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"Increasing Risk, Finance, and Ways to Avoid Future Crises: The Role of Public Banking"

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The 21st century has experienced at least two global financial crises, and myriad national level financial crises. At the same time, the world is in great need of capital development and deployment to mitigate and halt the climate crisis by transition away from carbon-emitting infrastructure towards carbon neutral solutions. As central banks have pivoted from historically low interest rates in the wake of the Coronavirus Pandemic and the Global Financial Crisis towards a rapid and wide-spread rate hiking regime, we are presented with a paradox. When central banks have targeted low interest rates in recent decades, private financial interests have promoted bubbles in crypto-currency, the stock market writ large, and widespread corporate stock buy-backs; as rates rise, formerly profitable ventures in the tech industry have crumbled, and financing for carbon transition may be at risk. This paper proposes two solutions. First, governments may create and build upon existing public finance at retail and corporate levels to ensure safe access to deposits and to promote the transitions they seek even as central banks hike interest rates. Second, central banks may build upon recent liquidity innovations they debuted during the Coronavirus pandemic: through the use of targeted credit facilities, central banks like the Federal Reserve might stimulate particular sectors, particularly if evidence mounts that transition efforts are hampered by bank failures and rising rates. Drawing on historical examples, this paper highlights that the US government has successfully deployed these strategies before, while acknowledging how the government has explicitly and implicitly discriminated using these policies, and how the government should approach these challenges differently going forward.

JEL codes: B5, G01, H12, Q58, E44

Keywords: Finance, Crisis, Monetary Policy, Keynesian Theory, Climate Finance

Introduction

At the time of writing, the combination of both a need to adapt to ongoing climate change and to reduce carbon emissions as well as inflation related to supply shortages both induced by the Coronavirus Pandemic as well as structural downsizing of the global economy after 2008 demand greater physical capital investment by firms and household world-wide. However, this need for investment has coincided with central banks' coordinated push to raise interest rates in order to reduce inflation, whether it was primarily driven by demand or supply factors, as well as obvious financial instability due to a spate of private bank failures, which were at least partially a consequence of deregulation measures implemented 10 years after the onset of the Global Financial Crisis [GFC] of 2008. Policy responses to those bank failures included liquidity support for banks in the forms of lower discount rates, billions of US dollars' worth of discount lending by the Federal Reserve, as well as a reinstatement of dollar swap lines for 14 central banks around the world, even as the Fed maintained interest rate hikes, with spillover effects around the world. (Smialek, 2023a; DePillis, 2023)

This paper argues that public finance in various forms has the potential to stimulate investment in targeted initiatives, particularly as the relative risk of private finance and the cost of borrowing has grown for households and firms. At the time of writing, climate mediation and supply shocks across multiple industrial sectors in US and elsewhere in the world have illuminated the need for greater

capital investment, while central banks have raised interest rates to stifle demand in response to inflation. (Zeitlin, 2023) While central banks have shown a propensity to assist firms and banks in recent crises, this support dissolved as economies returned from the brink of crises during the Pandemic and inflation rates increased worldwide. (Russell and Smialek, 2023) Moreover, recent bank-level instability has revealed the latent issues with financial deregulation in the past decade. Though many economies increased financial regulation measures in the wake of the 2008 GFC relative financial stability in the following decade and large-scale lobbying by financial actors and institutions fostered successful political movements to decrease financial regulations. In March and April of 2023, a series of bank failures at so-called medium-sized banks that had lobbied for deregulation focused global attention on this financial risk, and precipitated another round of liquidity support from central banks, even as households and firms have suffered from contractionary monetary policies designed to reduce demand at domestic and global levels. (Smialek, 2023b)

This paper links the Post-Keynesian ideas of increasing risk and financial fragility with supply-side uncertainty at the time of writing, including Pandemic-related shortages, climate change induced volatility, and financial risk embodied by private bank failures. It argues that while novel monetary policies during the Coronavirus Pandemic proved that central banks can foster spending and lessen the negative effects of crises, anti-inflationary policies that fail to address supply-side issues are likely to exacerbate increasing risk due to physical and political features of the global economy. There is a strong role for public financial institutions to insure private lending and borrowing as well as to lend directly to firms and households to foster development that may hedge against physical sources of instability in the global economy. While public finance is subject to its own limitations, including political jockeying over programs, prioritizing some interests over others (eg: corporations' interests over households'), well designed public finance policies have the potential to decrease the risk of private investment, as well as to kickstart spending when private lenders and investors are too bearish to lend.

The paper is structured as follows. The next section briefly defines the concept of increasing risk, and applies to both the real sector as well as the financial sector. The third describes current sources of increasing risk, including the physical consequences of climate change, political factors like ongoing wars, and financial factors like recent bank failures that have inhibited private investment in climate mediation other ventures, and contributed to supply-side inflation since the Coronavirus Pandemic of 2020. The fourth discusses how monetary policy could be supplemented by public finance to promote spending on physical capital crucial to both improving supply-side resilience as well as mitigating climate change at national and global levels. The final section concludes.

Fundamental Uncertainty, Increasing Risk, and Investment

This section of the paper discusses fundamental uncertainty and increasing risk as inhibitors of capital expenditure that might increase global resilience to climate change, mitigate carbon emissions, and generally increase production capacity in ways that might reduce production costs even as demand increases globally. It considers both Keynes's notion of fundamental uncertainty as well as Kalecki's notion of increasing risk as sources of bearishness for both the real and the financial sector of any given economy, and how an array of backstops including liquidity support, lending guarantees, and direct lending might counter those tendencies in the midst of uncertainty and increasing risk.

Both fundamental uncertainty and increasing risk deal with the reality of how different sectors of the economy make decisions given their inability to predict the future. Expectations of the

future are central components of consumption, investment, and lending in Keynesian economic theory. Since these sectors of the economy consider the future, their relative optimism, pessimism, or uncertainty about economic outcomes strongly shape their behavior. In *The General Theory*, Keynes argued that firms' propensity to invest in physical capital, and financial institutions' propensity to lend, were tempered by their relative uncertainty about outcomes. (Keynes, 1964) While firms and banks might be able to estimate relative risk for a given venture, their decisions were equally shaped by an understanding that they could never know what the future might be. (Crotty, 1992) Despite this fundamental uncertainty, firms would still spend on physical capital and banks would lend to those ventures conditional on their prediction that effective demand would sustain those decisions, and that there weren't better or more reliable investment alternatives, such as the purchase of securities or other forms of portfolio enhancement.

Kalecki's idea of 'increasing risk' expands on the consequences of uncertainty. In Kalecki's framing, non-financial firms and financial intermediaries both assess the relative payoff of investment and lending before initiating that spending. (Kalecki, 1937) Any nonfinancial firm deciding to invest in physical capital must consider the cost of those investments, both in terms of the cost of expansion as well as the capital costs if they must borrow to fund those expansions. Those firms also consider the likely return on those investments. This requires firms to consider the state of effective demand in both the present, near-term, and longer-term future. In periods of heightened uncertainty and volatility, investment costs are likely to increase, and the potential returns on investment may potentially decrease. Together, these dynamics increase the relative 'bearishness' that real sector firms exhibit vis-à-vis investment. (Mott, 2010) Financial intermediaries and firms also consider relative payoffs before lending. These entities consider both the likely return on business ventures as well as the potential return on alternative investment strategies. Increased volatility that pushes down the potential return on physical investment may make other investments more attractive, and limit the ability of firms to develop needed infrastructure.

Since capital investment is often irreversible or costly to reverse, nonfinancial and financial firms also assess the potential changes in liquidity and solvency that may occur after investment. The greater the volatility of an economy and the less certain effective demand, the greater the likelihood that firms will postpone capital investment expenditure, and the greater the likelihood that financial intermediaries will forgo lending, charge higher interest rates, or require more collateral from nonfinancial firms. (Mott, 2010) Increasing costs of financing physical capital expenditure are likely to further inhibit investment expenditure by firms that cannot afford to self-finance, particularly if effective demand is uncertain. (Minsky, 1980) However, policies that decrease uncertainty for firms and banks have the potential to reverse this trend. Loan guarantees, targeted asset buy-back facilities, and backstops have the potential to relieve financial intermediaries' fears that lending may lead to liquidity or insolvency issues in the future, and charge lower interest rates and require less expensive collateral. (Bordo and Duca, 2022) Nonfinancial firms then benefit from this willingness to lend through lower cost credit, inducing more expenditure despite uncertainty of payoff on the venture in question, or lower than normal effective demand.

The next section of this paper discusses an array of sources of increasing risk and uncertainty that have emerged since the onset of economic crises related to the Coronavirus Pandemic in March 2020. It includes physical, political, and economic sources of risk that have affected investment and lending globally at the time of writing.

