FEDERAL RESERVE BANK OF ST. LOUIS
REVIEW

FIRST QUARTER 2024
VOLUME 106 | NUMBER 1

REVIEW

Volume 106 • Number 1

REVIEW

Volume 106 • Number 1

FEDERAL RESERVE BANK of ST. LOUIS
CENTRAL TO AMERICA'S ECONOMY®

Technological Change and Central Banking

David Andolfatto

Abstract

The decentralized autonomous organization (DAO) represents a radically new way to manage databases. Since money and payments are all about managing databases and since banks play a central role in money and payments, DAO-based money and payments systems are potentially a disruptive force in the banking system—which includes central banks. One would normally expect regulatory frameworks to evolve with a changing technological landscape. However, the decentralized governance structure characteristic of DAOs renders it near impossible to regulate these entities directly—a property that makes them ideal vehicles to exploit regulatory arbitrage. In this article, I discuss some of the monetary policy implications of DAO-based money and payment systems. I highlight the prospect of a globally accessible DAO-based stablecoin that may conceivably end up financing a large fraction of global trade. To the extent that such a structure imposes systemic financial risk and to the extent it cannot be regulated directly, an alternative strategy is to offer a competing product. A central bank digital currency accessible to firms involved in the global supply chain may be one way to mitigate the systemic risk associated with an emergent, unregulated global stablecoin.

JEL codes: E02, G28

Federal Reserve Bank of St. Louis *Review*, First Quarter 2024, *106*(1), pp. 1-9.
https://doi.org/10.20955/r.106.1-9

1. INTRODUCTION

It is said that the only things we can be certain of in this world are death and taxes. Perhaps so. But I'm inclined to add technological change to this list. It is human nature to want to build a better mousetrap. And when technology changes, inescapable Darwinian forces compel institutions to adapt to their new environment. This includes central banks.

Central banks are, as their name suggests, central hubs in the networks that characterize modern day financial systems. They are typically delegated a host of responsibilities, including the conduct of monetary policy, along with the regulation, supervision, and oversight of the banking system. Banks are special in an important way. Unlike other businesses, the demand deposit liabilities created by banks

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to finance their assets are money. And because people value money for its ability to make payments, banks are necessarily involved in the payments system. Central banks play a key role the process of clearing and settling payments across banks in the payments system. It follows that technological advances that disrupt the money and payments system are likely to have both tactical and strategic repercussions for a central bank.

The technological changes that impact banking most dramatically are those that provide new or better ways of communicating, managing, storing, and analyzing information. This should hardly be surprising, as the successful operation of a money and payments system essentially boils down to an exercise in secure messaging and honest recordkeeping. The internet is probably the most important innovation in communication technology since the telegraph, at least as far as banking is concerned. Combined with advances in cryptography (necessary to secure communications), personal computers, computer processing power, and data storage capacity, the internet has transformed the way banks organize themselves and conduct their business. Virtually everyone now has access to online bank accounts and handheld devices to make payments.

Of course, technological change impacting the banking sector did not begin with the appearance of the internet. In 2003, James Dingle of the Bank of Canada wrote about technological changes from the 1970s:

> It is a challenge today to recapture the degree to which the financial world of the 1970s, indeed the entire society of that time, was awakening to the astonishing power of the combined technologies of computers and communications devices. The titles of two widely read and influential books of the period are suggestive: *The Coming of the Post-Industrial Age* by American sociologist Daniel Bell was published in 1975, and a report entitled *L'informatisation de la société*, by publisher and intellectual Simon Nora, appeared in 1978 in response to a request from the President of France. It is also noteworthy that, during this decade, the Canadian government felt it appropriate to have a Department of Communications, a ministry that worked jointly with the Department of Finance on several major policy papers shaping financial sector legislation.[1]

These pre-internet innovations resulted in a massive migration away from paper to electronic recordkeeping. The evolution in governance that these innovations spurred in Canada included the creation of a federal department of communications as well as new legislation (Canadian Payments Act, 1980), which established the Canadian Payments Association. The Canadian Payments Association (now Payments Canada) was assigned two legislated objectives, namely, to "establish and operate a national clearing and settlements system and...plan the evolution of the national payments system." While the Ministry of Finance retained oversight responsibilities for Payments Canada, the Bank of Canada was granted oversight responsibilities for the Large Value Transfer System (LVTS) and the Automated Clearing Settlement System (ACSS), which handle the bulk of retail and wholesale payments in Canada. The LVTS, in turn, changed the manner in which the Bank of Canada implemented monetary policy.[2]

Which emerging technologies today are likely to have a material impact on the future of commercial and central banking? The big invention, in my view, was Bitcoin: a radically new form of money and payments system introduced to the world in 2009. In a public lecture I delivered on March 31, 2014, I described Bitcoin as "a stroke of genius" and outlined the threat the innovation posed for central and private banks.[3] Regulators, including central banks, will have to think hard about how to deal with the risks these new structures are likely to present.

1. Dingle, James F. "Planning an Evolution: The Story of the Canadian Payments Association 1980-2002," Joint Publication of the Bank of Canada and the Canadian Payments Association, 2003.

2. See https://www.bankofcanada.ca/core-functions/monetary-policy/lynx/implementing-monetary-policy/.

3. Bitcoin and Beyond: Dialogue with the Fed, March 31, 2014; https://www.stlouisfed.org/dialogue-with-the-fed/the-possibilities-and-the-pitfalls-of-virtual-currencies/videos/part-1-introduction-and-welcoming-remarks.

2. DECENTRALIZED AUTONOMOUS ORGANIZATIONS

A decentralized autonomous organization (DAO) is an organization governed autonomously by a set of rules encoded in an open-source computer program. It is decentralized in the sense that there is no central authority—that is, no concentration of power—involved in any of its operations. People are free to participate in the organization anonymously if they wish. Participation may take the form of consumers availing themselves of the services provided by the DAO or in the form of a employee contributing to a collective effort needed to fuel the enterprise. Fees and compensation take the form of a tradeable native token that serves as a money instrument.

As far as I know, Bitcoin is the world's first DAO. There is no CEO of Bitcoin. There are no Bitcoin headquarters. There are no conventional Bitcoin employees. It exists as open-source computer code distributed across thousands of computers around the world. Its database, consisting of a ledger of money accounts—the so-called *blockchain*—is visible to the public. Its monetary policy, its protocol for clearing and settling payments, and its manner of compensating its voluntary workforce—the so-called *miners*—are all written in (virtually) unalterable open-source computer code.

An important property of a DAO is that it cannot be regulated in a direct manner by anyone, including any government authority. A DAO is basically a robot that anyone with access to the internet is free to use and help operate. Because a DAO exists simultaneously on potentially millions of computers located around the world, it is virtually impossible to shut down. Only indirect regulation is possible, for example, by placing restrictions on how identifiable individuals or registered businesses are legally permitted to interact with a DAO.

The implication of this property is that, in addition to any inherent benefits, DAOs are in a position to generate value for their community through regulatory arbitrage. Regulatory arbitrage is not new, of course. But whereas regulators in days gone by were in a position to identify and discipline transgressors, similar actions may no longer possible with a DAO. In those circumstances where a DAO poses a systemic risk, an alternative strategy is needed. This alternative strategy may entail having the government offer a competing product that diminishes the value of a potentially problematic DAO to its potential users. Of course, this strategy can be employed as a complement to indirect regulation designed to discourage the demand for the product, assuming that doing so is in the public interest.

While DAOs have potential uses in a wide variety of traditional economic activities, for the purpose of this article I will focus on their application as money and payment systems. It is important to keep in mind two things. First, DAOs come in a variety of flavors; and second, we are still in the early days of development. Much of what I have to say, therefore, is necessarily speculative in nature. But central bankers and regulators need to be prepared for all important future contingencies, even if some these events are unlikely to unfold.

3. FLOATING EXCHANGE RATE DAOs

DAOs related to money and payments can be divided into two broad categories—namely, fixed and floating exchange rate regimes. Bitcoin is a floating exchange rate regime because the value of its native token (BTC) is determined entirely by market demand (the supply of the token is essentially fixed).

Central bankers and regulators have a long history of dealing with currency competition. In some countries, the domestic demand for foreign currency is sufficiently strong to elicit a variety of currency controls designed to boost demand for the local product. In some jurisdictions, locals may even be prohibited from opening foreign bank accounts. Such restrictions are evidently binding. Americans traveling to foreign countries are familiar with how locals are often very eager to acquire US dollars (USDs).

3.1 Limits to Seigniorage

Foreign currency controls permit local governments to extract more seigniorage revenue than they might otherwise be able to collect. And, indeed, it is no surprise to see that inflation rates are often very high in lesser-developed economies. There is no need to take a stand here on whether high levels of seigniorage are a good or bad thing; the answer depends on how inflation tax revenue is employed. The point is that less seigniorage revenue will generally be available if locals can easily substitute into a competing currency. Might Bitcoin prove to be an important form of currency competition for some sovereigns? There is some evidence suggesting at least the potential for this to happen. A report issued by the United Nations Conference on Trade and Development, for example, found that 10.3% of citizens in Venezuela held cryptocurrencies in 2021.[4]

In countries with extreme currency controls, foreign currency might circulate in the underground economy and only in physical form. Locals would not have access to digital forms of money, like online bank deposits. Bitcoin, however, is a digital bearer instrument that can be used by anyone with access to the internet. Moreover, Bitcoin is permissionless, in the same way paper currency is. That is, no permission is needed to hold or spend the object. Enforcing currency controls over a permissionless digital bearer instrument might prove exceedingly costly. The only recourse a sovereign may have is to alter its monetary and fiscal policies in a manner that lowers the domestic inflation rate to a level that makes Bitcoin less attractive as a monetary instrument. It would also be advisable to upgrade the domestic payment system to further the same end. Alternatively, a government may be willing to give up on seigniorage and promote cryptocurrencies as a way to overcome inefficient or incomplete domestic payment systems. El Salvador, for example, has gone so far to declare Bitcoin legal tender.

3.2 Maturity Transformation

While Bitcoin is unlikely to displace a major world currency any time soon, it may conceivably play a prominent role in certain niche markets. I am reminded of the role the USD plays in some countries. An issue that arises in those jurisdictions is the creation of USD-denominated bank deposit liabilities by foreign-based banks. Might domestic banks (or, more likely, shadow banks) be similarly inclined to issue BTC-denominated loans or finance their assets with deposit liabilities demandable in bitcoin? How should regulators respond to such an activity? How can a central bank act as a lender-of-last resort when, in a crisis, people are wanting their BTC bank deposits and not the local currency? What role, if any, might the fiscal authority play in these circumstances? Lender-of-last resort interventions are not limited to central banks, after all.

The issue of USD-denominated debt in many countries is problematic enough. For better or worse, the practice has been supported by a set of relatively new policies introduced by the Federal Reserve. In response to the mounting pressures in bank funding markets in December 2007, the Fed established dollar swap lines with the European Central Bank and the Swiss National Bank. These swap lines effectively provide foreign banks that depend on dollar funding to manage liquidity crisis events. The number of countries with access to these swap lines has only grown over time. Second, the Fed introduced the Foreign and International Monetary Authorities (FIMA) repo facility at the onset of the COVID-19 crisis in March 2020. The FIMA essentially makes it more attractive for foreign financial firms to hold US Treasury securities, which they can now easily repo for needed dollar funding.

It seems difficult to imagine similar liquidity support programs managed by governments to support intermediaries that rely on BTC funding. For this reason, it seems prudent for domestic authorities to discourage the practice if it were ever to become too popular. On the other hand, given the extreme

4. See https://unctad.org/system/.les/official-document/presspb2022d8_en.pdf.

volatility of the bitcoin-dollar exchange rate, it seems unlikely that such a business model might even attract depositors in the first place. However unlikely it may be, regulators should nevertheless be prepared.

3.3 Bitcoin as a Safe Asset

In March 2016, I asked whether Bitcoin might be the next safe asset.[5] A safe asset is not a risk-free asset. Rather, it is a "flight to safety" asset. According to Yale economist Gary Gorton, a safe asset is "an asset that can be used to transact without fear of adverse selection; that is, there are no concerns that the counterparty privately knows more about the value of the asset."[6] Economists refer to assets with this property as "informationally insensitive."

The US dollar and US Treasury securities are classic "flight to safety" assets because they are informationally insensitive. But the same is potentially true of DAO securities like Bitcoin because the protocols creating and managing token supply are perfectly transparent. There is no asymmetric information. Safe assets often yield a very low return in normal times and extraordinarily high returns in low-frequency events like a financial crisis. In the case of the US dollar, a flight to safety imparts disinflationary forces, since the demand for money rises. In the case of US Treasury securities, flight to safety puts downward pressure on bond yields. Both of these forces make room for looser monetary and fiscal policies.

A question worth pondering is what might happen if one day DAO securities like Bitcoin are very much larger in terms of market capitalization and if they are viewed by investors as safe assets? An added attraction of DAOs is that their policies operate independently of forces that may cause fiscal strains for governments. A flight-to-safety event in this case may cause a large shift in wealth portfolios away from government securities into crypto assets. Such an event is likely to be inflationary and to put upward pressure on bond yields. These forces would greatly hinder the normal countercyclical response expected from monetary and fiscal authorities in a recession.

4. FIXED EXCHANGE RATE DAOs

Fixed exchange rate DAOs attempt to peg the value of their currency relative to the price of some other asset. These "stablecoins" come in a variety of flavors. The most popular stablecoins peg their value relative to the US dollar. Variations may peg relative to other dominant currencies, such as the euro or even gold.

Stablecoins also vary in how they back their liabilities. The most prominent stablecoins hold conventional securities, like US Treasury securities and commercial paper, as assets. This latter class of stablecoins resembles money market funds or uninsured banks. Another class of stablecoins back their liabilities with cryptoassets. Stablecoins differ from conventional structures in terms of their front-end services (e.g., permissionless access and use) and in their back-end protocols (e.g., their use of blockchain database management systems).

To a macroeconomist, stablecoins look very much like unilateral fixed exchange rate regimes, or currency boards, or money market funds, or uninsured banks. As such, they are prone to all the usual ills that often afflict these structures—namely, speculative attacks or bank runs that turn out to be self-fulfilling prophecies. What are the implications, if any, for central banks and regulators? Not surprisingly, the answer is likely to depend on several details.

To begin, many popular stablecoins do not organize themselves as pure DAOs. For example, USDC stablecoin is issued and managed by an incorporated company that submits itself to the relevant

5. See http://andolfatto.blogspot.com/2016/03/is-bitcoin-safe-asset.html.

6. Gorton, Gary. "The History and Economics of Safe Assets." *Annual Review of Economics*, 2017; https://www.annualreviews.org/doi/10.1146/annurev-economics-033017-125810.

regulatory authorities. These types of stablecoins are money funds by another name and can be regulated accordingly. They are no more problematic than regular money funds.

Other quasi-DAO stabecoins are potentially more problematic. Tether, for example, is incorporated in the British Virgin Islands and does not submit itself to US regulators. At the same time, Tether allegedly holds a substantial quantity of US commercial paper and US Treasury securities as part of its assets backing its liabilities (which are pegged to the USD). As of this writing, Tether is now the largest stablecoin by market capitalization, being valued at almost $80 billion.

The problem for regulators is not what Tether looks like now, but rather what Tether or Tether-like structures may look like in the near future. At the moment, Tether is used primarily to facilitate crypto asset exchanges. But the structure (or some similar structure) might conceivably operate as an unregulated global money fund payment system. The question is, what happens if such a structure grows by an order of magnitude or more and begins to be used extensively by businesses in the global supply chain to make payments among themselves? And then what happens when the inevitable run occurs and stablecoin is compelled to dispose of its commercial paper assets in a fire sale? Will the Fed stand ready to act as a lender of last resort? Should the Fed open a currency swap line with systemically important stablecoins? Should such entities be granted access to the FIMA facility? This is a troublesome issue and I am not sure what the answers should be.

Finally, there is a class of stablecoins organized as DAOs. The stablecoin DAI, for example, pegs a senior tranche of its liabilities to the USD, leaving a large junior tranche to absorb fluctuations in the underlying collateral, which takes the form of ETH, the second-most-popular cryptocurrency after Bitcoin.

Unlike the money fund model, a stablecoin backed with crypto assets is not as likely to be a source of systemic risk because a fire sale of, say, ETH, is not the same thing as a fire sale of, say, commercial paper. This is to say that the interlinkages between a stablecoin like DAI and conventional securities markets are not as direct as they are with conventional money funds. Nevertheless, interlinkages are possible, for example, if firms begin to use DAI extensively as collateral to support lines of credit. While regulations may in principle limit the extent to which registered businesses interact with a DAO stablecoin, in practice this could prove very difficult since it would require the coordination of regulatory agencies around the world. Moreover, as mentioned above, it is impossible to regulate a DAO directly. If stablecoins like DAI were to one day become large and sufficiently interconnected to constitute a systemic financial risk, there may be very little that regulators could do about it.

5. PROACTIVE STRATEGIES

As new technologies appear on the scene, entrants stand to profit in one of two ways. First, they may benefit from bona fide cost advantages made available by a better technology. While new technologies are often available to incumbents as well, entrants are typically able to exploit advantages more effectively and more rapidly. This is fair game—competition is generally encouraged in market-based economies. Second, they may benefit from lower costs that emanate not from an inherently superior technology, but rather by using the technology to circumvent existing regulations that constrain incumbents. In other words, new technologies may instead provide opportunities for regulatory arbitrage.

Regulatory arbitrage is not necessarily undesirable. It may very well be the case that new technologies imply the need for a new or revised regulatory framework. For example, if smart contracts are demonstrably able to make bank runs less likely, lower capital buffers may be in order. If this is the case, then the privilege should be extended to incumbents as well as entrants. On the other hand, it may be that the existing regulatory framework is judged to be adequate and that the purported benefits of a new technology stem entirely from regulatory arbitrage. The implication in this case is that the social cost of DAO-based money and payment systems exceed their private costs and that existing regulations

should be applied to the new entities. But what to do if these new entities are difficult, or even impossible, to regulate?

If direct regulation is not practical, there are other steps governments might take to mitigate the potential systemic risk of DAO-based money and payment systems. While some of what is driving DAO-based money and payment systems is regulatory arbitrage, I also believe the products are poised to satisfy a market place want. To the extent that this is the case, then rather than preempting risk through regulation, why not preempt it by providing—or paving the way for—a competing product?

The product I am envisioning is unlikely to compete on every relevant dimension. For example, a big attraction of DAO-based money and payment systems is permissionless access and use. While such a property is perfectly feasible using existing technology, it may not be desirable because of KYC and AML requirements.[7] But people do value a fast, secure, and cheap way to move money both domestically and internationally. This is a service that is easily within the grasp of existing technology. The issue is more one of coordination across multiple jurisdictions.

The idea here is not necessarily to eliminate DAO-based money and payment systems. They will continue to serve the needs of their constituents; and, in any case, it is probably not feasible to abolish them completely. This should not, in my view, be considered alarming. Coexistence is possible and desirable. The idea is to offer a product that can successfully compete for business that would otherwise be drawn to DAOs. The goal is to make sure that no DAO-based money and payments system becomes sufficiently large to be considered a systemic financial risk to the global economy.

5.1 Central Bank Digital Currencies

A central bank digital currency (CBDC) is basically an online checking account at a central bank. In the United States, these accounts are presently made available to depository institutions, the federal government, and a select number of other domestic and foreign agencies. In a sense, we already have a CBDC. The question is whether to expand the set of agencies who are granted access to central bank checking accounts. In the limit, one could imagine CBDC to be made available to all US persons (as is the case with online accounts with the US Treasury) or, indeed, to everyone in the world (as is the case with central bank liabilities in the form of paper bills).

The desirability of direct central bank involvement in clearing and settling payments for CBDC would likely depend on whether it is to be made available widely at the retail level or more exclusively at the wholesale level. Central banks already have experience at the wholesale level, so extending the privilege to a larger, but limited, set of reputable fintechs should not be problematic. But because government agencies are not built to service a large and demanding retail sector, daily payment operations should, in my view, be delegated to qualified private sector intermediaries.

Two versions of CBDC have been proposed. A "synthetic" CBDC is essentially a program where money accounts are offered through qualified narrow banks holding assets consisting only of reserves and possibly short-term Treasury bills. This is basically the wholesale CBDC I described above. An "intermediated" CBDC would permit the general public to have access to central bank checking accounts, but with private intermediaries handling customer service. A difference between these two versions is that depositors have direct claims against the central bank in the latter case but only indirect claims in the former. I do not consider this an important difference as long as fintechs operate as narrow banks.

5.2 Monetary Unions

From the perspective of facilitating payments in a monetary union, the value of a CBDC relative to what is presently in place is likely to depend on individual country characteristics. In Europe, for example,

7. "KYC" is know your customer, and "AML" is anti money laundering.

the Single European Payments Area (SEPA) appears to function sufficiently well for retail users. The same might be said of M-Pesa in Sub-Saharan Africa and of We-Chat and AliPay in China. Note that these latter three payment systems were private sector initiatives that now provide efficient payment services to literally billions of people.

While the United States continues to lag many other jurisdictions in terms of the cost, speed, and efficiency of making retail payments, the situation is improving rapidly. Americans now have 24/7 real-time payments services available via The Clearing House, a consortium of some of the world's largest banks. The Federal Reserve will soon offer a similar service for all US banks through FedNow. While a CBDC for these countries is not essential for facilitating retail payments, arguments can be made in their support.

A neglected aspect of CBDC is how it is likely to impact the shadow bank sector. Money market funds and repo arrangements are used extensively by corporate treasuries to manage cash flow. Because deposit insurance covers only small-value accounts, parking large amounts of cash in banks is not perfectly safe. Even if the cash is safe, access to it may be delayed if a bank becomes financially distressed, defeating the purpose of cash-on-demand. Repo arrangements with safe assets serving as collateral are particularly attractive in this regard because, if a deposit is not repaid, the corporate cash manager can seize and dispose of the collateral. Collateral in the form of a $50 million US Treasury bill is like a fully insured interest-bearing bank account.

Suppose that a CBDC is available and that it offers an attractive deposit rate (say, consistent with prevailing money market rates). Here, we have a product that offers fully insured (or fully reserve-backed) interest-bearing money accounts that offer 24/7 real-time payment services. It seems to me that corporate cash managers are likely to find such a product attractive. Such a product is likely to disintermediate government money funds repo arrangements that make use of Treasury security collateral. Some business may migrate to money funds that offer higher deposit rates supported by riskier assets, but current US regulations require such funds to price their units at net asset value (NAV), making them less desirable as a cash management tool.

The idea I want to stress here is that a well-designed CBDC is likely to disintermediate segments of the wholesale banking sector in a currency union like the United States or the European Monetary Union. Might the same principle be used to disintermediate potential private suppliers of global money and payments systems?

5.3 International Payments

From the perspective of a Martian looking in on the Earth's global payment system, things must seem a frightful mess. And yet, as always, we should keep matters in perspective. In particular, the situation was much worse fifty years ago. Travelers from North America to Europe, for example, would have to resort to cash or travelers checks. Today, one can hop on a plane, credit card in hand, and not give any thought to how one is to pay for things. Of course, there are still gaping holes in terms of access and interoperability of payment systems. And while the price of international money transfers remains high, competition does appear to be bringing these prices down. The question is whether a better-designed international payment system exploiting the most current technologies might broaden access and bring costs and prices down even further.

I am confident that the global payments system will continue to make advancements and that progress along this dimension will be sufficient to discourage the emergence and use of global stablecoins for retail use. I am somewhat less confident that the same will hold true at the wholesale level. The most popular stablecoin, Tether, requires a minimum deposit of $100,000, for example. While Tether is presently being used mainly to facilitate exchange of crypto assets, its USD peg may conceivably make it attractive for large corporate users.

Multinational corporations may very well avail themselves of the services provided by a global stablecoin for the same reason national corporate cash managers are attracted to the domestic shadow bank sector. Not only may large deposits be perceived to be safer, they may also be linked to highly efficient payment rails. If a sufficient number of multinational firms and their affiliates are connected via a global stablecoin, payments across firms along a global supply chain can be made without ever passing through a bank.

What sort of product might discourage a global stablecoin from growing to the point where it presents an ungovernable systemic financial risk to the global economy? Some sort of global CBDC seems to be in order. One could imagine, for example, the IMF setting up a payment rail and offering its special drawing rights (SDRs) as a global currency for multinational corporations. Something similar might instead be offered via the Bureau for International Settlements.

Alternatively, perhaps all that is needed is a set of CBDCs issued by a few of the world's largest common currency areas. Given the role of the USD as the world's reserve currency, a widely accessible wholesale CBDC issued by the US Federal Reserve seems like a natural candidate.

6. CONCLUSIONS

Central banks and regulators are accustomed to dealing with the repercussions of technological change. My discussion focused on money and payment systems, but there is also much happening in credit markets. The traditional local area expertise of bank credit officers is increasingly becoming less important given how artificial intelligence can be used to assess debtor characteristics anywhere in the country or even the globe. A number of interesting issues relating to data privacy and data ownership are also on the table.

In this article I considered how a new technology in payments—a DAO-based money and payment system—may one day grow to pose a systemic financial risk for the global economy. While my analysis has been speculative, I believe policymakers need to monitor these new technologies and consider their risk, even if the risk is perceived ex ante to be low.

As things stand today, I see the systemic risk of DAO-based money and payment systems at the retail level of less importance than at the wholesale level. Given the role of the US dollar as the world's reserve currency, a widely accessible wholesale CBDC issued by the US Federal Reserve is something I think should be considered with some urgency. The design and possible unintended consequences of such an arrangement need to be considered carefully. In addition to possibly crowding out global stablecoins, it may also crowd out money market funds and Eurodollar deposits. And if the arrangement is ultimately deemed to be socially desirable, the implementation must be thought through and managed carefully.

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What Is the Monetary Standard? The Fed Should Tell Us

Robert L. Hetzel

Abstract

The Federal Reserve System (Fed) is a regular feature in the media. When the Fed communicates with the public, its focus is on forward guidance related to monetary policy—specifically, for achieving low unemployment and low inflation. Fed participants on the Federal Open Market Committee (FOMC) convey what they see as the likely path of policy, including changes in the federal funds rate, a standard monetary policy tool. Because financial markets find this information useful, news stories thoroughly cover Fed communication.

However, such communication fails to explain the structure of the economy that disciplines how the FOMC achieves its objectives for employment and inflation. The FOMC necessarily conducts monetary policy based on assumptions about this structure. What is now implicit should be made explicit. Such explicitness by the FOMC is necessary for the public to understand the monetary standard that it has created. That is, the Fed needs to explain the framework it assumes to then explain how its actions translate into achievement of its objectives.

Such transparency will be challenging. The standard Fed narrative implicitly assumes that a free-market economy and financial markets are inherently unstable. Economic instability originates in the private sector, and an independent Fed is required to mitigate this instability. Again, implicitly, the assumption is that the Fed understands the structure of the economy so that it knows the origin of instability and how its actions will offset that instability.

Despite the Fed narrative, there is a need for a debate over the optimal monetary standard. In the 1960s, the monetarist-Keynesian debate raised the key issues relevant to the design of the optimal monetary standard. Is inflation a monetary or a nonmonetary phenomenon? What accounts for the simultaneous occurrence of monetary instability and real instability. Does the direction of causation go from monetary to real instability or vice versa? The intent of this article is to revive the earlier debate. To do so, it will be necessary to re-exposit monetarism in a way relevant to current central bank practice. To do so, I re-exposit monetarism in a way that is relevant to current central bank practice, using the term "Wicksellian monetarism" as the descriptive label.

Such a debate is especially urgent at present given the FOMC's current policy of disinflation. The FOMC needs to articulate a monetary policy in terms of a long-term strategy (rule) that will restore price stability and then maintain that stability. How does current policy ensure that a declining rate of inflation will stop at 2 percent and then remain there? That is, for the long run, the policy needs to provide a stable nominal anchor. Such a policy should allow the FOMC to lower the federal funds rate to prevent a serious recession while maintaining credibility for a long-run policy to restore price stability.

JEL codes: E4, E5, E42, E51, E52, E58

Federal Reserve Bank of St. Louis *Review*, First Quarter 2024, *106*(1), pp. 10-39.
https://doi.org/10.20955/r.106.10-39

INTRODUCTION

The monetary standard is the framework within which the FOMC pursues its objectives. That framework clarifies not only the objectives of monetary policy but also the structure of the economy that intermediates the monetary policy actions of the FOMC and the behavior of its objectives. Given those objectives, monetary policy is the reaction function (the rule) the FOMC uses to set its instrument (the federal funds rate) in response to incoming information on the economy. Although the FOMC lacks a detailed model of the structure of the economy, it still must choose a monetary policy based on assumptions about the basic character of that structure.

The design of the optimal monetary standard and of a stabilizing monetary policy depends upon the character of inflation. If inflation is a monetary phenomenon, monetary policy must provide for monetary control. The control of paper money creation through the bookkeeping open-market operations of the New York Fed's Open Market Trading Desk does not provide the FOMC with the ability to control systematically the behavior of the real economy. Monetary policy must give free rein to the stabilizing properties of the price system to control real variables (output and employment).

