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MONETARY POLICY IN ADVANCED ECONOMIES – WHAT NEW NORMAL?

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To my beloved ones, for their love, support and belief, even when I deemed it impossible.

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Abstract

Neutral real interest rates in advanced economies have decreased and remained persistently low since the 1980s, which constrains policy rates in the face of negative aggregate demand shocks and imply that central banks lose policy space and become unable to stabilize the economy. With the purpose of assessing the building blocks of the "new normal" of monetary policy, this dissertation consists of an extensive literature review of the research that has contributed to the debate on rethinking the future of monetary policy frameworks. Its specific aim is to assess the structural forces behind low neutral interest rates and to assess how monetary policy should adapt its framework to deal with these challenges, ultimately trying to establish an in-depth and amplified theoretical narrative of such recast of monetary policy.

JEL codes: E21, E22, E31, E43, E52, E58, F21, G51

Keywords: Monetary Policy, Central Banks, Neutral Interest Rates, Inflation, Effective Lower Bound, New Normal.

Resumo

As taxas de juro reais neutrais registaram uma diminuição desde os anos 80 nas economias avançadas e mantiveram-se persistentemente baixas desde então, restringindo as taxas de juro diretoras perante choques negativos da procura agregada, e implicando a perda de espaço para a formulação de política e a incapacidade de estabilizar a economia, por parte dos bancos centrais. Com o objetivo de aferir sobre os pilares do "novo normal" da política monetária, esta dissertação tem por base uma revisão exaustiva da literatura que contribuiu para o debate sobre o repensar do futuro dos enquadramentos de política monetária. O seu objetivo específico é o de aferir as forças estruturais por de trás das baixas taxas de juro neutrais e avaliar de que forma a política monetária deve adaptar o seu enquadramento de modo a lidar com estes desafios, tentando, em última instância, estabelecer uma narrativa teórica aprofundada e ampliada dessa reformulação.

Códigos JEL: E21, E22, E31, E43, E52, E58, F21, G51

Palavras-chave: Política Monetária, Bancos Centrais, Taxas de Juro Neutrais, Inflação, *Effective Lower Bound*, Novo Normal.

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Abbreviations

AIT – Average Inflation Targeting

BCBS – Basel Committee on Banking Supervision

BIS – Bank for International Settlements

BoE – Bank of England

BoJ – Bank of Japan

CB – Central Bank

CBI – Centra Bank Independence

CPI – Consumer Price Index

EA – Euro Area

ECB – European Central Bank

ELB – Effective Lower Bound

EME – Emerging Market Economies

ESDC – European Sovereign Debt Crisis

FED – Federal Reserve

FG – Forward Guidance

FOMC – Federal Open Market Committee

GDP – Gross Domestic Product

GFC – Great Financial Crisis

GSG – Global Savings Glut

HICP – Harmonised Indices of Consumer Prices

IMF – International Monetary Fund

IRS – Interest rate smoothing

IT – Inflation Targeting

LAW – Leaning Against the Wind

LFPR – Labour Force Participation Rate

L4L – Lower for Longer

MP – Monetary policy

NAIRU – Non-Accelerating Inflation Rate of Unemployment

NBER – National Bureau of Economic Research

NIRP – Negative Interest Rate Policies

PCE – Personal Consumption Expenditures

PLT – Price Level Targeting

QE – Quantitative Easing

R&D – Research & Development

TFP – Total Factor Productivity

TPLT – Temporary Price Level Targeting

UMP – Unconventional Monetary Policy

US – United States

WWII – Second World War

YCC – Yield Curve Control

ZLB – Zero Lower Bound

1. Introduction

The year was 2013. At the IMF's 2013 Annual Research Conference, Larry Summers was delivering a reviewed and updated version of the 'secular stagnation' hypothesis, an Alvin Hansen's theory of the late 1930s.[1] Four years after the financial normalization that followed the 2007-2008 Great Financial Crisis (GFC), Summers questioned how long conventional macroeconomic policy could handle the chronic excess of savings over capital investment, that was forcing neutral interest rates to fall below zero and holding economies back below from their potential (Summers, 2015a).

Even though plausible, the hypothesis of secular stagnation is not consensual among the academic community. Nevertheless, after a decade of unprecedented monetary stimulus through unconventional monetary policies, and prior to the COVID-19 pandemics, advanced economies continued to witness the persistency of low neutral real interest rates. Gerba (2018) presented evidence suggesting that the Euro Area (EA) and the United States (US) are under a permanent phenomenon of low economic growth, supported by long-run patterns associated with productivity stagnation, ageing population and shifts on capital and labour markets. Moreover, despite the announcement of a positive inflation target, a number of public commitments to reach it, and the launch of quantitative easing (QE) programmes, Japan entered in its second decade of stagnation. The Japanese economy witnessed a sustained depreciation of the Japanese yen against the dollar, an apparent erosion of central bank independence (CBI), and abnormally low levels of inflation (Posen, 2020).

Given that low neutral rates constrain policy rates in face of negative aggregate demand shocks, central banks (CBs) lost a large policy space due to the inability to use short-term nominal interest rates for stabilization purposes (Brainard, 2019b). Following the GFC, CBs had to develop alternative policy instruments to achieve their inflation and employment objectives, including large scale purchase of assets, forward guidance (FG), and, outside the US, negative interest rates and yield curve control. Particularly in the EA and the US, monetary policy was effective in stabilizing these regions (Bernanke, 2020; Hartwell, 2018). However, evidence of stagnation gave strength to the debate on whether the subdued growth

[1] For the full speech of Larry Summers at IMF Fourteenth Annual Research Conference in Honor of Stanley Fischer on November 8, 2013, Washington, DC, see http://larrysummers.com/imf-fourteenth-annual-research-conference-in-honor-of-stanley-fischer/.

prospects are temporary or permanent. Therefore, it is crucial for CBs to understand the forces behind the decline of neutral rates and its implication on their mandates.

Several factors have likely contributed to the decline in neutral interest rates, such as demographic trends, inequality in the distribution of income, a reduction in the rate of productivity growth, and an increase in the demand for safe assets. Moreover, debt overhang and later deleveraging in the public and private sectors may have strengthened the dynamics of secular stagnation, either directly or indirectly. Extensive research has established that there has been a steady decrease in neutral interest rates over the past 40 years and although the trend may flatten, it is unlikely to reverse (e.g., Rachel & Smith, 2017). Therefore, there is less room for monetary policy, as policy rates are more likely to be driven to the lower bound than before (Obstfeld, 2019). Since conventional monetary policy loses its stabilising power, a major rethinking of macroeconomic policy is arguably required (Krugman, 2014a). A decade after the end of the GFC, these fundamental economic changes prompted the major CBs to re-evaluate their policy frameworks through public reviews of monetary policy strategies, tools and communications.

Against this background, the purpose of this dissertation is to review recent research on structural changes that might explain the low levels of neutral interest rates, and to assess how monetary policy should adapt its framework to deal with these challenges. There is a growing body of literature that recognises the importance of studying how CBs should adjust their monetary policy strategy in order to strengthen their ability to offset future large adverse shocks. Accordingly, CBs need to weigh more carefully the evolving benefits and costs of lowering policy rates further and of deploying new unconventional instruments. At the same time, future macroeconomic stabilisation will likely rely not merely on monetary policy, but as well on the choices taken by fiscal policymakers, particularly on the structural side. One of the greatest challenges is thus to establish feasible paths for the future of monetary policy.