Physical, Political, and Economic Sources of Increasing Risk from 2020 Onward

In the 21st century, there have been two large global economic crises and recessions. While global spending took years to recover from the onset of the 2008 GFC, the dramatic downturn in spending

in the early months of global lockdown in March and April of 2020 was followed by much faster returns to spending, in part due to large fiscal and monetary responses. However, the economic aftermath of the COVID-19 pandemic has included prolonged supply shocks due to variations in national approaches to containing the virus, international wars that have depressed production of key primary goods and services, and sustained waves of extreme weather events linked to climate change that have destroyed crops, slowed trade, and otherwise inhibited production. These effects have been compounded by contractionary monetary policies designed to inhibit inflation as global prices have risen, and further complicated by bank failures in the US and beyond in early 2023. This section of the paper considers how these events have increased risk for producers and potential lenders, and constrained investment necessary for reducing carbon emissions and mitigating key drivers of inflation in many global economies.

Most global economies implemented lockdowns in the earliest months of the global Coronavirus pandemic in order to stem contagion. (Gopinath, 2020; Allain-Dupre et al, 2020; Yamaka et al, 2022) Lockdowns began occurring as early as January 2020 in China, which had ripple effects along the supply chain which were exacerbated by shutdowns occurring elsewhere in the world. (Çakmakli et al, 2020; Maria del Rio-Chanona, et al, 2020; Lafrogne-Joussier, Martin, and Mejean, 2023) When demand increased, producers world-wide struggled to keep pace, and many supply shortages ensued. (Sarkis, 2020; Weber et al, 2020) Surging demand also revealed the extent to which many industries had reduced their productive capacity in response to the GFC and the Great Recession. (Hein, 2015; Summers, 2015) While rapid and large fiscal responses by governments initiated an unprecedentedly large and quick recovery in the US and elsewhere in the world, structural lags in productive capacity contributed to bottlenecks in industrial production, which added to domestic and global inflation. (Weber et al, 2022; Khan and Williams, 2021) Different international approaches to lock down duration versus vaccine uptake heightened these shortages: economies that relied predominantly on lock-downs to inhibit the spread of COVID-19 once vaccines were available experienced longer and more frequent delays and temporary holds on production as a consequence of repeated outbreaks of Coronavirus in their economies. (Suárez Ricaurte, 2022)

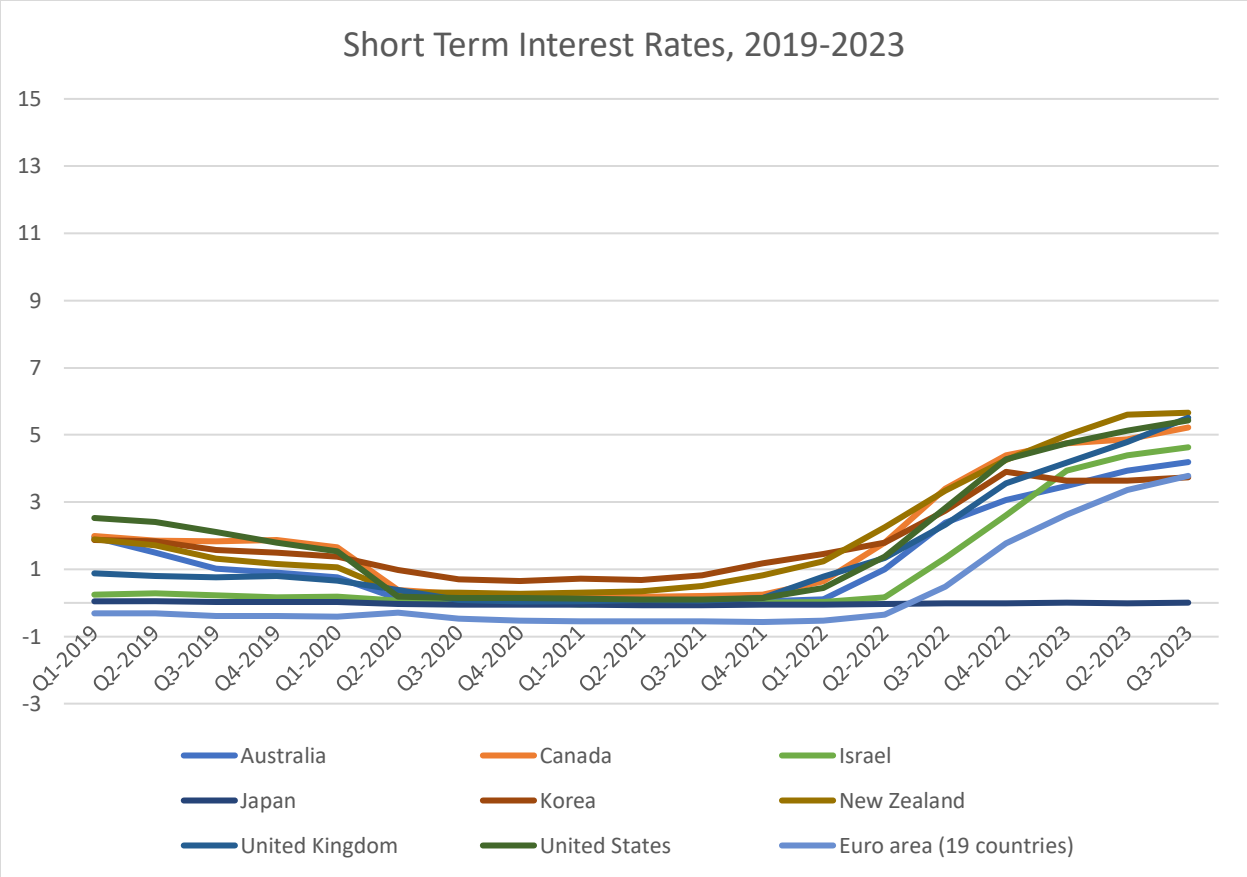
Global supply chains also proved their vulnerability to physical and political non-pandemic related shocks. Repeated bouts of climate change related severe weather—wild fires, droughts, floods—have decimated agricultural commodities including timber, wheat, rice, grapes, apples, peas, and myriad other agricultural products. (Gustin, 2022; Sengupta and Le Thuy, 2023; Severson, 2023) These agricultural shortages have contributed to supply shocks exacerbated by both the pandemic, in the case of lumber and housing shortages, as well as wars occurring in parts of the world that produce both fossil fuels, natural gas, and wheat. (Kabundi, Mlachila, and Yao, 2022;) All of these commodities are widely used in the production of other goods, heightening the inflationary pressures resulting from the pandemic. (Weber et al, 2022) Moreover, these developments follow years of turbulence in global markets resulting from the Trump administration's initiation of trade wars with other economies, namely China and European nations.

Central banks' global attempt to combat rising global prices with contractionary monetary policy has compounded physical sources of risk inhibiting both producers' willingness to invest in physical capital and production and banks' willingness to lend to those ventures. Since March 2022, the Federal Reserve has been hiking interest rates; the ECB followed suit in July 2022. The Bank of England raised interest rates as early as December 2021, while the Bank of Japan only began raising its interest rates in July 2023. At the same time, developing economies have faced rising interest rates as debt moratoria issued early in 2020 have expired, and as interest rates have risen in the core. The cost of physical capital has increased, and likewise the costs of building new infrastructure. In the US, this extends to public development projects that typically have long lags between approval and

implementation, in which the simultaneous increase in price of primary materials (such as lumber, metal, and glass) as well as the rising interest rates have increased the costs of projects to levels unmanageable with bonds months or years prior.