Alternatively, if inflation is a nonmonetary phenomenon, to control inflation, monetary policy must control slack in the utilization of resources. The control of slack necessitates balancing the objectives of unemployment, which increases with slack, and inflation, which decreases with slack. The trade-offs are given by the empirical relationship known as the Phillips curve. In the former case in which inflation is a monetary phenomenon, the FOMC is relying on the stabilizing properties of the price system to achieve full employment. In the latter case in which inflation is a nonmonetary phenomenon, it is overriding those properties by manipulating slack in the economy.

There is a lack of professional consensus over the nature of inflation and the strength of the stabilizing properties of the price system. That reality in no way obviates the need for the Fed to choose a monetary policy based on an assumption about these characteristics of the economy. Heuristically, the FOMC must decide whether to juggle one ball or two balls. That is, should it concentrate on one ball (price stability) and leave unaided market forces to deal with the other ball (unemployment)? Alternatively, should it juggle two balls by manipulating inflation-unemployment trade-offs? Transparency about the monetary standard that the FOMC has created would require it to clarify its assumptions and subject them to professional debate. The two views that have historically defined the debate are "traditional Keynesian" and "Wicksellian monetarism."

Throughout the 1970s, a vigorous monetarist-Keynesian debate contested the issues basic to the design of the optimal monetary standard. Given the long period of relative quiescence in inflation after the Volcker disinflation, the debate receded. Given the current rise in inflation, the debate should be

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The ideas in this article draw on the monetarist tradition developed by a remarkable assemblage of economists at the Federal Reserve Bank of St. Louis in the 1960s and 1970s, attracted by Homer Jones, the research director at the time: Leonall Andersen, Richard Anderson, Anatol (Ted) Balbach, Al Burger, Rik Hafer, Scott Hein, Jerry Jordan, Michael Keran, Jim Meigs, Robert Rasche, and Jack Tatom. The St. Louis Fed also publicized work by Karl Brunner, Allan Meltzer, and Anna Schwartz. See Bordo and Schwartz (2008). This article is dedicated to Marvin Goodfriend, from whom the author drew inspiration. An earlier iteration of this article appeared in the working paper series of the Mercatus Center at George Mason University.

revived. However, given the fact that the FOMC ignores the behavior of money and uses an interest rate rather than a reserves aggregate as its instrument, the original monetarist views appear to have lost relevance. This paper re-exposits monetarism as Wicksellian monetarism to make it relevant to current practice.[1] To reinforce the point that there remains a need to revive the earlier debate to confront the basic issues that must be decided in the design of the optimal monetary standard, this article contrasts the two views—traditional Keynesianism and Wicksellian monetarism.

Policy in the Keynesian tradition implicitly assumes that inflation is a nonmonetary phenomenon. A stickiness in relative prices that imparts inertia to market clearing prices causes the price system to work only poorly to maintain full employment. FOMC procedures for setting the federal funds rate must override the operation of the price system to manage purposefully slack in the economy. Necessarily, the FOMC balances off the two competing targets of low unemployment and low inflation using the trade-off given by the empirical relationship known as the Phillips curve.

Policy in the Wicksellian monetarist tradition implicitly assumes that inflation is a monetary phenomenon. Given a rule based on maintenance of the expectation of price stability—that is, a stable nominal anchor—the stabilizing properties of the price system work well to maintain full employment. FOMC procedures that cause the federal funds rate target to track the natural rate of interest turn over to the unfettered operation of the price system the determination of real variables (output and employment).

Section 1 makes the case that transparency and accountability require the FOMC to articulate the nature of the monetary standard that it has created. Section 2 makes explicit the issues the FOMC would have to address to defend its standard narrative that economic instability always arises in the private sector. In a re-exposition of the monetarist-Keynesian debate, sections 3 and 4 make relevant this earlier debate by delineating the differences in the structure of the economy assumed by each school. The terms used, "traditional Keynesian" and "Wicksellian monetarism," are meant to be broadly suggestive rather than historically rigorous.

Section 5 furnishes an historical narrative illustrating how the actual monetary standard has changed in a way dependent upon which of these views predominated within the FOMC. These alterations constitute the experiments for testing which standard constitutes the optimal monetary standard. The FOMC should defend its choice of standard in terms of which ones have worked and not worked in the past. Section 6 reviews the monetary policy the FOMC initiated in response to the pandemic. Section 7 explains how the FOMC should reorganize its discussion to reflect its choice of the monetary standard. Section 8 illustrates why at present given the FOMC's policy of disinflation it is especially important to articulate the nature of the monetary standard in a way that makes credible a long-term stable nominal anchor. Section 9 concludes.

1. THE FED SHOULD MAKE EXPLICIT THE MONETARY STANDARD IT HAS CREATED

Constitutionally, Congress is responsible for the monetary standard. It has delegated the responsibility for creating and implementing that standard to the Fed. The relevant language in Sec. 2A of the Federal Reserve Act explains: "The Board of Governors of the Federal Reserve System and the Federal Open Market Committee shall maintain long run growth of the monetary and credit aggregates commensurate with the economy's long run potential to increase production, so as to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates. [12 U.S.C. 225a] (as amended through P.L. 117-263, enacted December 23, 2022)

1. Belongia and Ireland (2019) argue that the monetary aggregates adjusted for changes in the output gap would work well as an FOMC intermediate target. Belongia and Ireland (2022) make the case for using Divisia aggregates. Both papers argue that money would work well as a target at the zero lower bound. Anderson, Bordo, and Duca (2015) examine the interest sensitivity of velocity. Sumner (2014) re-exposits the monetarist rule of steady money growth as nominal GDP targeting.

A statement of what constitutes a monetary standard shows how ambiguous is the congressional mandate delegated to the Fed. A monetary standard explains how the FOMC's reaction function for setting the federal funds rate gives money (the goods price of money, which is the inverse of the price level) a well-defined value. It also explains how the reaction function keeps output growing around its potential trend, which keeps employment at its "maximum" (sustainable) value. A characterization of the monetary standard requires explicitness not only about the objectives of monetary policy but also about *how* the FOMC pursues them given the constraints imposed by the structure of the economy.

In a wartime economy with rationing and price controls, operating as a central planner, the Fed can exercise at least partial direct control over its objectives. In a peacetime economy, however, the behavior of firms and households is coordinated by the decentralized operation of the price system. The FOMC must pursue its objectives through the way that its instrument, which is an interest rate (the intertemporal price of resources), interacts with the operation of the price system. The agents in the economy (households and firms) respond to the resulting signals of the price system in a way that determines the behavior of the FOMC's objectives. The monetary standard conceptualizes how the price system intermediates the two-way interaction between the behavior of the federal funds rate and the behavior of the economy.

The mandate Congress has given to the Fed is too general to determine the character of the monetary standard. The objectives of "stable prices" and "maximum employment" amount to little more than instructions to achieve all good things. As a condition for its independence to conduct monetary policy, the Fed should be transparent about the monetary standard that it has created. Accountability requires transparency and transparency is integrally related to learning. Without a clear articulation of the monetary standard, the Fed has no way of learning from the accumulation of experience. The Fed has a responsibility, now unfilled, to defend the existing monetary standard by articulating it and then by placing it in the historical context of what standards have stabilized the economy in the past and what standards have destabilized it. The Fed still has a long way to go to fulfill the program of transparency initiated by Marvin Goodfriend (1986) with his paper "Monetary Mystique: Secrecy and Central Banking." To a significant extent, the Fed remains in the "trust me" stage.

The Fed's failure to articulate the nature of the monetary standard is concerning because of the grave consequences of destabilizing monetary policy. That failure is a paradox. Significant time has passed since the Fed began operating in late 1914. Should the Fed not record what it did over time and assess when its actions were stabilizing or destabilizing? Would not the accumulation of experience over time then lead to an accumulation of knowledge about what constitutes the optimal monetary standard? To learn, however, the FOMC would have to address the simultaneity problem. Namely, the behavior of the FOMC affects the behavior of the economy, and the behavior of the economy affects the behavior of the FOMC. To learn from historical experience what kinds of monetary policies have been stabilizing or destabilizing, it is necessary to sort out the one-way causation from FOMC behavior to the behavior of the economy.

The standard FOMC narrative, however, simply attributes instability to external shocks, which monetary policy always mitigates. The implicit assumption is that the FOMC possesses the knowledge of the structure of the economy required to identify the one-way causation going from its monetary policy (rule) to the behavior of the economy. Because FOMC participants talk in detail about the state of the economy, the public assumes without questioning that the FOMC possesses the knowledge required to choose a rule for conducting monetary policy based on a solution to the simultaneity problem. The FOMC then is free to communicate a narrative in which economic instability is an inherent characteristic of a free-market economy. It follows that an independent Fed is essential to mitigate that instability.

The juxtaposition of the traditional Keynesian view and Wicksellian monetarist view below illustrates the reality that the basic issues that must be decided in the design of the optimal monetary standard

remain contentious. There remains a need for a vigorous debate over the design of the optimal monetary standard.[2]

2. SUBJECTING THE FED NARRATIVE TO SCRUTINY

The intuitive character of FOMC communication seems to render unnecessary any articulation of the monetary standard to explain how the FOMC achieves its objectives. When "maximum employment" is the primary problem, the FOMC lowers the federal funds rate to loosen conditions in financial markets. When "stable prices" is the primary problem, the FOMC raises the funds rate to tighten conditions in financial markets. Based on the (undefined) criterion of "optimal policy," FOMC participants also make quarterly forecasts of the evolution of the economy. However, intuition and undisciplined forecasts do not substitute for a monetary policy based on articulation of the structure of the economy that mediates how FOMC actions translate into the behavior of the economy.

As described above, the standard Fed narrative implicitly assumes that the FOMC has solved that simultaneity problem so that it can predictably mitigate rather than cause instability in the private sector. That is, policymakers understand the one-way causation going from their behavior to the behavior of the economy. But how? The problem is apparent in the interpretation of the FOMC's lean-against-the-wind (LAW) procedures that have formed the basis of monetary policy since their creation by William McChesney Martin in the post-1951 Treasury-Fed Accord period. With these procedures, the FOMC raises the funds rate above its prevailing value when the economy is growing unsustainably fast as measured by persistent declines in the economy's rate of resource utilization. Converse statements hold in the event of weakness in the economy.

Those LAW procedures produce a correlation between changes in the funds rate and changes in the economy's rate of resource utilization (measures of the degree of slack in the economy or an output gap). The question is how to interpret the correlation. With an interpretation in the Keynesian tradition, the FOMC is controlling the degree of slack. With the Wicksellian monetarist interpretation, the FOMC is tracking the natural rate of interest and the price system is working to keep output at potential.

The absence of money targets in central bank procedures and the routine LAW response to the behavior of the real economy can easily lead to an interpretation in the Keynesian tradition that the FOMC is balancing off competing targets for low inflation and low unemployment. That interpretation appears in the characterization of "flexible inflation targeting" (FIT) offered by Lars Svensson, the Deputy Governor of the Sveriges Riksbank at the time. Svensson (2009, p. 1-2) wrote

> The Riksbank and all other inflation-targeting central banks conduct *flexible* inflation targeting rather than *strict* inflation targeting. Flexible inflation targeting means that monetary policy aims at stabilizing *both* inflation around the inflation target and the real economy... By stabilizing the real economy I mean stabilizing resource utilization around a normal level... Because of the time lags between monetary-policy actions and their effect on inflation and the real economy, effective flexible inflation targeting has to rely on forecasts of inflation and the real economy... In the event of conflicting objectives, it achieves a reasonable compromise between the stability of inflation and the stability of resource utilization... Inflation and resource utilization are target variables here, that is, variables that are arguments of the central bank's loss function. (italics in original)

2. Bordo and Prescott (2019, 2022) argue that the Fed's federal structure ensures a vigorous debate over fundamental issues. The poster child for their position is the way that the Federal Reserve Bank of St. Louis in the 1960s and 1970s challenged the prevailing FOMC view that the control of inflation did not require the control of money growth. However, it could be that the willingness of the St. Louis Fed to challenge the status quo was an historical accident. It happened to have a Board of Directors both willing to appoint bank presidents (Delos Johns, Darryl Francis, and Lawrence Roos) who were willing to challenge the Fed narrative and to allow the directors of research (Homer Jones and Anatol Balbach) to build a research department with the resources necessary to support such a challenge.

Svensson (2009, p. 2) argued that his interpretation is "consistent with the standard quadratic loss function, $L_t = (\pi_t - \pi^*)^2 + \lambda(y_t - \bar{y}_t)^2$, where π_t denotes inflation, π^* the inflation target, $y_t - \bar{y}_t$ the output gap between output and potential output $\bar{y}_t$, and the output gap is used as a measure of resource utilization." Svensson assumes a structural model of the economy that allows the central bank to predict and to control the real economy and the relationship between the real economy and inflation. Through its knowledge of and control over slack in the economy (the output gap) and subject to the inflation-unemployment trade-offs given by the Phillips curve, the central bank can choose a socially optimal combination of inflation and unemployment. The implication of using slack in the economy (the difference between the unemployment rate and a NAIRU [non-accelerating inflation rate of unemployment] value consistent with no change in inflation) as an intermediate target to control a combination of inflation and slack implies that inflation is a nonmonetary phenomenon.

A related issue of identification is the nature of the transmission mechanism for monetary policy. Consider restrictive monetary policy, which causes a contraction in bank loans and deposits. There is an associated reduction in the debt of interest-rate-sensitive sectors of the economy and a decline in house and equity prices. These observed facts are consistent with a transmission mechanism based on the FOMC's influence on financial intermediation (the credit view). They are also consistent with a transmission mechanism based on a portfolio balance effect with which the FOMC reduces the liquidity of the public's asset portfolio below its desired amount (the monetary view).

Each version leads to a different conception of the control of inflation. With the monetary view, with its monopoly over reserves creation, the FOMC can exercise exclusive control of the trend growth of aggregate nominal demand relative to the growth of potential real output and thus can control trend inflation (Hendrickson, 2012). Inflation is a monetary phenomenon, and the central bank is an inflation creator. With the credit view, the central bank is only one of many influences on financial intermediation. The central bank is an inflation fighter.

3. THE TRADITIONAL KEYNESIAN MODEL

Since the 1951 Treasury-Fed Accord, the FOMC's choice of the monetary standard has depended on policymakers' implicit understanding of the price level as a nonmonetary or monetary phenomenon. This choice broadly reflects a traditional Keynesian or Wicksellian monetarist view of the world. To assess the validity of these contrasting views, it is useful to summarize their differing assumptions about the structure of the economy.

Traditional Keynesianism starts with the assumption that external shocks overwhelm the stabilizing properties of the price system. To maintain the full employment of resources, policymakers need to manage aggregate demand (the spending of the public). Moreover, Keynesians view the price level as a nonmonetary phenomenon. At times, inflation originates from an eclectic assortment of real factors that cause relative prices to pass through in a persistent way to the price level (cost-push inflation). At other times, inflation originates from an excessive amount of aggregate demand with money growth as a possible but not a necessary cause (demand-pull inflation). Using the interest rate (monetary policy) and the deficit (fiscal policy), policymakers should aim for a socially desirable mix of low unemployment and low inflation.

Macroeconomic instability possesses a microeconomic foundation based on two factors. First, for a variety of institutional reasons, relative prices are rigid in that they fail to vary sufficiently to clear markets in response to external shocks. The classic example is nominal wage rigidity that prevents wages from falling to maintain full employment in recessions. Second, the public's expectations of the future behavior of inflation are backward looking. They can be viewed as derived from a weighted average of current and past values of realized inflation. Because expectations are not tethered to the systematic behavior of monetary policy, policymakers can take them as given when they choose the values of their

instrument. An analogy is a ship captain steering a course through a storm. The winds that buffet the ship in no way reflect a forecast of how the captain will behave in the future.

Backward-looking expectations impart persistence to inflation shocks, causing the relative price shocks that pass through to the price level to propagate. Inflation can turn into a wage-price spiral because the expectation of inflation becomes unmoored from the FOMC's inflation target. A consistent focus on price stability would impose a significant cost in terms of high unemployment.

The failure of the stabilizing properties of the price system to maintain full employment means that policymakers must set a goal for unemployment as well as for inflation. The dual mandate goals of maximum employment and stable prices become goals for low unemployment and low inflation. The trade-off is given by the Phillips curve. The nonmonetary character of inflation is what gives substance to the ability of the Phillips curve to predict the inflation-unemployment trade-off. The two factors referred to above, inflexible dollar prices and backward-looking expectations, are the levers that make it possible for the Fed to control the amount of slack in the economy and move along the Phillips curve in a predictable way.

The FOMC moves inflation by controlling the amount of slack in the economy: the unemployment rate relative to the unemployment rate consistent with no change in inflation, the NAIRU (Modigliani and Papademos, 1975). At each meeting, the FOMC can take as given some part of nominal (dollar) prices that are determined by institutional factors and the monopoly power of corporations and labor unions. That nominal rigidity gives the FOMC a lever for controlling slack. Over time, it can offset increases in these rigid prices by increasing slack, as predicted by the Phillips curve. When the FOMC reduces an entrenched inflation, the cost in terms of slack is given by the sacrifice ratio: the number of person-years of excess unemployment required to reduce inflation by 1 percentage point.

In this world, the Fed is an inflation fighter, not an inflation creator. The behavior of the Phillips curve is the central focus of monetary policy. External forces produce headwinds in this fight (cost-push inflation) by raising the level of the Phillips curve or tailwinds (cost-pull deflation) by lowering the level of the Phillips curve. Discretion is required to choose a socially optimal combination of inflation and unemployment. The desirability of discretionary management of aggregate demand to manage Phillips curve trade-offs is necessitated by the existence of cost-push inflation. The higher is cost-push inflation, the higher is the unemployment rate (the NAIRU) required to restrain inflation. The presumed existence of cost-push inflation in the 1970s formed the rationale for the Fed's tolerance of high rates of inflation. That is, the Fed assumed that it needed to allow significant inflation to maintain a socially desirable amount of low unemployment.

The character of monetary policy must change over time with the evolution in the behavior of the Phillips curve. Following that evolution necessarily requires discretion. A rule is impractical because of lack of knowledge of how the Phillips curve will evolve. Mary Daly (2023), president of the San Francisco Fed expressed this view:

> Policymakers have to respond to an economy that is evolving in real time and prepare for what the economy will look like in the future... Before the pandemic and the current episode of high inflation, the world was starkly different. The principal and decade-long challenge for the Federal Reserve and most other central banks was trying to bring inflation up to target, rather than pushing it down... Large structural forces were to blame. The most notable was population aging... Despite sustained monetary policy accommodation after the Great Recession, annual personal consumption expenditures (PCE) inflation remained below 2% for 84 out of 98 months... Over that same period, the federal funds rate was set near zero almost half of the time... Let me offer four things that I think could be important for our future inflation path. One is a decline in global price competition... Another potential factor affecting future inflation is the ongoing domestic labor shortage... Inflation pressures could also move upward as firms make the transition to a greener economy... If the old dynamics are eclipsed by other, newer influences and the pressures on inflation start pushing upward instead of downward, then policy will likely need to do more.

Consistent with the assumption that economic instability arises in the private sector, it follows that financial markets are also one source of economic instability. For most of its history, the Fed refrained from intervening in credit markets to allocate credit (Goodfriend, 1994). However, beginning with the Bernanke FOMC, the Fed reinvented itself as a combination central bank and housing GSE. Under the presumption that financial markets fail to assess risk adequately and that the Fed can stimulate aggregate demand by stimulating financial intermediation, the Fed has made the size and composition of the asset side of its balance sheet an independent instrument of aggregate-demand stabilization.

4. WICKSELLIAN MONETARISM

In fall 1982, the FOMC abandoned the experiment of setting a target for the monetary aggregate M1 when its growth changed from procyclical to countercyclical. The precipitating factor was a reduction in the cost of moving funds electronically between money market instruments and bank deposits. When money market interest rates change, banks only tardily adjust the rates they pay on deposits. The public then possesses an incentive to reintermediate funds into bank deposits when market rates decline and disintermediate funds from bank deposits when market rates rise. The resulting inflows into or outflows out of bank deposits from money market instruments used primarily as savings rather than transactions instruments change the liquidity incorporated in bank deposits. M1 then ceased to measure the liquidity in the public's asset portfolio. Specifically, weakness in the economy and the accompanying decline in market interest rates caused M1 growth to strengthen without signaling an expansionary monetary policy. A target for M1 growth would inappropriately indicate that the federal funds rate should rise rather than fall.

The fact that the monetary aggregates M1 and M2 no longer serve as accurate measures of the liquidity of the public's asset portfolio does not mean that the liquidity desired by the public is no longer captured by a stable functional form. The FOMC still needs to control reserves creation to allow bank deposit creation to provide the public with the liquidity it desires in an environment of expected price stability. The rule that controls liquidity (money) creation to be consistent with price stability possesses a demand and a supply aspect.

The demand aspect comprises a rule that creates the expectation of price stability. The seller in a transaction accepts money because they believe that it will possess value in exchange in the future. The rule disciplines the expectation that a dollar will possess a stable value for an average of the transactions that could arise in the future for the seller. The supply aspect entails procedures that cause the funds rate to track the natural rate of interest. (The natural rate of interest is the real interest rate that controls the intertemporal allocation of aggregate demand to maintain contemporaneous demand equal to potential output.) As explained below, the practical implementation of such a rule suggests the label "LAW with credibility."

With the funds rate tracking the natural rate of interest, real output grows in line with growth in potential output. Money demand then grows in line with growth in potential output. Given the FOMC's interest rate target, banks accommodate the demand for money through their deposit creation. Because money grows in line with potential output, it remains consistent with price stability. Alternatively, with output equal to potential, the New York Desk does not need to defend its interest rate target by monetizing excess supply in the bond market arising from excess demand in the goods (output) market. Consequently, it avoids creating destabilizing monetary emissions. (Converse statements hold for preventing monetary contraction.)

Specifically, with an FOMC interest rate target, increases in the demand for money are accommodated by commercial bank creation of deposits. That is, if the public wants additional deposits, it sells securities to banks and the banks create the deposits. The associated increased reserves demand is met

as the result of the New York Desk's buying of Treasury securities to prevent increases in the funds rate above its interest rate peg. With an interest rate instrument, the discipline required for monetary control emerges from procedures that allow the price system freedom to operate and thus avoid interference with its stabilizing properties. Such interference is the macroeconomic equivalent of price fixing and creates destabilizing changes in bank deposits and the liquidity of the public's asset portfolio (measured by destabilizing fluctuations in the monetary aggregates before the early 1980s).

The equation of exchange is written as $MV = py$. (M is money, V is the velocity of money, p is the price level, and y is real output.) As described above, a rule that causes the funds rate to track the natural rate of interest and thus maintains growth in output, y, equal to growth in potential output maintains the demand for money, the inverse of V, consistent with the expectation of price stability. Given the funds rate target, money grows at a rate consistent with price stability. All the variables in the equation of exchange are endogenous and determined in a way shaped by the FOMC's rule.[3] However, a failure of FOMC procedures to respect the working of the price system by failing to keep the funds rate in line with the natural rate of interest creates destabilizing monetary emissions or contractions. The standard interpretation of the equation of exchange, with money an independent variable, is then appropriate.

Why should one accept the fundamental premises of Wicksellian monetarism that inflation is a monetary phenomenon and that the natural rate of interest determined by market forces clears the goods market? The reason is that they bring coherence to the Volcker-Greenspan policy that produced the Great Moderation. The relevant model is the New Keynesian model of Goodfriend and King (1997). In their model, price stability turns the determination of real variables (output and employment) over to the real business cycle core of the economy. Price stability allows the stabilizing properties of the price system to maintain full employment. Broaddus and Goodfriend (2004, pp. 3, 9) use the Goodfriend-King model to capture the spirit of the Volcker-Greenspan era:

> The case for maintaining price stability—in the United States and elsewhere—is rooted in experience and theory, which indicate that monetary policy best supports employment, economic growth, and financial stability by making price stability a priority... The long campaign from the late 1970s through the early 1990s to reduce inflation and establish price stability arguably succeeded only when the Fed finally acquired credibility for low inflation in the eyes of the public in the late 1990s. Indeed, the acquisition of this credibility was essentially equivalent to establishing price stability—two ways to describe the same achievement. Similarly, the Fed needs to acquire credibility for *sustaining* price stability going forward. (italics in original)

To give empirical content to the rule that implements the separation of the behavior of the real economy from maintenance of price stability, it is necessary to incorporate Aoki (2001). Aoki classifies firms as belonging to the flexible-price sector in which prices are set in auction markets and firms belonging to the sticky-price sector in which firms set prices for multiple periods. Through a credible rule, the FOMC can control the expectation of inflation of firms in the sticky-price sector and cause them all to coordinate on the FOMC's inflation target—ideally, price stability. The rule then ties down trend inflation while allowing transitory fluctuations originating in the flexible-price sector to pass through to headline inflation. Because only the interaction between inflation and sticky prices distorts the optimal allocation of resources, this distinction is desirable. Moreover, by controlling trend inflation through controlling the expectation of inflation in the sticky-price sector, the FOMC is free to implement procedures that cause the funds rate to track the natural rate of interest.

The failure of markets to clear in recession and the accompanying unemployment comes from monetary instability, which takes the form of an unpredictable evolution of the price level. Firms that

3. Money is like a "stick in the closet." If expected inflation exceeds price stability, the FOMC can raise the federal funds rate; create a monetary contraction that sets off a negative portfolio balance effect, depressing output; and restore credibility for price stability.

set dollar prices for multiple periods do so based on an expectation of the future price level. Without a stable nominal anchor in the form of the expectation of price stability, different firms in the sticky-price sector will base their price setting on different values of the expected future price level. Moreover, there is no guarantee that whatever expected value firms choose will be consistent with the value ultimately determined by monetary policy. Setting market-clearing relative prices will then be problematic. Because the public forms its expectations in conformity with the monetary policy followed by the Fed, assuming that policy is clearly articulated and pursued consistently, a policy of price stability eliminates monetary instability as the major source of economic instability.

Households and firms are forward looking. Provided that the FOMC operates with a rule that makes the evolution of the price level predictable, ideally through a policy of price stability, agents can sort out changes in the price level from changes in relative prices (Lucas, 1972). They can then make optimal allocative decisions. A policy of keeping sticky-price inflation steady while allowing flexible-price inflation to fluctuate freely facilitates the unhindered determination of relative prices (Aoki, 2001). Moreover, as long as the FOMC allows the price system to operate, despite shocks to the economy, agents will remain optimistic about the future. They will then maintain their current consumption to smooth their consumption over time.

Confusion exists over the monetary control feature of the procedures developed in the Volcker-Greenspan era because they do not entail a feedback rule for eliminating misses in money from target. Confusion also exists over the FOMC's concentration on the restoration of the expectation of price stability in the Volcker-Greenspan era as opposed to direct targeting of inflation. Direct targeting of the price level though a feedback rule using the FOMC's instrument for implementing policy runs afoul of Friedman's "long and variable lags" phenomenon as Friedman (1960, pp. 87-8) illustrated with just such an example[4,5]:

> There is much evidence that monetary changes have their effect only after a considerable lag and over a long period and that the lag is rather variable... Under these circumstances, the price level—or for that matter any other set of economic indicators—could be an effective guide only if it were possible to predict, first, the effects of non-monetary factors on the price level for a considerable period of time in the future, second, the length of time it will take in each particular instance of monetary actions to have their effect, and third, the amount of effect of alternative monetary actions.

The reference to "non-monetary factors" can be taken to be the behavior of relative price changes originating in the flexible-price sector that pass through to the price level. The reference to "any other set of indicators" generalizes the argument to a criticism of any policy of aggregate-demand management designed to control the behavior of real variables (fine tuning). After the above quotation, Friedman argues that such a policy would founder in that the phenomenon of long and variable lags would lead to destabilizing go-stop monetary policy. Friedman's vindication came in the 1970s with the FOMC's policy of aggregate-demand management turned into stop-go monetary policy.

Despite the need to start from a model, it is important to appreciate that models are abstractions. Policymakers do not know the structure of the economy except very generally in the form of beliefs about basic principles and are ignorant of the equilibrium values of real variables (the natural rate of interest, the natural rate of unemployment, and potential output with the concomitant value of the

4. Hetzel (2022a, chap. 23) argues that the European Central Bank (ECB) was responsible for the 2008-2009 recession in the Eurozone by attempting to directly target the price level in 2008, which was elevated because of a world inflation shock due to an increase in commodity prices caused by the integration of the BRIC's (Brazil, Russia, India, and China) into the world economy.

5. Milton Friedman (1960) advocated steady growth in the money stock. At the time he formulated the rule, monetary aggregates existed that were relatively interest inelastic and that bore a predictable relationship to the nominal expenditure of the public. Steady growth in nominal expenditure would have provided a stable nominal anchor by maintaining rough price stability. It would also have turned over to the unfettered operation of the price system the determination of the real rate of interest and other real variables (output and employment).

output gap). It follows from the Goodfriend-King model that FOMC procedures must cause the real funds rate to track the natural rate of interest and in so doing turn the determination of real variables over to the unfettered operation of the price system. Without a structural model of the economy, the procedures that cause the funds rate to track the natural rate of interest must be determined through empirical investigation of Fed history. In the past, what FOMC procedures have been associated with price stability and, by implication, have satisfied this condition?