This dissertation attempts to provide a picture of the new normal of monetary policy, contributing to answer the following questions: What are the causes of low neutral interest rates? To what extent are those causes permanent in nature? What are the policy implications of low neutral interest rates? Would the current model of monetary policy be sustainable, if conditions regarding low neutral interest rates turn out to be permanent? What shape can the 'new normal' of monetary policy take in the medium-to-long term? Will the 'new normal' of monetary policy mark the beginning of a new era of macroeconomic policy?

The objectives of the dissertation are thus addressed by means of an extensive literature review, which is composed by two themed chapters. Chapter 2 reviews the last decade's research on possible explanations for lower neutral interest rates, including the secular stagnation, the global savings glut and safe assets shortage and the problem of debt overhang and deleveraging. Then, we present the main conclusions of the body of empirical work on the measurement of the neutral rate, in order to determine which explanations are most relevant for the debate on the new normal of monetary policy. The last section covers the policy implications of persistent low neutral interest rates, setting the stage for the debate on the "new normal" of monetary policy. Chapter 3 is a synthesis and evaluation of the recent debate on monetary policy, in which we intend to show how academics, policymakers and CBs reacted to the constraints of lower neutral rates. First, we will discuss the three key mandates referenced in the literature, including how their frameworks have evolved and the relevant aspects of their measurement. Second, we will review the performance of unconventional monetary policies during the GFC and its aftermath, as well as questions related to the future use of the new tools. Third, we give an account of the most recent pressures on CBI and the reasoning for CBI in the current environment. Finally, we present the recent monetary policy strategy reviews undertaken by the Federal Reserve (FED) and the European Central Bank (ECB) and review whether the new frameworks' major elements connect to the literature reviewed in the previous sections. Chapter Four concludes and offers open questions for future debates.

2. Monetary Policy Challenges

The long-run neutral interest rate is very low among advanced economies.[2] The neutral (or natural) real interest rate is the real rate of interest that equals the desired saving with desired investment, at full employment with stable inflation (Busetti and Caivano, 2019; Glick, 2020). The term "neutral" is used because, at this level, monetary policy does not stimulate any change in aggregate demand and output away from the flexible price equilibrium or natural rate of output. Thus, the ample evidence of the downward trend in neutral interest rates over the last four decades (e.g. Holston et al., 2017) implies that policy rates are expected to be limited by the effective lower bound (ELB) more frequently than in

[2] Albeit this dissertation will focus on the persistent levels of low neutral interest rates, policymakers and the academic community were faced with other two major challenges consisting in the recurrent undershooting of inflation targets, and the apparent flattening of the Phillips curve.

the past. Despite the problems of estimating neutral rates, it is highly consensual that the neutral real rates will remain low over the next decade (Rachel & Smith, 2017).

The debate over the dangers and limitations of the zero lower bound (ZLB) dates back to 1896, when Irving Fisher pointed out that a negative interest rate would be impossible to maintain as long as money could be hoarded (Fisher, 1896). It was believed that interest rates could not go below zero (Lombardi et al., 2018), until the introduction of negative short-term rates by the European Central Bank (ECB) and the Bank of Japan (BoJ), among others. Negative rates introduced the term effective lower bound (ELB), the limit beyond which CBs are unable to reduce nominal interest rates, under the risk that agents would prefer to hold cash instead of interest-bearing assets (Gerlach & Lewis, 2014).

As a result, expansionary monetary policy loses effectiveness at the ELB. Thus, liquidity trap risks increase. It results in an interest rate lower than the liquidity premium, which leads agents to maintain consumption levels below equilibrium and, consequently, to hold their most liquid assets instead of debt. It happens in anticipation of future interest rate hikes (Keynes, 1936). Years later, while discussing the Japanese experience, Krugman (1998) relaunched the topic. Accordingly, conventional monetary policies were ineffective as the quantity of monetary base injected in the economy was irrelevant and failed to stimulate growth. The private sector assumed money and bonds as perfect substitutes and any monetary expansion was believed to be temporary (Krugman, 1998). In addition, following Krugman (1998) well-known expression, unless CBs can "credibly promise to be irresponsible" and expectations are affected by unusual actions (Krugman, 2000), monetary expansions will not be effective. The liquidity trap may result in deflation and create a "deflationary spiral" (Krugman, 1999), possibly caused by self-fulfilling deflationary expectations. Hence, the worsening of deflation would lead to an increase in the real interest rate since the nominal rate is limited by the ELB, leading to a worsening of the output gap and thus to a "death spiral" (Krugman, 1999). Therefore, to promise efforts to achieve more inflation, which would reduce real interest rates, would affect agents' expectations and create conditions to relaunch the economy and sustain expected inflation (Krugman, 2014a).

Several factors have likely contributed to the decline in neutral interest rates. A more detailed account of these factors is given in the following sections, where we discuss the secular stagnation, the global savings glut and safe assets shortage and the problem of debt overhang and deleveraging.

2.1. Secular Stagnation

In 1938, Alvin Hansen introduced the secular stagnation theory to explain the US underemployment in the late 1930s (Hansen, 1939). Hansen (1939, p. 4) described the "essence of secular stagnation" as "sick recoveries which die in their infancy and depressions which feed on themselves and leave a hard and seemingly immovable core of unemployment". A stagnant economy would face chronic unemployment, as secular forces including declining population growth and lack of innovations reduced demand for investment (Backhouse & Boianovsky, 2016a; Summers, 2018). Technical progress would be crucial to revert the trend, along with public investment (Hansen, 1939).

Hansen projected long-term US economic stagnation. However, the post-WWII economic boom disproved his thesis. George Terborgh was the first sceptic about the secular factors of stagnation since they were already prevalent in the late 19th century US economy (Terborgh, 1945), and economic maturity stopped being associated with secular stagnation (see Galbraith, 1958; Rostow, 1990). As a result, Hansen's prediction turned out to be irrelevant and the argument on secular stagnation lost relevance in the following decades. The modern debate of secular stagnation would thus start in 2013, with Summers (2013), Gordon (2015), Eichengreen (2015) and others.

The following two sub-sections discuss secular stagnation. On the demand side, the secular decline in neutral interest rates owes to an investment-saving imbalance that reduces effective demand, and ultimately results in actual growth below its potential (Baldwin & Teulings, 2014). Here, the core of secular stagnation is described as a permanent ZLB environment which, ultimately, inhibits economic activity (Summers, 2013, 2016a). Alternatively, Robert J. Gordon introduces the supply side and is largely untroubled by the ZLB (Baldwin & Teulings, 2014). Rather, Gordon (2015) stresses low productivity growth, population growth and labour-force participation in explaining slower growth in potential output, which reduces aggregate demand and feeds-back into slower productivity growth. Ultimately, both authors acknowledge the demand-supply link (Bernanke, 2015a; Gordon, 2015; Summers, 2015a); however, they disagree on the sources of secular stagnation.

2.1.1. Demand Side Secular Stagnation

Lawrence Summers (2013) reintroduced the "secular stagnation" after the GFC, when growth was slower than expected, despite authorities' attempts to normalise the economy (Gualerzi, 2018; Summers, 2018). Summers (2016b) suggested that a lack of investment and

an excess of savings were dragging demand and neutral interest rates. The pattern might lead to deflation and more frequent ZLB events (Krugman, 2014a).