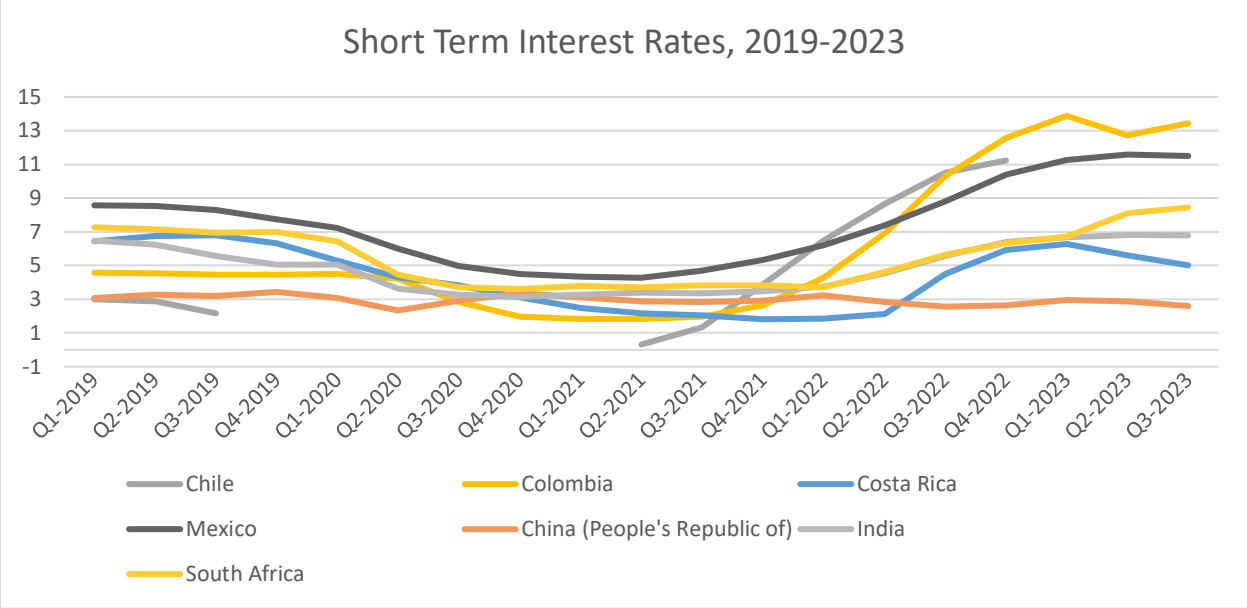
Figures A and B show trends in short-term interest rates among a selection of core and peripheral economies. They demonstrate the decline in rates early in 2020 and the rapid increase in short-term interest rates in late 2021 and early 2022, with the notable exceptions of Japan and China, which have maintained less volatile short term rates. While the trends of a decrease in rates early in the Pandemic, and a rise in rates in late 2021 onward exist for both samples of economies, wealthier economies saw lower rates overall in the worst months of the pandemic, and poorer economies have observed much higher interest rates since major central banks have begun their series of rate hikes. These rising rates come at a bad time as many economies are navigating the need to transition away from fossil fuels and decrease overall emissions as the economic damage from weather volatility has increased on an annual basis.

Figure A: Short-Term Interest Rates in a Selection of Core Economics, 2019-2023



Source: OECD Statistics, stats.oecd.org

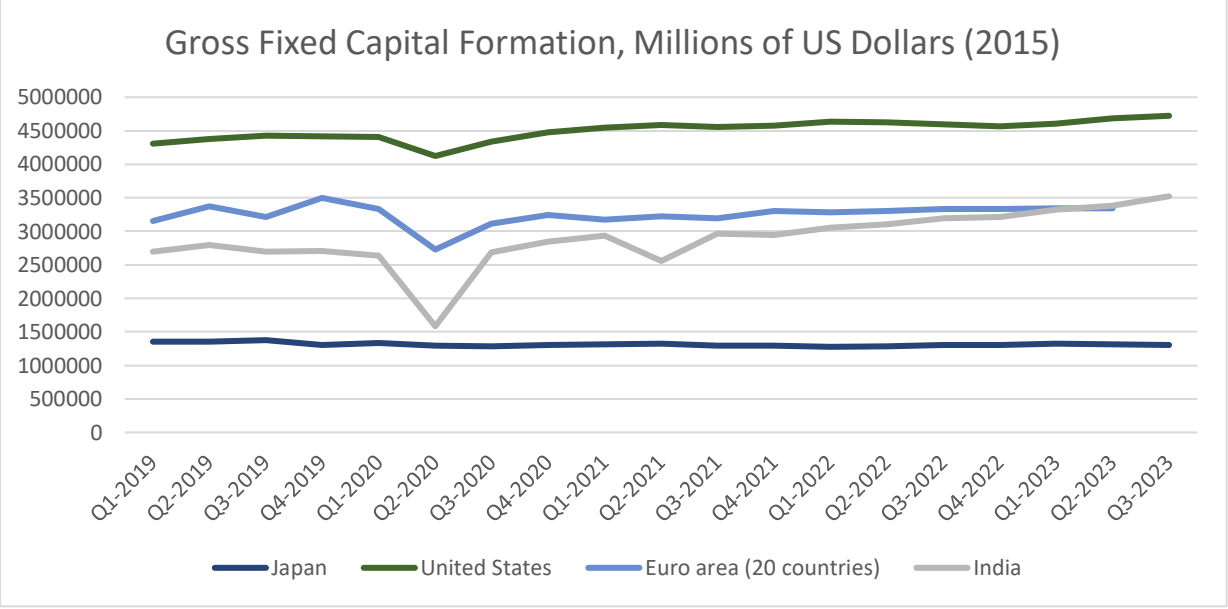
Figure B: Short-Term Interest Rates in a Selection of Peripheral Economies, 2019-2023



Source: OECD Statistics, stats.oecd.org

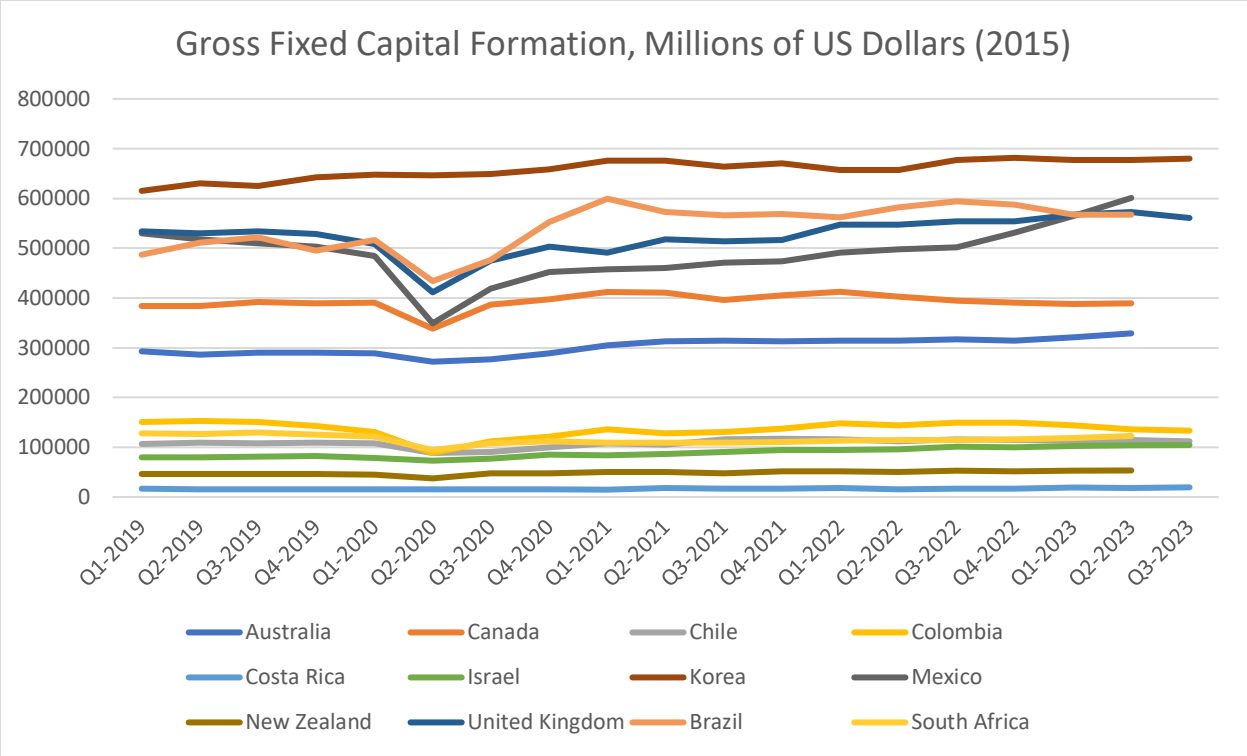
Figures C and D show trends in Gross Fixed Capital Formation across the selection of core and peripheral economies. Figures C and D are divided to account for scale discrepancies in gross investment expenditure across the sample – the largest industrial spending economies are included in Figure C, and the others in Figure D to better visualize the rebound in investment spending that happened across these economies early in 2020 in response to lower interest rates. While these trends do not show granular change in investment in late 2022 and 2023 as interest rates have risen, Figure E, which shows real private investment expenditure in the US registers a decrease in investment in real terms as prices have risen alongside interest rates.