Such an investigation must start in the post-Treasury-Fed Accord period with the invention of the aforementioned lean-against-the-wind (LAW) procedures by William McChesney Martin and his assistant Winfield Riefler. As an empirical matter, Hetzel (2008, 2012, and 2022a) terms the FOMC procedures associated with price stability "LAW with credibility." LAW with credibility focuses on an ongoing assessment by the FOMC of whether the economy's rate of resource utilization is increasing or decreasing in an unsustainable way (the unemployment rate is decreasing or increasing in a persistent way). In the event of unsustainable strength or weakness, the FOMC raises or lowers the funds rate in a sustained way to counter persistent changes in the rate of resource utilization.

When the rate of resource utilization is steady, the economy is growing at potential. However, when the economy is growing unsustainably fast and the rate of resource utilization is rising persistently, the real funds rate lies below the natural rate of interest—and conversely in the event of weakness. These LAW procedures move the funds rate in a way that discovers the natural rate of interest, which keeps the economy growing at potential.[6]

Starting with the Volcker era, the concern for nominal expectational stability prompted the FOMC to make preemptive increases in the funds rate to prevent the emergence of inflation. Through 1994, this concern caused the FOMC to make these preemptive changes based on the FOMC's observation of long-term bond rates for confirmation that markets believed that funds rate changes would cumulate to whatever extent required to maintain price stability (Goodfriend, 1993). After 1994, when the FOMC's preemptive increases in the funds rate vanquished the bond market vigilantes, the criterion for such preemptive increases became evidence of overheating in labor markets. Credibility for price stability was critical to the operation of the Volcker-Greenspan version of LAW. With such credibility, the stabilizing properties of the price system work because the yield curve responds in a stabilizing way to, say, news that the economy is growing faster than anticipated with all the rise in forward rates taking the form of real increases rather than increases in inflation premia.

With this framework, one can give content to how monetary policy transmits to the economy. There are two cases. When the FOMC follows its LAW with credibility procedures, the price system works well to keep output fluctuating around potential. Money is a veil. Monetary policy is passive in

6. That is, they keep the output gap equal to zero by tracking the natural rate of interest. The exposition follows Barsky et al. (2014). The real rate of interest, r_t, is $r_t = i_t - E_t\pi_{t+1}$ where i_t is the market rate of interest and π_{t+1} is expected inflation. The natural rate of interest, r_t^n, equals (1).

$$r_t^n = \rho_t + s^{-1}E_t(\Delta y_{t+1}^n) \tag{1}$$

where y_t^n is the natural rate of output, ρ_t is the subjective rate of time preference, and s is the intertemporal elasticity of substitution in consumption. The output gap equals $\tilde{y}_t \equiv y_t - y_t^n$.

Using (1) and its counterpart, the household Euler equation expressed in actual values of the real rate of interest and output, using the output gap, and solving forward yields (2).

$$\tilde{y}_t = -s\sum_{k=0}^{\infty} E_t(r_{t+k} - r_{t+k}^n) \tag{2}$$

That is, the output gap equals the sum of future interest-rate gaps. Finally, (3) expresses the NK Phillips curve.

$$\pi_t = \beta E_t[\pi_{t+1}] + k\tilde{y}_t \tag{3}$$

As Barsky et al. (2014, p. 38) note, "An interest rate path in which the actual real rate is always equal to the natural rate achieves both an output gap of zero... and zero inflation." The former implication follows from (2). The latter follows from (3) because with price stability actual and expected inflation are equal and $\tilde{y}_t$ equals zero.

its effect on the real economy. In the second case in which FOMC procedures for implementing policy interfere with the unfettered operation of the price system through eschewing preemptive funds rate increases, thereby imparting cyclical inertia to the required funds rate changes, monetary policy exerts its influence on the real economy through a (destabilizing) portfolio balance effect.

Specifically, if the FOMC maintains its target for the funds rate below the natural rate of interest by failing to follow LAW with credibility procedures, the resulting money creation stimulates the expenditure of the public by increasing the liquidity (moneyness) of the public's asset portfolio. The open market purchases required to maintain an unsustainably low funds rate target replace illiquid assets like long-term Treasuries and mortgage-backed securities (MBS) in the public's portfolio with liquid bank deposits. The public is reconciled to holding a more liquid asset portfolio through expenditure on illiquid assets (equities, houses, consumer durables) that raises their prices. The resulting increase in the price of these illiquid assets relative to their service flows produces an increase in investment that raises the stock of such assets (Tobin's Q; Friedman, 1961 [1969]).

With LAW with credibility, the natural rate of interest moves in a measured way with strength or weakness in the economy. However, destabilizing money creation that sets off a portfolio balance effect initiates changes in the natural rate of interest, making it hard to track. The time required for the effects of the portfolio balance effect to work themselves out on asset prices and expenditures accounts for the Friedman phenomenon of "long and variable lags." Unwinding an inflationary monetary policy and its effect on asset prices requires a cyclically high real rate of interest and a problematic recourse to creating slack in the economy.

With purposeful money creation through open market purchases in the form of quantitative easing (QE), there are three separate cases. The first case, relevant to the early part of the recovery from the Great Recession, is when the natural rate of interest is negative, and the funds rate is at the zero lower bound (ZLB). QE and the stimulus associated with the portfolio balance effect is desirable in that it raises the natural rate of interest. The second case, relevant to the preemptive increases in the recovery by the Yellen FOMC, is when the FOMC is following a neutral monetary policy (LAW with credibility). As long as FOMC procedures maintain aggregate demand growing in line with growth in potential output, the money creation associated with QE possesses no predictive ability for nominal or real output. The third case, relevant to the QE starting March 2020, occurs with forward guidance that promises to maintain the funds rate at the ZLB until inflation rises. In this case, money creation is helicopter money and is ultimately inflationary. There is a difference in degree but not in kind from the monetization of government debt practiced in a country like Zimbabwe or Venezuela.

LAW with credibility preserves the sharp distinction between monetary policy and credit policy. From the March 1951 Treasury-Fed Accord lasting through fall 2008, the Fed scrupulously avoided intervention in credit markets to allocate credit. The allocation of credit is inherently political. Favoring some borrowers over others is fiscal policy, which by the Constitution is reserved for Congress. Goodfriend (1994) especially argues that involvement in credit policy poses dangers for the Fed's independence to conduct monetary policy. Given a stabilizing path for the funds rate and a yield curve that fluctuates with the risk-free interest rate, avoidance of intervention in credit markets leaves to the private sector how many IOUs (credit) get created, with what risk and liquidity premia, and the allocation of credit among competing uses.

The fact that the FOMC implements monetary policy by setting a target for an interest rate, the funds rate, leaves ambiguous the role of the interest rate in the transmission of monetary policy. According to the Keynesian tradition, monetary policy works through its influence on financial intermediation. It is then just one influence on aggregate nominal demand and inflation. A large bank or collection of banks like Bank of America and JPMorgan Chase could act like a central bank by raising interest rates and tightening credit conditions. Starting in early 2009 and again in March 2020, the Fed

bought massive amounts of MBS. Because FNMA also buys MBS, it can duplicate this aspect of FOMC policy. However, according to Wicksellian monetarism, the interest rate is a part of the price system with the natural rate of interest as a price that clears the goods market. The ideal rule gives the price system free rein to regulate the real economy and avoids the allocation of credit.

The ideal rule that makes money a "veil" appears in Friedman's (1974) quotation from John Stuart Mill (1848 [1987], p. 488):

> There cannot... be intrinsically a more insignificant thing... than money; except in the contrivance for sparing time and labor. It is a machine for doing quickly and commodiously, what would be done, though less quickly and commodiously, without it: and like many other kinds of machinery, it only exerts a distinct and independent influence of its own when it gets out of order.

Friedman (1974, p. 349) then added, "Mill was perfectly correct although one must add that there is hardly a contrivance man possesses that can do more damage to a society when it goes wrong."

5. USING NARRATIVE HISTORY TO SORT OUT THE SOURCE OF ECONOMIC INSTABILITY

The FOMC has no choice but to make monetary policy based on a belief about the general structure of the economy that intermediates between its actions and the behavior of the economy. Since the 1951 Accord, those beliefs can be characterized as falling into one or the other of two classes, the Keynesian tradition or Wicksellian monetarism. That fact provides the "experiments" for assessing the optimal monetary standard. Learning about the source of macroeconomic instability requires a narrative history that treats changes in the monetary standard as semi-controlled experiments yielding predictions about the source of instability. Unfortunately, policymakers never articulate their understanding of the monetary standard they have created. As a result, there is no consensus over the characterization of the monetary standard and how changes in it can serve as semi-controlled experiments. There is then no clear way to learn from historical experience. Researchers interested in an alternative to the Fed narrative must construct a history that elucidates policymakers' understanding of their world and how that understanding shaped the pursuit of the objectives they took as their responsibility.

The alternations in the monetary standard can be expressed in terms of a two balls metaphor. When policymakers treated the price level as a nonmonetary phenomenon and dismissed the stabilizing properties of the price system, they pursued two competing, independent objectives—low unemployment and low inflation. That is, they tried to juggle two balls (the Keynesian tradition). When policymakers treated the price level as a monetary phenomenon and accepted the stabilizing properties of the price system, they pursued the single goal of price stability. They juggled a single ball (Wicksellian monetarism). This distinction serves as a marker for identifying the character of the monetary standard and its changes over time.

In March 1951, the Treasury-Fed Accord restored to the Fed its independence from the Treasury.[7] Starting with the Roosevelt administration in 1933, the Fed had been subservient to the Treasury, whose dominant concern was with selling its debt at a low, stable interest rate. In World War II, the Fed operated under the constraint that it had to buy all the bonds the Treasury could not sell at an interest rate of 2½ percent. That imposed peg was still in effect at the start of the Korean War. When the Chinese crossed the Yalu River and created the prospect of a World War III, the fear of a return to wartime price controls and shortages led to an increase in the price of commodities and in inflation. Banks and insurance companies sold Treasury securities, which the peg forced the Fed to buy and monetize. Governor Marriner Eccles, who earlier had been FOMC chairman, talked about the Fed as "an engine of inflation."

7. See Hetzel (2008, 2012, 2022a and 2022b) for a detailed defense of the generalizations summarized in this section.

Unlike their Keynesian counterparts in academia, the confidence gained by the victory in WWII reinforced in Fed policymakers (such as the new FOMC chairman William McChesney Martin) a belief in free markets. They did not want a return to wartime price controls and shortages. They had a firm attachment to price stability, which would obviate the need for price controls. The concern that the Truman administration would turn to Congress if the Fed abandoned its role as buyer of last resort for Treasury debt had constrained the Fed after the war. However, pushed by the deceitful way in which it was treated by the Treasury and administration and emboldened by the rift between Congress and the administration over the firing of General Douglas MacArthur, the FOMC credibly threatened to unilaterally abandon the peg. The result was the March 1951 Accord (Hetzel and Leach, 2001a and 2001b).

The problem for the Fed was what to do after having regained its independence from domination by the Treasury, which lasted from 1933 until 1951. In the aftermath of WWII, real bills as a guiding principle collapsed. The failure of a credit structure built on government debt, rather than on real bills to collapse leading to depression and deflation discredited the real bills doctrine. In filling the void left by the obvious failure of real bills as an organizing principle, FOMC chairman William McChesney Martin and his aide Winfield Riefler created the modern central bank through a monetary policy organized around LAW procedures, which Martin coined.[8]

The two related imperatives of policy were a commitment to price stability and a determination to remain free of Treasury control. For Martin, the rationale behind LAW was that persistent excess growth in output reflected in persistent increases in the economy's rate of resource utilization would generate excess demands for credit, which would be inflationary. Despite breaking with real bills, he retained the view that inflation came from speculative excess caused by excessive growth in credit. Martin wanted steady growth in credit in line with growth in the economy. However, he could not set a target for credit growth, which would create pressure from the Treasury to set the target at a level that would accommodate Treasury debt issuance. LAW would discipline credit growth indirectly through the way in which free reserves targets influenced bank credit growth by causing free reserves to vary inversely with strength in output growth. Also, LAW conveyed the message to the public that the focus of monetary policy should be on the health of the economy not on keeping interest rates low to facilitate the financing of government debt.

LAW procedures developed only over the course of the 1950s. Inflation rose to 3 percent in 1955 and 1956. Policymakers understood that rise in inflation as the result of a failure to tighten sufficiently quickly as the economy recovered from the 1953-1954 recession. After the 1958 recession, undertaken to restore price stability, Martin settled on LAW with preemptive increases in interest rates, termed here LAW with credibility. Martin also used long-term bond rates as indicators of inflationary expectations and rejected the former real bills focus on stock market prices and inventory accumulation as evidence of speculative excess.

Finally, Martin implemented LAW through a policy of "bills only," that is, of restricting the Fed's portfolio to short-term Treasury securities. "Bills only" precluded credit policy, which entailed the allocation of credit. To support that policy, Martin worked to develop the market for government bonds so that the Fed could confine its operations to bills and avoid Treasury pressure to intervene to support the price of long-term Treasury bonds. That priority reflected a belief in the stabilizing properties of free markets.

Originally, LAW concentrated on price stability. The Eisenhower administration supported price stability and believed that confidence in the dollar was the bedrock for the success of the Bretton Woods

8. Martin never admitted that the Fed had an interest rate target. The FOMC effectively controlled short-term interest rates indirectly, however, by setting a target for free reserves, excess reserves of banks minus discount window borrowing. These procedures determined the marginal cost of bank reserves as the sum of the discount rate plus an amount inversely related to the level of free reserves.

system of pegged exchange rates. Supported by the conservative Douglas Dillon Treasury, the Kennedy administration deferred to the Martin FOMC because of Kennedy's desire to avoid a dollar crisis while dealing with the Cuban missile crisis.

At the same time, the Walter Heller Council of Economic Advisors (CEA) in the Kennedy administration was quintessentially Keynesian. It advocated 4 percent as a national objective for unemployment. Although the target was not constraining in the Kennedy administration, it became a constraint on the FOMC in the Johnson administration. Conflict between the Fed and the Johnson administration emerged over preemptive increases in interest rates to prevent the emergence of inflation. The Heller CEA wanted increases only as the recovery from the 1960-1961 recession had proceeded sufficiently to ensure 4 percent unemployment.

During the Johnson administration, the political system united in pressuring the Fed to add low unemployment as an objective of monetary policy. With the riots in inner cities (such as in Watts in Los Angeles), with a militant civil rights movement, and with protests over the Vietnam War and flag burning, Congress and the administration formed a consensus for the desirability of low unemployment as a social balm for a deeply fractured society. Keynesian economists, who had been sidelined up to that point, became vocal in promising to deliver with fiscal and monetary policy a low unemployment rate accompanied by only a modest amount of inflation.

Hampered by a divided Board of Governors, Martin tried to forestall inflation by lobbying for a tax increase to balance the budget and pay for the guns and butter programs of the Johnson administration. When Martin held off raising interest rates to encourage Congress to pass a tax increase and presumably to make higher interest rates unnecessary, money growth and inflation surged. Congress did pass a tax surcharge in June 1968, which turned a deficit into a surplus. If the Keynesian consensus had been correct about the power of the deficit for economic stabilization, the resulting surplus should have more than offset a monetary policy that held the real rate of interest below the natural rate of interest, as evidenced by high rates of money growth. In the event, economic stability both real and nominal required a monetary policy that tracked the natural rate of interest and that ensured moderate growth in money.

Martin realized his mistake too late. Although he implemented a contractionary monetary policy in 1969 intended to restore price stability, his term as chair ended in January 1970, too soon to succeed. In contrast, with their nonmonetary view of inflation, Keynesians focused on the presumed trade-offs offered by the Phillips curve and accepted 4 percent as a target for full employment. They had interpreted the behavior of the Phillips curve earlier in the 1960s as evidence favoring this view. With unemployment in excess of 4 percent during the recovery from the 1960 recession, price stability had prevailed. From 1960:Q1 to 1966:Q1, core CPI inflation averaged only 1.3 percent. Furthermore, when the unemployment rate fell below 4 percent in the second half of the 1960s, reaching 3.9 percent in 1966:Q1 and 3.4 percent in 1968:Q4, inflation (core CPI) rose, averaging 5.8 percent from 1967:Q4 through 1970:Q4.

With 4 percent the assumed level of unemployment consistent with full employment, inflation should not have been a problem as the unemployment rate rose from its cyclical low starting in January 1970. Although the unemployment rate rose from 3.5 percent in December 1969 to 6.1 percent in December 1970, inflation did not abate. Instead, inflation (core CPI) averaged 6.5 percent in 1970. Instead of giving up on the Phillips curve, however, Keynesians explained high inflation as arising from cost-push forces that raised its level. FOMC chair Arthur Burns accepted the Keynesian view that the inflation that arose when the unemployment rate exceeded its presumed full-employment rate of 4 percent had to be due to cost-push forces. With 6 percent unemployment and 6 percent inflation in 1970, Burns believed that inflation arose from the exercise of the monopoly power of corporations and labor unions.

Consequently, controlling inflation required raising unemployment, a difficult task in a deeply divided society. Burns lobbied for wage and price controls to lessen the pain of such a trade-off and regularly held off raising the funds rate as part of getting the policy he wanted from Congress and the administration. Burns dismissed the inflationary consequences of high rates of money growth. The result was stop-go monetary policy combined with an inflation rate that rose over the decade of the 1970s.

The Keynesian aggregate-demand policy of the 1970s oscillated between either expansionary or contractionary monetary policy as Friedman (1960) had predicted. As summarized in the title of Burns's (1979) defense of his tenure as FOMC chairman, *The Anguish of Central Banking*, the FOMC allowed high inflation to avoid the presumed social cost of raising unemployment to suppress inflation understood as cost-push.

Goodfriend (2005, pp. 244, 245, and 247) summarized monetary policy (LAW with trade-offs) in the 1970s:

> Inflation would rise slowly as monetary policy stimulated employment in the go phase of the policy cycle. By the time the public and Fed became sufficiently concerned about rising inflation for monetary policy to act against it, pricing decisions had already begun to embody higher inflation expectations. At that point, a given degree of restraint on inflation required a more aggressive increase in short-term interest rates, with greater risk of recession... The absence of an anchor for inflation caused inflation expectations and long bond rates to fluctuate widely... [It] became increasingly difficult to track the public's inflation expectations to tell how nominal federal funds rate policy actions translated into real rate actions.

The change in the monetary standard between the Arthur Burns and G. William Miller FOMCs to the Paul Volcker and Alan Greenspan FOMCs offers a test of traditional Keynesian and Wicksellian monetarism. In the Volcker-Greenspan era, the overriding desire to return to price stability and nominal expectational stability disciplined policy. In practice, that discipline required preemptive increases in the funds rate to prevent the emergence of inflation. Monetary policy returned to Martin's original preferred policy of LAW with credibility.

By the time Volcker became FOMC chairman in August 1979, spurred by the Newsweek columns of Milton Friedman, public opinion had changed from blaming inflation on the exercise of private monopoly power to blaming it on the Fed. However, success of a policy of disinflation was far from assured. It was uncertain whether Jimmy Carter and then Ronald Reagan would tolerate a serious recession, much less Congress and the public. Also, the Keynesian consensus in academia held that price stability would require recurrent recourse to socially unacceptable high rates of unemployment. The commentary of Paul Samuelson (1979 [1986], p. 972) with its obvious reference to Milton Friedman and the latter's trip to Chile expressed the consensus:

> Today's inflation is chronic. Its roots are deep in the very nature of the welfare state. [Establishment of price stability through monetary policy would require] abolishing the humane society [and would] reimpose inequality and suffering not tolerated under democracy. A fascist political state would be required to impose such a regime and preserve it. Short of a military junta that imprisons trade union activists and terrorizes intellectuals, this solution to inflation is unrealistic—and, to most of us, undesirable.

Instead, the Volcker-Greenspan policy restored price stability and produced the Great Moderation.[9]

Given his commitment to a disinflationary monetary policy, Volcker had to convince markets that it was not a repeat of the stop phase of a continued go-stop monetary policy. Initially, he attempted to do so by giving substance to money targets, which the FOMC had vitiated in the 1970s by changing

9. See the articles in Federal Reserve Bank of St. Louis Review (2005) and Hetzel (2022b), who summarizes Goodfriend's account of the change in the monetary standard that occurred with Volcker.

the base for targeted growth rates each quarter to incorporate the misses in money. When the velocity of M1 fell in 1982, the Fed gave up on money as an operational target. (Greenspan continued to follow M2 until FDICIA; the FDIC Improvement Act, passed in December 1991, caused velocity to rise as banks pushed out interest-sensitive deposits to limit required capital.) Volcker then returned to LAW procedures but with a focus on forestalling an increase in inflationary expectations, which would propagate into higher inflation.

The bond market vigilantes, who had been burned by the inflation of the 1970s, held the Volcker FOMC's feet to the fire. Sensitive to any evidence of the reemergence of an expansionary go phase in monetary policy, they raised bond rates at any sign that the FOMC would allow a trade-off of strong growth and low unemployment for increased inflation. To discipline inflationary expectations, Volcker restored the preemptive increases in the funds rate favored by Martin. Volcker's successor, Alan Greenspan, would continue the campaign to restore genuine price stability rather than the 4 percent inflation he inherited. Greenspan, a disciple of Ayn Rand, worked to restore the expectation of price stability that had characterized the gold standard. He used signs of overheating in labor markets (not "low" unemployment) as a signal of the need for preemptive increases in the funds rate to forestall the reemergence of inflation. When in 2003 Greenspan (2004, p. 35) expressed satisfaction at the restoration of price stability, he commented "Unstinting and largely preemptive efforts over two decades had finally paid off" (cited in Orphanides 2006, p. 178). The period after the initial Volcker disinflation earned the moniker of the Great Moderation for its real and nominal stability.

Athanasios Orphanides summarized how the Volcker-Greenspan monetary standard concentrated on the objective of price stability implemented with preemptive increases in the funds rate. Orphanides (2006, p. 178) wrote: "One of the most significant improvements in monetary policy since 1979 can be identified with the reaffirmation of the unique role of price stability as an operational objective for monetary policy. . . . Both chairmen also identified the value of preempting destabilizing forces, when possible." Orphanides (2006, p. 179) excerpted the commentary of Greenspan (1989) on the bill of Rep. Neal (D. NC) to change the Federal Reserve Act to make price stability the unique goal of monetary policy:

> The Zero-Inflation Resolution represents a constructive effort to provide congressional guidance to the Federal Reserve... Legislative direction as to the appropriate goals for macroeconomic policy in general and monetary policy in particular have been provided before. Unfortunately, the instructions have defined multiple objectives for policy, which have not always been entirely consistent—at least over the near term. The current resolution is laudable, in part because it directs monetary policy toward a single goal, price stability, that monetary policy is uniquely suited to pursue.

The discipline of restoring a stable nominal anchor in the form of the expectation of price stability required that monetary policy abandon pursuit of low unemployment as an independent objective. The emphasis changed to LAW with credibility with its focus on the elimination of growth gaps (stabilization of the economy's rate of resource utilization) rather than on achievement of a "low" rate of unemployment deemed socially desirable. Greenspan (U.S. Cong. 1999, p. 19) testified to Congress: "We cannot tell... what the actual potential [growth rate] is... but it shouldn't be our concern. Our concern should be the imbalances that emerge." Greenspan (U.S. Cong. 2000, p. 14) reiterated the point in rejecting criticism that raising interest rates limited growth in the economy.

> The question of how fast this economy grows is not something the central bank should be involved in... What we are looking at is basically the indications that demand chronically exceeds supply... The best way to measure that is to look at what is happening to the total number of people who... are unemployed... What... we are concerned about is not the rate of increase in demand or the rate of increase in supply, but only the difference between the two... We don't know whether the potential growth rate is 4, 5, 6, or 8 percent. What we need to focus on... is solely the difference between the two.

LAW with credibility ignores Phillips curve trade-offs and leaves the behavior of the real economy and the determination of unemployment to the unfettered operation of the price system.

The Great Moderation ended with the Great Recession. Although popularly attributed to a disruption in bank lending produced by the housing bust, contractionary monetary policy offers an explanation in line with earlier recessions. A characteristic of postwar recessions is that, in the recovery after the past recession, the FOMC had failed to implement the preemptive increases in the funds rate required to maintain low inflation. When inflation rose, the FOMC initiated sustained increases in the funds rate until the economy weakened. Despite the weakness in the economy, the FOMC limited reductions in the funds rate out of concern that it would be sending the signal to financial markets that it was resigned to a higher rate of inflation.

The Great Recession diverged from this pattern in two respects. First, inflation came from an inflation shock powered by an increase in commodity prices due to the integration of the BRICs (Brazil, Russia, India, and China) into the world economy. From $20 per barrel in January 2002, the price of a barrel of oil (WTI) rose from $20 to $134 in June 2008. Headline PCE inflation rose from 0.8 percent in 2002:Q1 to almost 4 percent in 2008:Q3. With some passthrough from headline inflation, core PCE inflation (four quarter percentage changes) rose from 1.3 percent in 2003:Q3 to 2.2 percent over the interval 2006:Q2 to 2008:Q3.

Second, initially, the FOMC did lower the funds rate in response to the recession, which began in December 2007. By its April 30, 2008, meeting, the FOMC had lowered the funds rate to 2 percent. After the April meeting, however, the FOMC remained focused on high headline inflation for fear that it would raise the inflationary expectations of the public. The FOMC sent the message to markets that the next change in the funds rate would likely be an increase. The consensus was that the zero realized real funds rate (a 2 percent funds rate and underlying inflation of 2 percent) made monetary policy undesirably stimulative in an environ*ment of high inflation. The June 24-25, 2008, FOMC minutes (Board of Governors,* FOMC Minutes 6/24-25/2008, pp. 6-8) released in the inter-meeting period after an FOMC meeting captured the consensus:

Participants continued to see significant downside risks to growth. At the same time, however, the outlook for inflation had deteriorated. Recent increases in energy and some other commodity prices would boost inflation sharply in coming months... [P]articipants had become more concerned about upside risks to the inflation outlook—including the possibility that persistent advances in energy and food prices could spur increases in long-run inflation expectations... Participants agreed that the possibilities of greater pass through of cost increases into prices, higher long-run inflation expectations feeding into labor costs and other prices, and further increases in energy prices all posed upside risks to inflation that had intensified since the time of the April FOMC meeting.

The FOMC had steadily raised the funds rate from mid-2004 to mid-2006. Well before the peak in the business cycle in December 2007, the economy had begun to weaken with real disposable personal income failing to grow after March 2007 until increased by the Bush Administration rebates in May 2008. The average of annualized, monthly real personal consumption expenditures was –5.4 percent for July, August, and September 2008; the decline was slightly less, at –5.0 percent, for the months of October, November, and December 2008. Payroll employment declined by 267,000 and 424,000 in the months of August and September, respectively. Annualized monthly changes in nonfarm payrolls averaged only 0.5 percent from June 2007 through December 2007. By September 2008, they were declining at an annualized rate of –3.9 percent. (The September numbers were recorded in the survey conducted before the Lehman bankruptcy on September 15.) However, after its April 2008 meeting, the FOMC ceased lowering the funds rate as the economy continued weakening.

Given the concern for inflation, the FOMC became willing to allow the magnitude of a projected negative output gap to grow to restrain inflation. The unemployment rate, which is a lagging indicator,

rose steadily from 4.7 percent in November 2007 to 6.1 percent in August 2008. (For the Board staff estimate of the output gap, see Board of Governors *Current Economic and Financial Conditions*, "Outlook and Summary," "Other Macroeconomic Indicators," 7/30/2008, I-30). Governor Kohn (Board of Governors *FOMC Transcript* 8/5/2008, p. 76) stated, "About the output gap, the incoming information strongly suggests that we are on a trajectory that at least for some time will have the economy growing appreciably below the growth rate of its potential. The most obvious evidence is the persistence of a soft labor market." Although Bernanke recommended a reduction in the funds rate from 2 percent to 1 ½ percent on October 7, 2008, he did so to accommodate the ECB, which needed to assuage its hawks that it was following the FOMC (Hetzel 2022a, p. 460). The FOMC did not lower the funds rate to the zero lower bound (ZLB) until its December 15-16, 2008, meeting.

The mistaken belief that monetary policy was expansionary came from observing the near-zero real funds rate, which the FOMC interpreted as expansionary monetary policy. From January 2008 through August 2008, core PCE inflation (compounded annual monthly changes, chain-weighted price index) averaged 1.9 percent. With a 2 percent funds rate, the real funds rate was near zero. Only later did it become clear that the natural rate of interest was negative—an unprecedented occurrence. That fact can be inferred from two observations. First, over the period from January 2009 through December 2016, the real funds rate averaged –1.24 percent.[10] Over the same interval, inflation (12-month percentage changes in the core PCE, chain-weighted deflator) remained steady at 1.5 percent. If monetary policy had been expansionary because the real funds rate lay below the natural rate of interest, inflation would have risen instead of remaining stable. Second, with the funds rate at the ZLB, economic recovery required both forward guidance and quantitative easing.

The severe recession of 2008-2009 began before the turmoil in financial markets with the Lehman bankruptcy on September 15, 2008. A dramatic increase in the inventory/sales ratio began in July 2008. The severe drops in GDP in 2008:Q4 and 2009:Q1 were baked in by 2008:Q3. The economies of the OECD countries other than the United States began sharp downturns in 2008:Q2.