Summers presents two arguments to justify the revival of secular stagnation. First, output and employment fluctuations around the equilibrium are small and cannot return to full employment by market forces. The required nominal interest rate that re-establishes equilibrium is negative (Summers, 2015a) and, indeed, neutral interest rates have declined over the last three decades (e.g., Holston et al., 2017), as it can be seen in Figure 1.

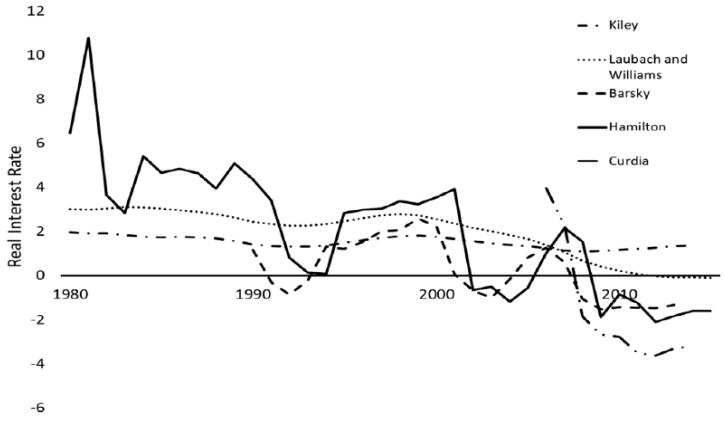

Fig. 7 Real equilibrium rate. *Sources*: Kiley (2015), Laubach and Williams (2015), Curdia (2015) and Hamilton et al. (2016)

Figure 1 - Real Equilibrium Rate Estimates, source: Summers (2018)

Second, growth might have been slower before 2007-2008, but an unsustainable financial environment disguised it (Summers, 2018). Before the GFC, the US had a period of satisfactory growth without clear evidence of overheating (Summers, 2015a). Likewise, the EA's growth performance before 2007 also relied on unsustainable financial flows to the periphery (Summers, 2014). Contrary to expected, the large financial stimulus of the last decades did not generate excess of demand (Summers, 2013), but rather asset price inflation and unsustainable levels of household indebtedness (Backhouse & Boianovsky, 2016a; Summers, 2015a, 2016b, 2018).

Hereupon Summers develops his premise: deceleration is the outcome of a downward trend in investment and an upward trend in savings propensities (Summers, 2016b). It results in desired levels of saving higher than desired levels of investment, dragging demand and reducing growth and inflation (Summers, 2016a). Moreover, the saving-investment mismatch generates a long-term decline in real interest rates (Summers, 2016b), which increases the likelihood of ZLB events (Summers, 2016a). Therefore, the core of the secular stagnation hypothesis relies on the permanence of the ZLB, which requires a major rethinking of policy

paradigm (Krugman, 2014a). Otherwise, conventional monetary policies are insufficient to attain the required level of the neutral rate that balances saving and investment, thus failing to stimulate real economy during a recession. At this point, it is useful to distinguish the main factors behind the low levels of neutral interest rates according to the demand side view. The following summary builds on Summers's research over the past decade.

2.1.1.1. Determinants of savings

The increase in supply of loanable funds, i.e., savings, can be ascribed to four main secular factors (Summers, 2014, 2015a, 2016a, 2016b, 2018). First, demographic changes consisting of slower population growth and increased life expectancy are encouraging retirement savings and reducing loan demand, putting a downward pressure on neutral interest rates (Eggertsson et al., 2019). Krugman (1998) has already argued that unfavourable demographic growth might well have contributed to Japan's liquidity trap. Slower population growth and longer longevity imply an increase in the dependency ratio, defined by Carvalho, Ferrero, et al. (2016) as the ratio of the 65-and-older population to the working age population. According to Rachel and Smith (2017), the dependency ratio is negatively related to national savings and positively related to real interest rates. In the past 30 years, the percentage of dependents fell from 50% to 42% of the world population (Rachel & Smith, 2017).[3] In addition, higher life expectancy is expected to persist (Lisack et al., 2017). Nonetheless, Rachel and Smith (2017) expect demography's effect on rates to reverse. Among the reasons are the decrease of working age population over the next generation along with below-replacement fertility levels in countries that account for half of the global population (Summers, 2018).[4] However, Aksoy et al. (2019) pessimistic view notes that a decrease in the working age population depresses the trend of innovation and growth (Kiley, 2020), leading to lower interest rates.

Second, inequality in the distribution of income increases the average propensity to save, as the rich save more than the poor (Summers, 2016b, 2018). Alichi et al. (2016) highlight the increase in income polarisation: there has been a redistribution from those with lower incomes, which have higher marginal propensity to consume, to those with high

[3] Such evolution reflects the boost in the proportion of working age population, the ones with higher propensity to save, in anticipation of a longer retirement (Kiley, 2020). This generation was born between 1946 and 1964 – the well-known baby boom generation (Eggertsson et al., 2019; Gagnon et al., 2016).

[4] See, for example, 65 and Older Population Grows Rapidly as Baby Boomers Age, (Retrieved in 12 April, 2021) https://www.census.gov/newsroom/press-releases/2020/65-older-population-grows.html

marginal propensity to save. Inequality works either by decreasing aggregate demand or by changing demand structure and reducing employment (e.g., Backhouse & Boianovsky, 2016b). Moreover, Rachel and Smith (2017) argue that inequality is expected to increase if technological progress grows faster than educational attainment, which might be exacerbated if low-skilled employment is replaced by technology. Although Summers added this mechanism to his theory, Stiglitz (2012), Krugman (2013, 2014b) and Piketty (2018) headed the revival of research on the link between rising inequality and sluggish growth.

Third, there has been global build-up of reserves by CBs, particularly by emerging market economies (EME), especially China (Summers, 2014, 2016b). Additionally, capital outflows from nations with controlled exchange rate regimes have increased (Summers, 2018). Although the savings glut will be discussed in further detail in section 2.2, since 2000, there has been a rise in EME savings rates which has been correlated with faster income growth. Nevertheless, given that inequality between advanced economies and EME continues to decline, the phenomenon may revert if savings rates in EME fall below those in developed countries (Rachel & Smith, 2017). Finally, the upsurge in savings may also be attributed to debt limits, especially restrictions on mortgage borrowing. Summers (2015a, 2016b, 2018) cites a number of relevant restrictions inherited from the crisis. These include capital collateral requirements, which have boosted the demand for secure assets, increasing costs of financial intermediation, and household deleveraging.

2.1.1.2. Determinants of investment

The reduced demand for loanable funds, i.e., investment demand, is affected by three main variables. The first is demography, since a decline in population growth entails a slower growth in the labour force, lowering demand for new equipment, business structures and housing. These implications will predictably persist (Summers, 2016b, 2018).

The second is the decline in debt-financed investment (Summers, 2014). Several factors may have contributed to this reduction, including limits on financial intermediation following the GFC, but Summers (2014) emphasises the role of structural changes in economic activity. In contrast to traditional industries, technology corporations hoard large amounts of cash and achieve high market values with little capital investment (Summers, 2014). This de-massification of the economy, in which more value is assigned to less tangible goods, implies lower need for physical investment (Summers, 2016b, 2018).