Figure C: Gross Fixed Capital Formation in the US, EU, India, and Japan



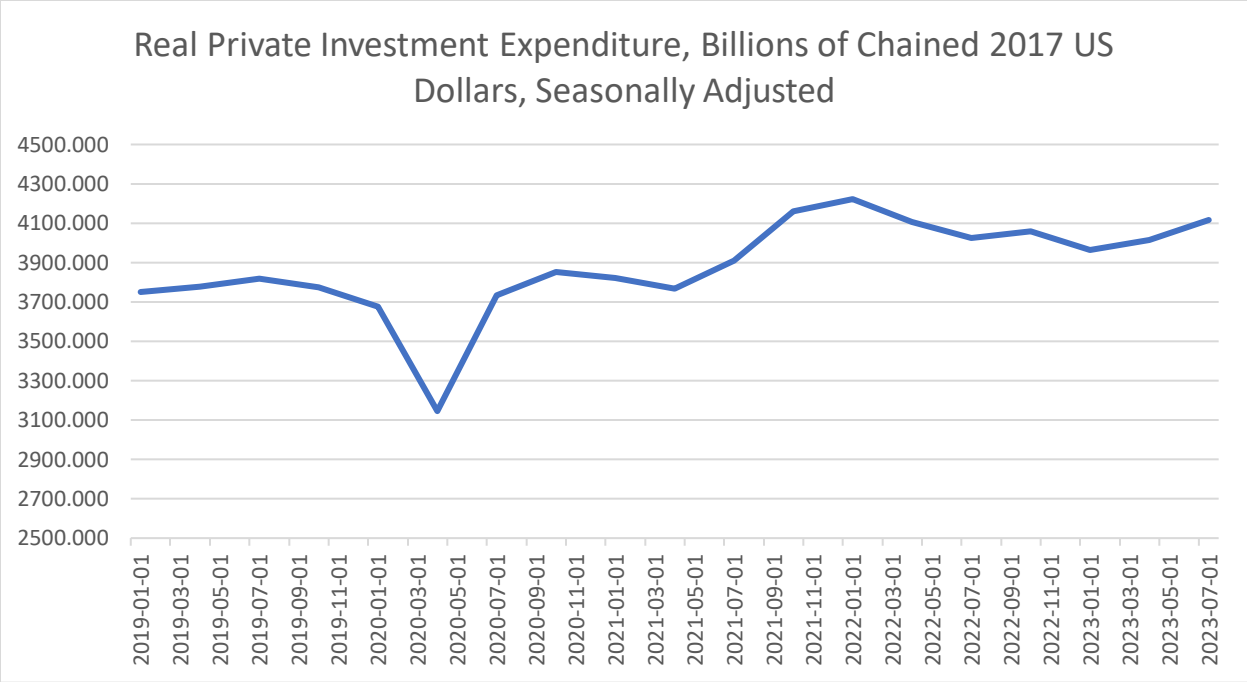
Source: OECD Statistics, stats.oecd.org

Figure D: Gross Fixed Capital formation in Other Members of the Sample



Source: OECD Statistics, Stats.oecd.org

Figure E:



Source: St. Louis Federal Reserve, Economic Data, https://fred.stlouisfed.org/series/GPDIC1

One consequence of central banks raising interest rates has been a decline in major global stock indices as corporate stock- and bondholders have sold off shares of numerous large tech corporations including Apple, Tesla, Amazon, Meta (formerly Facebook), and many much smaller tech startups. (Sorkin et al, 2023; Streitfeld, 2023) For nearly a decade after the 2008 crisis, low interest rates in the US fostered billions of $US in venture capital investment, acquisitions, and capital investment in tech startups. Between the onset of the Pandemic in 2020 when the Fed again cut rates close to zero, and 2022, when the Fed began hiking, another wave of investment in tech stocks and low interest rates further enriched businesses in this sector. (Streitfeld, 2023) Lockdowns in 2020 were good for many tech sector businesses, like Zoom, Netflix, and Amazon, fostering more investment and acquisitions by large players in the sector when interest rates were very low. However, when rates began to rise in March 2022, businesses accustomed to low interest rates were caught by both a decline in earnings and rising costs, which squeezed sectoral profits, resulting in widespread layoffs, closures, and defaults. (Mickle, 2022; Pandurangi, 2023)

These defaults created another source of risk for the US and global economy in 2023: private bank failures and rising risks of bank runs increased volatility for would-be lenders and creditors, and further reduced lending in early 2023. (Allyn, 2023) In late 2022, rising interest rates, lower corporate earnings and rising withdrawals, and depreciation of US Treasuries as interest rates rose created a funding problem for a range of officially medium sized banks, with between 100 billion $US and 250 billion $US in assets. (Flitter and Copeland, 2023) These developments were perhaps a logical consequence of deregulatory measures the US government had passed in 2018, thanks to lobbying by key financial institutions, including several that failed in 2023, to reduce financial oversight and capital standards for those institutions. (Russell and Zhang, 2023) Problems for these banks included large uninsured deposit holdings, inadequate enforcement by the Federal Reserve of key regulatory standards, and declining funding of oversight even as its business expanded rapidly shortly before the downturn in 2022. (Smialek, 2023b) Diminished oversight operations and decreased funding of regulatory enforcement from 2016 through 2022 occurred across the Federal Reserve. Furthermore, the speed and scope of bank runs that brought about failures at Silicon Valley Bank (SVB), First Republic Bank, Signature Bank had been fostered by depositors' public communication of their fears of these banks' solvency on social media platforms; Fed oversight notes acknowledged that it had failed to adapt to changing technologies with consequences for the financial system and global economy. (Smialek, 2023b) These bank failures both compounded worries for real sector operations in the US, since many of the banks that failed served firms in the tech industry, while they also prompted runs and failures of banks elsewhere in the world. (Allyn, 2023; de la Merced and Farrell, 2023) (The next section of this paper describes how central banks have responded to these sources of risk in greater detail.)

These trends have also inhibited firms' investment in carbon mitigation and technology to facilitate global transition away from greenhouse gas emitting goods and services. The cost for firms investing in climate mitigation infrastructure – for firms building technology like off-shore wind turbines, rising costs and rising interest rates have delayed and even caused some developers to cancel planned projects. After substantial growth from the third quarter of 2020 through the end of 2022, real private investment expenditure in the US has decreased from the first quarter of 2022 through the second quarter of 2023 as businesses have internalized higher interest rates. (Smialek, 2023a) Some of the canceled and postponed projects include wind turbines off the Eastern seaboard in the US, home construction (despite elevated demand across the US), nuclear startups, and electric vehicle development. (DePillis, 2023; Meyer, 2023; Zeitlin, 2023; Pontecorvo, 2023) These problems are compounded for developing economies. Developing economies in the Global South are generally more vulnerable to the negative effects of climate change, from flooding to drought,

despite emitting far less greenhouse gas emissions overall (and especially per capita) compared to richer nations. (Georgieva, Gaspar, and Pazarbasioglu, 2022) However, they typically have less fiscal space than core economies, both in terms of how much they can spend as well as in terms of how they spend. (Kentikelenis, Stubbs, and King, 2016) The next section discusses how central banks have attempted to mitigate problems described in this section, as well as the limitations of those approaches.

Central Bank Responses to Supply Shocks and Financial Vulnerability at the Time of Writing

Since 2008 GFC and the 2020 Pandemic, major central banks like the Federal Reserve have shown their ability to respond quickly and expansively to financial sources of increasing risk; however, they have also demonstrated the limitations of their primary policy tools. This section of the paper discusses various means deployed by central banks to respond to these recent crises, and the gaps that remain.