Confusion as to the source of the Great Recession also came from the post hoc ergo propter hoc association of the recession with the turbulence in financial markets that arose with the Lehman failure on September 15, 2008. What had been a moderate recession turned into a severe recession in summer 2008, however, when the business inventory/sales ratio shot up and businesses had to work off significant excess inventories (Hetzel, 2022a, Figure 21.3). The payroll employment number for September 2008, for which the survey was conducted early in the month before the Lehman bankruptcy, declined at an annualized rate of -3.9 percent. The economy of the industrialized world went into recession in summer 2008 (Hetzel, 2022, Figure 21.7). However, because of the lag in data reporting, that fact was only reported in early October 2008, coincidentally shortly after the Lehman bankruptcy. The disruption in financial markets, however, likely contributed to the recession by making the natural rate of interest even more negative.[11]

What should the FOMC have done in fall 2008? First, it should have addressed its concern over the unanchoring of inflationary expectations by announcing an inflation target, something it did not do until January 2012. Second, it should have undertaken QE to maintain the aggregate spending of the public (Sumner, 2021). The emergency lending of the Fed after the Lehman failure provided liquidity but failed to stimulate demand. The reason was that the Fed loans were short term and had to be repaid

10. See Hetzel (2022a, Figure 18.5). The series for expected inflation is from Board of Governors staff forecasts of inflation.

11. The investment company Lehman Brothers was a victim of its holding of subprime mortgages. With the Lehman failure, shocked cash investors, who had assumed that the financial safety net would prevent the failure of any significant financial institution (too-indebted-to-fail), had no way of knowing to what extent the Fed and the FDIC had retracted the financial safety net. Investors who had been buying the short-term debt of financial companies heavily invested in subprime mortgages therefore fled to the large too-big-to-fail banks like JPMorgan Chase, which were undoubtedly protected by the Fed's safety net.

with interest. It was the QE undertaken starting in early 2009 that demonstrated the power of the portfolio balance effect, which began with purchases of federal agency debt and MBS and continued with Treasury securities after March 2009.

On the statement date September 9, 2008, just before the Lehman bankruptcy, reserve bank credit amounted to $888 billion with $480 billion in securities held outright. As of November 5, 2008, reserve bank credit had jumped to about $2 trillion because of the Fed's emergency lending programs with almost no change in securities held outright. As of June 4, 2009, the month the recovery began, with no change in reserve bank credit, securities held outright (mainly Treasuries and MBS) amounted to half the total of reserve bank credit. By January 6, 2010, again with little change in reserve bank credit, securities held outright had basically replaced emergency lending and amounted to almost all reserve bank credit.[12]

Only at its December 15, 2008, meeting did the FOMC lower the funds rate to the ZLB. The economy began the recovery from the Great Recession in June 2009. With the disruption to financial intermediation after the Lehman bankruptcy, the demand for liquidity increased. The credit programs initiated by the Fed provided the desired reserves, but only through borrowing from the Fed at market interest rates. When QE replaced those reserves and allowed repayment of the borrowing while the demand for additional liquidity abated, the economy recovered. Nevertheless, initially in the recovery monetary policy remained moderately contractionary even with the funds rate at the ZLB. The reason was because the yield curve sloped steeply upward. That behavior reflected the fact that in the past strong recoveries had always followed deep recessions. Initially, markets as well as the FOMC anticipated a rise in interest rates in the recovery.

Janet Yellen succeeded Ben Bernanke as FOMC chair in February 2014. In the recovery from the Great Recession, the Yellen FOMC acted on the lessons of the Great Inflation incorporated by Volcker and Greenspan in the policy of preemptive increases in the funds rate to forestall a rise in inflation. In defense of such increases, Yellen (2017b, p. 16) said

> We should also be wary of moving too gradually. Job gains continue to run well ahead of the longer-run pace we estimate would be sufficient, on average, to provide jobs for new entrants to the labor force. Thus, without further modest increases in the federal funds rate over time, there is a risk that the labor market could eventually become overheated, potentially creating an inflationary problem down the road that might be difficult to overcome without triggering a recession. Persistently easy monetary policy might also eventually lead to increased leverage and other developments, with adverse implications for financial stability. For these reasons, and given that monetary policy affects economic activity and inflation with a substantial lag, it would be imprudent to keep monetary policy on hold until inflation is back to 2 percent.

Yellen (2017a) summarized, "[I]f the economy ends up over heating and inflation threatens to rise well above our target, we don't want to be in a position where we have to raise rates rapidly, which could conceivably cause another recession. So we want to be ahead of the curve and not behind it."

6. THE POWELL FOMC PANDEMIC MONETARY POLICY

Jerome Powell became a governor on the Board of Governors in May 2012 and became FOMC chair in March 2018. In March 2020, he and the FOMC had to confront the reality of a severe pandemic. Even though it was a negative productivity shock to output, the FOMC responded with an expansionary monetary policy to stimulate demand. Although the public stayed away from restaurants out of fear of COVID-19 and supply-chain disruptions reduced the supply of goods, presumably stimulative monetary policy would offset any reduction in demand. Even though the recovery from the Great Recession

12. Data from Federal Reserve Statistics, statistical release H.4.1. For a graphical overview, see Hetzel (2022a, Figure 21.5).

was a time of remarkable stability in inflation and the unemployment rate declined steadily to near historic lows, the FOMC designed its stimulative policy based on the presumed failures of policy in the earlier period. With the Yellen FOMC, policy in the recovery had followed in the Volcker-Greenspan tradition of concentrating on price stability through preemptive increases in the funds rate. However, after lying dormant since Volcker's accession to FOMC chair in August 1979, the Powell FOMC revived aggregate-demand management based on presumed Phillips curve trade-offs and greatly amplified the credit market interventions first initiated by the Bernanke FOMC.

When the pandemic unfurled in March 2020 and the unemployment rate rose to 14.7 percent in April 2020, the issue became how to design a monetary policy expansionary enough to return unemployment to the pre-pandemic low of 3.5 percent in a time frame greatly accelerated from the recoveries in the past 3 recessions. Monetary policy would have to be highly expansionary despite the FOMC's unwillingness to make the funds rate negative.

The challenge was to convince financial markets that the FOMC was abandoning the Volcker-Greenspan-Yellen policy of preemptive increases in the funds rate. The FOMC met that challenge with a policy called "flexible-average-inflation-targeting" (FAIT). In a historic first, with FAIT, the FOMC *purposefully* directed policy at raising inflation. Policy aimed at raising inflation above 2 percent for an unspecified period of time and by an unspecified amount. In that way, the FOMC hoped to convince bond markets that it had abandoned the earlier policy of preemptive increases in the funds rate.

In doing so, the FOMC was giving up on the desideratum of Volcker and Greenspan in establishing credibility for price stability such that price setters would simply ignore inflation in setting dollar prices. Greenspan (2002, p. 6) had said "Price stability is best thought of as an environment in which inflation is so low and stable over time that it does not materially enter into the decisions of households and firms." Earlier, Volcker (1983, p. 5) had said

> A workable definition of reasonable "price stability" would seem to me to be a situation in which expectations of generally rising (or falling) prices over a considerable period are not a pervasive influence on economic and financial behavior. Stated more positively, "stability" would imply that decision-making should be able to proceed on the basis that "real" and "nominal" values are substantially the same over the planning horizon—and that planning horizons should be suitably long. (Greenspan and Volcker citations from Orphanides 2006, pp. 179-80).

With core PCE inflation (annualized quarterly) averaging 1.6 percent in the recovery from 2009:Q2 to 2020:Q1, the Fed had achieved the goal of Volcker and Greenspan. Although not strictly price stability, inflation was low enough that firms setting prices for multiple periods could adjust on an ad hoc basis without building-in an explicit allowance for inflation.

The objective of FAIT was to raise inflation above 2 percent and then return it to 2 percent at some unspecified later time. However, nothing in its history suggested that the FOMC could manipulate inflation with that kind of precision. Powell (2020) claimed that "inflation that is persistently too low can pose serious risks to the economy. Inflation that runs below its desired level can lead to an unwelcome fall in longer-term inflation expectations, which, in turn, can pull actual inflation even lower, resulting in an adverse cycle of ever-lower inflation and inflation expectations." However, the argument appears opportunistic. Nothing suggested such unmoored inflation. Inflation (12-month percentage changes in monthly data for core CPI) reached a low after the Great Recession of 0.6 percent, but then recovered. Beginning in fall 2011 and continuing through February 2020, core CPI inflation barely departed from 2 percent. The maximum departures were 1.6 percent in February 2014 and 2.4 percent in February 2020.

One way for the Powell FOMC to make credible abandonment of the policy of preemption that had restored price stability was to criticize policy in the recovery from the Great Recession. The FOMC faulted the practice of the prior Yellen FOMC of raising the funds rate preemptively to prevent the emergence of inflation. The assumption was that, without the preemptive increases, the FOMC could

have achieved an even lower unemployment rate than the February 2020 cyclical low of 3.5 percent with a minimal increase in inflation. Given its Keynesian temperament, the FOMC considered irrelevant the stability of underlying inflation during the recovery.

That criticism represented an opportunistic defense of a return to a policy of aggregate demand management to speed greatly a return to the pre-pandemic low unemployment. The FOMC also revived the Phillips curve—the centerpiece of a policy of aggregate demand management presumed to offer predictable forecasts of the relationship between the two target variables of inflation and unemployment. The claim was that the Phillips curve was flat so that an expansionary monetary policy could push the unemployment rate down to at least the pre-pandemic low of 3.5 percent with no increase in inflation.

Powell (2020) explained the change by arguing that the economy had evolved. "Because the economy is always evolving, the FOMC's strategy for achieving its goals—our policy framework—must adapt to meet the new challenges that arise." Powell then mentioned how, in the recovery from the Great Recession,

> the historically strong labor market did not trigger a significant rise in inflation... The muted responsiveness of inflation to labor market tightness, which we refer to as the flattening of the Phillips curve, also contributed to low inflation outcomes... Our policy decision will be informed by our assessments of the *shortfalls* of employment from its maximum level rather than by *deviations* from its maximum level... In earlier decades when the Phillips curve was steeper, inflation tended to rise noticeably in response to a strengthening labor market. It was sometimes appropriate for the Fed to tighten monetary policy as employment rose toward its estimated maximum level in order to stave off an unwelcome rise in inflation... Going forward, employment can run at or above real-time estimates of its maximum level without causing concern. [italics in original]

The convoluted language expressed how with the new policy the FOMC would no longer make preemptive increases in the funds rate to prevent the emergence of inflation based on signs of overheating in the labor market.

It is instructive to conjecture what policy would have looked like if the FOMC had retained the Volcker-Greenspan-Yellen policy of price stability in March 2020. The Fed would still fulfill its lender-of-last-resort function to meet unusual liquidity needs. However, it would have done so by buying short-term Treasuries to supply markets with additional reserves. Those reserves would then be allowed to run off when the "dash for cash" abated.

With the funds rate at the ZLB, the FOMC would have observed whether the labor market was recovering steadily. If employment growth stalled, the FOMC would have undertaken open market purchases of long-term Treasury securities to initiate a portfolio balance effect to stimulate spending and raise the natural rate of interest. The FOMC would also have watched TIPS breakevens (5-year and 5-year, 5-year forward breakevens) for evidence that markets continued to expect price stability rather than deflation. The FOMC would have followed the Volcker-Greenspan-Yellen policy of preemptive increases in the funds rate to prevent the emergence of inflation. In doing so, it would have begun raising the funds rate and started quantitative tightening (sold Treasuries and MBS) in early 2021.

Powell (2021a) explained why the FOMC ignored the increase in underlying inflation in 2021 in a speech at the Economic Club of New York:

> We need only look to February of last year [2020] to see how beneficial a strong labor market can be. The overall unemployment rate was 3.5 percent, the lowest level in a half-century. The unemployment rate for African Americans had also reached historical lows... These late-breaking improvements in the labor market did not result in unwanted upward pressures on inflation, as might have been expected; in fact, inflation did not even rise to 2 percent on a sustained basis. There was every reason to expect that the labor market could have strengthened even further without causing a worrisome increase in inflation were it not for the onset of the pandemic.

The revised statement [Review of Monetary Policy Strategy, Tools, and Communications] emphasizes that maximum employment is a broad and inclusive goal. This change reflects our appreciation for the benefits of a strong labor market, particularly for many in low- and moderate-income communities. Recognizing the economy's ability to sustain a robust job market without causing an unwanted increase in inflation, the statement says that our policy decisions will be informed by our "assessments of the *shortfalls* of employment from its maximum level" rather than by "*deviations* from its maximum level." This means that we will not tighten monetary policy solely in response to a strong labor market. [italics in original]

Powell (2021b) also stated that

> We have a flat Phillips curve, meaning there's still a small connection ["between slack in the labor market and inflation"] but you need a microscope to find it. We've also got low persistence of inflation, so that if inflation were to go up for any reason it [inflation]... doesn't stay up... Remember, we're a long way from maximum employment. There's plenty of slack in the labor market.

However, in 2022, it became evident that underlying inflation had risen well above the FOMC's 2 percent target and was persistent. Policy then repeated the stop phase of the go-stop pattern of the 1970s.

The QE undertaken by the FOMC starting in March 2020 reflected the traditional Keynesian view of the transmission process as working though financial intermediation. As reported in *The Wall Street Journal* (2020), Richard Clarida, governor on the FOMC, said, "The Fed last week announced an expansion of nine different programs it has unveiled to support lending to U.S. states and businesses. It has said those programs will enable $2.3 trillion in new lending." (The number is from the Board of Governors Press Release, Board of Governors, 2020).

That interpretation of QE also reflected chair Powell's belief in the irrelevance of money. In congressional testimony, Sen. Kennedy (R. LA) posed this question: "M2, the money supply... over the past year... is up 26 percent, the highest amount since 1943. What does that tell you?" Powell (2021c, 24) responded as follows:

> When you and I studied economics a million years ago, M2 and monetary aggregates generally seemed to have a relationship to economic growth. Right now, I would say the growth of M2, which is quite substantial, does not really have important implications for the economic outlook... That classic relationship between monetary aggregates and economic growth and the size of the economy, it just no longer holds. We have had big growth of monetary aggregates at various times without inflation, so something we have to unlearn.

This view contrasts with an earlier view expressed by Bernanke (2000, p. 158) in the context of Japanese deflation: "The monetary authorities can issue as much money as they like. Hence, if the price level were truly independent of money issuance, then the monetary authorities could use the money they create to acquire indefinite quantities of goods and assets. This is manifestly impossible."

Powell's understanding of QE also reflected the way in which at an earlier date Bernanke had reconceptualized the role of the FOMC as a combination central bank and GSE. Bernanke was a student of the Depression and had read the Milton Friedman and Anna Schwartz (1963a) classic work on the Depression, *A Monetary History of the United States*. Friedman and Schwartz emphasized how in the Depression the contraction of the banking system had forced a contraction of the money stock by 33 percent. In a fundamental departure from Friedman and Schwartz, in his earlier published work, Bernanke (1983) had focused instead on how the contraction of the banking system had disrupted financial intermediation.

Based on that understanding, the Bernanke FOMC attempted to undo the flight of the cash investors precipitated by the unanticipated retraction of the financial safety net with the Lehman bankruptcy. Through a variety of programs, the Bernanke Fed became heavily involved in credit markets. Bernanke's

perspective on the stabilizing role of the Fed as centered on the allocation of credit to underserved areas rather than on its role as creator of money set the Fed on a course that it had studiously avoided since gaining its independence with the 1951 Treasury-Fed Accord. Although Bernanke initiated quantitative easing (QE) with purchases of mortgages (MBS), which started in early 2009, he did so to allocate credit to the housing market. Effectively, the Fed became a hybrid central bank and a housing GSE like Fannie Mae. In fall 2008, M2 grew but only because of the flight to safety out of money market instruments and into the deposits of the too-big-to-fail banks. The FOMC avoided a policy of stimulating aggregate demand through QE and the purposeful money creation it entailed. (See also Sumner, 2021.)

In the spirit of the credit channel, Bernanke reoriented policy toward the allocation of credit. Bernanke (2009) commented:

> The provision of ample liquidity to banks and primary dealers is no panacea. Today, concerns about capital, asset quality, and credit risk continue to limit the willingness of many intermediaries to extend credit, even when liquidity is ample. Moreover, providing liquidity to financial institutions does not address directly instability or declining credit availability in critical nonbank markets, such as the commercial paper market or the market for asset-backed securities, both of which normally play major roles in the extension of credit in the United States. To address these issues, the Federal Reserve has developed a second set of policy tools, which involve the provision of liquidity directly to borrowers and investors in key credit markets.

In evaluating Bernanke's reorientation of the Fed, it is important to distinguish the two roles a central bank can serve. It can conduct monetary policy, which has to do with having a rule that causes markets to move the risk-free yield curve in a way that stabilizes the economy in response to incoming information about strength or weakness in the economy. It can also serve as a financial intermediary allocating credit.

Bernanke's switch from the first understanding of the role of monetary policy to the second role can be seen in his earlier characterization of monetary policy in which he does not mention the Fed's role as a financial intermediary. Bernanke (2005) explained:

> The Fed controls very short-term interest rates quite effectively, but the long-term rates that really matter for the economy depend not on the current short-term rate but on the whole trajectory of future short-term rates expected by market participants. Thus, to affect long-term rates, the FOMC must somehow signal to the financial markets its plans for setting future short-term rates... FOMC talk probably has the greatest influence on expectations of short-term rates a year or so into the future, as beyond that point the FOMC has very little, if any, advantage over market participants in forecasting the economy or even its own policy actions... First, to the extent practical, the FOMC strives to be consistent in how it responds to particular configurations of economic conditions and transparent in explaining the reasons for its response. By building a consistent track record, the FOMC increases its own predictability as well as public confidence in its policies. Second, more generally, comments by FOMC officials about the Committee's general policy framework, including the Committee's economic objectives and members' views about the channels of monetary policy transmission and the structure of the economy, help the public deduce how policy is likely to respond to future economic circumstances.

Michael Woodford (2004, p. 16) also expressed this view, which was standard at the time.

> Not only do expectations about policy matter, but, at least under current conditions, very little *else* matters. Few central banks of major industrial nations still make much use of credit controls or other attempts to directly regulate the flow of funds through financial markets and institutions. Increases in the sophistication of the financial system have made it more difficult for such controls to be effective. And, in any event, the goal of improving the efficiency of the sectoral allocation of resources stressed above hardly would be served by such controls, which (if successful) inevitably create inefficient distortions in the relative cost of funds to different parts of the economy. [italics in original]

It is important to highlight the experiment that the FOMC delivered with its monetization of a significant fraction of the government pandemic payments. The rise in underlying inflation in early 2021

is evidence in favor of the monetary character of inflation and the transmission of monetary policy through a portfolio balance effect. As Friedman (1963 [1968], p. 39) said, "Inflation is always and everywhere a monetary phenomenon." In "The Lag in Effect of Monetary Policy," Friedman (1961 [1969], p. 255-6) outlined the monetary view:

> Suppose the monetary authorities increase the stock of money by open-market purchases... Holders of cash will seek to purchase assets... If the extra demand is initially directed at a particular class of assets, say government securities, or commercial paper, or the like, the result will be to pull the prices of such assets out of line with other assets and thus to widen the area into which the extra cash spills. The increased demand will spread, sooner or later affecting equities, houses, durable producer goods, durable consumer goods, and so on... The key feature of this process is that it tends to raise the prices of sources of both producer and consumer services relative to the prices of the services themselves... It therefore encourages the production of such sources (this is the stimulus to "investment" conceived broadly as including a much wider range of items than are ordinarily included in that term) and, at the same time, the direct acquisition of services rather than of the source (this is the stimulus to "consumption" relative to "savings.")

Specifically, the QE undertaken by the FOMC starting in March 2020 replaced illiquid assets (long-term Treasuries and MBS) in the public's asset portfolio with liquid bank deposits. To reconcile the public to holding a more-liquid asset portfolio, the price of illiquid assets (equities, houses, consumer durables, commodities) had to rise. As Friedman noted, the rise in the price of assets relative to their service flows initially produces an increase in investment and real output. Later, inflation rises to restore the amount of real cash balances (liquidity) desired by the public. This process takes time to unfold and unwind and is affected by extraneous forces.

Friedman (1960) used the resulting "long and variable lag" critique to explain the economic instability introduced with the FOMC's 1970s policy of activist aggregate-demand management. Friedman and Schwartz (1963b [1969], p. 234) wrote that "The central element in the transmission mechanism... is the concept of cyclical fluctuations as the outcome of balance sheet adjustments, as the effects on flows of adjustment between desired and actual stocks. It is this interconnection of stocks and flows that stretches the effect of shocks out in time."[13] Despite the power of the portfolio balance effect, these lags make monetary policy an inappropriate tool for fine tuning the economy. Friedman (1970, p. 13) wrote that "Our present understanding of the relation between money, output, and prices is so meager, that there is so much leeway in these relations, that... discretionary changes do more harm than good."

7. REORGANIZING FOMC DEBATE

What would the FOMC have to do to articulate the nature of the monetary standard? It would need to start by organizing its debate over how it pursues its objectives and how well its monetary policy is working to achieve those objectives. The required debate would necessitate a reorganization of the Tealbook. The reason is that the Tealbook, which provides detailed forecasts of the evolution of the economy, organizes FOMC debate. It would not be possible for 19 participants sitting around the table at the Board of Governors to start from scratch each meeting to come up with a forecast of the economy and a statement outlining the associated behavior of the funds rate.

The Tealbook forecasts, which include a path for the funds rate, are judgmental. That is, they provide no clarification of the structure of the economy that underlies the funds rate path and the forecasts of the economy. Moreover, the Tealbook provides only half of the background required for full FOMC debate. The missing half should explain how the economy evolved to its present position. As an example, on April 28, 2023, the Bureau of Economic Analysis (BEA) announced that the core personal consumption

13. See also Friedman and Schwartz (1963b [1969]), "Money and Business Cycles," pp. 231-32.

expenditure (PCE) index rose 4.6 percent from March 2022 through March 2023. The Board staff, which constructs the Tealbook, should offer its explanation for how inflation rose at a rate well above the FOMC's 2 percent target.

Tealbook forecasts should be made subject to FOMC specification of a rule. For example, a Taylor rule contains both objectives for unemployment and inflation (Taylor, 1999). The Board model FRBUS, which serves as an input to the Tealbook forecast, could use a loss function like that in Svensson (2009). The rule would reflect the FOMC's choice about the basic structure of the economy. The two possibilities offered here are traditional Keynesianism and Wicksellian monetarism. Tealbooks contain a forecast of the inflation rate and the unemployment rate. If traditional Keynesianism captures the structure chosen by the FOMC, the current Tealbook would contain a table of these dual forecasts made at FOMC meetings for the past 5 years. The Board staff would then evaluate how well monetary policy has balanced these dual objectives along with measurement of how close inflation has come to averaging 2 percent.

If instead Wicksellian monetarism captures the structure of the economy chosen by the FOMC, each Tealbook would contain a graph showing a forecast of a path for nominal output and an estimated path of potential output. The difference in growth rates is the inflation rate. To achieve its inflation objective, the FOMC would choose its funds rate target based on a forecast consistent with the growth rate in the path for nominal output that converged to an excess in a range of 1 ½ to 2 percentage points over the growth rate in the path of potential output (Hetzel, 2023). The single objective of price stability implied by these procedures would turn the determination of unemployment over to market forces. Tealbooks would evaluate how well the procedures have worked to maintain price stability in underlying measures of inflation.

The reason for the 1½ to 2 percentage point range is that prior to 2020 inflation averaged somewhat less than 2 percent. The record shows that the FOMC can maintain economic stability with a monetary policy that maintains the expectation of price stability as recommended by Volcker (1983) and Greenspan (2002) in the quotations cited above. The measured inflation associated with the expectation of price stability is somewhat less than 2 percent. There is no evidence in the historical record that the FOMC can choose an arbitrary positive inflation rate and maintain it. The FOMC need not worry that a policy of price stability would be impeded by occasional periods of interest rates at the ZLB. One reason is the strength of QE as evidenced with the post March 2020 open market purchases. The other reason is the ability to implement a negative funds rate as evidenced by such a policy with the European central banks.

One stumbling block to the widespread public debate required for transparency is the complexity of monetary policy. The Tealbook should be released with only a six-month lag rather than at present with a delay of five calendar years. Such transparency would greatly facilitate public discussion of monetary policy.

8. WHY FOMC TRANSPARENCY IS ESPECIALLY IMPORTANT GIVEN THE POLICY OF DISINFLATION

The FOMC's current policy of disinflation raises several questions whose answer requires articulation of the longer-run strategy. How does the FOMC ensure that the reduction in inflation stops at 2 percent? How does it ensure that inflation then remains at 2 percent? Can the FOMC avoid a serious recession? In the post-World War II recessions undertaken to lower inflation, the FOMC has maintained the funds rate at its cyclical high when the economy weakened to avoid sending the signal to financial markets that it was willing to accept the elevated level of inflation. What happens if later in 2023 it becomes evident that the economy is entering into a recession, but underlying inflation remains well above the 2 percent target? Marvin Goodfriend (2004) argued that a benefit of an inflation target was

that it would allow the FOMC to lower the funds rate in such a situation without raising inflationary expectations

However, such an outcome is less certain now since the FOMC has focused on targeting unemployment. The argument here is that the FOMC needs to go beyond articulating an inflation target and its current forward guidance and make explicit the rule that will guide policy in the long run. Such a rule must necessarily emerge from specification of the FOMC's view of the optimal monetary standard.

There are a number of reasons why the current contractionary monetary policy could cause a repetition of the earlier severe recessions. The Fed is focusing on labor market tightness and wage growth as the underlying causes of inflation in the services sector. They are lagging indicators as the unemployment rate rises and wage pressures abate only with the onset of recession. Moreover, the earlier expansionary monetary policy caused the labor market to become overly tight. As a result, firms are reluctant to lay off workers when it has been so hard to hire them. Labor market tightness may then persist even longer beyond the start of a recession. Given the Fed's reaction function for setting the funds rate, these factors are likely to support its current Summary of Economic Projections (SEP) forecasts of a funds rate kept at a cyclical high through the end of 2023.

An unusual feature of the current situation is the existence of a significant monetary overhang. The continued spending supported by the monetary overhang may obscure the reality that monetary policy is extremely tight. That is, while the level of the funds rate causes an unwinding of the earlier positive portfolio balance effect by depressing expenditure in interest-rate-sensitive sectors such as housing and consumer durables, the monetary overhang could maintain spending on services for some time. Different approaches to estimating the overhang point to a magnitude high enough to prevent its unwinding until the end of the year.

Abdelrahman and Oliveira (2023) wrote:

> We examine how household saving patterns since the onset of the pandemic recession compare with previous recessions. We show that households rapidly accumulated unprecedented levels of excess savings—defined as the difference between actual savings and the pre-recession trend— relative to previous recessions. Moreover, despite a rapid drawdown of savings in recent months, there is still a large stock of aggregate excess savings in the economy—some $500 billion... We expect that these excess savings could continue to support consumer spending at least into the fourth quarter of 2023.

Stanley (2023) uses "household liquid assets" reported in the Board of Governors statistical release Z.1 (formerly called Flow of Funds), Table B. 101, which includes currency and checkable deposits, time deposits, and money market shares. These data give a similar estimate of excess savings to that of Abdelrahman and Oliveira. Hetzel (2023, p. 19) looks at real M2 and also finds a significant monetary overhang. (The last series is available from the St. Louis Fed FRED database.)

The market's forecast of the future funds rate path, which indicates a pivot to reductions in 2023, could be evidence that the Fed is overdoing tightness. Depletion of the monetary overhang could precipitate a serious recession in the absence of a significant reduction in the funds rate. If so, without an explicit strategy committing the FOMC to maintaining price stability, the FOMC could face a difficult dilemma. Given that core inflation is a lagging indicator, underlying inflation could still be significantly above 2 percent when that weakening becomes evident. Does the FOMC then lower the funds rate and risk being accused of giving up on restoring 2 percent inflation? Does it delay lowering the funds rate and set off a serious recession?

9. CONCLUDING COMMENT

It is true that, with the Powell FOMC, participants have become actively involved in offering their own forward guidance about the future path of the funds rate (not an FOMC consensus forecast). How-

ever, real transparency would require specification of the FOMC's strategy, that is, a reaction function. Bernanke (2005) made this point indirectly. Because the FOMC possesses a limited ability to forecast, what matters is how news about the economy alters the FOMC's consensus over the future path of the funds rate. Greenspan made the point directly (Board of Governors, 2004, p. 78) when he told the FOMC that, "When it comes to policy... we have to acknowledge to ourselves that our forecast is going to be wrong. It always is. We expect it to be wrong." The reaction function derives from the FOMC's articulation of the monetary standard that it has chosen.

Part of Fed rhetoric is that the structure of the economy evolves and the Fed adjusts monetary policy accordingly. Specifically, in an ongoing way, the Fed adapts the monetary standard that it constructs, where the monetary standard captures how the monetary policy of the Fed interacts with the price system to achieve its objectives. Specifically, the monetary standard explains how monetary policy gives the price level a well-defined value and whether that policy rests on the stabilizing properties of the price system or overrides them. The FOMC should supply examples of how such evaluation of the structure of the economy has worked successfully in the past.