Finally, the decline in the relative price of capital goods, particularly the relative cost of investment in information technology (Summers, 2018), implies that a lower amount of savings may now purchase more capital than in the past (Summers, 2016b). The same investment projects require a lower share of nominal GDP (Eichengreen, 2015), which decreases borrowing, spending and the propensity to invest (Summers, 2014). According to the IMF (2014), the relative price of capital goods has decreased 30% since the 1980s and according to Gordon (1990), this trend can be explained by research and development being incorporated into cheaper, more efficient capital goods (Eichengreen, 2015). In addition, Rachel and Smith (2017) suggested that desired investment has become less sensitive to interest rates as its opportunity cost has decreased. Thus, the lower cost of capital may not attract additional projects. Overall, these factors result in an excess of desired saving over desired investment and lower real interest rates (Eichengreen, 2015).

2.1.1.3. A Problem of Aggregate Demand

Ultimately, the outcome of these fundamental factors is a stagnant economy with structural demand deficiencies (Summers, 2016b). Bernanke (2015a) emphasizes that the secular stagnation hypothesis is about inadequate demand, not aggregate supply. Shortfalls in investment and consumption spending prevent the economy from reaching full employment, even if potential output is increasing (Bernanke, 2015a).

Summers supports his argument with the general approach that distinguishes demand shocks from supply shocks. Prices go down when unfavourable shocks come from demand, while negative supply shocks often lead to price increases (Summers, 2015a). Given the decade of low inflation, Summers (2015a) emphasises the importance of demand and mentions the inverse Say's Law, which refers to the Keynesian notion that "lack of demand creates lack of supply". Moreover, Summers (2014) foresees a detrimental effect of demand side secular stagnation on potential output. This deceleration of potential output may be mostly attributed to the reduced capital investment and labour input, and to a lesser extent to a decline in total factor productivity (Summers, 2014). Indeed, Storm (2019) found evidence that the slowdown in productivity growth in the US economy has been demand-driven since the mid-1970s, owing to a crisis of "under-consumption" caused by declining real wages and rising inequality. In the section that follows, the supply-side theory for secular stagnation is contrasted with these concepts.

2.1.2. Supply Side Secular Stagnation

Gordon set the tone for the "supply-side" discussion on secular stagnation with the statement "America is riding on a slow-moving turtle" (Gordon, 2014, p. 191). In contrast with the 1930s, when secular stagnation referred to an economy with actual output 20 percent lower than potential output, the problem of stagnation now refers to an exceptionally small gap between actual and a slowly-growing potential output (Gordon, 2014; Storm, 2019). Recent empirical evidence points to a major slowdown in both actual and potential growth, which was already noticeable prior to 2007 (Fernald, 2014; Fontanari et al., 2020). Therefore, Gordon (2014, 2015), among others, refutes Summers's view of secular stagnation, and emphasizes that the slowdown of potential real GDP growth is pressuring actual output downward (Storm, 2019). The downward pressure owes to a decline in productivity growth, associated with the gains of the third industrial revolution (Backhouse & Boianovsky, 2016b).

2.1.2.1. Main determinants of potential output growth

According to US data published by Gordon (2018), during 1920-1970 and 2006-2016, annual average real GDP growth decreased from 3.7% to 1.4%. The slowdown of potential real GDP growth might be explained by a decline of population growth, a fall of labour force participation, and slower productivity growth. In fact, even with low unemployment rates, declining population growth and the exceptional decline in labour force participation are holding output trend (Gordon, 2014). From 2007-2014, the employment-to-working-age population ratio declined at a rate of 0.8% per year (Gordon, 2014), mostly owing to secular factors like the ageing of the baby-boom generation (Aaronson et al., 2014), differently from the period 1972-1996, during which baby boomers and women entered the labour market (Gordon, 2014). Moreover, the trend is not expected to be reversed (Aaronson et al., 2014).

Considering the "once-in-a-century acceleration of innovation" (Greenspan, 2000) and the poor average economic growth, the last 50 years have been labelled as a "paradox". During 2004-2014, productivity fell to 1.2%, notwithstanding the recovery of 1996-2004, when it registered an annual rate of 2.5%. (Gordon, 2015).[5] Moreover, there is no signals of a reversal until 2018 (Gordon & Sayed, 2019). Gordon (2016) distinguishes three main factors behind this trend: education attainment, capital deepening and TFP growth.

[5] If one compares these eras with the period of 1920-1970, the difference is even more considerable. Gordon (2018) documents annual growth rates of labor productivity of 2.8% during that period.

2.1.2.2. Sources of slow productivity growth

Education attainment, particularly in the US, has been a relevant trigger for productivity growth since 1890. However, it has grown at a slower rate over the last decades, inhibiting productivity growth (Gordon, 2016). It owes to the fall in college graduates, rising educational costs and rising student indebtedness. The outcome has been lower business dynamism and delayed household formation (Gordon, 2018). Regarding rising capital deepening, i.e., the capital-labour ratio, it did not explain the productivity trend prior to 1970 (Gordon & Sayed, 2019). At the time, capital deepening was considerably lower. After 1970, however, they have found highly significant coefficients in regressions relating productivity growth trend and the capital-labour ratio. Together with tight labour markets and higher investment, rising capital deepening could generate a moderate trend revival.

Nonetheless, standard growth models such as Gordon and Sayed (2019) fail to explain the strong trend of productivity growth before 1970 and the low trend after 2012. Such class of models must consider the contribution of a residual that measures total factor productivity (TFP) growth. TFP growth is a proxy for the effect of innovation and technological change on economic growth (Gordon, 2016). Its evolution over the past decades has diverged considerably. During 1920-1970, US TFP growth was over three times that of 1890-1920 or 1970-2014, owing to the "Great Inventions" of the "Second Industrial Revolution" (Gordon, 2018, p. 8). Since then, a boost of TFP growth caused the productivity revival of 1996-2004. However, it only lasted temporarily. After 2004, the yearly growth rate of TFP slowed to 0.5%, 0.9 p.p. below the 1996-2004 average (Gordon, 2015). Due to post-war rebuilding and the delay in adopting the "Great Inventions," developed East Asia and Western Europe saw faster productivity growth than the US during 1950-1970. Nevertheless, the productivity revival of 1996-2006 did not materialize in these regions (Gordon, 2018).

2.1.2.3. Implications and prospects for the future

Evidence led Gordon (2018) to conclude that unlike past innovations, which have had a global impact on human life, digital revolution has mainly hit office practices, with less impact on manufacturing or consumers lives. Thus, the current decline of TFP growth reflects "the maturation of the revolution in business methods" (Gordon, 2018, p. 8). Gordon and Sayed (2019) conclude that robotics, artificial intelligence, or autonomous vehicles do not have as great an impact as the 1980s and 1990s digital transformations. Hence, these authors do not expect a productivity revival like the one of the 1990s.

Eichengreen (2015), among others (e.g., Brynjolfsson & McAfee, 2014; Mokyr, 2014), takes an optimistic perspective of innovation, suggesting that once the economies complete a range of adaptations, productivity will step up. The newest wave of innovations is already disrupting health care, education and finance sectors. Nonetheless, Gordon (2014) still predicts that four main headwinds will hold back potential growth on the supply side (Gordon, 2012), including demographics, education, inequality, and government debt. Under this view, rather than influencing the supply of savings and thus determining consumption and investment, these headwinds will primarily determine labour force participation, productivity growth and potential output (Gordon, 2012).