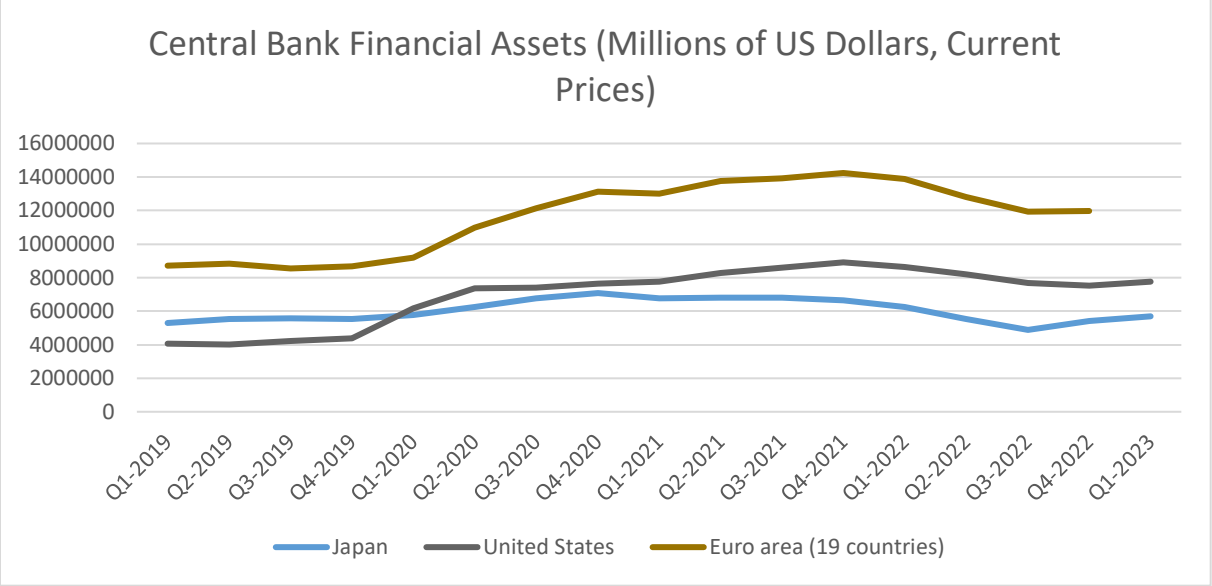
Central banks have myriad tools to support economies in the midst of crises. They can lower interest rates to encourage lending between banks and to the real sector when economies are on the brink of recession or when bearishness increases. They can act as lenders of last resort to financial systems in distress by lending directly to banks. They can also act as dealers or market-makers of last resort by purchasing assets that are at risk of depreciation, and hindering lending and other expansionary activity by banks. (Grad, Mehrling, and Neilson, 2013) At the same time, they may use contractionary policies if they are mandated to limit inflation rates, on the assumption that discouraging lending, borrowing, and spending will suffice to slow the rate that prices are increasing. Unfortunately, inflation-targeting monetary policy has the potential to exacerbate inflation if producers internalize higher interest rates, or international financial dynamics induce exchange rate volatility. (Blanchard, 2004; Tawadros, 2009; Willard, 2012) For economies that lack currency sovereignty and that are more peripheral in the global economy, access to SDRS, claims to currencies including the $USD, Euro, Pound Sterling, Japanese Yen, and Chinese Renminbi, distributed by the IMF can likewise increase potential spending and relieve bearishness induced by global volatility. (Murau, Pape, and Pforr, 2023)

Recent experiences with monetary responses to crises in 2008 and beyond have revealed the positive and negative potential of trusting central banks' discretion in moments of increasing risk. In the years since 2008, the Federal Reserve has responded to major crises both by lowering interest rates to nearly zero, lending large volumes to domestic and international banks as a lender of last resort, as well as by purchasing billions of $US worth of assets as dealer of last resort. In 2008, the Federal Reserve purchased toxic assets including mortgage backed securities from banks in the US and abroad. In 2020, the Federal Reserve initiated domestic credit facilities for small banks and businesses, corporations, and municipal government with a series of programs including both direct lending to smaller banks as well as a corporate bond and municipal bond purchasing program. In 2007, the Federal Reserve also initiated dollar swap lines with 14 other central banks around the world, including the Bank of Canada, the Bank of Mexico, the European Central Bank, the Bank of England, the Bank of Japan, the Bank of Korea, the Reserve Banks of Australia and New Zealand, and the central banks of Brazil, Denmark, Norway, Singapore, Sweden, and Switzerland. Under the dollar swap line program, qualifying central banks could exchange securities denominated in their economies' domestic currency for $US. The Federal Reserve also created a repurchase (repo) facility under which central banks could use US Treasury securities as collateral for $US; this eased potential liquidity demand for banks in economies whose central banks had not qualified for dollar swap lines. Other central banks around the world have initiated similar dealer-of-last resort programs, both to

stimulate domestic lending and investment and to backstop municipal debt. (Mehrling, 2022; Buiter et al, 2023)

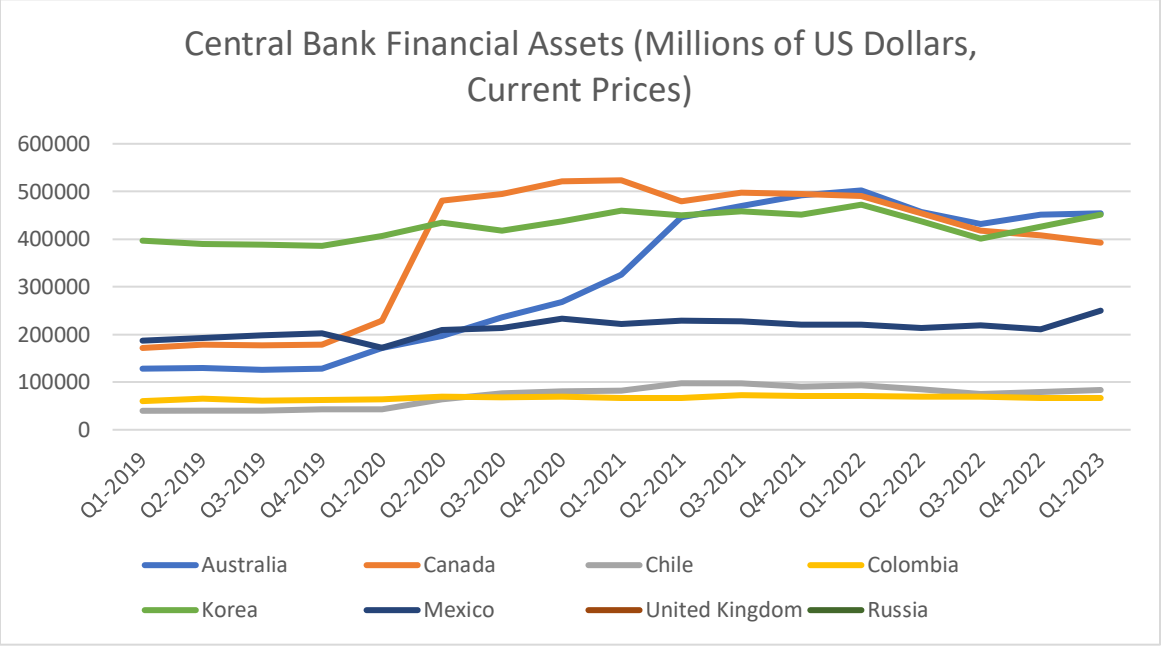
Figures F and G show trends in monetary policy over this period. These diagrams show the increase in financial assets of many central banks in the sample as they engaged in an expansive wave of monetary policy early in the Pandemic, and also the decrease in financial assets of these institutions in 2022 and 2023.

Figure F:



Source: OECD Statistics, stats.oecd.org

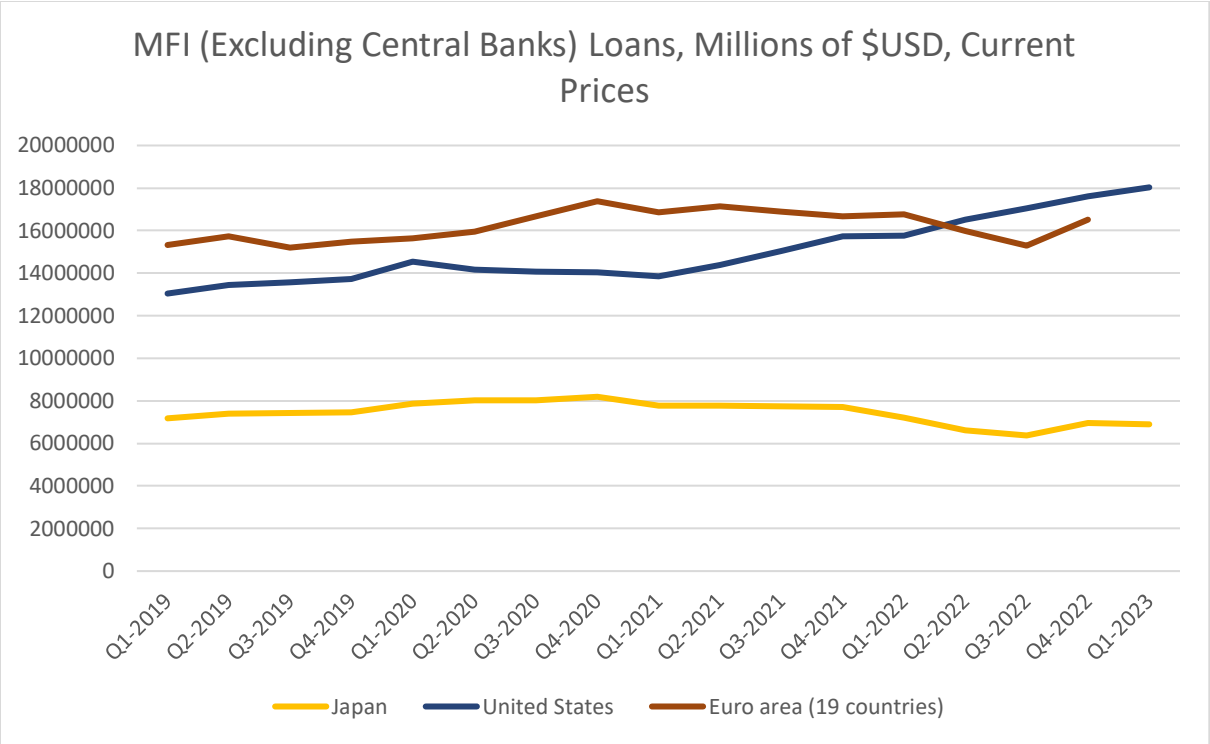
Figure G:



Source: OECD Statistics, stats.oecd.org

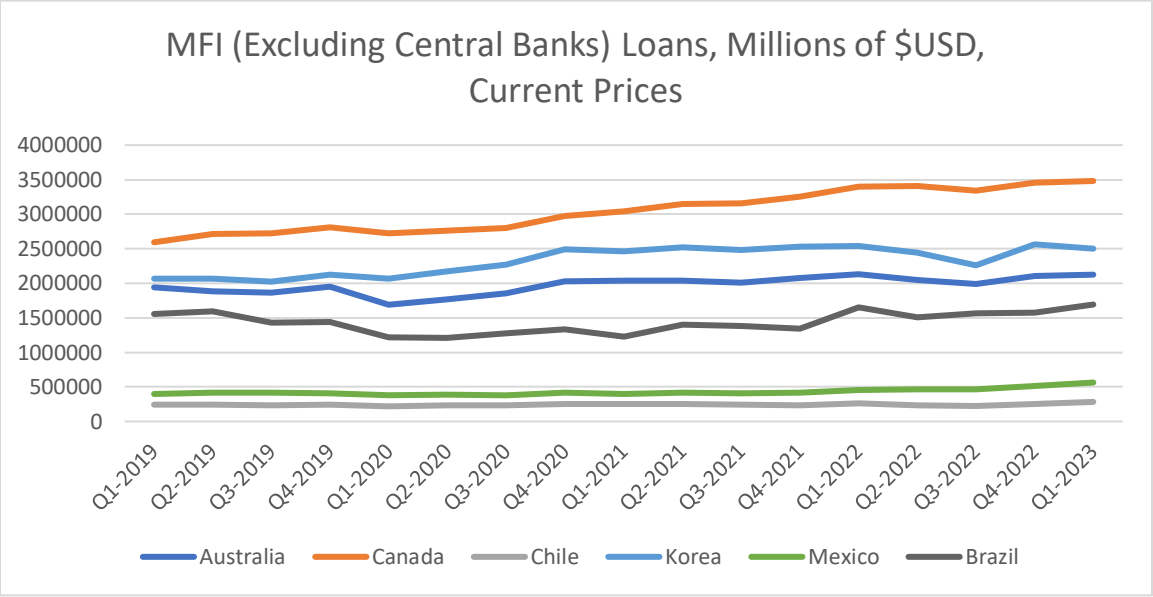
Figures H and I show the performance of bank lending following the onset of the Pandemic, and the success of expansionary monetary policy. Despite the large shock to global output, banks in the sample of countries mostly maintained lending, and in some cases, they increased aggregate lending even in the midst of the global pandemic.

Figure H:



Source: OECD Statistics; stats.oecd.org

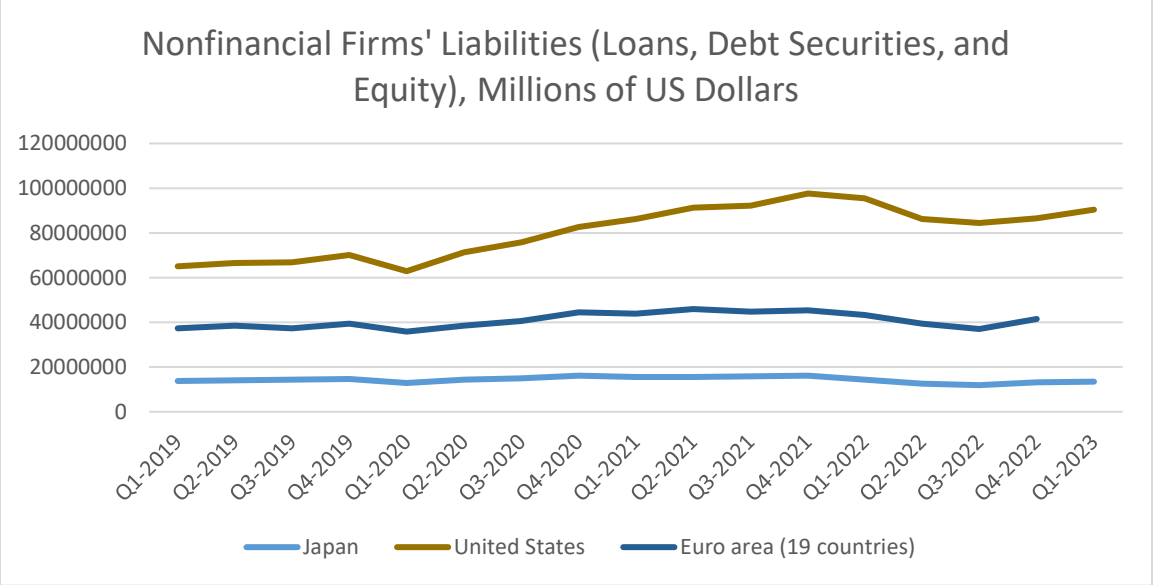
Figure I:



Source: OECD Statistics; stats.oecd.org

Figures J and K in turn show how nonfinancial firms' liabilities have changed in tandem with these changes in interest rates and lending. When accounting for loans, debt securities, and equity liabilities, nonfinancial firms appeared to borrow and receive more credit due to the sale of their bonds and stock in the aggregate during the period of low interest rates, despite the massive global recession that resulted from the Coronavirus Pandemic. This borrowing slowed in early 2022 as interest rates again increased. While corporate liabilities seem to be increasing again across the sample since early 2023 as rate hikes have slowed, the future is uncertain.

Figure J:



Source: OECD Statistics; stats.oecd.org

Figure K:

Source: OECD Statistics; stats.oecd.org

Relying on central bank and financial discretion to respond to financial and economic instability clearly has pitfalls. Central banks cannot control what banks do with monetary financing, or how firms respond to lower interest rates. A comparison of near-zero rates after 2008 and after 2020 reveals discrepancies in how banks and firms have responded. After 2008, banks in the US contracted their lending to the real sector, and particularly to smaller enterprises, despite then-historically low interest rates. (Pollin, 2012) In the decade following the GFC, many corporations in the US took advantage of low interest rates to purchase financialized assets, rather than investing in physical capital. (Palladino, 2020) Moreover, the Fed's responses likewise neglected households, leaving their economic fates at the mercy of domestic banks, in the midst of unprecedentedly low fiscal spending relative to recessionary GDP. (Barofsky, 2012) Outside of the US, monetary policy tended to benefit core economies at the expense of peripheral ones, through political decisions about which economies to provide with the most liquidity support, and which to provide liquidity support on the condition of austerity and other restructuring measures. (Eichacker, 2022; Casagrande and Dallago, 2023) Finally, when inflation rates rise, there is a perpetual threat that central banks will roll back expansionary measures, regardless of whether inflation has been predominantly determined by demand or supply factors.

Given the remove at which monetary policy may encourage spending and central banks' propensity to reversing course from expansionary to contractionary policies, it is important to consider more direct means of responding to increasing risk. The next section of this paper considers how public banks and other financial policies can more directly enable physical capital expenditure and investment by firms.

Public Finance vs Increasing Risk

Given current and recurring sources of uncertainty, risk, and bearishness, insuring that there are sources of credit for firms attempting to address physical sources of risk in the midst of climate change is imperative. This section of the paper argues that public finance institutions and programs have the potential to mediate the aforementioned bearishness that can affect firms' willingness to spend and banks' willingness to lend to foster that change.

Public banks and other financial institutions have a long historical legacy. They have existed since the 1500s in the form of municipal banks in "Barcelona and Genoa, followed by Venice, Naples, Amsterdam, and Hamburg." (Marois, 2021, 356) Since the late 19th century, public banks have grown in importance as drivers of industrial development, repositories for household savings, and lenders to households and small and medium enterprises. (Quinn, 2019; Marois, 2021; Eichacker, 2023) At the present, public banks exist in many forms around the world, whether as primary funders of public infrastructure projects and services such as water provision, incubators of technological innovation, or lenders to households and firms. (Peterson, 2002; Griffith-Jones, 2016; Marshall and Rochon, 2022) Given this history, there is much experience against which to evaluate economic theories opposing and supporting public finance.