The ability of FOMC participants to describe in detail the state of the economy gives the impression that the FOMC understands the structure of the economy and how its actions work to achieve the dual mandate. However, that detailed knowledge about the economy does not provide a framework for understanding causation. That is, how do the actions of the FOMC in setting the funds rate interact with the price system to achieve its objectives? The FOMC chair should be able to not only articulate an FOMC consensus over such a framework but also defend that framework based on how past frameworks have worked. In sum, the chair should articulate the nature of the monetary standard the FOMC has created.

A public and professional debate over the optimal monetary standard needs to accompany this FOMC transparency. Is inflation a nonmonetary or a monetary phenomenon? Is economic instability an inherent feature of a market economy or does it result from FOMC interference with the operation of the price system? Based on the outcome of such a debate, what is the optimal monetary policy (rule)? Should such a rule be organized around the competing goals of low unemployment and low inflation with the trade-offs given by the Phillips curve? Alternatively, should the rule be organized around maintaining the expectation of stable prices and maintaining stability in the economy's rate of resource utilization? The intensity of the debate should reflect the extraordinary importance of putting in place a stable framework that supports the operation of a market economy.

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Pandemic Labor Force Participation and Net Worth Fluctuations

Miguel Faria-e-Castro and Samuel Jordan-Wood

Abstract

The US labor force participation rate (LFPR) experienced a record drop during the early pandemic. While it has since recovered to 62.2 percent as of December 2022, it was still 1.41 percentage points below its pre-pandemic peak. This gap is explained mostly by a permanent decline in the LFPR for workers older than 55. This article argues that wealth effects driven by the historically high returns in major asset classes such as stocks and housing may have influenced these trends. Combining an estimated model of wealth effects on labor supply with micro data on balance sheet composition, we show that changes in net worth caused by realized returns explain half of the drop in LFPR in the 2020–21 period and over 80 percent of "excess retirements" during the same period.

JEL codes: E2, G1, J2

Federal Reserve Bank of St. Louis *Review*, First Quarter 2024, *106*(1), pp. 40–58.
https://doi.org/10.20955/r.106.40-58

1. INTRODUCTION

The COVID-19 pandemic threw the US economy into a short but deep recession, during which the labor force participation rate (LFPR) fell by 2.2 percentage points (pp)—its largest drop on record. While the LFPR quickly rebounded, it remained 1.41 pp below its pre-pandemic peak as of the end of 2022. Researchers, market practitioners, and policymakers alike have argued that the drop in the LFPR may be contributing to a shortage of workers and excessive tightness of the labor market, which in turn may be contributing to inflation remaining high (Powell, 2022). However, a closer inspection of the data indicates that while the LFPR for prime-age workers (under age 54) has mostly recovered, the LFPR for older workers seems to have permanently fallen and failed to recover.

Applying the pre-pandemic peak LFPR to the level of the civilian noninstitutional population aged 16 and over as of December 2022 suggests that there were about 3.73 million "missing workers" in the US economy. Additionally, the share of the retired population has increased considerably, over and beyond what long-run demographic and shorter-run business cycle trends would predict. Comparing actual retirements with those predicted by a statistical model that allows for such trends (Montes, Smith, and Dajon, 2022) leads us to conclude that there were 3.27 million "excess retirees" in the US economy as of December 2022.

At the same time as the US economy was recovering from the short pandemic recession, real returns boomed across various asset classes, namely stocks and housing. Driven partly by the reopening of the US economy after the 2020 lockdowns and partly by the robust monetary and fiscal policy responses to the macroeconomic effects of the pandemic, real returns for many assets were abnormally high during the years 2020 and 2021, at least when compared with the historical record. The cumulative real return on a diversified index of stocks,

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the S&P 500, surpassed 35 percent between December 2019 and December 2021, versus a historical average of 17.5 percent for a two-year period. The real return on housing was close to 20 percent over the same period, versus a historical average of 7.3 percent.

Neoclassical theory offers a natural connection between these two patterns: wealth effects on labor supply. Standard models of labor supply assume that leisure is a normal good, with its desired consumption rising in response to an increase in income or wealth. There is broad empirical evidence for this effect, especially when such increases in wealth are unexpected (Imbens, Rubin, and Sacerdote, 2001). Moreover, these effects are likely to be more salient and relevant for older individuals, who are nearing retirement age, and for whom extensive-margin labor force participation decisions may be more elastic with respect to unexpected changes in wealth (Cheng and French, 2000; Zhao, 2018).

In this article, we try to quantify what share of the missing workers and excess retirees may be plausibly attributed to rising asset values during the pandemic. We proceed in three steps: First, we use the 2019 wave of the Survey of Consumer Finances (SCF) as a representative sample of the balance sheet composition of US individuals at the beginning of the pandemic. In particular, we can estimate exposures to major asset classes such as stocks, housing, government bonds, and corporate bonds. Second, we impute realized returns on these asset classes to compute how the net worth for each individual changed during the pandemic given their initial portfolio composition. Finally, we use an empirical model of wealth effects on labor supply (Benson and French, 2011) to estimate the impact of the estimated changes in net worth on labor force participation decisions at the individual level, and we aggregate these estimates using the appropriate weights. The final output is an estimate of the number of people who left the labor force due to changes in asset values. Since these estimates are generated at the individual level and are then aggregated, we can produce them for different demographic groups.

In our baseline, most conservative exercise, we focus on people aged 55-70, whose retirement decision is plausibly more sensitive to wealth effects. We find that the predicted change in the LFPR for this group accounts for almost 30 percent of the drop in aggregate LFPR between 2020 and 2021. If we expand the analysis to all those 55 and older, we can explain over 50 percent of the drop in aggregate LFPR over the same period. In terms of "excess retirements," we can explain close to half of the observed excess retirements by considering only the 55-70 age group and close to more than 80 percent when focusing on all those 55 and older.

There are many reasons why people may have chosen to retire early or leave the labor force during the pandemic period other than unexpected changes in wealth. Older people were at greater risk of severe illness and death from COVID, which undoubtedly played an important role for those with occupations involving greater physical contact. Many news stories also reported on older members of the household being responsible for taking care of loved ones as childcare facilities or other daycare institutions closed due to government-mandated lockdowns.[1] Wealth effects may not have been the only reason why people chose to retire but may have rather compounded these other reasons by allowing people to retire (as opposed to causing the retirement). We also report estimates for the 2020-2022 period, which include 2022, a year of declining asset valuations. While asset values declined during this year, there were no significant changes in terms of the LFPR, so our model explains a smaller share of the drop during this period. There are several other explanations for why the LFPR has failed to recover, such as reduced immigration flows starting in 2020 (Peri and Zaiour, 2022).

Our work aligns with several studies that put forward rising (declining) asset values as a driver of early (late) retirement decisions and declines (increases) in the LFPR. Coronado and Perzoek, 2003 find that individuals who benefited from the bull stock market in the 1990s retired earlier than those who did not. Benson and French, 2011 argue that sudden and unexpected declines in asset values, especially housing, during the Great Recession led to delayed retirements and higher than the expected LFPR. Goda, Shoven, and Slavov, 2011 find that individuals exposed to stock market declines during the Great Financial Crisis of 2007-08 delayed retirement but that this effect was partly attenuated by worsening labor market conditions. In more closely related work, Favilukis and Li, 2023 argue that increases in housing wealth can fully explain the "Great Resignation" among older workers and that metropolitan statistical areas with more substantial price growth tend to have a lower LFPR for homeowners around retirement age.

Our work is also related to the literature that dissects the post-pandemic drop in workers and hours worked. Lee, Park, and Shin, 2023 focus on the decline in aggregate hours worked post-pandemic and use micro data to decompose it into intensive and extensive margins. They find that more than half of the decline in total hours worked is due to a decline in the intensive margin, i.e., workers who remained in the labor force but reduced the number of hours they worked. Furthermore, they find that those whose hours declined tend to be prime age, educated men who tended to work long hours and had high earnings before the pandemic. They

1. See, for example, this NPR story: https://www.npr.org/2021/08/23/1028993124/these-older-workers-hadnt-planned-to-retire-so-soon-the-pandemic-sped-

argue that this helps explain why the labor market remains tight even after the partial recovery in the LFPR. However, in our study, we abstract from the intensive margin and focus on extensive-margin decisions only.

Hobijn and Şahin, 2022 argue that the decline in the LFPR may be overstated as it does not account for either (i) the fact that the LFPR was probably above trend pre-pandemic due to business cycle factors or that (ii) there are natural long-term downward trends on the LFPR due to demographics. Furthermore, Garcia and Cowan, 2022 show that both women and men saw a reduction in work hours and the likelihood of working full-time in response to school closures. However, only women were less likely to work at all. These effects were concentrated among uneducated parents in occupations less likely to be compatible with telework.

The rest of the article is organized as follows. Section 2 presents and discusses trends in the LFPR and in the retiree share, along with formal definitions of missing workers and excess retirees. Section 3 presents data on asset valuations during the pandemic and the distribution of assets and net worth across ages before and during the pandemic. Section 4 presents our main exercise, where we impute realized net worth to compute predicted changes in the LFPR across age groups. Section 5 concludes.

2. THE LFPR AND THE COVID RETIREMENT BOOM

In this section, we discuss recent trends in the US LFPR and the retirement share.

2.1 Trends in the LFPR

We start by analyzing the recent evolution of the US LFPR. Figure 1 plots the seasonally adjusted LFPR between January 2017 and December 2022. It is worth mentioning that we compute the LFPR using microdata from the Current Population Survey (CPS) and apply a smoothing procedure over the CPS weights to account for breaks introduced by updated population controls, as suggested by the Bureau of Labor Statistics (BLS). This step is important due to the significant revisions of the CPS weights in January 2022 as a result of the 2020 census, which made the published LFPR series incomparable with previous dates. This issue is pointed out and discussed in detail by Robertson and Willis, 2022 and Montes, Smith, and Dajon, 2022, who show the importance of using this smoothed procedure to generate LFPR estimates that are comparable throughout the period in analysis.[2] This weight-smoothing procedure is described in detail in Appendix 1. It is applied to all statistics reported in this article based on the CPS, as this is particularly relevant for the LFPR and the retirement share.

Figure 1 shows that the LFPR was stable and slightly increasing in the three years before the pandemic, rising from 62.98 percent in January 2017 to 63.64 percent in February 2020, the last full month before the effects of the COVID pandemic and associated policy responses started percolating through the US economy. The first few months of the pandemic were characterized by the sharpest drop in the LFPR on record: As of April 2020, the LFPR had fallen to 60.52 percent, a full 3.12 pp below its value two months prior. The following month was marked by what seemed to be a sharp recovery, to 61.74 percent in June 2020, but which then seemed to have stalled. The recovery has since been much slower: 61.81 percent at the end of 2020, 62.27 percent at the end of 2021, and 62.23 percent at the end of 2022. As of December 2022, the LFPR was 1.41 pp below its pre-pandemic peak. Accounting for the evolution of the civilian noninstitutional population aged 16 and over between February 2020 and December 2022, this corresponds to about 3.73 million workers "missing" from the labor force.[3]

Throughout this article, we use this 3.73 million figure as the baseline number of missing workers in the US economy. As we show in the next section, this number is in the same order of magnitude as the estimates for excess retirements in 2020-2022 that are obtained once demographic and business cycle trends are taken into account. It is, however, worth pointing out that Hobijn and Şahin, 2022 argue that this simple back-of-the-envelope calculation may overstate the real number of missing workers as it does not account for preexisting demographic trends that pushed the LFPR downwards. In other words, they argue that the LFPR in December 2022 should not be compared to its value in February 2020 but rather to a lower value that accounts for these downward trends.[4]

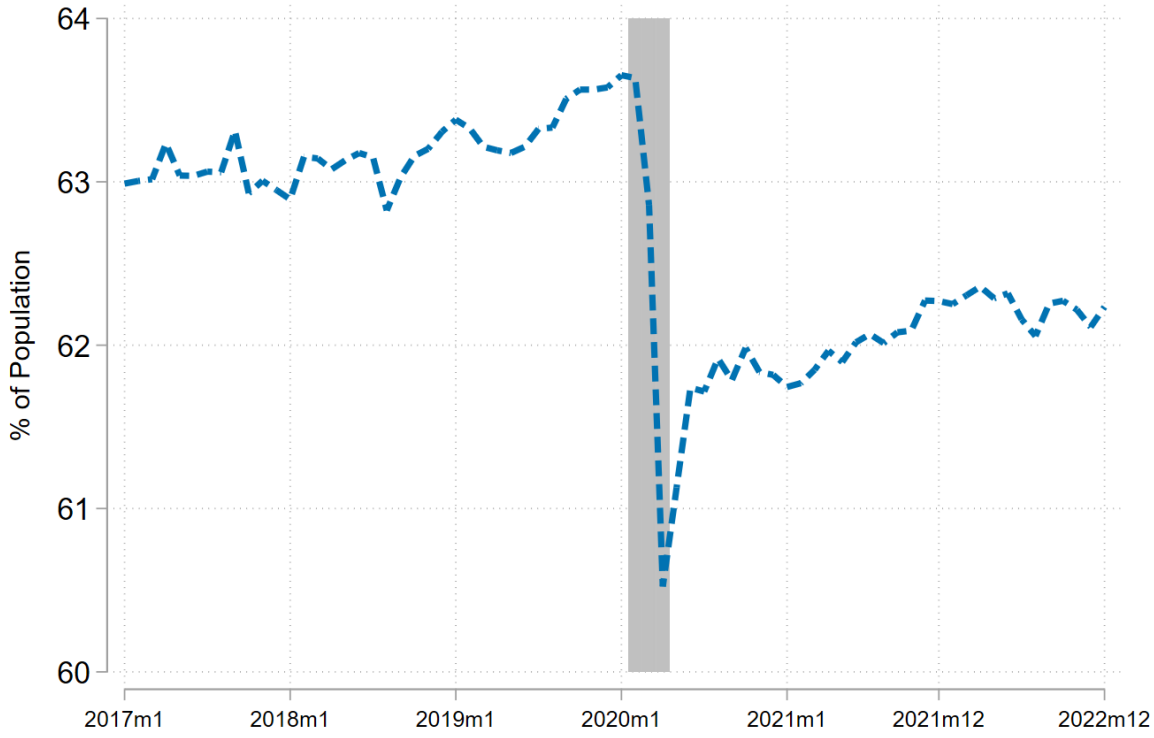
Figure 2 decomposes the evolution of the LFPR across two age groups: those aged 54 and younger (left panel) and those aged 55 and older (right panel). The left panel shows that the LFPR for those 54 and younger had been increasing before the pandemic, rising from 75.32 percent in January 2017 to 76.82 percent in February 2020. As with pretty much any demographic group, the LFPR fell sharply in April 2020 to 72.86 percent

2. In particular, these adjustments showed that the US population was larger and younger than previously considered.

3. This number corresponds to the difference between the size of the counterfactual labor force that we would observe given the population in December 2022 and the February 2020 LFPR of 63.64 percent, and the actual size of the LFPR in December 2022.

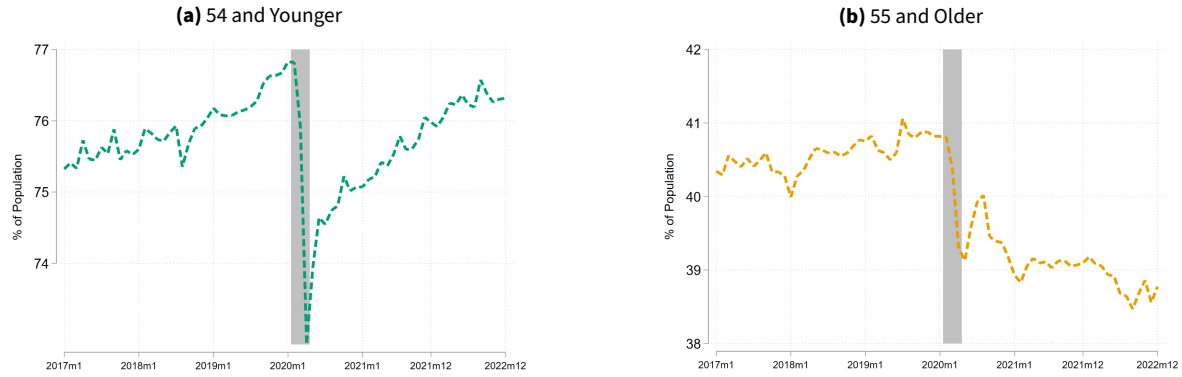
4. This point is also emphasized by Bullard, 2022, who argues that the LFPR was on trend as of the beginning of January 2022, after an above-trend cycle in the pre-pandemic period.

Figure 1
Labor Force Participation Rate



NOTE: The LFPR is computed using CPS microdata with weights adjusted for changes in population controls as a result of the 2020 census. Data are seasonally adjusted using the X13-ARIMA-SEATS procedure from the Census Bureau.

Figure 2
Labor Force Participation Rates by Age



NOTE: The LFPR is computed using CPS microdata with weights adjusted for changes in population controls as a result of the 2020 census. Data are seasonally adjusted using the X13-ARIMA-SEATS procedure from the Census Bureau.

but has recovered briskly since then. As of December 2022, it stood at 76.31 percent, 0.51 pp below its pre-pandemic peak. Given the size of the population in this age group, this percentage corresponds to about 832,000 missing workers, less than a quarter of the total number of missing workers in the US economy.

The right panel shows a very different picture for those aged 55 and older: Their LFPR had been stable pre-pandemic and then fell in the first few months of the pandemic, and despite a brief apparent recovery in late 2020, it has further declined since then. As of December 2022, the LFPR for this age group was 38.77 percent, 2 pp below its pre-pandemic level. This percentage corresponds to about 2.1 million missing workers in this age group. These aggregate patterns are consistent with the micro evidence documented by Gregory, 2023, who finds that those who exit the labor force during large recessions tend to be older on average and were particularly older during the pandemic recession.

2.2 The COVID Retirement Boom

Our analysis of LFPR trends around the pandemic displays different dynamics for younger and older workers. While the former seem to have mostly returned to the labor force, a significant fraction of the latter seem to have dropped out permanently. An important difference between younger and older workers is that the latter are much closer to their retirement. Older workers are much closer to an age where they can access retirement benefits from Social Security or private pension funds without penalties. Nie and Yang, 2021 and Faria-e-Castro, 2021 both document a significant increase in retirements in mid- to late 2021, more significant than what previous data trends would have suggested. In this subsection, we try to assess how much of the observed drop in the LFPR can be ascribed to excess retirements, i.e., retirements above and beyond the level that would be predicted by long-run demographic and short- and medium-run business cycle trends as well as changes to the retirement benefits system.

We closely follow the methodology of Montes, Smith, and Dajon, 2022 and estimate a statistical model of retirement for different demographic groups that accounts for several long- and short-run factors that could affect retirement decisions at the group level. We then compare observed retirement shares with those implied by the model and treat the difference as excess retirements. We divide the US population into 780 demographic subgroups j. Each subgroup is a tuple of age (16 to 80, with 80 corresponding to 80 or older), sex (men and women), education (less than a bachelor's degree and a bachelor's degree or more), and ethnicity (non-Hispanic white, non-Hispanic non-white, and Hispanic). For each subgroup, we compute retirement shares from the CPS microdata, where the retirement share is simply the fraction of people in that subgroup who are retired at any given point in time t:

$$r_{j,t} = \frac{\sum_{i \in j} \omega_{i,t} \mathbb{I}[\text{retired}_{i,t}]}{\sum_{i \in j} \omega_{i,t}},$$

where $\omega_{i,t}$ is the (smoothed) CPS weight and $\mathbb{I}[\text{retired}_{i,t}]$ is an indicator variable equal to 1 if individual i identifies as being retired at time t.[5]

5. To define retirement, we use the EMPSTAT variable from CPS, available from IPUMS. We classify an individual as retired if EMP-

We compute retirement shares for each subgroup between January 1995 and December 2019. We then average them over each year and run regressions at the annual frequency between 1995 and 2019 for each subgroup j:

$$r_{j,t} = \beta_0^j + \beta_1^j \text{PIA}_{j,t} + \beta_2^j \hat{u}_t + \beta_3^j t + \varepsilon_{j,t}, \forall j.$$

That is, we regress $r_{j,t}$ on three variables: the Social Security primary insurance amount (PIA) ratio for that subgroup in a given year $PIA_{j,t}$, the Congressional Budget Office's (CBO) estimate of the unemployment rate gap $\hat{u}_t$, and a linear time trend. $\varepsilon_{j,t}$ is the regression residual.

The PIA ratio is the fraction of a person's full retirement benefit (called the PIA) that the person receives and depends on at what age the person decides to retire. People who retire at full retirement age receive their full PIA, so $PIA = 1$. Those who retire before their full retirement age receive a fraction of their full retirement benefits, with that fraction depending on "how far" they are from their full retirement age when choosing to retire (Social Security benefits can only be collected after the age of 62), and so they have $PIA < 1$. Similarly, those who retire after their full retirement age receive a premium over their full retirement benefits up to the age of 70, after which the premium ceases growing if the person decides to delay retirement further. For these people, we have $PIA > 1$. For each subgroup, we compute the PIA of all the persons in that subgroup and then take an average for the subgroup to obtain $PIA_{j,t}$. More details on these calculations can be found in Appendix 2. The PIA ratio is only included in the regressions for the subgroups aged 62 to 70.

Besides the PIA ratio, the other two variables are the CBO unemployment rate gap and a linear time trend. The unemployment gap is a proxy for the business cycle and labor market slack. It is well documented by Hobijn and Şahin, 2021, for example, that labor force participation decisions (on which we include the retirement decision) are sensitive to the state of the macroeconomy and the extent of slack in the labor market, with participation falling during recessions and rising during booms. Thus, the business cycle is an important determinant of retirement decisions. Finally, we include the time trend to account for other longer-term trends that may affect different demographic subgroups differently during the period under analysis.

We use the model estimates to arrive at predicted, counterfactual retirement shares for each subgroup for the 1995–2022 period, $\hat{r}_{j,t}$. For the estimation period 1995–2019, we use the predicted values from the regression. To extrapolate during the COVID years, 2020–2022, we again closely follow the assumptions in Montes, Smith, and Dajon, 2022: We assume that (i) the PIA ratio would have evolved as legislated, (ii) the unemployment gap would have remained at its 2019 level, and (iii) the linear time trend would have evolved as predicted. We can then use these predictions to compute a counterfactual aggregate retirement share by aggregating the predicted shares for each subgroup using the subgroup weights:

$$\hat{r}_t = \frac{\sum_{j \in J} \omega_{j,t} \hat{r}_{j,t}}{\sum_{j \in J} \omega_{j,t}},$$

where $\omega_{j,t} \equiv \sum_{i \in j} \omega_{i,t}$ are the aggregate CPS weights for each of the subgroups.

Figure 3 plots the retirement share observed in the data (solid line) versus the model prediction (dashed line). The figure shows that the model accurately tracks the retirement share over the estimation period. However, we observe a significant divergence starting in 2020, as the observed retirement share rises considerably over the predicted share. The difference between the two (the excess retirement share) increases from 0.1 pp in February 2020 to 0.6 pp in August 2020. The excess retirement share has kept increasing, surpassing 1 pp in late 2022. Given the civilian noninstitutional population aged 16 and over as of December 2022, this increase corresponds to 3.27 million excess retirees. These numbers align with those obtained using simpler statistical models, such as nonlinear time trends in Faria-e-Castro, 2021.

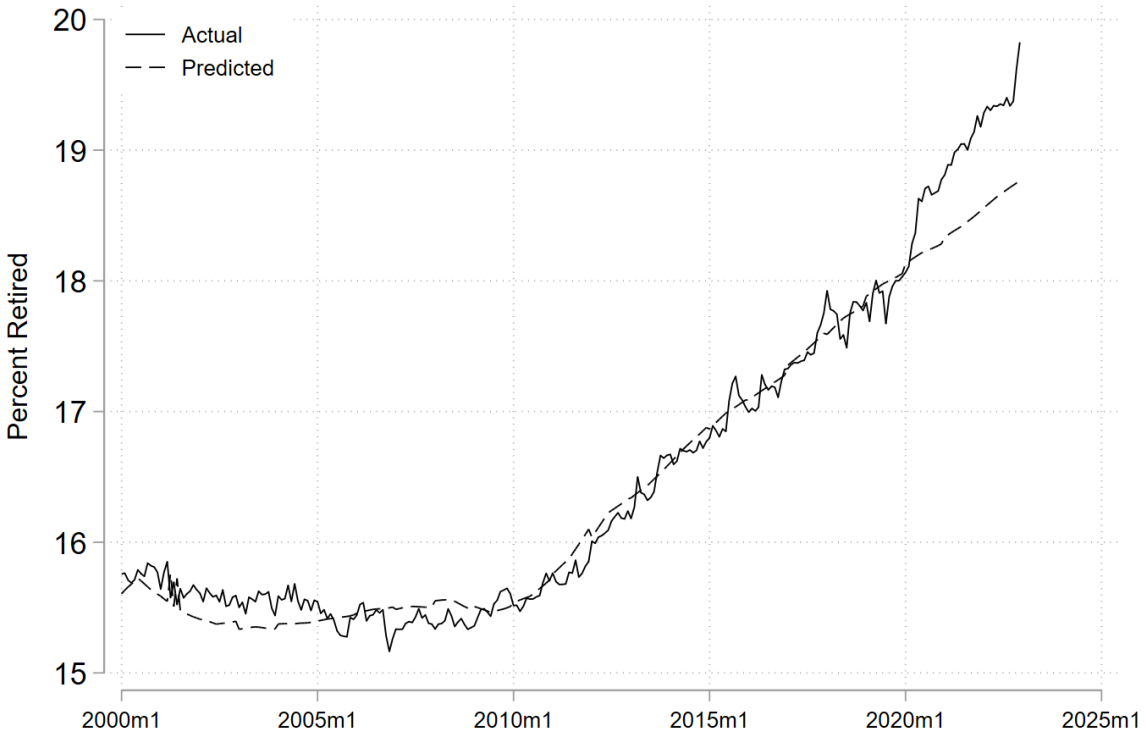
These estimates are in line with those in the literature. Tuzemen (2022), for example, finds that the number of missing workers as of March 2022 was 3.6 million, out of which about 2 million were estimated to be associated with a lower LFPR for older workers. Our headline number of 3.27 million excess retirees corresponds to the estimate of our model as of December 2022 due to a large increase in excess retirements in late 2022. For March 2022, our model predicts 1.85 million excess retirees, a number that is very close to the one estimated by Tuzemen (2022).

2.3 Factors Influencing Retirement Decisions

There are many potential reasons why people chose to retire in larger numbers during the pandemic. First, COVID had much graver consequences for older people, and it had become known early on in the pandemic

STAT is equal to 36 (Not in labor force, retired).

Figure 3
Actual versus Expected Retirements



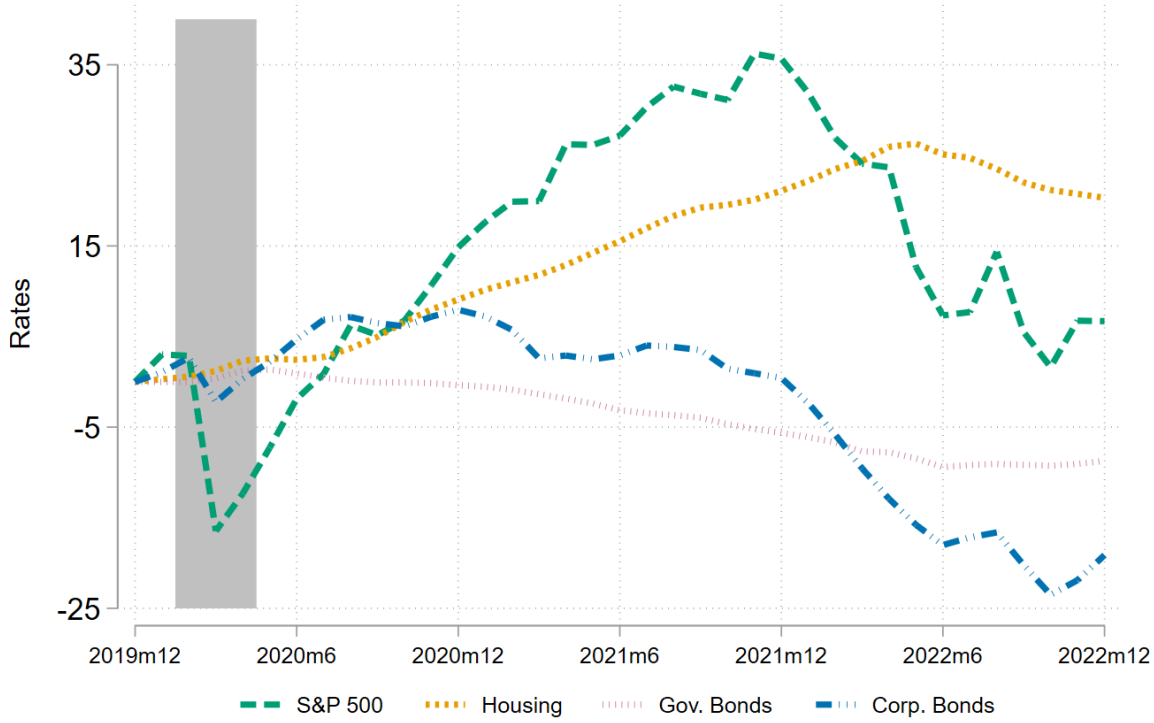
NOTE: The retirement shares are computed using CPS microdata with weights adjusted for changes in population controls as a result of the 2020 census. The model predicting the retirement share follows Montes, Smith, and Dajon, 2022. Data are seasonally adjusted using the X13-ARIMA-SEATS procedure from the Census Bureau.

that older adults were much more likely to be hospitalized and die from COVID. This significantly increased incentives to stop working, especially for those in contact-intensive occupations and those who could not easily transition to a remote working environment (Leibovici, Santacreu, and Famiglietti, 2020). Second, with daycare facilities closing under lockdowns, such as childcare centers or nursing homes, caring for loved ones often fell on family members closer to retirement. Third, labor force participation tends to be procyclical, and people tend to join the labor force when labor market conditions are good and leave during recessions. These fluctuations are heterogeneous across demographic groups. The pandemic recession was associated with the largest documented increase in the unemployment rate in US history, and Hobijn and Şahin, 2021 document a longer participation cycle for older workers, meaning that this group takes longer to return to the labor force after a recession.

