (AS OF 2019) FOR 2020–2024



Source: Office of Management and Budget.

We have focused on money and the Fed balance sheet, but central banks today follow New Keynesian theories of target interest rates rather than money directly. Over the 2009–14 period, the Fed maintained nominal short-term rates at essentially zero, as Figure 1 shows. According to the New Keynesian theory, targeting rates at zero should have led to either unstable inflation or spiraling deflation, which did not happen. The behavior of rates and inflation strongly contradicted New Keynesian theory.

Phase 4: COVID Era Balance Sheet Expansion

Turning to the substantial expansion of the Fed's balance sheet that started in March 2020 in response to the coronavirus pandemic, we can see that many of the same forces that arose in the immediate aftermath of 2008 are probably relevant in this period. Liquidity demand—banks' desires to hold reserves and the public's desire for money versus bonds—probably increased dramatically.

Table 2 shows that the expansion of the Fed's balance sheet followed many of the same patterns in both periods. Liabilities in the form of bank reserves and repos jumped upward. In 2020, the increase on the asset side was primarily in the form of bonds held by the Fed, with Treasuries showing the largest jump.

We would expect this *initial* expansion in money and the Fed balance sheet to have little impact on inflation for two reasons. First, as in 2008, COVID has been a substantial shock to the economic system and presumably induces both the public and banks to increase demand for liquid assets (money in particular). In the quantity theory, the result would be a shift out in the demand for money (as in Figure 7) or in the quantity equation $MV = PQ$, a decrease in velocity. In either case, an increase in money supply would not necessarily imply an increase

in prices (inflation). In Equation 1 of the fiscal theory, a fall in the real discount rate and an increase in $EPV(FS)$ would result, so again, an increase in the money supply would not necessarily imply an increase in prices.

In comparing 2020 with 2008, however, we note an important difference. The shock in 2008 originated in and dramatically affected the financial system; it was a liquidity crisis. Examining the history of financial and liquidity crises shows that such shocks often entail falling prices and severe—sometimes long-lasting—damage to the real economy. The shock in 2020, originating in the real economy as the coronavirus disrupted our economic and social lives, was very different. Although the disruption in 2020 imposed strains on the financial system, the financial system was not the origin of the shock. This difference implies that the long-term effects and recovery from the 2020 pandemic could differ from the post-2008 experience.

After 2008, the expansion in money and in the Fed balance sheet had little inflationary impact, but inflation is not guaranteed to be similarly restrained after the pandemic ends. We have argued that we need to look beyond monetary expansion to the overall monetary *and fiscal* position of the government. That is, the mere switching of bonds into money (the Fed buying bonds and issuing money) need not be inflationary. The FTPL says that increases in overall liabilities relative to expected future surpluses matter for inflation: $(M + B)/P = EPV\,(FS)$. The form of those liabilities (money or bonds) is of secondary importance.

The FTPL says that postpandemic inflation prospects depend on looking beyond the monetary expansion alone (for example, the large increase in reserves seen in Figure 1) to the balance between current liabilities $[(M + B)/P]$ and future revenue to pay off those liabilities (expected future primary surpluses). Debt did increase substantially in 2020. What should affect inflation is the increases in debt *and* the public's expectations about the government's willingness to pay it down in the future. The path of spending and economic recovery could be quite different after the pandemic than it was after 2008, so the path of inflation could also be quite different.

Summary of 2008–2020

During the period from 2008 to the present (2021), the world economy has experienced two severe shocks. The first, the 2008 financial crisis, originated in and was driven by the financial system. The second, the 2020 coronavirus pandemic, was a shock to the real economy. Both put severe stress on the financial system and also (presumably) caused a jump in demand for liquid assets (money, in particular) and a flight to quality (a decrease in real discount rates). The response of the Fed (and central banks worldwide) to both crises was to lower rates and substantially increase liquidity, reserves, and money.

The unprecedented increase in liquidity and money was not (through early 2021) accompanied by any marked rise in prices or inflation. In fact, the absence of inflationary pressure was a prime puzzle of the 2010–19 decade. In this section, we have explored, using the framework of the FTPL, why we might expect subdued inflation in such circumstances.

This analysis does not fully answer the question of why inflation was low during the 2009–14 period. It changes the question from "Why was inflation low in the face of large increases in money?" to "Why was inflation low in the face of increases in government debt?" (High-powered money grew by 14%, M1 by 12%, and government debt by 11% per year during this period.)

The answer is that what matters for the FTPL is not changes in liabilities or current debt (the $M + B$ in Equation 1) but changes in the government's overall fiscal position in present value terms—that is, changes in debt relative to expectations of future government surpluses used to pay back the debt [the *EPV* (Future real surpluses)]. This comparison is similar to a stock investor observing that a stock's price has risen because the expectation of future earnings rose rather than because the P/E rose. If debt and expected future surpluses both rise, the price level will be unaffected.

This answer is only partially satisfactory, of course, because we cannot directly measure the expectations of future surpluses and independent projections of surpluses, such as those coming from the Congressional Budget Office, are not optimistic.

Cochrane (2021, pp. 48–49) points out, however, that, if the FTPL is correct, investors' expectations of future surpluses did apparently rise in line with rising debt. During the 2008–2019 period, the increasing debt

> did not raise interest rates, did raise revenue, and did raise the total market value of debt. These facts speak directly to investors' expectations that subsequent surpluses would rise. If the present value of subsequent surpluses did not change, producing inflation, then we would have seen interest rate rises, no revenue, and no rise in the real value of government debt.