2.1.3. The Ultimate Interaction Between Demand and Supply

Ultimately, slower potential output growth reduces the need for capital formation and aggregate demand, hence exacerbating the effect on productivity and secular stagnation (Gordon, 2015). At this point, Gordon (2015) does not refer to secular stagnation as something limited to the supply or demand side, but rather as the result of supply and demand interactions. This perspective is supported by Summers (2015a) who acknowledges the importance of the supply side in explaining the slowdown in growth, namely demographic headwinds towards a slowdown in productivity growth. However, their perspectives are primarily divergent on the mechanism that leads to stagnation: Gordon "refers to potential output itself" (Gordon, 2014, p. 185) and is largely unperturbed by the liquidity trap and negative neutral interest rates (Baldwin & Teulings, 2014). Summers, instead refers to actual output and emphasizes the incapacity of policymakers to manage the economy when the ZLB is holding it below its potential.

2.2. Global Savings Glut

Initially, the secular stagnation theory was applied to a small number of advanced countries, namely the US and, to a lesser extent, Europe and Japan, concentrated on domestic capital creation and domestic family saving. However, Bernanke (2015a) argued that the hypothesis lacks an international dimension, since it does not account for the availability of attractive investment opportunities abroad (Bernanke, 2015b). Therefore, international capital movements are an important alternative to explain low neutral interest rates.

The "global savings glut" (GSG) was first discussed by Ben Bernanke in 2005. The increase in the global supply of savings would account for the "conundrum" of low long-term real interest rates (Greenspan, 2005) as well as the increase in the US current account

deficit (Bernanke, 2005). The majority of these savings come from Asian EME, mainly China, and oil-producing economies. It essentially reflected the Asian governments' propensity for building-up foreign reserves after financial crises of the 1990s, and the escalation of oil prices in international markets (Bernanke, 2005). Due to the attractiveness of the US's financial markets, these flows of savings increased US asset prices, appreciated the dollar and deteriorated the US current account balance (Bernanke, 2005).

Bernanke's approach is supported by the original textbook model of Metzler (1968). In the two-country model with integrated capital markets, a Home current account deficit is counterbalanced by a Foreign current account surplus, so that Home's desire to borrow is ensured by Foreign's willingness to lend, at a unique global equilibrium neutral real interest rate (Holmes, 1973; Obstfeld, 2021). In Bernanke (2005), the Home country is the US and its current account deficit could be either considered the US net foreign borrowing, or the excess of investment over national saving that would be covered by Foreign savings.

The GSG and the demand-side secular stagnation have similarities. Indeed, both posit a problem of excessive desired savings over desired investment (Bernanke (2015b). Summers (2015b) even states that "secular stagnation and excess foreign savings are best seen as alternative ways of describing the same phenomenon." Also, both can account for slower US growth (Bernanke, 2015b; Summers, 2015b), since the GSG weakens aggregate demand through large trade deficits and weak exports (Bernanke, 2015b). However, while the secular stagnation approach stems from fundamental factors, the savings glut results largely from government policy decisions, such as the attempt of Asian economies to build-up international reserves or to diminish burrowing, since the late 1990s (Bernanke, 2015b).

This difference has significant policy implications. Summers (2016a) response to secular stagnation is, as it will be discussed in further detail in section 2.5, fiscal policy and structural reforms. Bernanke (2015b), instead, suggests that the proper response is to attempt to reverse policies that cause the excess of savings, so establishing a more balanced international trade system. Examples include the liberalization of international capital flows and the reduction of foreign exchange market interventions. Nonetheless, the savings glut could be a possible solution to defeat secular stagnation, since profitable foreign investment could compensate for the lack of domestic investment opportunities (Bernanke, 2015a). Therefore, the GSG suggests a more optimistic perspective of the current stagnation (Bernanke, 2015b), seeing it as transitory (Gehringer & Mayer, 2019).

The US current account deficit and the EME current account surpluses have been falling since 2006. Future applicability of the GSG as an explanation for low neutral interest rates will be conditional upon three observations (Bernanke, 2015b). First, if China continues its efforts to reduce its reliance on exports and increase its focus on domestic demand. Second, if the build-up of foreign reserves amongst EME continues to diminish. And third, if oil prices remain low. This gradual unwind of the excess of savings of EME is already suggested by the IMF (2014) and Rachel and Smith (2017). However, this trend has been offset by the collective current account surplus of the EA, notably Germany (Bernanke, 2015b), which recorded the second largest current account surplus in 2020.[6]

2.2.1. Safe Assets Shortage

Bernanke (2005) was challenged by Caballero (2006) for tying the GSG to a general shortage of assets, without isolating its safe asset component. In fact, according to the IMF (2014), the rapid accumulation of reserves in EME largely increased demand for safe assets, defined as simple debt instruments expected to maintain its value amid adverse systemic events (Caballero et al., 2017). Their supply is generally associated with a small number of advanced economies, notably the US, which guarantee improved financial and fiscal conditions. However, the distinction between general and safe assets only became relevant following the GFC and the European Sovereign Debt Crisis (ESDC) (Caballero et al., 2017).

In this sense, there has been a growing shortage of safe assets in recent decades, as supply has not kept pace with global demand due to a lower growth rate of advanced economies (Caballero et al., 2017). Accordingly, the shortage became noticeable with the increase in equity risk premia since 2002, which is the outcome of a disconnect between balanced expected returns on equity and falling short-term interest rates (Caballero & Farhi, 2018). During 2005-2007, this shortage was hidden in part by a fast rise in the supply of "pseudo-safe assets", either created by the US financial sector or issued by fiscally weak sovereign governments such as Greece, Spain or Italy (Caballero et al., 2017). However, these assets lost their "safety" quality from 2007-2011. As a result, global supply decreased (Caballero et al., 2017; Eichengreen, 2016) whilst demand grew owing to deleveraging motives and regulatory restraints. Thus, the shortage of safe assets intensified.

[6] Refer to the IMF, 2021 External Sector Report. China has the largest current account surplus, in the amount of 271 billion dollars, while Germany accounts 265 billion dollars. (For the full report, see https://www.imf.org/-/media/Files/Publications/ESR/2021/English/text.ashx).

There is a large strand of literature that recognizes the shortage of safe assets as a major macroeconomic event. When a shortage occurs, the price of safe assets increases, the safe interest rate falls and the risk premium rises. Behind this mechanism, there is a process of securitization of risky assets through which financial intermediaries issue safe assets, driving down safe rates and generating benign effects for output (Caballero & Farhi, 2018). However, once the scarcity of safe assets strengthens, whether due to a decrease in supply (see e.g. Barclays, 2012) or an increase in demand (see e.g. Sachs, 2012), neutral safe rates fall to negative values and reach the ZLB. Therefore, markets cannot be cleared through a fall of safe real interest rates which remain above their equilibrium level. The economy stays below its potential, which implies delayed savings, lower consumption, delayed investment, and lower aggregate demand. As real interest rates increase, a recession begins with probable deflationary effects that further decrease the output (Caballero & Farhi, 2018; Caballero et al., 2017). The ZLB is therefore a tipping point from which safe assets shortages turn out to be malign. A "safety trap" is the result of equilibrium adjustments that come at the expense of lower output (Caballero & Farhi, 2018). This situation is similar to a liquidity trap, as real rates cannot be further reduced, resulting in a recession. However, Caballero and Farhi (2018) stress three broad differences between safety traps and liquidity traps.