A fourth reason why people may have chosen to retire in larger numbers is wealth effects on labor supply. Standard neoclassical economic theory postulates that labor supply decisions, both at the extensive and intensive margins, are driven by substitution effects from changes in wages and wealth effects from changes in income and wealth, among many other factors. In particular, when leisure is assumed to be a normal good, increases in nonlabor income or wealth should induce people to supply less labor at a given wage rate, everything else constant. For example, Daly, Hobijn, and Kwok, 2009 and Benson and French, 2011 study how wealth and income losses may have kept the LFPR higher than what it would have been otherwise during the Great Recession.

Moreover, as we discuss in the next section, US households experienced historically large increases in net worth during the pandemic period. That is, they became wealthier due to booming returns in asset markets such as stocks and housing, and this may have negatively affected their willingness to work, contributing to a decline in the LFPR. While this increase in net worth may not have been the main driver behind labor force participation decisions, it may have compounded the other three, which were already particularly strong for older workers. It is also worth mentioning that while we focus our analysis on the extensive margin, wealth

Figure 4
Cumulative Real Returns by Asset Class



NOTE: We use the following series to compute returns for each asset class: the S&P 500 index for US equities, the S&P/Case-Shiller US National Home Price Index for housing, the constant maturity 10-year Treasury yield for government bonds, and the ICE BofA US Corporate Index for corporate bonds. All returns are deflated by the core consumer price index. Shading represents a recession.

effects may also drive labor supply decisions at the intensive margin—increases in wealth during the pandemic would then be consistent with the intensive-margin declines in hours documented by Lee, Park, and Shin, 2023 for that period.

3. ASSET PRICES AND NET WORTH AROUND COVID

As discussed in the previous section, wealth effects can play an important role in people's labor force participation decisions. Concurrent with the aforementioned dynamics of the LFPR and retirement share, there were large fluctuations in valuations for major asset classes during the pandemic. These changes in valuations had plausibly significant effects on households' net worth. In this section, we first document these fluctuations in valuations for major asset classes and then analyze their impact on net worth at the individual level.

3.1 Asset Prices

We start by looking at the evolution of cumulative returns on major asset categories throughout the pandemic. Figure 4 plots cumulative real returns for four major asset categories from December 2019 to December 2022: stocks, housing, government bonds, and corporate bonds. In addition, a fifth asset category, private businesses, is quantitatively significant for US households' portfolios, according to the Federal Reserve Board of Governors SCF. There are, however, no good data sources for returns on private businesses besides other issues, namely the fact that the nature of private businesses is extremely heterogeneous and so are their returns. This is likely to be less of an issue for financial assets such as stocks and bonds, which are traded frequently and have publicly observable returns, or even housing, whose geographically heterogeneous returns tend to be correlated with national trends.[6]

6. We do not explicitly consider bank deposits as they make up a relatively small percentage of household assets, ranging from 4.9 percent for people aged 35-44 to 7.4 percent for those under the age of 35. Due to low interest rates, deposits earned very low returns during the period in analysis.

We choose proxies for the returns of each asset class. For stocks, we use the cumulative return on the S&P 500 index. For housing, we use the S&P/Case-Shiller US National Home Price Index. For government bonds, we use 10-year Treasury yields; and for corporate bonds, we use the ICE Bank of America (BofA) US Corporate Index. The figure shows that despite negative returns in the first few months of the pandemic, stocks and housing performed exceptionally well during 2020 and 2021 due to the high degree of economic uncertainty and instability. Cumulative stock returns peaked at the end of 2021, at slightly over 35 percent, and subsequently fell during 2022, possibly due to elevated inflation and a more restrictive monetary policy stance. Housing returns behaved more sluggishly, slightly exceeding 20 percent at their peak in the first half of 2022. As of the end of 2022, they were still above 15 percent. The returns on bonds, government or corporate, were relatively low at the early stages of the pandemic and eventually became negative in 2021.

This figure shows a wide variation in cumulative returns for major asset classes. Bonds, which posted the worst performances out of these four categories, tend to be a smaller fraction of individual portfolios, which are dominated by stocks and housing. These two asset categories performed extremely well by historical standards during 2020 and 2021 despite declines in cumulative returns during 2022. Since these assets are a significant part of household balance sheets, these high returns may have caused significant increases in household net worth during 2020 and 2021. Next, we investigate the effect of these return fluctuations on the net worth of individuals.

3.2 Impact on Individual Net Worth

3.2.1 Net Worth across the Age Distribution

We are particularly interested in studying how the large fluctuations in returns observed during the pandemic affected the net worth of different households across the age distribution. To this end, we directly estimate changes in net worth caused by fluctuations in the returns of different assets given the portfolio composition of US households in different age groups. Our starting point is the 2019 SCF published by the Board of Governors of the Federal Reserve System. The SCF is a triennial survey of US households' balance sheets and income. Of particular interest to us is the fact that it contains detailed information about the value and categories of different types of assets held by US households as well as demographic characteristics such as age. While the SCF is conducted at the household level, we are interested in studying the impact of changes in net worth at the individual level as we want to be able to express the results of our analysis in terms of the number of people. For that reason, we transform the SCF to an individual-level dataset, and all SCF results and statistics we report refer to this individual-level-transformed dataset unless otherwise noted.[7]

Figure 5 reports the portfolio composition for an average individual in each of six age groups as of 2019: under the age of 35, 35-44, 45-54, 55-64, 64-74, and 75 and older. The figure decomposes the portfolio of individuals in each age category into three major asset classes (stocks, real estate, bonds), other assets, and debt owed by the individuals. As expected, younger individuals tend to own fewer assets. The assets are increasing in age and peak for those aged 65-74. Younger individuals tend to hold primarily real estate (55.4 percent of their total assets), while the share of stocks increases with age, peaking at 27.6 percent for those aged 75 and older. Other assets is a residual category that is a significant and relatively constant share of total assets (between 35 percent for those 75 and older and 41.5 percent for those aged 55-64). A significant component of this residual category is private businesses. A predictable life-cycle pattern also emerges regarding debt: Younger individuals tend to owe more debt. Debt is largest for those aged 35-44, likely due to mortgages associated with first-time home purchases. As age increases from this category onward, the absolute value of debt falls even as the level of assets increases considerably, suggesting a very stark life-cycle profile in terms of net worth.

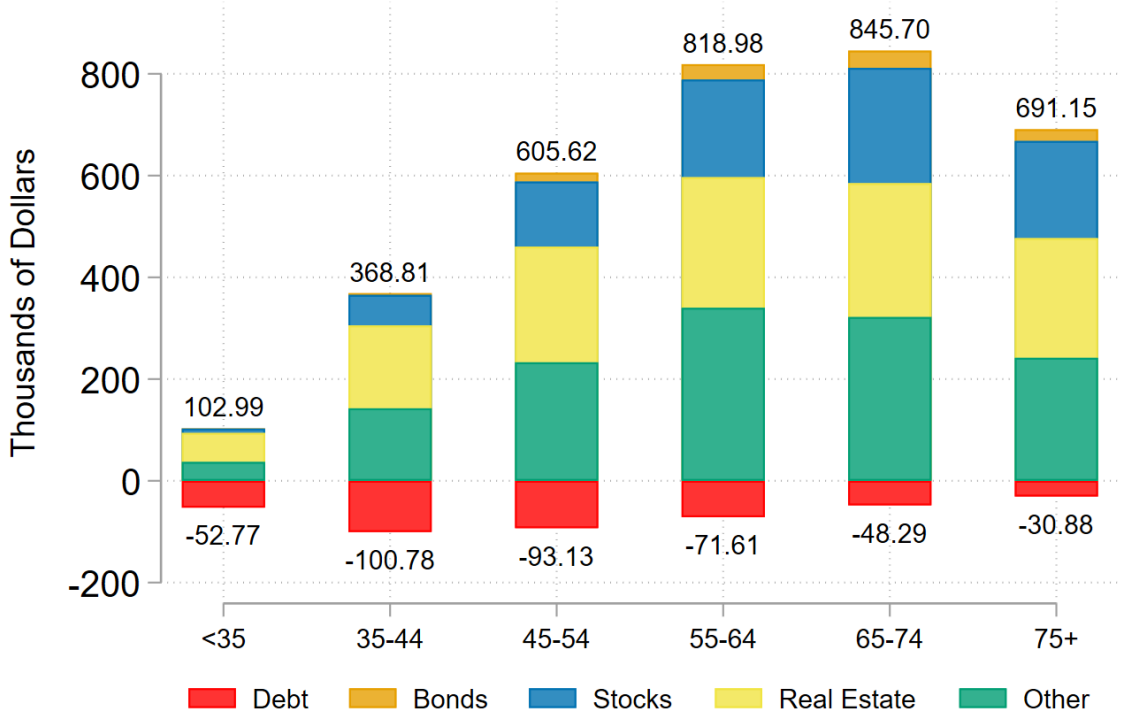
We plot average net worth across the same age categories in Figure 6. The net worth is lowest for the younger individuals, rising steeply as individuals become older and peaking at almost $800,000 in 2019 dollars for those aged 65-74.

3.2.2 Net Worth in 2019-2022

We now combine the 2019 SCF with data on realized returns for different asset classes to estimate the change in net worth experienced by different households during the pandemic period. Our approach relies on a series of assumptions: First, we assume that 2019 portfolios, as observed in the SCF, are kept constant through 2022, including debt owed. Second, we assume that individuals are perfectly diversified within each asset category—this can either under- or overstate changes in net worth due to a specific asset class. Third, we only consider changes in net worth arising from asset classes for which we can access data on realized returns. This means

7. More specifically, we use the marital status indicator and assume that if the household is married, it is composed of two individuals, and if it is not married, it is composed of one individual only. This follows Dettling and Hsu, 2014, who also argue that this is only an imperfect approximation for a minimal number of households since most of the dependents in a household who are not captured by our approximation would be under the age of 16 and thus not be part of the civilian noninstitutional population aged 16 and over.

Figure 5
Portfolio Composition in 2019 SCF by Age



that we disregard potentially important asset categories such as private business, which may lead us to either under- or overstate the actual change in net worth. Formally, we define net worth for individual i in 2019 as follows:

$$NW_{i,2019} = \sum_{j \in J} A^{j}_{i,2019} - B_{i,2019},$$

where J = {stocks, real estate, corp. bonds, govt. bonds, other} are the asset classes we consider separately, and $B_{i,2019}$ is debt owed by the individual at the end of 2019.

We then define net worth for individual i at some arbitrary period $t \geq 2019$ as follows:

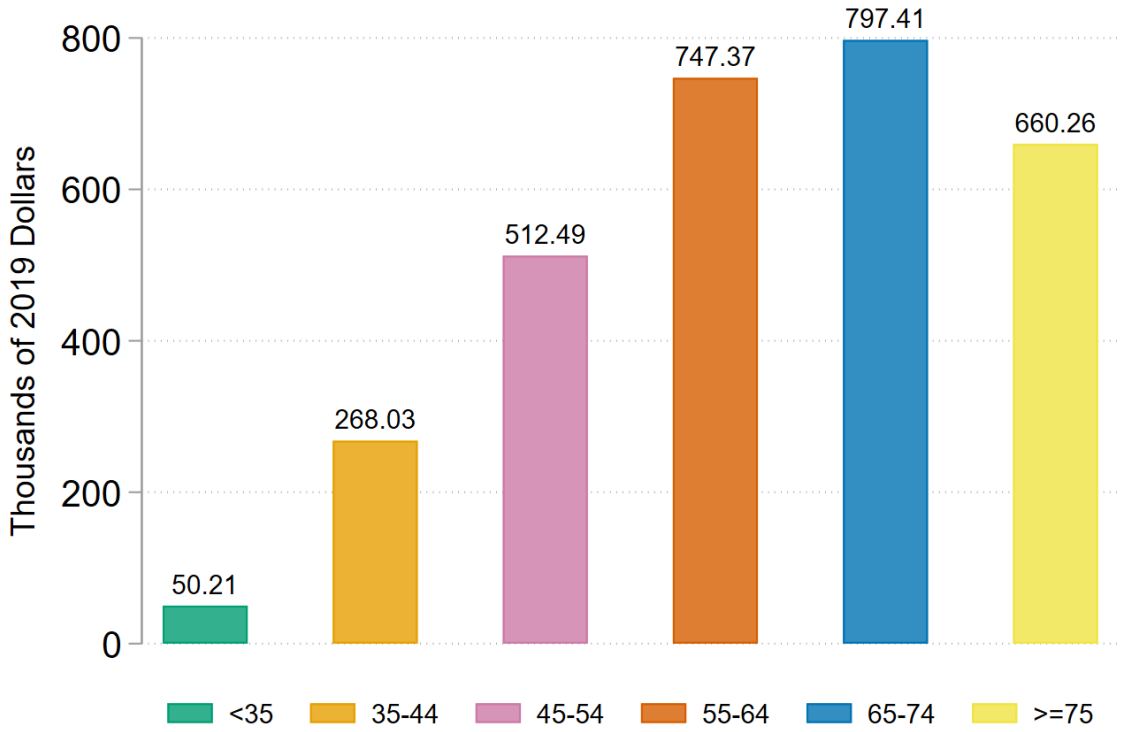
$$NW_{i,t} = \sum_{j \in J} R^{j}_{t,2019} A^{j}_{i,2019} - B_{i,2019},$$

where $R^{j}_{t,2019}$ is the cumulative gross real return between 2019 and t of asset category j. We measure $R^{j}_{t,2019}$ directly from the data for stocks, real estate, and both types of bonds, and we set $R^{\text{other}}_{t,2019} = 1$, i.e., zero real return for other assets. The change in net worth between 2019 and an arbitrary period $t \geq 2019$ is then given by the difference between the two:

$$\Delta NW_{i,t} = NW_{i,t} - NW_{i,2019}.$$

While we perform this calculation at the individual level, Figure 7 summarizes the output across the age distribution, reporting the average change in net worth within each age category we consider. We conduct the exercise for two periods: the "return boom" period in 2020-2021, during which stock returns peaked (top panel), and the full 2020-2022 sample (bottom panel), which also accounts for the drop in cumulative returns during 2022. During the boom period, while all age categories benefited from rising asset valuations in terms of their net worth, there was substantial heterogeneity. The youngest benefited the least in absolute terms, with their net worth rising by $15,000 in 2019 dollars, on average. Those aged 65-74 benefited the most in absolute terms, with an average increase of $135,000 in 2019 dollars. This large increase is due to their initially

Figure 6
Net Worth in 2019 SCF by Age



larger portfolios and their exposure to asset classes that performed well during this period, namely real estate and stocks.[8]

The bottom panel of Figure 7 considers the full sample period, including 2022, during which a fraction of the 2020–2021 cumulative returns reversed. The figure shows that, while lower, net worth returns were still quite positive across age groups. The large exposure of older individuals to stocks means that their returns fell relatively more compared with the boom period. Still, individuals in the 65–74 age range generated a total average cumulative return of $62,000 during this period, more than the average in any other age category.

4. IMPACT OF NET WORTH CHANGES ON THE LFPR

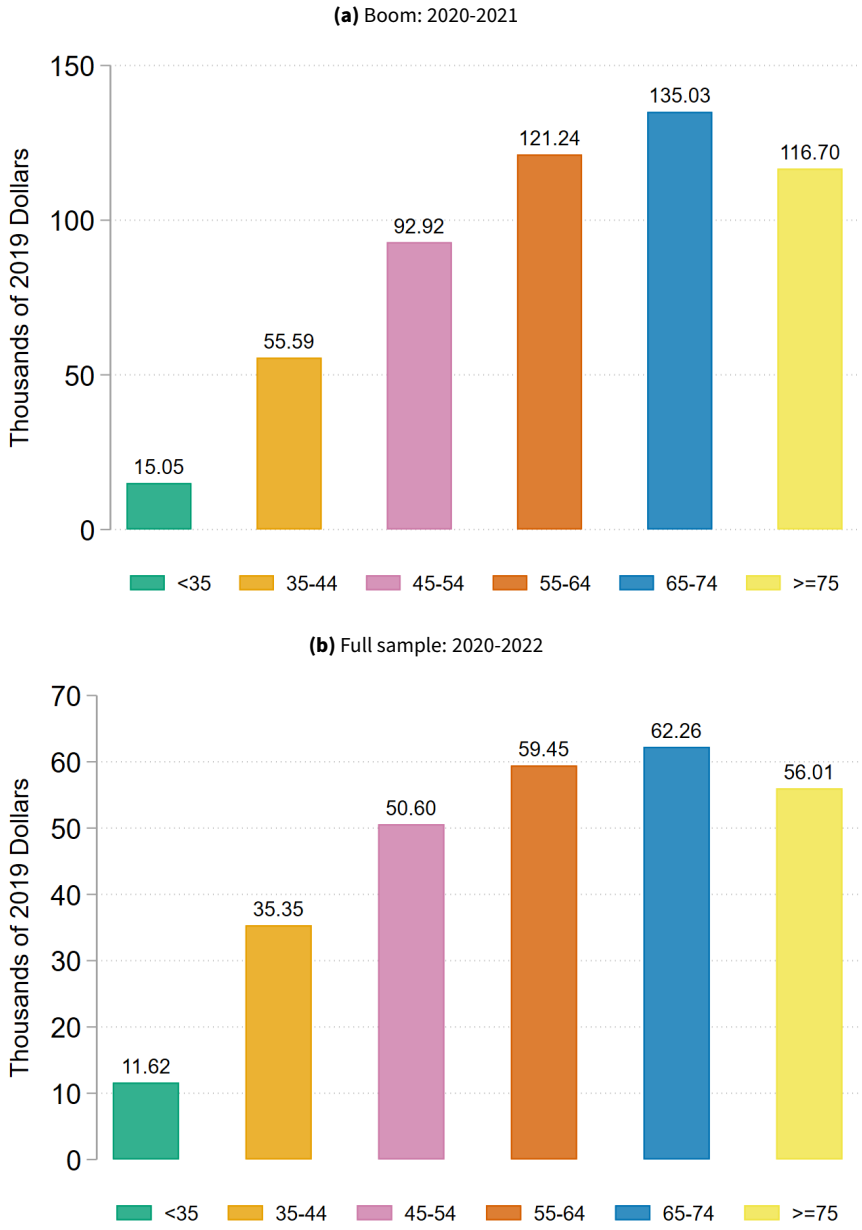
Having documented the differential changes in LFPR trends across age groups and the heterogeneity in terms of exposures to asset gains and realized changes in net worth, we now try to quantify the relationship between the two.

4.1 A Simple Model of Wealth Effects

Our goal in this subsection is to determine how much of the decline in the LFPR and the increase in excess retirements since the beginning of the pandemic could be explained by changes in net worth for US individuals across the age distribution. To this end, we adapt the methodology in Cheng and French, 2000, who estimate a statistical model that relates wealth shocks as a percentage of annual income to labor force participation decisions. Benson and French, 2011 use this model to measure the impact of declines in wealth during the Great Recession on labor force participation. We closely follow these authors and apply their model estimates to the pandemic period.[9] The model estimated by Cheng and French, 2000 is the following:

8. In terms of cumulative returns on net worth, the youngest age category performs the best, earning a cumulative return of 30 percent during the boom period, while those aged 55–64 perform the worst, earning an average return of 16.2 percent. This likely reflects the large weight of other assets in the portfolio of older individuals, for which we impute a zero return.
9. This procedure is the same used in Faria-e-Castro, 2022.

Figure 7
Average Returns on Net Worth



NOTE: We use the 2019 SCF for net worth and assume a constant portfolio over the period. We use the following series to compute returns for each asset class: the S&P 500 index for US equities, the S&P/Case-Shiller US National Home Price Index for housing, the constant maturity 10-year Treasury yield for government bonds, and the ICE BofA US Corporate Index for corporate bonds. All returns are deflated by the core consumer price index. Shading represents a recession.

$$-\Delta LFPR_i = \begin{cases} 0.010 \times \left(\frac{\Delta NW}{Y}\right)_i & \text{, if } \left|\left(\frac{\Delta NW}{Y}\right)_i\right| < 8 \\ 0.032 + 0.006 \times \left(\frac{\Delta NW}{Y}\right)_i & \text{, if } 8 \leq \left|\left(\frac{\Delta NW}{Y}\right)_i\right| < 30 \\ 0.152 + 0.002 \times \left(\frac{\Delta NW}{Y}\right)_i & \text{, if } \left|\left(\frac{\Delta NW}{Y}\right)_i\right| \geq 30. \end{cases} \quad (1)$$

The model relates the labor force participation decision (on the left-hand side) to the change in net worth divided by annual earnings, allowing for nonlinearities in the response, depending on the specific ratio of change

Table 1
Estimated Impact of Changes in Net Worth on the LFPR

	Age	(1) LFPR impact (pp)	(2) People (million)	(3) % of LFPR drop
2019-2021	55-70	0.00376	0.99	28.73%
	55+	0.00669	1.76	51.13%
	16+	0.01002	2.64	76.62%
2019-2022	55-70	0.0024	0.65	18.13%
	55+	0.0044	1.17	32.77%
	16+	0.0069	1.84	51.62%

in net worth to earnings. This is a simple model of labor supply that abstracts from many other relevant factors that could be important for individual decisions on whether to participate or not in the labor force. Neoclassical models typically account for other factors that could influence this decision, such as the age, health status, and human capital—not just the financial capital—of the worker. It is also likely that these factors interact with changes in net worth: The participation decision of older workers, for example, is plausibly more sensitive to changes in net worth since the present discounted value of labor income and of their human capital is lower at that point. While the model does not explicitly account for these factors, we do control for the worker's age by separately applying this model to different age groups.

In the previous section, we computed the change in net worth for each individual in the SCF, from where we can also observe individual earnings. Doing this allows us to compute the ratio $\left(\frac{\Delta NW}{Y}\right)_i$ for each individual. We then apply the model in equation (1) to each individual in the SCF and obtain an aggregate LFPR response by applying the appropriate SCF weights.

4.2 Explaining the Decline in the LFPR

Table 1 summarizes our main results, which are reported for two time periods, December 2019 to December 2021 (the asset return boom period), as well as the full sample, December 2019 to December 2022. Within each period, each row corresponds to wealth effects in a single age group, and we think of these age groups as generating progressively fewer conservative results. The first row, for example, corresponds to a situation where we assume that the labor force participation decision is sensitive to wealth effects only for those aged 55-70. In the second row, we assume that all people older than 55 are sensitive to wealth effects, while in the last row we assume that everyone aged 16 or older is sensitive. Cheng and French, 2000 argue that those younger than 51 are unlikely to adjust their labor supply much in response to changes in asset values. Daly, Hobijn, and Kwok, 2009, however, argue that financial and credit market conditions could have been an important driver of labor force participation decisions for young people during the Great Recession.[10]

Column (1) of Table 1 reports the direct impact on aggregate LFPR from wealth effects for each age group. These numbers correspond to the weighted average of the predicted values obtained from applying equation (1) to each individual in the SCF. Columns (2) and (3) correspond to more interpretable versions of the same result. In column (2), we multiply the LFPR impact by the size of the civilian noninstitutional population over the age of 16 as of the final period (December 2021 or 2022) to convert the estimated LFPR impact into a population estimate. Column (3) divides the LFPR impact by the total LFPR drop during the period in analysis, reporting the share of the total LFPR drop that can be plausibly explained by net worth effects.

The results show that during the asset boom period, almost a third of the total LFPR drop of 1.3 pp can be attributed to wealth effects for the population aged 55-70, likely to be the population segment whose retirement decision is most sensitive to wealth effects. If one expands the analysis to all those 55 and older, wealth effects can explain more than half of the drop in the LFPR (51 percent). The population estimates imply that rising asset valuations during this period led to between 1 and 1.8 million people exiting the labor force out of about 3.4 million missing workers. If one considers the full period, 2019-2022, the results are smaller due to declining asset values during 2022. Still, wealth effects can explain between 18 and 33 percent of the total drop in the LFPR during this period, depending on whether we consider only those aged 55-70 or 55 and older.

4.3 Explaining Excess Retirements

The same analysis can be applied to excess retirements, defined in Section 2.2 as the difference between observed retirements and the number of retirements that would be predicted by a statistical model that accounts for

10. More specifically, they argue that the credit crunch that followed the 2008-09 financial crisis may have hampered the ability of prospective college students to contract student loans, forcing them to look for jobs instead.

Table 2
Estimated Impact of Changes in Net Worth on Excess Retirements

	Age	(1) LFPR impact (pp)	(2) People (million)	(3) % of Excess retirements
2019-2021	55-70	0.00376	0.99	45.96%
	55+	0.00669	1.76	81.79%
2019-2022	55-70	0.0024	0.65	19.73%
	55+	0.0044	1.17	35.66%

Table 3
Robustness Exercise: Private Businesses Earning Same Returns as Stocks

	2019-2021		2019-2022	
	55-70	55+	55-70	55+
(1) LFPR impact (pp)	0.00443	0.00788	0.00255	0.00460
(2) People (M)	1.17	2.07	0.67	1.22
(3) % of LFPR drop	33.87%	60.24%	18.96%	34.26%
(4) % of excess ret.	54.19%	96.36%	20.64%	37.29%

demographic trends, the business cycle, and changes in retirement benefits legislation. Table 2 is similar to Table 1, but column (3) is replaced by the percentage of excess retirements that are explained by changes in net worth. The table shows that between 45 and 82 percent of the 2.2 million excess retirements can be explained by wealth effects for those aged 55-70 or 55 and older. For the entire 2019-2022 period, between 20 and 36 percent of the 3.3 million excess retirements can be explained by wealth effects.

4.4 Robustness Checks

In this subsection, we perform a couple of robustness checks that involve recalculating by how much the increase in wealth can explain the LFPR drop and excess retirees under different assumptions. First, we relax our assumption on private business, namely that it provides zero returns, and instead assume that private business follows the return of the S&P 500. Second, we calculate the impact of excess returns on LFPR decisions as opposed to total returns as in the baseline.

Returns on Private Businesses. In our baseline, we make a strong assumption regarding the returns on private businesses—that they earn zero return. We assume this because it is hard to compute the rates of return on this asset class, especially with the available public data. Therefore, we choose zero return because it provides a conservative lower bound for our estimations. We can assume instead that private businesses earned the same return as the S&P 500 during the period in analysis. This is a strong assumption in the opposite extreme, and we treat these numbers as an upper bound for the effects of changes in wealth on the LFPR.

As shown in Table 3, the percentage of the LFPR drop than can be explained by the increase in wealth during 2019-2021 increases by 5 pp and 9 pp, for those 55-70 and 55 and older, respectively. For the 2019-2022 period, when cumulative returns to the S&P 500 since 2019 were falling, our results are similar to the baseline. Additionally, we find that the increases in wealth during 2019-2021 account for 54 percent of excess retirees aged 55-70 and 96 percent of excess retirees 55 and older. These estimates are 10-15 pp higher than our baseline. For the 2019-2022 period, we find comparable estimates to our baseline.

Excess Returns. In our baseline exercise, we apply the total return on each asset class to the LFPR model. Originally, Cheng and French (2000) apply the LFPR model to excess returns only, arguing that only returns in excess of what agents anticipated should have significant effects in terms of LFPR decisions. In this robustness exercise, we adopt this more conservative approach and compute excess returns for each asset class, which are then imputed into the LFPR model.

To calculate excess returns, we measure the average real return of our four asset classes between December 2009 and November 2019. We treat these average real returns as the expectation of returns for each asset class for the following periods. We then compute excess returns by subtracting these average real returns from the realized ones. Since expected real returns are positive for all asset classes, this generates estimates for the change in the LFPR that are smaller than our baseline estimates.

Table 4
Robustness Exercise: Excess Returns

	2019-2021		2019-2022	
	55-70	55+	55-70	55+
(1) LFPR impact (pp)	0.00254	0.00456	0.00052	0.00103
(2) People (M)	0.67	1.20	0.14	0.27
(3) % of LFPR drop	19.44%	34.88%	3.87%	7.66%
(4) % of excess ret.	31.10%	55.79%	4.22%	8.34%

Our estimates for the impact of excess returns on the LFPR are shown in Table 4. During the 2019-2021 period, asset returns were high; and thus, by using excess returns, we can still account for 19 and 35 percent of the drop in the LFPR for the 55-70 and 55 and older age groups. However, when considering the 2019-2022 period, we find that excess returns to wealth can only account for 4 percent of the LFPR drop for those aged 55-70 and 7.5 percent for those aged 55 and older. In terms of excess retirees for the 2019-2021 period, we can account for 31 and 56 percent of excess retirees for the 55-70 and 55 and older groups—compared with 46 and 82 percent in the baseline.