Mainstream economic theory has long dismissed public investment and finance on the grounds of both inefficiency and corruption. First, neoclassical and new classical economic theory holds that public expenditure is liable to crowd out private spending by firms, assumed *a priori* to be more efficient than government spending. (Buiter, 1977) While public expenditure can be funded through taxation (which itself is likely to limit private spending that might more efficiently spur growth), it might also be funded through bond issues, which adherents to the loanable funds theory assume will cause interest rates to rise in a zero sum fashion for other borrowing in the economy at large. (Hoelscher, 1986) If public banks were to provide credit for ventures conducted by either the government or the private sector, similar fears prevail. Public banks are assumed to be inefficient

compared to private financial institutions due both to their likelihood of funding government projects, assumed to be inefficient, and their propensity for cronyism. (Barth, Caprio, and Levine, 2008) At the base of these fears of inefficiency is the argument that public banks are inherently corrupt, and prone to political manipulation. (La Porta et al, 2002) Public enterprises, whether they are financial or nonfinancial firms, are assumed to be used for political gain, and thus "subject to political interference from politicians, special pressure, or interest groups." (Marcelin and Mathur, 2015, 259) While some empirical assessments of the performance of public banks find incontrovertible proof of inefficiency relative to private financial institutions, others find the evidence is more ambiguous, since private financial institutions may likewise exhibit inefficiencies relative to banks elsewhere in the world. (Megginson, 2005) While some of these critiques may have bases in historical experience, public finance is both heterogeneous and dynamic: regulators can adapt to observed failures in public banking just as they can implement new regulations of private finance in the face of banking failures. (Marois, 2021)

Despite their dismissal by mainstream theorists of the economics of banking, there are multiple theoretical benefits from public investment and public banking, particularly in the context of increasing risk. It is far from guaranteed that private banks will operate efficiently, or take advantage of low interest rates to lend. Even advocates for bank privatization note that private ownership alone cannot guarantee better financial performance at the firm and industry level. (Megginson, 2005) Following the 2008 GFC, banks used bailout funds from the US government to pay bonuses to upper management and dividends to shareholders as well as to buy back stock. (Marshall and Rochon, 2019) In theory, public banks can be more easily regulated and overseen than private banks, which have demonstrated risky management time and again. (Marshall and Rochon, 2019, Epstein 2010) With adequate funding and oversight, public banks and other financial institutions have the potential provide an antidote to private sector financial capitalism's tendencies toward the pursuit of profit relative to stability and equity. (Marois, 2021)

While expansionary monetary policy has the potential to induce spending, historical and empirical studies reveal that private banks' responses to low interest rates may contradict that theory. (Marshall and Rochon, 2019) There is a wide literature showing the importance of institutional factors in ensuring that monetary policy achieves its intended effect. (Schaechter, Stone, and Zelmer, 2000; Mishkin and Schmidt-Hebbel, 2001; Little and Romano, 2009; Beggs, 2017) However, public banks have the potential to encourage more expenditure and physical investment than private financial institutions, particularly since they can be managed as non-profit institutions. A nonprofit public bank might be more likely to lend than a private peer institution worried about the potential spread between the cost of investment and the likely profit for a firm borrowing from the financial sector. This might have the potential to increase credit demand from firms, particularly if public financial institutions charged lower rates than private financial institutions. Public may be able to spur demand in the midst of market failures: public banks can lower the barrier to spending by firms producing less obviously profitable goods and services, and halt financial crises' transformation into economic crises through increasingly conservative lending standards. (Vidal, Marshall, and Corea, 2011; Mazzucato and Penna, 2016) Conversely, nonprofit public banks might be less likely to lend during periods of collective mania, decreasing households' and smaller firms' exposure to financial risk during boom times. (Marshall and Rochon, 2019)

Finally, while a system of public banks makes a productive complement to fiscal expenditure, public banks have the potential to foster spending more nimbly than fiscal grants might. (Marshall and Rochon, 2019; Beggs, 2022) If there are large barriers to direct fiscal spending, whether as a result of political bias or a function of vulnerability to external creditors, public banks may provide an institutional workaround for direct fiscal expenditure. (Marshall and Rochon, 2019) Streeck and Mertens (2011) argued that Germany's public banks played an important role in

fostering German business spending when the German state pursued fiscal surplus in the midst of the Eurozone Crisis. In such circumstances, a public bank's relative distance from appearing to be a fiscal institution can sustain lending and spending when actors within government oppose expanding such expenditure. More generally, an independent public financial institution may be better positioned to review existing projects in the private sector, which themselves may be more efficiently designed and implemented than a wholly government-run venture might. (Beggs, 2022)

Public banking is not just a historical relic or a theoretical pursuit. At the time of writing, many examples of public financial institutions and services exist in the US and beyond. Germany has a long history of public banking in various forms. There is a public industrial bank, expressly for funding large infrastructure projects; there is a network of savings and loans banks primarily oriented toward serving households and small and medium enterprises, and there are larger regional public banks that both serve those smaller public savings and loans banks and fund larger industrial ventures in their respective states within Germany. (Deeg, 1999; Quinn, 2019; Griffith-Jones, 2016) Elsewhere in Europe, it is common for public banks to fund municipal services and public goods like water utilities. (Clifton, Díaz-Fuentes, and Revuelta, 2014; Juuti, Juuti, and McDonald, 2022; Marois and McDonald, 2022) Though European economic unification encouraged privatization of financial services, these institutions persist, with social benefits to spare. (Eichacker, 2017; Griffith-Jones, 2016)

Public banks have served to spur industrial development in myriad developing economies. In the 1950s, the Indian government nationalized a number of private banks and created the State Bank of India, expressly to provide credit to large sectors of the population that had previously been ignored by private banks. (Kumbhakar and Sarkar, 2003) These public banks were governed by "a detailed and elaborate structure of banking regulations … developed to channel credit in desired directions," and "brought about a rapid transformation of the economy and society." (Bhattachryya, Bhattacharyya, and Kumbhakar, 1997) While advocates for Indian financial privatization note that subsequent measures to privatize these institutions have increased banking productivity, recent analyses show that measures of productivity are driven predominantly by access to technology; better funding for public banks could improve their performance accordingly. (Zaman, Valiyattoor, and Bhandari, 2022) Public banks have a long history of funding East Asian industrial development. (Chang, 2006) In Japan, Korea, Taiwan, China, and other East Asian states, public financial institutions initiated lending to industrial projects, both state-owned enterprises as well as fully private enterprises, and provided a basis for those economies' strength as industrial producers. (Chang, 2006; Storm and Naastepad, 2005) In China, evaluations of green finance show that state-owned banks exhibit less risk in their funding of environmental transition projects. (Zhou et al, 2022)

The US itself has a long history of public financial institutions and policies that backstop private investment. Public banks include State Infrastructure Banks (SIBs), the Federal Financing Bank (FFB), the Export-Import Bank (Exim), and others; the US government also maintains direct lending programs for expenses related to education, small business administration, agriculture and fisheries, various home loans, and other programs specifically for veterans. (USAGov, 2023) In addition to direct lending, the US government also has numerous loan guarantee programs, both through these different banks, as well as for specific ends. It has used versions of loan guarantee programs for environmental ends like cleaning polluted water, developing alternative energy technology, building and maintaining highways, supporting US corporations with their export business, backstopping education and home loans, and more. (Brown, 2012; Chen, 2016; Hopewell, 2017) Ample empirical evidence attests to the importance of these institutions in increasing output, innovation, and sales of US goods and service. Chen (2016) highlights the history of State Revolving Funds, precursors to loan guarantees, in facilitating public water purification projects, and shows

that spending on US highways can be clearly attributed to the actions of state-level banks, federal loan guarantee programs, and hybrid partnerships. Yusuf and Liu (2008) show that at the state level, State Investment Banks can foster lower cost public improvement spending compared to using an equivalent amount in municipal bonds. Myriad analyses of Department of Energy lending programs—both loan guarantees and direct lending—have funded environmental mitigation and climate related innovations that underpin current developments in those sectors at the time of writing. (Brown, 2012; Kao, 2013; Mazzucato, 2022)