The first refers to the risk premium. Caballero et al. (2017) described liquidity traps as situations of excess of savings across asset classes, while safety traps are exclusive to safe assets. Therefore, whereas risk premia play a limited part in liquidity traps, because the general shortage of assets implies a general reduction in interest rates, safety traps have at their core positive and endogenous risk premia, because the shortage of safe assets results in a lower safe real interest rate compared with a broad real interest rate (Caballero & Farhi, 2018). The second difference is that safety traps may be persistent or even permanent., due to a zero net supply of safe assets (Caballero & Farhi, 2018). Contrary to liquidity traps, escaping safety traps requires a rise in the supply of safe assets (or a decrease in its demand), irrespective of the supply or demand fluctuations of other assets, including risky assets (Caballero et al., 2017). Finally, effective policies in safety traps are those which influence the value of safe assets and safe real interest rates (Caballero & Farhi, 2018). This topic will be further developed in section 2.5.

Since a safety trap might be a permanent phenomenon, it may be compatible with the secular stagnation hypothesis (Caballero & Farhi, 2018). Summers (2013) found that even

large financial bubbles, such as the GFC, failed to lift the economy out of secular stagnation, which may have been the result of a safety trap. Only safe bubbles could boost economic activity by mitigating the dearth of safe assets, as opposed to the risk bubble which turned out to burst (Caballero & Farhi, 2018).

In conclusion, Lo and Rogoff (2015) made the crucial point that the low level of interest rates prior to 2007 is not necessarily a puzzle, but rather it is consistent with the GSG hypothesis. In this framework, the phenomenon is temporary and unwinding, providing a far more optimistic perspective on neutral interest rates than secular stagnation. If one distinguishes the demand for assets by their type, however, the excess global demand for safe assets stands out as a situation that may become more permanent. Ultimately, the safety trap is compatible with the secular stagnation hypothesis, sustaining the downward trend in neutral rates. The safe asset shortage supports thus the argument of Summers (2013) that secular stagnation may have been a reality way before the GFC.

2.3. Debt Overhang and Debt Deleveraging

To close the range of explanations for the low neutral interest rates, we will focus on the debt overhang and deleveraging cycle. The idea was initially proposed by Rogoff (2016) as a more useful alternative to secular stagnation, given that the poor recovery after the Great Recession resulted from the usual aftermath of a financial crisis (Lo & Rogoff, 2015), as several other episodes documented by Reinhart and Rogoff (2008, 2009a, 2009b) demonstrate.[7] Therefore, a debt super-cycle is temporary, impacting only cyclical output (Rogoff, 2016). However, due to the remarkable growth of private, public, and external debt over the last half-century and its recent upsurge with the COVID-19 pandemic, the repercussions of debt go beyond its cyclical effects. This section builds on the premise that the high levels of debt aggravate secular stagnation, by making the recovery from the financial crisis more difficult and slower than in past historical contexts. Thus, our perspective is a complement to secular stagnation rather than an alternative.

[7] The work of Reinhart and Rogoff (2008, 2009a), documented in their 2009 book This Time is Different, establishes quantitative and qualitative parallels between the 2008 financial crisis and other financial crises, namely at the level of the fall in output, the housing boom and bust, the U-shaped recovery in per capita income, and the increase in private leverage (see also Claessens et al., 2010).

2.3.1. Debt Overhang, Deleveraging, and Slower Nominal Growth

Debt overhang is excessive debt that economic actors are unable to service given their cash flows (e.g., Priftis & Theofilakou, 2021). Accordingly, it may have hampered the recovery of global economy since the GFC, given the lack or absence of deleveraging in key global sectors. To which levels debt should return is still uncertain, since low global interest rates reduce carrying costs (Lo & Rogoff, 2015), but decelerate growth, compromising debt sustainability. Debt overhang leads to slower growth and lower inflation, which impedes deleveraging, and results in continued sluggish growth (Buttiglione et al., 2014).

This vicious cycle is consistent with the forecasts of Eggertsson and Krugman (2012) who modelled the liquidity trap as an outcome of deleveraging shocks. In practise, debt overhang would demand a larger interest rate drop to sustain potential output, not feasible near the ZLB. Therefore, the higher the debt overhang, the greater the output contraction and the slower the recovery (Eggertsson & Krugman, 2012). Thus, it may be the case that the effects of debt overhang and deleveraging on output and recovery are aggravated at the ZLB. This feedback loop between debt overhang, deleveraging and growth is reminiscent of Fisher (1933) theory of debt-deflation spiral, in which deflation raises real debt burdens, hence increasing the pressure on deleveraging and generating further deflation.[8]

Significant evidence exists that the financial boom and bust cycle leave lasting or even permanent impairment to the real economy (e.g. BCBS, 2010; Claessens et al., 2012). Drehmann et al. (2017) identified a link between future debt service due to current credit expansions and lower future output growth. This is a specific sort of "hysteresis", associated with financial upheavals (see Ball, 2014b for evidence on strong hysteresis effects after the GFC). It differs from the standard concept of hysteresis first proposed by Blanchard and Summers (1986), which suggests that persistent aggregate demand shortfalls produce recessions that may have extremely enduring effects on the level of output relative to trend (Blanchard et al., 2015; see Cerra et al., 2020 for a recent review of the literature on hysteresis). In light of this, the sections that follow seek to establish a link between debt overhang and deleveraging in the public and private sectors and the possibility of this resulting in another push in the secular stagnation.

[8] The hypothesis of negative feedback loops between debt and growth when countries are highly indebted is consistent with the analysis of Bornhorst and Arranz (2014), which suggests that the negative growth impact of debt in one sector, whether it be the government, household, or corporate sector, is exacerbated when other sectors also hold high levels of debt.

2.3.2. Public Sector Debt Overhang and Deleveraging

The causality from high levels of public debt to output growth is not consensual. In economic theory, larger public debt is often associated with the phenomenon of crowding out, with several authors finding that high public debt has a negative effect on growth.[9] Reinhart and Rogoff (2010), for instance, published a widely cited academic paper concluding that, over certain threshold, public debt is detrimental to growth, which had major influence in supporting austerity programs in early 2010s. However, other authors have questioned the causal negative link between debt and growth, making it difficult to prove (e.g., Herndon et al., 2014; Panizza & Presbitero, 2013; Simon et al., 2012).

Nevertheless, the reaction of governments to debt is key to understand the potential impact of public debt overhang in the economy (Lo & Rogoff, 2015). The crucial idea is that high debt may require an active reaction during public deleveraging, through orthodox measures such as primary surpluses (see, e.g., Mauro et al., 2015), or heterodox measures such as default, inflation, or financial repression, that ultimately contribute to further decreased growth (Lo & Rogoff, 2015). Alternatively, it may involve a passive deleveraging, in which governments rely on growth to decrease the debt-to-GDP ratio. In this sense, the sharp contraction in the aftermath of the GFC motivated a body of empirical literature on the contractionary effects of austerity, either on the demand side (see, e.g., House et al., 2020 for the negative effects on consumption, investment, inflation, and GDP growth); or on the and supply-side (see, e.g., Bardaka et al., 2021 for the negative effects on TFP). The fact that governments are more prone to run primary surpluses when debt levels are high is consistent with a connection between high debt and lower growth (Lo & Rogoff, 2015), enabling us to establish a link between debt overhang and secular stagnation.