5. CONCLUSION

In this article, we have argued that wealth effects arising from the increase in net worth caused by booming asset returns in 2020-2021 help explain a significant share of the drop in the LFPR during the same period, especially for older workers close to retirement. We first showed that while the LFPR for prime-age workers has more or less recovered to its pre-pandemic levels, the LFPR for workers older than 55 seems to have declined permanently. Using a statistical model for the retired share that controls for several demographic characteristics as well as medium-term business cycle factors and longer-term trends, we also showed that the percentage of Americans who have retired is significantly higher than the predicted trend and there were 3.3 million excess retirees as of December 2022.

We then argued that a significant share of these missing workers and excess retirees can be explained by combining a model of wealth effects on labor supply and estimated changes in net worth. More specifically, we imputed realized returns on major asset classes to micro data on individual balance sheets and portfolio composition as of 2019 from the SCF. We then applied a model that relates changes in net worth to labor force participation decisions to obtain predicted changes in labor supply from those fluctuations in net worth. We showed that this exercise helps explain between 28.7 and 51.1 percent of the drop in the LFPR in the 2020-2021 period and between 46 and 82 percent of all excess retirements, depending on whether we consider the population aged 55-70 or everyone aged 55 and older.

There are many other reasons, besides wealth effects, why individuals may have chosen to retire during this period. However, these changes in net worth may have enabled retirements even if they were primarily driven by these other reasons. An important question is whether these individuals may return to the labor force. On the one hand, recent developments in financial markets during 2022 have undone some of these abnormally high returns, especially in the stock market. On the other hand, long-run demographic trends related to decreased fertility and population aging create downward pressure on the LFPR, preventing it from returning to its pre-pandemic levels.

APPENDIX 1. CPS WEIGHT SMOOTHING

After every census, there is a period before the complete population counts are released where BLS publications use population estimates. In January 2022, the BLS released the 2020 census revisions to its population estimates, and there was a significant revision to the number of people aged 65 and over. In fact, there were over 1.4 million fewer people 65 and older than were predicted in the BLS population estimates made before the final release of 2020 census data. These BLS revisions led to a 0.3 pp increase in labor force participation between December 2021 and January 2022. However, the 0.3 pp increase in the LFPR is driven by a change in the population base being measured—not by an actual increase to the LFPR. To remove this jump in the LFPR, we smooth the CPS weights between 2010 and 2022 to spread out the total effect of this jump. We obtain the population

effects at the gender and age group sublevels, [11] and we adjust for those employed, unemployed, and not in the labor force. Thus we have 48 total subgroups for which we adjust the weights based on the January 2022 population revisions. To smooth, we closely follow Robertson and Willis, 2022 and Montes, Smith, and Dajon, 2022. We first calculate an adjustment factor:

$$AF_j = \frac{w_j + \alpha_j}{w_j} - 1,$$

where the adjustment factor for group j, AF_j, equals the original weight, w_j, plus the 2022 revision amount, α_j, over the original weight, subtracted by one. We then linearly distribute the adjustment factor over the 2010–2022 time period, following Montes, Smith, and Dajon, 2022. This can be done in the following manner:

$$\hat{w_j} = w_j \times \left(1 + AF_j \times \frac{t}{T}\right),$$

where the smoothed weight for group j, $\hat{w_j}$, is equal to the original weight, w_j, multiplied by one plus the adjustment factor multiplied by the current period t, over the total number of smoothing period T. In our application, the total number of smoothing periods is $T = 144$ because we smooth over 12 years at the monthly level.

APPENDIX 2. RETIREMENT MODEL

One of the main components of the retirement model is the value of retirement Social Security, called PIA. Here we describe in depth the process of calculating the PIA. First, find a person's age in months in any given month, and subtract that from their normal retirement age (NRA) in months. If they are past their NRA, multiply their months past NRA by the benefit for delaying retirement. If they are retiring early, multiply their months past NRA by the penalty for early retirement. The CPS, however, provides age in years but not the month of birth, making the calculation of PIA challenging as the month of birth within a given year matters.

Further, the year a person is born matters because the NRA and the premium paid on delaying retirement change over time. This means that if a person was 65 in January 2005, they might have been born in 1940 and have an NRA of 65 years and 6 months, or they might have been born in 1939 and have an NRA of 65 years and 4 months. Because of this issue, we calculate the PIA ratio at the subgroup level. We assume a uniform distribution of birth months for each subgroup, with the current observation month being a potential birth month. Take, for example, a subgroup of uneducated, white women aged 65 in January 2005. For this subgroup, individuals could have been born in January 1940 or February 1939 through December 1939. For each possible birth year, we calculate the average PIA ratio. Then, we weight the two PIA ratios uniformly based on the number of months one could have been born in that year:

$$\text{PIA} = \frac{11}{12} \times \text{PIA}_{1939} + \frac{1}{12} \times \text{PIA}_{1940}.$$

The PIA ratio of each year will depend first on the NRA of that year.[12]

For the case where the person is younger—in our example their birth year is 1940—we calculate the time from normal retirement as

$$\text{time from NRA} = \text{NRA} - \text{age} - \frac{\text{month} - 1}{2}.$$

Here, the NRA and age are both expressed in months. The last term accounts for the average months of a person's age for the more recent birth year. In our example, the person born in 1940 would have turned 65 in January 2005, so the calculation would be $786 - 780 - \frac{1-1}{2}$. Thus, the time from retirement would be 6 months.

For the case where the person is older—1939 in our example—we calculate the time from normal retirement as

$$\text{time from NRA} = \text{NRA} - \text{age} - \frac{12 + \text{month} - 1}{2}.$$

For our example, this would be 784 months - 780 - $\frac{12+1-1}{2}$. In this example, the time from normal retirement would be -2 months, indicating that the person is past their NRA. This calculation is based on our assumption

11. We get this report in PDF format directly from the BLS. The age groups are 16-17, 18-19, 20-24, 25-34, 35-44, 45-54, 55-64, and older than 65.

12. We obtain NRAs from https://www.ssa.gov/oact/progdata/nra.html.

Birth year	Age of normal retirement
≤1937	65
1938	65 and 2 months
1939	65 and 4 months
1940	65 and 6 months
1941	65 and 8 months
1942	65 and 10 months
1943-54	66
1955	66 and 2 months
1956	66 and 4 months
1957	66 and 6 months
1958	66 and 8 months
1959	66 and 10 months
≥1960	67

of a uniform distribution of birth months. Thus, on average, for the people in our subgroup born in 1939, their birth month would be July, making them 65 years and 6 months old in January 2005—two months past their NRA of 65 and 4 months.

Once we have the months from NRA for both possible birth years, we can calculate the PIA ratio. For early retirement, the penalty follows a standard calculation:[13]

$$\text{penalty} = \begin{cases} -\frac{5}{9} \times .01 \times t & \text{if } t \leq 36 \\ -\left[\frac{5}{9} \times 0.01 \times 36 + \frac{5}{12} \times 0.01 \times (t-36)\right] & \text{if } t > 36. \end{cases}$$

The penalty for early retirement is 5/9ths of 1 percent for the first 36 months. Then, on top of the 36 months, there is a 5/12ths of 1 percent penalty for each additional month. The premium for delayed retirement depends on the birth year and is capped once the person reaches 70. The maximum number of months for which a person can increase the premium for delayed retirement is the difference between 70 and their NRA.

Birth year	Gains for delayed retirement
1917-24	3%
1925-26	3.5%
1927-28	4%
1929-30	4.5%
1931-32	5%
1933-34	5.5%
1935-36	6%
1937-38	6.5%
1939-40	7%
1941-42	7.5%
≥1943	8%

The final calculation for the PIA ratio for the subgroup of uneducated, white women aged 65 in January 2005 is then given by

$$\text{PIA} = 1 + \frac{11}{12} \times (0.07 \times 2) + \frac{1}{12}\left(-\frac{5}{9} \times 0.01 \times 6\right).$$

13. For information on penalties for early retirement and gains for delayed retirement, see https://www.ssa.gov/OACT/quickcalc/early_late.html.

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Where Are the Workers? From Great Resignation to Quiet Quitting

Dain Lee, Jinhyeok Park, and Yongseok Shin

Abstract

To better understand the tight post-pandemic labor market in the US, we decompose the decline in aggregate hours worked into extensive margin changes (fewer people working) and intensive margin changes (workers working fewer hours). Although the preexisting trend of lower labor force participation, especially by young men without a bachelor's degree, accounts for some of the decline in aggregate hours, the intensive margin accounts for more than half of the decline between 2019 and 2022. The decline in hours among workers was larger for men than women. Among men, the decline was larger for those with a bachelor's degree than those with less education, for prime-age workers than older workers, and also for those who already worked long hours and had high earnings. The reduction in workers' hours can explain why the labor market is even tighter than what is expected at the current levels of unemployment and labor force participation.

JEL codes: J21, J22

Federal Reserve Bank of St. Louis *Review*, First Quarter 2024, *106*(1), pp. 59-71.
https://doi.org/10.20955/r.106.59-71

1. INTRODUCTION

Throughout 2022, US labor markets remained stubbornly tight despite the Federal Reserve raising interest rates rapidly in an effort to cool demand and tame inflation. The latest unemployment rate stood at 3.4 percent as of April 2023. The demand for workers is still unusually strong, with the vacancy rate at 5.8 percent in March 2023, although it has fallen from the historically high levels of 2022.[1] The tightness of the labor market has often been attributed to the decline in the labor force participation rate (see the references in Section 2.3). Indeed, the participation rate as of April 2023 is 0.7 percentage points below its pre-pandemic level in early 2020. But is this the whole story?

The aggregate hours worked of an economy can fall because fewer people work (extensive margin) or because those who work reduce their hours (intensive margin). In this article, we decompose the change in aggregate hours worked since 2007 into extensive and intensive margin changes and compare their relative importance.

Our main findings are as follows. First, the negative impact of the 2007-08 Great Recession on aggregate hours worked and the ensuing slow recovery through 2019 materialized almost exclusively along the extensive

1. The vacancy rate is defined as the number of job openings divided by the sum of employment and job openings.

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margin. However, of the 3 percent decline in annual hours worked *per person* (including those who do not work) between 2019 and 2022, more than half is accounted for by the intensive margin. That is, focusing only on the extensive margin (lower employment and participation rates) will underestimate the total decline in labor supply by more than half.

Second, the decline in labor force participation is a continuation of a trend that existed before the pandemic. The most striking fact is the lower participation of young male cohorts without a bachelor's degree, whose participation rate is up to 7 percentage points below that of older cohorts at the same age. The Great Recession seems to be casting a very long shadow, even on those who were in their teens when it happened.

Third, the decline in hours worked *per worker* (excluding those who do not work) between 2019 and 2022 was larger for men than for women. Among male workers, the decline was larger for those with a bachelor's degree than those with less education and for prime-age workers than older workers. Furthermore, the hours declined by more for workers who already worked longer hours and had higher earnings.

Finally, circumstantial and direct evidence indicates that the hours reduction among workers is voluntary. In addition, although the reduction may have been caused by the pandemic situation, it is expected to persist.

Two labor market phenomena were popularized following the pandemic: the Great Resignation in 2021 and Quiet Quitting in 2022, both of which appear in the title of this article. Although some of the people who quit as part of the Great Resignation did exit from the labor force (extensive margin), many others simply found a new job, possibly with an employer offering more flexible work arrangements and less demanding hours (intensive margin) as well as better pay.[2] Those who engage in quiet quitting do not actually quit or leave the labor force but instead stop placing excessive value on work and seek better work-life balance, including fewer hours (intensive margin). Our analysis helps us understand the role of both phenomena in the tightening of the labor market.

The rest of the article is organized as follows. Section 2 covers the trends in unemployment, vacancies, and labor force participation and discusses how the participation rates changed over time across various demographic groups. In Section 3, we decompose the changes in annual hours worked into the extensive and the intensive margins and compare their relative importance across demographic groups. We further discuss the significant decline in hours along the intensive margin between 2019 and 2022 in a broader context. Section 4 offers a summary and discusses the policy implications of our findings.

2. UNEMPLOYMENT AND LABOR FORCE PARTICIPATION

2.1 Trends in Unemployment and Vacancies

The left panel of Figure 1 shows the seasonally adjusted unemployment rate since 2007 as well as the impact of the Great Recession and the slow recovery that followed. In contrast, the recovery from the pandemic lockdown was swift, with the unemployment rate falling from the April 2020 peak of 14.7 percent to below 4 percent in 20 months.[3] The right panel plots the vacancy rate against the unemployment rate, which is known as the Beveridge curve. The vacancy numbers are from the Job Openings and Labor Turnover Survey by the Bureau of Labor Statistics (BLS). The panel shows an overall negative relationship between vacancies and unemployment, and it confirms that the vacancy rates of 2022 are historically high, even when the low unemployment rate is factored in. In the past, when unemployment rates were below 4 percent, vacancy rates were around 4 percent.[4] The US labor market at the end of 2022 was even tighter than what is expected at the near-record-low unemployment rate.[5]

2.2 Trends in Labor Force Participation

Whereas the demand for labor bounced back stronger during and after the pandemic, the supply of labor slackened. Figure 2 shows the participation rate, which is the percentage of the civilian noninstitutional population 16 years and older who is working or actively looking for work. The left panel shows the aggregate participation rate and the participation rates by gender (all seasonally adjusted). The dashed lines are the respective pre-pandemic average between 2017 and 2019. The aggregate participation rate fell steadily after the Great Recession until 2014, from 66 percent in July 2007 to 62.9 percent in January 2014. Although the downward

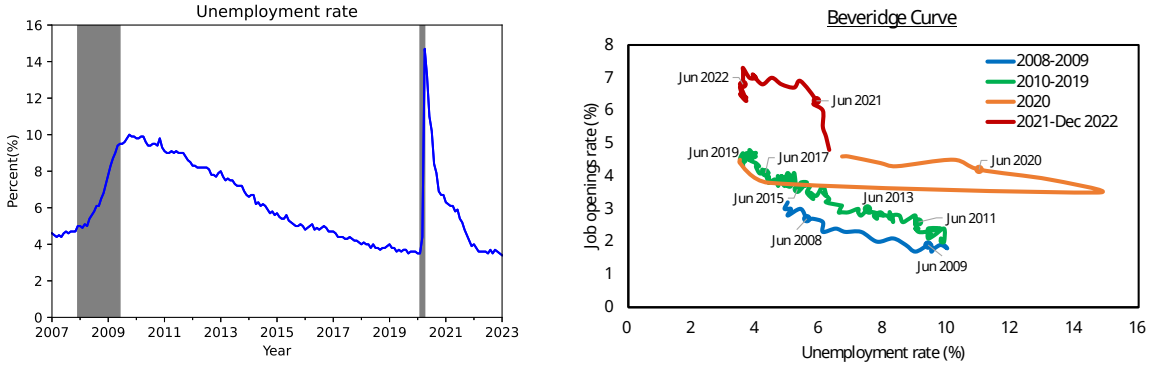
2. For this reason, the Planet Money blog of the National Public Radio called the Great Resignation "the Great Renegotiation" (https://www.npr.org/sections/money/2022/01/25/1075115539/the-great-resignation-more-like-the-great-renegotiation).

3. In comparison, after the Great Recession, it took six full years for the unemployment rate to fall from the October 2009 peak of 10 percent to the pre-recession level of below 5 percent. The rapid decline after the lockdown is explained by "recall" unemployment (Buera et al., 2021; Hall and Kudlyak, 2022; Lee, Park, and Shin, 2021).

4. Under the lockdown in April 2020, the unemployment rate shot up without much of a fall in vacancies. As unemployed workers were recalled to their previous employers, unemployment fell rapidly without much of a rise in vacancies.

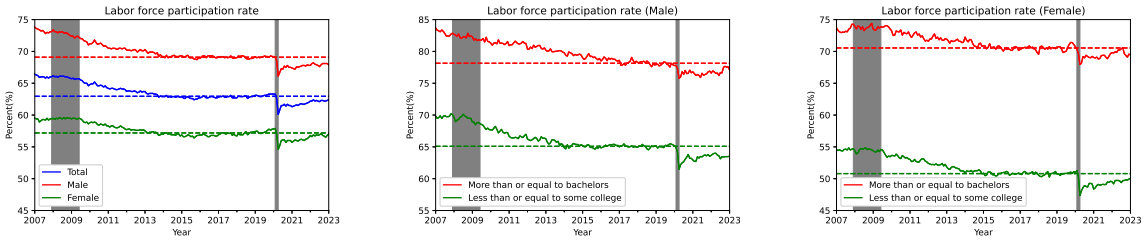
5. Domash and Summers (2022) made a similar point about the labor market at the end of 2021.

Figure 1
Unemployment Rate and the Beveridge Curve



NOTE: The left panel shows the monthly unemployment rate of the US since January 2007. The right panel shows the relationship between vacancy rates (vertical axis) and unemployment rates (horizontal axis) between January 2008 and December 2022. This relationship is known as the Beveridge curve.

Figure 2
Labor Force Participation Rate



NOTE: The left panel shows the labor force population rate for the overall population (blue line) and by gender (red for male, green for female). The middle panel divides men into two groups based on educational attainment and shows their participation rate: The first group (in green) includes those who never went to college and those who did but did not earn a four-year college degree, and the second group (in red) includes those who earned a four-year college degree or more. The right panel similarly divides women by educational attainment.

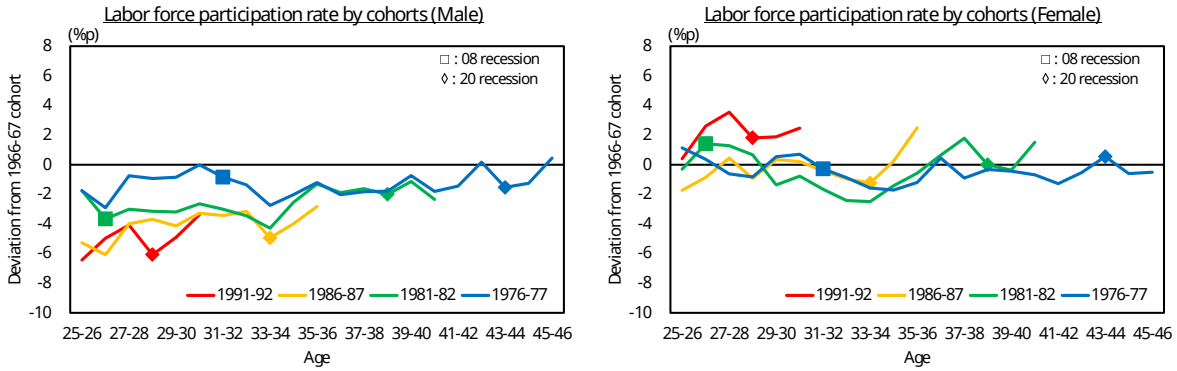
trend was arrested, the participation rate never recovered.[6] When the pandemic hit and the economy went into lockdown, the participation rate declined to 60.2 percent. Since then, it has risen steadily, and its level of 62.6 percent in April 2023 is 0.3 percentage points lower than the pre-pandemic level, the average between 2017 and 2019 represented by the horizontal dashed line.

The same panel shows that men and women have different levels but similar time trends. One difference is that men's participation rate fell by more than women's after both the Great Recession and the pandemic. Between July 2007 and January 2014, men's participation rate fell by 3.9 percentage points compared with women's 2.3. Similarly, men's participation rate in April 2023 of 68.1 percent is 1.0 percentage point lower than the average between 2017 and 2019, while women's participation rate in April 2023 of 57.3 percent is actually 0.1 percentage points *higher* than the average between 2017 and 2019.

The other two panels of Figure 2 show the participation rates by education for men (center panel) and women (right panel). Those with a four-year college degree or more are in the BA+ (more than or equal to a bachelor's) category, and the rest are in the SMC- category (less than or equal to some college). For both men and women, the two education groups have different levels but similar time trends. What is relevant for our purpose is the gap between the current and the pre-pandemic participation rates for each group. As of this writing, the latest figures by education are for March 2023. For men, the participation rate of both the less-educated and the more-educated groups in March 2023 is 0.9 percentage points lower than their pre-pandemic average. The gaps are 1.0 and 0.2 percentage points, respectively, for the less-educated and the more-educated women.

6. The peak participation rate was 67.3 percent, recorded during the first three months of 2000.

Figure 3
Participation Rates over Life Cycle, Deviation from the 1966-67 Cohort's Rate, by Gender



NOTE: Separately for men (left panel) and women (right panel), we compute the life cycle of participation rates for four cohorts, whose birth years are shown at the bottom. Their age profile of participation rates is shown as deviations from the participation rate of the 1966–67 birth cohort at the same age. The squares denote when the Great Recession hit each cohort, and the diamonds denote the COVID-19 lockdown.

Next, we examine the pattern in participation rates over the life cycle. To emphasize how the age profile of participation rates differs across cohorts, we first select five birth cohorts: those born in 1966–67 (ages 55–56 in 2022), 1976–77 (ages 45–46), 1981–82 (ages 40–41), 1986–87 (ages 35–36), and 1991–92 (ages 30–31). We then use the participation rates over the life cycle of the 1966–67 cohort as the baseline, and for each of the other four cohorts, we calculate how much their participation rates deviate from the 1966–67 cohort's rate at any given age.

Figure 3 shows the result, where the horizontal axis is age and the vertical axis is the deviation in the participation rate from the 1966–67 cohort's rate. The four lines end at the respective cohort's age in 2022. Since each cohort's age is different in any given calendar year (i.e., age = current year – birth year), we denote 2008 (Great Recession) with a square and 2020 (COVID-19 lockdown) with a diamond. The left panel shows the results for men and the right for women.

The first notable observation is that the participation rates of successive younger male cohorts are significantly lower than earlier male cohorts' rates at the same age. The 1981–82 and the 1976–77 cohorts' experiences show the long shadow cast by the Great Recession, denoted with squares. The age profiles of their participation rates fell significantly compared with the 1966–67 cohort, coinciding with the Great Recession, and a full recovery has not been achieved.[7] The 1991–92 and the 1986–87 cohorts, who experienced the Great Recession at even younger ages (16–17 and 21–22, respectively, not shown in the figure), have even lower participation rates in their late 20s and early 30s, which are on average 5 percentage points lower than the 1966–67 cohort's rate at the same age. For all cohorts, the pandemic lockdown seems to show only temporary effects.

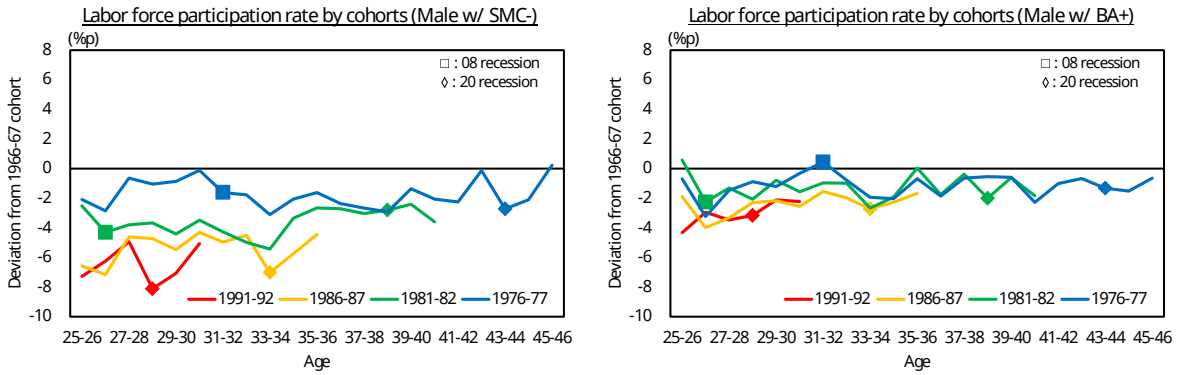
On the other hand, younger female cohorts' participation rates hew closely to the 1966–67 cohort's rates over the life cycle, in spite of the Great Recession. If anything, the youngest cohorts have higher participation rates than earlier cohorts at the same stages of the life cycle.

The lower participation rates of younger male cohorts are especially puzzling since younger cohorts tend to have more education, and more-educated people are more likely to participate, as seen in Figure 2. To be precise, 35.3 percent of the men in the 1991–92 cohort are in the BA+ category compared with 30.2 percent of the men in the 1966–67 cohort. Women show a much larger difference in educational attainment across cohorts. The fraction in the BA+ category is 42.1 percent for the 1991–92 cohort and 31.6 percent for the 1966–67 cohort. This difference may explain the slightly higher participation rates of the younger female cohorts.

To understand the role of education in the difference in participation rates across cohorts, we construct the analogue of Figure 3 separately for the two education groups for each gender. In the left panel of Figure 4, we plot the deviation of the participation rates of younger male cohorts in the SMC- category from those of the 1966–67 cohort in the SMC- category. In the right panel, we do the same for those in the BA+ category. It is clear that the lower participation rates of younger male cohorts are largely driven by those with less education.

7. The 1976–77 cohort seems to recover at ages 42–43 but only because the baseline cohort, 1966–67, is hit with the Great Recession at these ages.

Figure 4
Participation Rates over Life Cycle, Deviation from the 1966-67 Cohort's Rate, Men by Education



NOTE: We divide men into two groups by educational attainment: those with a four-year college degree or more in the right panel (BA+) and the rest in the left panel (SMC-). Separately for the two education groups, we compute the life cycle of participation rates for four cohorts, whose birth years are shown at the bottom. Their age profile of participation rates is shown as deviations from the participation rate of the 1966-67 birth cohort in the same education group at the same age. The squares denote when the Great Recession hit each cohort, and the diamonds denote the COVID-19 lockdown.

Compared with the SMC- group of the 1966-67 cohort, the SMC- group of the 1991-92 and the 1986-87 cohorts has participation rates that are on average 7 percentage points lower. While the BA+ group of younger cohorts also has lower participation rates than the BA+ group of the 1966-67 cohort, the gap is smaller, 3 percentage points on average.

Figure 5 shows the results for women, with the left panel representing the SMC- group and the right panel the BA+ group. The two education groups paint very different pictures. For the less educated, younger female cohorts have lower participation rates than the 1966-67 cohort, after they turn 30. In contrast, the BA+ group of younger cohorts has higher participation rates than the BA+ group of the 1966-67 cohort, after they turn 30. These opposing patterns of the two education groups roughly offset each other, generating the flat pattern around zero in the right panel of Figure 3.

2.3 Discussion on Labor Force Participation

Much has been written about the low participation rate during and after the economic recovery from the COVID pandemic, although the latest figure (April 2023) is fairly close to the pre-pandemic average from 2017 to 2019. Faria e Castro (2021) and Forsythe et al. (2022) point to the wave of earlier retirements by older workers. Goda and Soltas (2022) find that workers with a week-long COVID-related absence were more likely to leave the labor force the following year, which contributed to a 0.2-percentage-point decrease in the participation rate through June 2022. Abraham and Rendell (forthcoming) provide a comprehensive review of the above discussion.

Our finding emphasizing the low participation rates of less-educated young men suggests the effect of the pandemic was temporary and that the current participation rate reflects certain trends that have been ongoing for some time. This last point is related to Cooper et al. (2021) and Hobijn and Şahin (2022), who show that the claims of missing workers are exaggerated because of the downward trend in participation that was already present before 2020. They point to population aging in general as the cause of the trend, whereas we emphasize the low participation rates of young male cohorts.

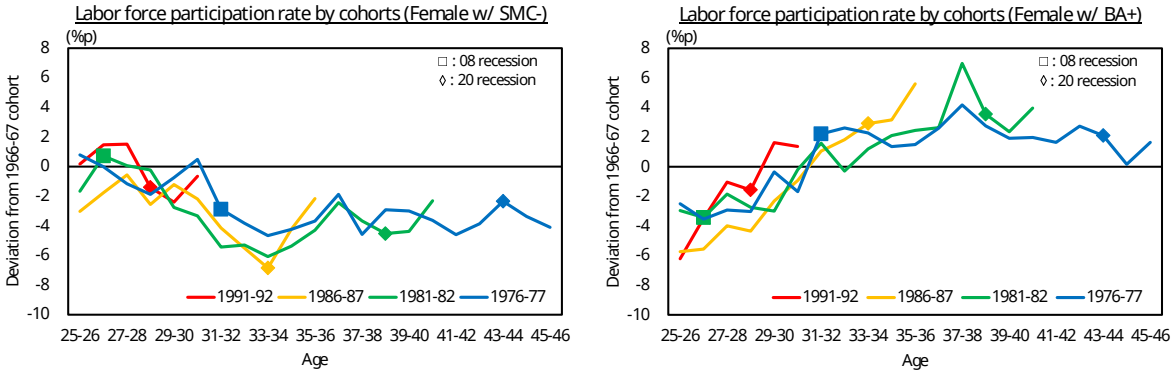
3. EXTENSIVE AND INTENSIVE MARGINS

The slack in the labor supply can arise not only from fewer people working or looking for jobs (lower participation rates) but also from workers working fewer hours. The former is the extensive margin, and the latter is the intensive margin. In this section, we more formally analyze how the change in aggregate hours worked of a population can be decomposed into extensive and intensive margin changes.