In other words, without observing investors' expectations of future surpluses, we can infer them from the inflation rate and the FTPL. One might wonder why investors believed the government would in the future increase its revenue by more than was expected before the additional debt was issued—but apparently they did.

To sum up, the Fed balance sheet is not the only place we should be looking for information about the course of prices (inflation). We need to look beyond the Fed at the totality of government liabilities—traditional "money" plus all other government obligations. Although the rising level of government debt is a legitimate concern for many reasons, it has not (so far) meaningfully increased the price level. Whether it will affect prices and inflation in the future is beyond our powers of prediction.

The unprecedented monetary stimulus pursued in the wake of the 2007–09 global financial crisis should have, according to classic monetary theory, caused considerable inflation. The "money supply" that is relevant to setting the price level in the fiscal theory, however, is the sum total of government liabilities (money plus debt) *relative to the government's assets,* which consist primarily of the present value of future tax revenues. Although total government debt increased greatly from 2008 through the present, the market price of government bonds tells us that bondholders expect to be repaid almost fully. The inflation expectation implied by bond and TIPS (Treasury inflation-protected securities) yields is about 2%, meaning that the market expects the government to run significant primary surpluses (revenues minus expenses other than bond interest) in the future.

CONCLUSION

Neoclassical monetarism, in particular the quantity theory of money as interpreted by Friedman and Schwartz (1963), served well for many years in helping us to understand inflation and the price level. Some historical

events, however, including recent ones, have called into question its applicability "always and everywhere." Most glaring is the post-2008 experience, when massive money creation and near-zero interest rates produced not the high or unstable inflation predicted by standard theories but low and stable inflation. In future work, we will discuss in more detail additional historical events, such as the end of the German hyperinflation in 1923 and the end of deflation in the United States in 1933, that provide puzzles for standard monetary theory.

The more comprehensive theory we discuss, which academics call "the fiscal theory of the price level," builds on neoclassical monetarism and helps to explain the seemingly anomalous events. The fiscal theory observes that government liabilities—bonds, notes, bills, and currency—derive their value from the assets that back the liabilities. These assets are chiefly the present value of future tax revenues, minus government spending other than that part of spending used to service the liabilities themselves. This net "profit" of the government is the *primary surplus*.

The primary surplus can be expressed in real terms (a quantity of goods and services, rather than a money amount). The total *real* value of the bonds is thus the total *real* value of the assets backing the bonds: the present value of all future *real* primary surpluses, which we call "the expected present value of future surpluses," *EPV*(*FS*). In an important sense, the fiscal theory harkens back to commodity-based theories of money—except now the "commodity" is the real value of future surpluses earned by the government.

Given this value, we can then solve for the price level. It is simply the nominal value of the bonds (the face value or number of bonds issued) divided by the real value of the bonds, the *PV*(*FS*). If the nominal value of the bonds is held constant, and the underlying asset (the future surplus) becomes less valuable, prices go up. If the *PV*(*FS*) becomes more valuable, prices go down. The FTPL is that simple.

In this approach, we calculate the value of "money" (including government liabilities of all maturities) the way one would calculate the value of any security: through discounted cash flow analysis. Note that doing so is consistent with the quantity theory of money because if money is defined in the traditional way as currency and demand deposits and we now hold the *PV*(*FS*) (the backing of the money) constant, then the price level is proportional to the amount of money in circulation. But the FTPL is a more complete theory because it incorporates *all* government liabilities, not traditional money alone, and because, rather than looking only at conditions in the present, it is forward looking and dynamic.

The lack of substantial inflation in the period following the global financial crisis in 2007–2009—and again during the initial stages of the coronavirus pandemic in 2020—is consistent with bondholders believing that US government debt will be paid back in something close to full (in real, not just nominal, terms), which would be consistent with most historical experience. The post-2008 inflation experience is a strong rejection of the current theories (both quantity theory and New Keynesian interest-rate-targeting theory).

LAST WORD

The nature of money has changed since Milton Friedman's seminal work in the 1960s, which tied price levels to the quantity of fiat money. Friedman's quantity theory of money was

specifically designed as a theory of unbacked fiat money, which has no value except for its use as money.

The fiscal theory of the price level, in contrast, says that fiat money *is backed*, not by a commodity but by the promise of redemption (or payback) by the government. In that sense, the backing of fiat money resembles a commodity backing, but the commodity backing the currency is not gold or some other precious substance. Rather, it is something even more valuable—the government's ability to legitimately extract real resources from the economy (that is, from the people) through future taxation and the resultant primary surpluses.

When this backing is insecure because the government lacks the ability or willingness to extract sufficient real resources through primary surpluses, the shortfall is made up by revenue from the inflation tax[19] and from inflating away the government's liabilities—that is, the depreciation of money and bond balances held by the people. These conditions are what occurred in Weimar Germany. When the backing is secure, we have the conditions that now prevail in the United States and other modern advanced economies. This circumstance is why fiat money is an acceptable form of money.

In this sense, the quantity theory was wrong and the theory of money that underlies the gold standard was more right. We are not, of course, advocating for a return to the gold standard. Rather, we are saying that the fiat money standard we already have is akin to a gold standard if supported by the reasonable expectation of future primary surpluses. It is up to the government to adopt fiscal policies that make such an expectation realistic—and up to citizens to hold the government responsible for doing so.

[19]"Inflation tax" refers not to a legal tax but to the revenue collected by the government when printing and issuing new non-interest-bearing cash during a time of high inflation.

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ISBN 978-1-952927-22-5