2.3.3. Private Sector Debt Overhang and Deleveraging

According to Bornhorst and Arranz (2014), private sector debt may be more detrimental to economic growth than public sector debt. Indeed, the aftermath of a financial crisis is often marked by a sharp decline in private debt, followed by a decline in growth and an increase in unemployment (Cuerpo et al., 2013; Reinhart & Rogoff, 2010). It is mostly attributed to cuts in investment or expenditures on durable goods, rather than on perishable consumption (e.g., Cecchetti et al., 2011; Eggertsson & Krugman, 2012; Gertler & Gilchrist,

[9] Refer to Elmendorf and Mankiw (1999) for the landmark study on the "conventional theory of government debt" and the long-run contractionary effects of higher public debt.

2018; Guerrieri et al., 2020). Thus, as extremely indebted households will likely borrow and consume less, it will weigh down demand, profitability estimates and corporate balance sheets (Bricongne & Mordonu, 2017). Companies with a high level of debt must go through lengthy procedures of balance sheet repair, resulting in a prolonged decline in investment, which has a significant negative effect on growth (Priftis & Theofilakou, 2021). Firms responses include increase savings by cuts in the wage bill (Giroud & Mueller, 2017).

Literature is clear in pointing the potentially permanent effects that deep recessions fuelled by credit-intensive expansions tend to have on recoveries (Jordà et al., 2012). Thus, debt overhang and later deleveraging may have strengthened the dynamics of secular stagnation, either directly or indirectly, which contributes to explain the trend in neutral rates.

2.4. Empirical Evidence

Thus far, we have discussed three explanations for the declining trend growth that has driven down equilibrium real interest rates to persistently low levels, constraining the conduct of monetary policy. In fact, the neutral interest rate has a pivotal role in the policy rule literature as it provides a benchmark for gauging the monetary policy stance (Laubach & Williams, 2003). Therefore, in the last decade, there has been a resurgence of interest in measuring the neutral interest rate and determining whether it has decreased and what factors explain the trend. What follows is a review of this empirical literature, in order to determine which explanations are most relevant for the debate on the new normal of monetary policy.

Generally, estimates of neutral interest rates are associated with great uncertainty, due to sensitivities to small changes of econometric specifications, short data samples, or collinearity (e.g., Beyer & Wieland, 2019; Orphanides & Williams, 2002; Weber et al., 2008). At least three approaches are used to assess the determinants of neutral interest rates, which can coexist in the same model (Lunsford & West, 2019). The first links the downward trend in real interest rates to the secular decline in growth, (e.g., Laubach & Williams, 2003; Yi & Zhang, 2017); the second relates the trend to the determinants of aggregate desired saving and investment, (e.g., Barro & Sala-i-Martin, 1990; Rachel & Smith, 2017); and the third employs reduced-form VARs to examine additional factors (e.g., Lunsford & West, 2019).

Simple models of aggregate saving and investment are amongst the most relevant empirical work, either conducted at an individual country level (e.g., Lunsford & West, 2019) or with a panel of countries (e.g., Aksoy et al., 2019; Ferrero et al., 2017; Hamilton et al., 2016; Holston et al., 2017). However, the existence of cross-border financial flows

establishes a global trend in interest rates, blurring the impact of country-specific factors (Kiley, 2020). In this sense, Bernanke (2005) and, more recently, Caballero et al. (2017) have redirected recent research to a greater emphasis on global factors (e.g., Del Negro et al., 2019; Obstfeld, 2019; Rachel & Smith, 2017; Rachel & Summers, 2019). Therefore, we begin by examining the saving-investment framework on advanced economies, whose approaches are generally based on overlapping-generation models. Those are the cases of Rachel and Smith (2017), Rachel and Summers (2019), Eggertsson et al. (2019) and Lunsford and West (2019).

First of all, Rachel and Smith (2017) suggest that savings and investment schedules are relatively inelastic in relation to interest rates, which explains the modest changes in levels of savings and investment in recent years, compared to the considerable fluctuations in interest rates. Since the 1980s, the global neutral interest rate has declined by 4.5 p.p.. The combination of reduced trend growth expectations and changes in savings and investment preferences can account for around 4 pp of this decline (see Figure 2 for a representation).

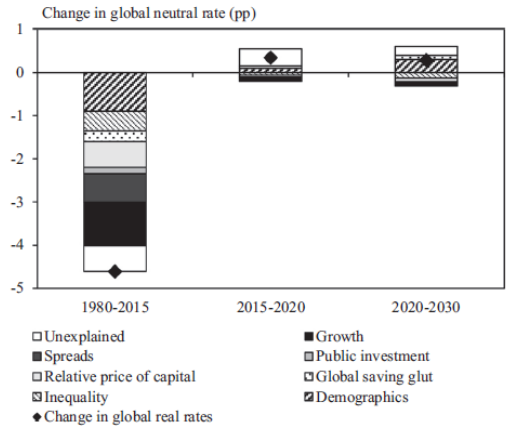

Figure 2 - Decomposition of the decline in the neutral interest rate, estimates of Rachel and Smith (2017)

Shifts in desired savings are mostly attributable to demographic factors, such as the fall in the dependency ratio, whereas shifts in desired investment are primarily explained by the increase in the spreads between the risk-free rate and the rate of return on capital. These findings support Caballero et al. (2017) and Caballero and Farhi (2018) work on the shortage of safe assets and the safety trap. The GSG, on the other hand, has a much lower influence – roughly a fifth that of demography – suggesting the stand down of this factor in explaining the fall of global interest rates (Rachel & Smith, 2017).

In addition, Rachel and Summers (2019) emphasise the impact of fiscal policy on real interest rates (Figure 3). Since the 1970s, had no fiscal measures been implemented to counteract private trends, the neutral real rate would have declined by 7 p.p.. Through model

simulations with profiles of government debt, government spending, social security and old-age healthcare expenditures, Rachel and Summers (2019) found that fiscal policies have increased neutral rates by around 4 p.p., indicating that budget deficits were necessary to promote full employment in the US. This has important policy implications, including promoting the debate on the use of fiscal policy to address stagnation, as discussed in section 2.5 in further detail. Demographics and TFP growth are the main forces operating contrariwise, with inequality having also a negative albeit smaller effect.

Eggertsson et al. (2019) findings are in line with the previous studies (Table 1). Demographics, including mortality rate and total fertility rate, and TFP growth seem to account for the bulk of the decline in the neutral interest rate, while government debt appears to have acted as a counterweight. Shifts in the labour share and the relative price of capital goods contributed less to the decline in rates. In turn, Lunsford and West (2019) took a reduced-form approach to estimate long-run correlations between a set of variables and safe real interest rates for the US. Demographic variables and labour hours growth appear to explain most of the trend in rates since the 1980s, while government dissaving, understood as the federal deficits and debt, may be of second-order significance.