3.1 Data and Methodology

For population weights, worker characteristics, employment status, and actual hours worked, we use the Current Population Survey (CPS) from January 2007 to December 2022, taking yearly averages of the monthly

Figure 5
Participation Rates over Life Cycle, Deviation from the 1966-67 Cohort's Rate, Women by Education



NOTE: We divide women into two groups by educational attainment: those with a four-year college degree or more in the right panel (BA+) and the rest in the left panel (SMC-). Separately for the two education groups, we compute the life cycle of participation rates for four cohorts, whose birth years are shown at the bottom. Their age profile of participation rates is shown as deviations from the participation rate of the 1966-67 birth cohort in the same education group at the same age. The squares denote when the Great Recession hit each cohort, and the diamonds denote the COVID-19 lockdown.

data.[8] We restrict our analysis to the civilian noninstitutional population 25 years and older and do not use the panel dimension of the CPS. We use the actual number of hours the respondent reported working at their main job last week instead of relying on the usual hours worked question, as the latter does not specify the time frame and is thus less useful for measuring recent short-term changes in hours. The appendix has more details on the data, including a discussion of the actual versus usual hours.

We divide the entire sample period into three subperiods: 2007-13, 2013-19, and 2019-22. The first period is the impact and the sluggish recovery from the Great Recession. The middle is the second phase of the recovery from the Great Recession and a "new normal" leading up to the COVID pandemic. The last period is the recovery from the pandemic.

We decompose the changes in aggregate hours worked into the intensive and the extensive margins following Blundell, Bozio, and Laroque (2011). The total hours worked of a group change from one year to the next when (i) the number of people in the group (population weight) changes, (ii) the fraction of people in the group who work (employment rate) changes, or (iii) the average hours worked of those who work change. Since the number of people in a given demographic group is stable in the short run, we drop this channel from our analysis and focus on the other two channels. The extensive margin is the change in the employment rate multiplied by the average hours worked of those who worked in the current year. The intensive margin is the change in the average hours worked of those who worked, multiplied by the employment rate in the previous year.[9] The formal definition of the intensive and the extensive margin changes is in the appendix.

3.2 Results

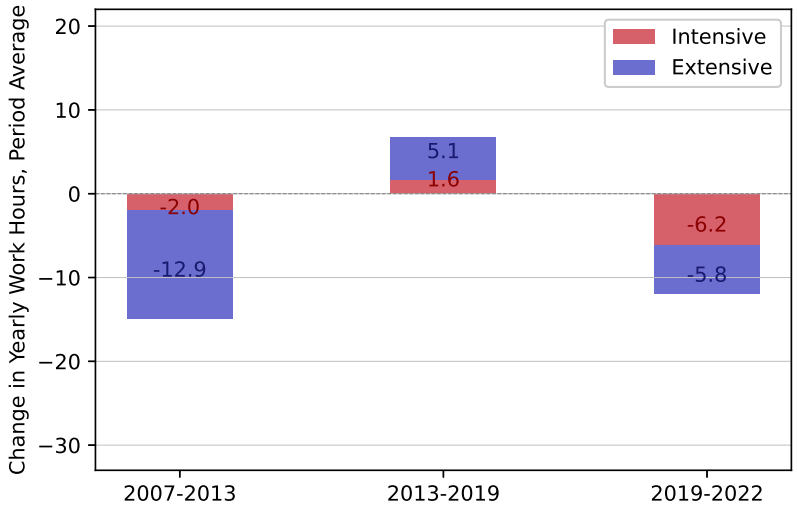
We start with the changes in annual hours worked per person of the entire population. Note that annual hours per person is computed as the product of average annual hours per worker and the employment rate, so those who did not work are included in this calculation. Between 2007 and 2013, the annual hours worked per person decreased by 14.9 hours each year on average, which means that, over the six years, the annual hours worked per person fell by 89.4 hours. Since the annual hours worked per person was 1,278 in 2007, this is a 7 percent decline of annual hours. Of the 14.9-hour-per-year decline, the vast majority, 12.9, comes through the extensive margin (i.e., fall in the employment rate) and the rest through the intensive margin (i.e., reduction in hours worked per worker). This result is consistent with the rise in unemployment in Figure 1 and the fall in participation in Figure 2 between 2007 and 2013, shown as the left bar in Figure 6.

The middle bar in Figure 6 shows the recovery in annual hours worked per person between 2013 and 2019. The 6.7-hour-per-year increase is mostly through the extensive margin, but the 40.2-hour increase in annual

8. An alternative data source for hours worked is Current Employment Statistics (CES). In the appendix, we explain why hours reported in the CPS are the relevant measure for our purpose.

9. As explained in Blundell, Bozio, and Laroque, 2011, this procedure picks the lower bound of the intensive margin change and the upper bound of the extensive margin change. An alternative is to construct the extensive margin by multiplying by the average hours worked of the previous year and the intensive margin by multiplying by the employment rate of the current year, which gives the upper bound of the intensive margin and the lower bound of the extensive margin. The decomposition results are similar either way.

Figure 6
Decomposition of Change in Aggregate Hours Worked



NOTE: The vertical positions of the red and the blue bars are the changes in annual hours worked per person through the intensive and the extensive margins, respectively. The numbers are the average change per year over the given period, so the total change can be computed by multiplying each number by the period length, six years for the first two periods and three years for the last period.

hours worked per person over this six-year period did not fully offset the 89.4-hour decline in the previous six years. This result is consistent with the finding in Figure 2 that the participation rate never went back to its level before the Great Recession.

The right bar shows the change in annual hours worked per person between 2019 and 2022, which is meant to capture the impact and the recovery from the COVID pandemic. The 12.0-hour decline per year over the three years translates into a 36.0-hour drop in annual hours worked per person (from 1,229 to 1,193), and it obliterated more than 80 percent of the 40.2-hour increase recorded during the preceding six years. What stands out is that more than half of the decline came through the intensive margin rather than the extensive margin. That is, focusing only on the extensive margin as we did in Section 2, one will miss more than half of the hours worked decline since 2019.

In the left panel of Figure 7, we repeat the decomposition but separately for men and women. During the first period, men recorded more than double the fall in annual hours worked that women did. The recovery during the second period was more even between men and women. In both periods, most of the adjustments occurred along the extensive margin, as in Figure 6. During the last period, it was again men who experienced a much larger drop in annual hours worked per person. For them, the drop along the intensive margin was larger than that along the extensive margin.[10]

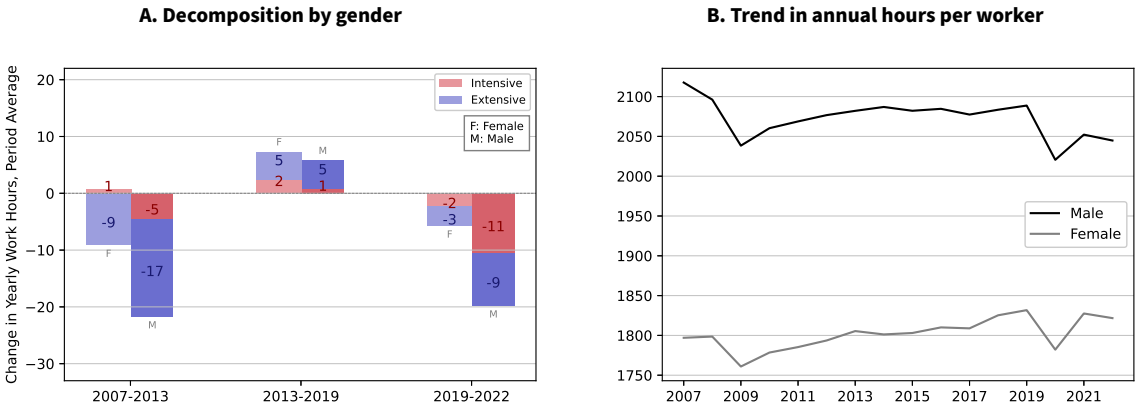
The right panel of Figure 7 shows the annual hours worked per worker (i.e., excluding those not working) for men and women since 2007. Working men log longer hours than working women on average, but the drop in hours since 2019 is larger for men than for women. In addition, we see that working women's hours has actually increased since 2007, unlike working men's hours.

As in Section 2, we further group men and women by educational attainment. Unlike in that section, however, we have three education groups here: those with a high school degree or less, those with some college education but no bachelor's degree, and those with a bachelor's degree or more.[11] Figure 8 shows the results. The first sets of bars in the left (women) and the right (men) panels show that, between 2007 and 2013, high school and some college groups experienced larger declines in annual hours worked per person than college graduates, with nearly all adjustments occurring at the extensive margin. The middle sets of bars show that the recovery between 2013 and 2019 was strongest for women (left panel) and men (right panel) with a

10. Alon et al. (2021) find that in the pandemic recession, women were hit harder and the employment gap (extensive margin) between men and women widened. This was true during their sample period, which is from February to October 2020. Our pandemic period is from 2019 to 2022, and we find the opposite pattern.

11. The first group, labeled "HS," includes high school graduates as well as dropouts. The second group, labeled "SMC," has attended some college but have no degree or has an associate's degree. The third group, labeled "BA+," has at least a bachelor's degree.

Figure 7
Decomposition of Change in Aggregate Hours Worked by Gender



NOTE: In the left panel, the vertical positions of the red and the blue bars are the changes in annual hours worked per person through the intensive and the extensive margins, respectively. The numbers are the average change per year over the given period, so the total change can be computed by multiplying each number by the period length. For each period, the left bar represents women and the right represents men. The widths of the bars are proportional to the population weight of each group at the beginning of the period. The right panel shows the annual hours worked per worker for men and women, from 2007 to 2022.

high school degree or less, again mostly through the extensive margin. The right sets of bars show the change between 2019 and 2022. For both women (left panel) and men (right panel), the drop in annual hours worked per person was largest for the some college group. Furthermore, the intensive margin (hours per worker) was much more important for men. In particular, for men with a bachelor's degree or more, the intensive margin change was more than double the extensive margin change.

We can also do the decomposition across age groups. For both men and women, we construct four age groups: ages 25 to 39, 40 to 54, 55 to 64, and 65 and older. Unlike in Section 2.2, where we follow cohorts over time, we group people by their age in each year. During the first period, 2007–13, as shown by the left sets of bars in both panels of Figure 9, annual hours worked per person fell the most for the first two age groups of women and men (prime-age women and men), mostly along the extensive margin. Surprisingly, the oldest group increased their annual hours worked per person along the extensive and the intensive margins.[12]

During the second period (the middle set of bars in both panels), the annual hours worked per person grew robustly for all age groups, both for women and men. Again, most of the rise occurred along the extensive margin. One difference is that for women, the annual hours per person of the youngest group (25–39) grew the most, whereas for men, it was those aged 55–64 that increased their hours per person the most.

The final period, 2019–22 (the right set of bars in both panels), shows very different patterns between women and men. For women, the annual hours of the youngest group move in opposite directions along the extensive and the intensive margins, resulting in negligible net changes in hours per person. Women aged 40–54 and 55–64 decreased their hours modestly along the intensive margin. For women 65 and older, the annual hours per person fell, almost exclusively along the extensive margin. For men, between 2019 and 2022, the fall in annual hours per person was largest among prime-age men, most of it along the intensive margin.

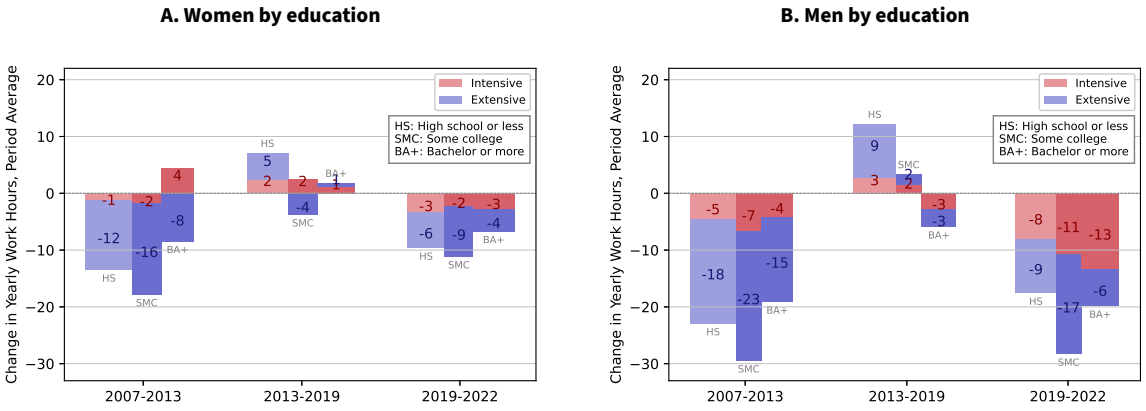
In summary, the 2019–22 period is unique in that the majority of the changes in annual hours worked per person occurred along the intensive margin rather than the extensive margin. In earlier periods, the intensive margin changes were negligible. During this period, the intensive margin decline was more pronounced for men than women, especially men with a bachelor's degree or more and in prime ages (25–54). Consistent with the result from Section 2, the extensive margin declines were larger for young men without a bachelor's degree.

3.3 Decline of Hours Worked among Male Workers

The result of our decomposition for the 2019–22 period emphasizes the reduction in hours by those who work. In this section, we examine how the distribution of annual hours among those who work changed over time. Since the intensive margin changes were more pronounced for men than for women, we only consider men in this section.

12. The increased employment rate of older workers in the early stages of recovery from the Great Recession is consistent with the evidence discussed in Aum, Lee, and Shin (2017).

Figure 8
Decomposition of Change in Aggregate Hours Worked by Education and Gender



NOTE: The vertical positions of the red and the blue bars are the changes in annual hours worked per person through the intensive and the extensive margins, respectively. The numbers are the average change per year over the given period, so the total change can be computed by multiplying each number by the period length. The left panel shows results for women and the right for men. For each period, the left bar represents those with only a high school education, the middle represents those with some college education but no four-year degree, and the right represents those with a four-year college degree or more. The widths of the bars are proportional to the population weight of each group at the beginning of the period.

Table 1
Percentiles of Annual Hours Worked, Male Workers

Percentile	2007	2013	2019	2022	2013-17	2013-19	2019-22
10th	1,560	1,560	1,560	1,560	0	0	0
25th	2,080	2,080	2,080	2,080	0	0	0
50th	2,080	2,080	2,080	2,080	0	0	0
75th	2,496	2,340	2,340	2,340	-156	0	0
90th	2,964	2,860	2,860	2,704	-104	0	-156

In Table 1, we report selected percentiles of the annual hours worked distribution among men who worked in a given year. Because people report weekly hours, which we then multiply by 52, the values cluster to certain integers. For example, in all four years, the 25th percentile and the median are 2,080 hours of work during the year. Nevertheless, it is clear that those who work very long hours cut back on their hours between 2019 and 2022, evidenced by the significant hours reduction at the 90th percentiles but not at the median. In 2019, one had to work for at least 2,860 hours (55 hours per week) to rank in the top 10 percent of workers working longest hours. In 2022, one needed to work "only" 2,704 hours (52 hours per week) to win this dubious honor.

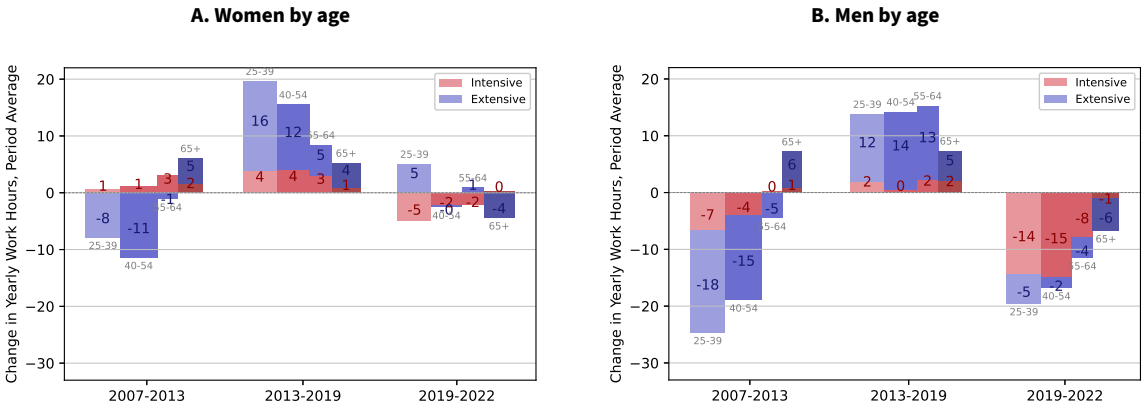
We can also examine the reduction in annual hours across the earnings distribution. For each year, we construct earnings deciles and compute the average hours worked of male workers in each decile. Figure 10 shows the result, and we make two observations. First, the average hours worked in a given earnings decile remained fairly stable between 2007 and 2019. Second, the average annual hours worked between 2019 and 2022 declined in all deciles except the lowest two but declined more at the higher end of the earnings distribution. Male workers in the ninth and the top deciles of the 2022 earnings distribution worked 51 and 79 fewer hours than those in the respective earnings decile in 2019. In summary, male workers with long hours and high earnings reduced their annual hours worked between 2019 and 2022 the most.

3.4 Discussion on Hours Decline

One natural question is whether this reduction in hours among those who work is voluntary or involuntary. Both circumstantial and direct evidence indicates that it is voluntary. The tight labor markets with high vacancy rates (Section 2.1) suggest that workers would have opportunities to work more hours if they so choose. More important, Faberman, Mueller, and Şahin (2022) provide direct survey evidence revealing a sharp decline in people's desired work hours during the COVID pandemic that persisted through the end of 2021. Our analysis shows that workers indeed reduced their work hours at least through the end of 2022.

In addition, as shown in the left panel of Figure 7, the hours per worker actually fell between 2021 and 2022

Figure 9
Decomposition of Change in Aggregate Hours Worked by Age and Gender



NOTE: The vertical positions of the red and the blue bars are the changes in annual hours worked per person through the intensive and the extensive margins, respectively. The numbers are the average change per year over the given period, so the total change can be computed by multiplying each number by the period length. The left panel shows results for women and the right for men. For each period, each bar stands for an age group as noted. The widths of the bars are proportional to the population weight of each group at the beginning of the period.

as the pandemic was fast receding. This pattern suggests that the hours reduction lasting through the end of 2022 cannot be explained by such pandemic-period factors such as sickness (Ham, 2022), fear of infection (Aum, Lee, and Shin, 2021), or child care needs during school closures (Garcia and Cowan, 2022). While determining the cause of the hours reduction is beyond the scope of this article, we conjecture that shifts in preference toward better work-life balance, manifested by the quiet quitting phenomenon, is an important factor. The pandemic may have motivated people to reevaluate their life priorities and also gotten them accustomed to more flexible work arrangements (e.g., work from home), leading them to choose to work fewer hours, especially if they could afford it. Our finding that the hours reduction is larger for those in the right tail of the hours and the earnings distributions supports this interpretation.

In this view, the reduction in hours worked may well persist, and that would not be a perverse outcome. The US stands out among advanced economies in terms of annual hours worked per worker. According to the OECD, the average US worker worked 1,791 hours in 2021. This amount is significantly higher than the corresponding number from other advanced economies: Canada (1,685), Japan (1,607), the UK (1,497), France (1,490), and Germany (1,349), for example.[13] In this context, if anything, there is room for hours worked per worker to further decline in the US.[14]

4. CONCLUDING REMARKS

Widespread worker shortages are what defined the tight labor markets of 2021 and 2022. The 1-percentage-point decline in the labor force participation rate between 2019 and 2022 is definitely part of the story, but this article shows that it is not the whole story. In fact, more than half of the decline in aggregate hours worked occurred through the intensive margin: Those who worked reduced their hours.

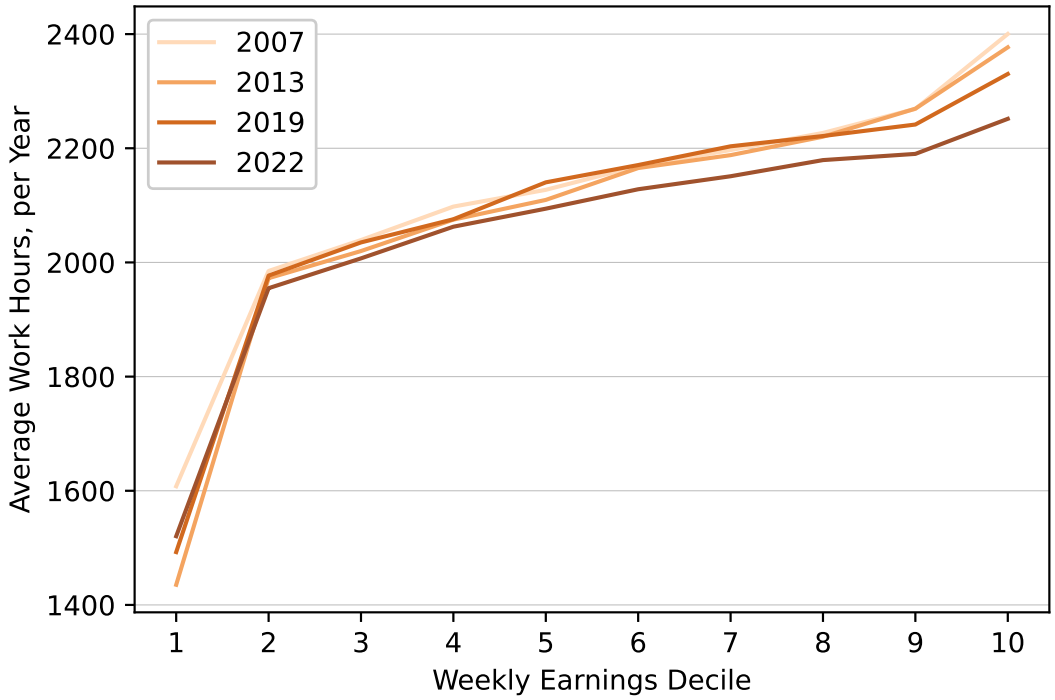
The lower participation rate is, to a large extent, a continuation of a trend that existed since the Great Recession, especially the lower participation of younger male cohorts without a bachelor's degree. The reduction in hours among workers is a new phenomenon induced by the pandemic, but available evidence suggests that it will likely stay with us. Indeed, as of May 2023, the participation rate has returned to the pre-pandemic level, but the hours worked per worker still shows no sign of recovering. The reduction in hours was larger for prime-age male workers with a bachelor's degree as well as for those male workers who already worked longer hours and earned more.

A lesson for researchers and policymakers is that one must pay attention to hours worked of workers, in

13. The OECD countries with higher annual hours worked per worker than the US are, in descending order, Mexico (2,127), Costa Rica (2,073), Colombia (1,964), Chile (1,915), Korea (1,915), Greece (1,872), and Poland (1,830). The richest among them is Korea, but even its GDP per capita is only two-thirds of the US's.

14. To provide a historical background, the annual hours worked per worker fell from over 2,000 in the 1950s to 1,770 in 1982, after which it exhibited neither downward nor upward trends.

Figure 10
Average Annual Hours Worked across Earnings Deciles, Male Workers



addition to the employment or participation rate, to have an accurate assessment of the labor market conditions. In the current labor market, focusing only on unemployment and labor force participation will lead to a significant underestimation of the tightness of the labor market, which echoes the conclusion of Domash and Summers (2022) and Faberman, Mueller, and Şahin (2022) about the labor market of 2021. Relatedly, Bick, Blandin, and Fuchs-Schündeln (2022) emphasize the importance of the hours margin in growth-accounting exercises and in the projection of potential labor supply.[15]

While we made some conjectures based on available evidence as to why workers reduced their hours and whether they will continue to do so, these remain open questions. In addition, it will be fruitful to have a better understanding of the lower labor force participation of younger male cohorts, both its causes and consequences. These important topics are left for future research.

APPENDIX 1. NOTE ON DATA

Hours Worked We use AHRSWORK1 in IPUMS-CPS (Flood et al., 2022). Hours worked is the actual number of hours the respondent reported working at their main job last week. They are reported only for those who are employed during the survey week. The values for this variable are integers ranging from 0 to 99. Hours above 99 are recorded as 99 hours. Those who report zero hours account for less than 0.1 percent of the employed. About 4 percent of the employed do not report hours, but they are included when the employment rates are calculated.

Earnings Figure 10 uses EARNWEEK in IPUMS-CPS. Earnings is how much the respondent usually earned per week at their current job, before deductions. We exclude samples with weekly earnings smaller than $1.

Employment Status "Employed" includes both those employed and at work last week and those employed but not at work, for example, due to sick leave, in the EMPSTAT variable in IPUMS-CPS.

15. In their analysis of data from 18 European countries and the US between 1997 and 2019, they document a downward trend in hours per worker and an upward trend in the employment rate in most countries. They construct a model that rationalizes these divergent trends.

APPENDIX 2. ALTERNATIVE DATA SOURCE FOR HOURS WORKED

Usual Hours Worked As explained in the main text, we choose actual hours worked because the timeframe is unspecified for the usual hours question (variable name UHRSWORK1) in the monthly CPS samples. The usual hours variable (UHRSWORKLY) in the Annual Social and Economic Supplement (ASEC) samples of the CPS is an alternative. This variable specifies the timeframe as the previous calendar year and reports hours worked over all jobs. We could get annual hours worked last year by multiplying this usual hours variable by weeks worked last year. Using this specification, data are available up to 2021. The results for the first two periods, 2007–13 and 2013–19, are similar except that extensive margins come out slightly stronger than in our benchmark result. This could be explained by the fact that respondents are reporting their usual hours of work, which may exclude short-term decreases in hours, or they may be prompted to include paid vacation and sick leaves as part of their weeks worked variable.

CES CES, a payroll survey, is an alternative source of hours worked data. It shows there has been a small increase in the average hours per worker between 2019 and 2022, whereas the CPS shows the opposite. There are four possible reasons for this discrepancy. First, the coverage of the survey is different. CES samples establishments with employees and excludes those who are self-employed. However, when we exclude the self-employed from our CPS sample, the discrepancy between the two series remains, so this cannot be the reason. Second, the unit of CES is a job in an establishment, while the unit of the CPS is an individual. This distinction matters because an individual may have multiple jobs. Third, CES reports all paid hours, so if employees go on a paid vacation or a paid medical leave, they will be still counted as if they were working. In the CPS, a vacation or medical leave shows up as fewer work hours, whether it is paid or not.

Last, there is a measurement issue. The CPS asks workers directly how many hours they work during a week. However, CES is an establishment-level survey, so an HR manager would possibly answer this question. For hourly workers and those eligible for overtime pay, it is reasonable to think that the manager has an accurate record of their hours. However, a large fraction of workers in the US are salaried exempt workers.[16] It is unlikely that the HR manager has a good statistic on the work hours of exempt workers since there is no need to keep track of their work hours. Based on the last three reasons, we believe that directly asking workers about their hours will give us a more reliable answer.

In addition, the American Time Use Survey by the BLS, which is another individual survey, also shows that hours worked has declined since COVID, although the 2022 data are not yet available as of this writing.

APPENDIX 3. DEFINITION OF INTENSIVE AND EXTENSIVE MARGINS

We closely follow the method of Blundell, Bozio, and Laroque (2011). A period is a year and is indexed by t, and groups are indexed by $j = 1, ..., J$. q_{jt} is the population share of group j. Hours per person for each group j in year t, H_{jt}, is the product of hours per worker h_{jt} and employment rate p_{jt}: $H_{jt} = h_{jt}p_{jt}$. Aggregate hours per person, H_t, is the population-weighted sum of hours per person of each group: $H_t = \sum_{j\in J} q_{jt}H_{jt}$.

The structural effect due to the change in the composition of population is $S_t = \sum_{j\in J} H_{jt}[q_{jt} - q_{j,t-1}]$. In addition, the change in hours per person of group j, using the population weight of period $t-1$, is $\Delta_{jt} = q_{j,t-1}[H_{jt} - H_{j,t-1}]$. The total change across all J groups is then $\Delta_t = \sum_{j\in J} \Delta_{jt}$. By construction, $H_t - H_{t-1} = S_t + \Delta_t$.

To obtain the desired decomposition, assume linearity and that the intensive margin has the same sign as the change in hours per worker from the previous period ($\Delta h_{jt} = h_{jt} - h_{j,t-1}$). Then we have

$$I_{jt} = p^I_{jt}\Delta h_{jt} \quad \text{and} \quad E_{jt} = h^E_{jt}\Delta p_{jt},$$

where $\Delta p_{jt} = p_{jt} - p_{j,t-1}$, and the extensive margin follows from the identity $\Delta_{jt} = q_{j,t-1}(I_{jt} + E_{jt})$.

There are two alternatives for p^I_{jt}: $p_{j,t-1}$ and $p_{j,t}$, corresponding to $h^E_{jt} = h_{j,t}$ and $h_{j,t-1}$ respectively. That is,

$$\Delta_{jt} = q_{j,t-1}[p_{jt}\Delta h_{jt} + h_{j,t-1}\Delta p_{jt}] \quad \text{and} \quad \Delta_{jt} = q_{j,t-1}[p_{j,t-1}\Delta h_{jt} + h_{j,t}\Delta p_{jt}].$$

16. The term "exempt" comes from the Fair Labor Standards Act (FLSA). These workers are exempt from overtime pay. Employees exempt from the FLSA must be paid a salary above a certain level and work in an administrative, professional, executive, computer, or outside sales role.

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