These public finance institutions and programs have not been without controversies. Federal home loan guarantees have been cited as a central feature of the subprime mortgage market, which fostered the growth of the subprime mortgage backed asset market, and which underpinned the transformation of the subprime mortgage crisis into the Global Financial Crisis. (Jaffee and Quigley, 2008) However, analyses of Federal Home Loan banks have revealed them to be cautious institutions; housing loans extended by Federal Home Loan banks were predominantly prime rate mortgages that had been subject to stringent review, in contrast with the lax standards exhibited by many mortgage lenders before 2008, and less than 1% of Federal Home Loan banks' mortgage loans in the period defaulted. The main source of risk for Federal Home Loan banks in the subprime mortgage market related to their purchase of subprime mortgage backed securities; however, these banks generally acquired smaller concentrations of these assets than private financial institutions did on average. (Cassell and Hoffmann, 2009) The failure of Department of Energy loan guarantees for the solar firm Solyndra has been used frequently to denounce public finance in recent decades, usually by libertarian think tanks and actors. (Wald, 2011; Upton and Stearns, 2012; Vlasic and Wald, 2012; de Rugy, 2012, Goss, 2021) However, many of these critiques ignore the successes of the Department of Energy's loan guarantee program, including the automotive company Tesla. (Kao, 2013; Mazzucato, 2022) There has also been substantial political jockeying over the fate of key public financial institutions, including the Export-Import bank, during recent waves of right populism in the US. During the Trump presidency, funding for the Export-Import bank was cut, and its operations were substantially reduced, often to the detriment of firms in the US and abroad that relied on its low cost credit to facilitate trade. (Hopewell, 2017)

The US's public financial institutions and policies are not unique for being criticized. German regional public banks have been criticized for their risky activities in European repurchase markets before 2008. However, their activities were small relative to their overall business, and particularly when compared with Germany's large private banks; moreover, smaller public banks in Germany lent more to small and medium enterprises relative to total assets soon after the onset of the GFC than their private peers. (Eichacker, 2023) Public banks are not immune to failure, particularly when they are subject to market discipline and forced to yield profits; as Marois (2021) notes, institutional factors that shape public banks' risk taking behavior matter a lot for ensuring their positive contributions to overall welfare. And though public banks may be subject to political sway, the potential for public financial institutions to mobilize funds more quickly than government organizations and to lend more than profit and loss conscious private peer institutions is another argument for supporting institutional design that allows them to thrive.

Existing public financial institutions have shown the ability to diminish risk for firms in the midst of uncertainty; their durability over time speaks to the historic relevance public banks have held for fueling growth and stabilizing economic systems for centuries. Yet, despite the proven capabilities of public banks, and the relative inability of proponents of private banking to definitely prove that public banks perform worse than their private counterparts, there is still public skepticism about the effects of these policies. Critics of loan guarantees on the left argue that they are insufficient to ensure more than green washing, and that corporate interests will generally be prioritized over social welfare as a whole, while critics from mainstream economics point to their

potential to crowd out more efficient investment. (Dafermos, Gabor, and Michell, 2021; Gale, 1991) More generous assessments of the ability of public lending and loan guarantees to stimulate economic activity in addition to fiscal support often question or critique whether these policies are the most efficient means of stimulating spending or helping households and firms engage in the expenditure necessary to foster development. (Li, 1998; Brown, 2016; Lucas, 2016)

The inability of public finance critiques to prove that this strategy is negative opens space to considering how to expand upon and improve existing public financial institutions and policies. Since public finance has the potential to 'crowd in' private investment, by lowering the risk inherent to expanding physical capital in periods of volatility, governments ought to maintain these facilities, even if they may be less crucial to business expansion during expansions. Alternatively, government designers of these institutions can lean into their ability to act as a haven from market pressures: during boom times, these institutions may pivot towards funding ventures that are less obviously profitable, though important for improving social welfare, for example by funding the retrofitting buildings to make them more resilient to climate change or carbon neutral, or societal equity, such as building more public transit to serve lower-income populations and provide more alternatives to car transit. The greater the exposure of public financial institutions to profit incentives, the less likely these sorts of policies will be to receive funding, and the greater the likelihood the failure of these public institutions. (Marois, 2021; Eichacker, 2023)

Expansion of public banking does not need to replace expansionary monetary policy—central banks have proven their ability to sustain expenditure and lending by banks during recent crises. However, the liquidity relief that central banks have provided in response to the 2008 GFC and to the rapid onset of the economic crises related to the Coronavirus were primarily directed (in order) at rescuing large banks and firms, then smaller banks and firms, and then municipal governments. (Grad, Mehrling, and Neilson, 2013; Bordo and Duca, 2022) Since the economic responses to the Coronavirus have proven the benefits of widespread assistance to households, especially compared to firms, central banks like the Federal Reserve might consider the creation of banking services for households, as well as more direct monetary assistance for households. (Edelberg, Sheiner, and Wessel, 2022) The Federal Reserve and other central banks should follow the lead of other major public financial institutions by creating accounts for households at large; doing so would facilitate rapid distribution of fiscal aid, mobilization of lending in periods of recession, and safer alternatives to private banks in moments of crisis. (Rochon and Vallet, 2022; Temperini, D'Ippoliti, and Gobbi, 2023) At the same time, central banks might approach the physical and economic risks of climate change with more targeted lending programs, in addition to broader infrastructure banks. Van't Klooster and van Tilburg (2020) have proposed direct liquidity programs for the ECB, under which the ECB would act as a dealer of last resort for securities issued on behalf of firms pursuing climate mitigation in any number of forms; given the Federal Reserve's proven track record of reducing volatility in bond markets, it should be easy for it to create a new program to facilitate climate mitigation by backstopping firms and governments at risk of suspending such programs. (Bordo and Duca, 2022; Chu and Smyth, 2023) Rather than merely waiting for central banks to make these political changes, governments might do what they can to increase the scope of their other financial tools to expedite these changes to hedge against increasing risk.

Conclusion:

This paper has argued that expanding public finance institutions and policies has the potential to hedge against risk resulting from the physical consequences of climate change as well as broader economic instability apparent in the US and global economies. Given fundamental uncertainty and

increasing risk, firms and banks exhibit more caution about spending when they fear that the profits of intended projects may not exceed the costs of executing those projects. Current sources of risk for firms and banks include the physical effects of climate change, lingering supply side shortages due to the COVID-19 pandemic, high interest rates after more than a year of rate hikes by major central banks, and a wave of banking failures in early 2023. While major central banks have shown a willingness to rescue banks and firms in the midst of major economic crises, their pivot toward inflation-targeting policies since early 2022 has likely curtailed investments that have the potential to mitigate climate change and further reduce the physical and economic risks facing households around the world. Increasing the scope of existing public financial institutions can more aggressively mobilize funding for carbon mitigation, support households and firms cautious about the future, and improve broader welfare.

This paper has shown that firms, households, and governments are currently exposed to substantial sources of uncertainty and volatility. However, in the absence of substantial changes to increase productive capacity, achieve carbon neutrality, and ensure stable sources of funding and places to deposit funds, uncertainty is likely to grow, and risk will likely continue to discourage spending that could change these trajectories. Public banks and financial policies like loan guarantees have the ability to reduce this uncertainty. (Lucas, 2016) In the past, public credit and loan guarantees have functioned like extra fiscal spending by sustaining domestic spending in the aftermath of crises. Moreover, these policies have helped propagate new innovations that are presently reducing carbon emissions, and predicted to do more in the future. (Brown, 2012; Meyer, 2023)

Persistent critiques of public finance remain. These critiques tend to focus on its potential to crowd out efficient private spending, past failures of public lending, and the political jockeying that can engender cronyism or conversely scuttle effective programs. However, these critiques ignore that private finance is equally prone to corruption and failure, that institutional structures in which public banks operate shape their propensity to succeed or fail, and that reforming policies governing these institutions can reduce their propensity to fail and improve their effectiveness at serving the public at large. (Brown, 2012; Lucas, 2016; Marois, 2021) In the face of heightened risk and volatility, public financial institutions and programs have proven track records of increasing investment, ensuring stable credit flows, and propelling economic growth in more equitable ways than purely private systems. (Brown, 2012; Chen, 2016; Bhattacharyya et al, 1997; Marois, 2012)

There is plenty of research to continue in this sphere. Comprehensive and comparative empirical analyses of the changes in investment expenditure relative to both central bank policies, public lending, and loan guarantee programs will clarify how these policies have worked in tandem. Institutional analyses of the benefits and shortcomings of developmental banks in East Asia, Germany, and elsewhere can illuminate how best to craft these institutions going forward. Comparisons of the relative stability of public financial institutions vis a vis private banks can also clarify the additional benefits of improving public financial infrastructure in order to reduce uncertainty and hedge against increasing risk. Going forward, more scholarship should highlight the benefits and shortcomings of public financial policies as they exist, in order to better tailor these tools to meet the challenge of transforming the world for the better. (Marois, 2021; Beggs, 2022)

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