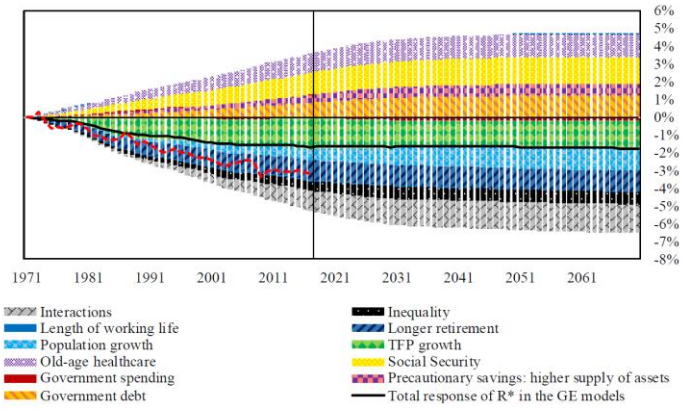

Figure 3 - Decomposition of the decline in the neutral interest rate, estimates of Rachel and Summers (2019)

Forcing variable	Δ in *r*	Percent of total Δ
Total interest rate change	−4.02%	100
Mortality rate	−1.82	43
Total fertility rate	−1.84	43
Productivity growth	−1.90	44
Government debt (percent of GDP)	+2.11	−49
Labor share	−0.52	12
Relative price of investment goods	−0.44	10
Change in debt limit	+0.13	−3

Table 1 – Decomposition of the decline in the neutral interest rate (1970-2015), estimates of Eggertsson et al. (2019)

These results suggest that demographics is a transversal determinant and must be considered in calibrated general equilibrium models. A large body of research studies solely the demographic effects on interest rates. For example, Carvalho, Ferrero, et al. (2016) and Gagnon et al. (2021) estimated that the demographic transition associated with the ageing of the baby boom generation and higher life expectancy have led to a 1.5 p.p. fall in neutral interest rates. Apart from demographics, Lisack et al. (2017), Aksoy et al. (2019) and Busetti and Caivano (2019) attribute also the trend in neutral rates to a decline in TFP growth.

In contrast to the saving-investment framework, another strand of literature has focused on the effect of safe assets demand. The empirical work of Del Negro et al. (2019) demonstrates that the rising demand for safe assets after the Asian crisis of the late 1990s is a major explanation for the global downward trend, as the global convenience yield, i.e., the risk premium, accounts for half of the decline in the global real interest rate. Previously, Rachel and Smith (2017) estimated that the rising spread between the risk-free rate and the rate of return on capital accounted for about 16% of the decline in global real interest rates.

In conclusion, since the 1970s, the causes of the fall in neutral interest rates are likely numerous, distinct, and difficult to identify (Kiley, 2020). A major conclusion of Kiley (2020) is that financial and macroeconomic approaches must be further integrated, in order to comprehend trends. Our analysis of the literature allows us to draw some preliminary conclusions. Demographics, underlying growth, TFP growth and inequality appear all to be exerting a downward trend on neutral interest rates, suggesting the importance of supply-side factors. Rising spreads seem to also account for the pattern, suggesting a role for savings, demand for safe assets and common global factors in the decline in neutral interest (Kiley, 2020). In addition, government debt also appears to have functioned as a counterweight to the trend, suggesting the potential role of fiscal policy in addressing stagnation. Moreover, reduced-form regressions (e.g., Aksoy et al., 2019; Ferrero et al., 2017) show how many of the determinants of the neutral interest rates have exhibited similar trends, suggesting high degrees of co-movement, i.e., multicollinearity between relevant variables (Kiley, 2020). Therefore, the global determination of real interest rates implies that CBs may be driven to the ZLB more frequently than before due to foreign events (Obstfeld, 2019).

In this sense, these fundamentals suggest that there has been a steady decrease in neutral interest rates over the past 40 years and although the trend may flatten, it is unlikely to reverse (e.g., Rachel & Smith, 2017). Therefore, there is less room for monetary policy, as

policy rates are more likely to be driven to the ZLB than before (Obstfeld, 2019). Since conventional monetary policy loses its stabilising power, a major rethinking of macroeconomic policy is arguably required (Krugman, 2014a). In the following section, we briefly cover the policy implications of persistent low neutral interest rates, setting the stage for the debate on the "new normal" of monetary policy.

2.5. Policy Implications

Prior to the 1960s, policymakers relied mainly on fiscal policy to manage the business cycle, while the primary role of monetary policy was to maintain low interest rates and promote government investment (Friedman, 1968). In the 1960s and 1970s, monetary and fiscal policy had "roughly equal billing" for policymaking (Blanchard et al., 2010). Since the "stagflation" in the late 1970s, a period of high inflation and high unemployment, fiscal policy was disregarded in favour of monetary policy. Monetary policy should be run by independent, inflation-targeting CBs, whereas fiscal policy should aim at keeping prudential debt and deficit limits (Baldwin & Teulings, 2014). This entailed relying primarily on automatic stabilisers and strictly controlling discretionary fiscal policy. The work of Friedman on the role of money (Friedman, 1956, 1957) and Friedman and Schwartz (1963) gave rise to the influential monetarist theory, which emphasized the role of the quantity of money in affecting output and price changes in the short-run, and postulated the neutrality of money in the long run (Nobay & Johnson, 1977). Such theoretical apparatus was later incorporated into new Keynesian models in which interest rates came to be the main policy instrument, and decisively shaped the institutional framework and conduct of monetary policy since the early 1990s. It started to be implemented by independent CBs to manage short-term interest rates to stabilize aggregate demand with a clear priority for price stability and a secondary objective of stabilizing output and employment at their natural levels.

This was the conventional wisdom and consensual policy framework when deflation, the ZLB and the liquidity trap became a reality in Japan. Given the inefficacy of conventional monetary policy, Krugman (1998) proposed the classic approach of using fiscal policy under the form of "pump-priming fiscal expansions", i.e., a temporary fiscal stimulus until the economy re-established the equilibrium. However, expansionary fiscal policy would have to be sustained long enough, which might raise solvency questions (Krugman, 2000). Since fiscal policy might not be a definitive answer, Krugman (1998) developed a theoretical model

of unconventional monetary policy, launching debate on this approach.[10] Nevertheless, excluding Japan, attention to the possibility of a liquidity trap was limited at the time, and monetary policy remained the primary countercyclical tool, according to the general principles of the prevailing policy consensus (e.g., Blanchard et al., 2010). It was only after the GFC that macroeconomic policy debates deepened, due to the threats of secular stagnation and of a permanent liquidity trap in advanced economies.

Given the ineffectiveness of monetary policy, "demand side" secular stagnation proponents turned to fiscal policy. Accordingly, it should reduce national savings, raise neutral interest rates, and promote growth (Summers, 2016a). Moreover, the size of fiscal multipliers is usually amplified at the ZLB (e.g., Batini et al., 2014). Since neutral interest rates are at historically low levels, there may be more breadth for public spending and public investment without crowding out private investment (Eichengreen, 2020). Blanchard (2019) and Rachel and Summers (2019) increasingly supported fiscal policy responses, suggesting that without government debt and spending, interest rates would be considerably lower.

Differently, proponents of the "supply side" aim to improve long-term potential growth, as opposed to actual GDP growth rate or neutral interest rates (Summers, 2018). As a result, they favour structural policy above macroeconomic policy. For instance, Fernald (2016) does a brief but broad set of recommendations that may help to improve labour productivity and capitalise on innovation, including more public investment in education and life-long learning, R&D, infrastructures and an increase in economic flexibility and dynamism. Such measures are consistent with Gordon (2014), Glaeser (2014) and Eichengreen (2015), to which trade liberalisation, additional labour market deregulation, business tax reform and anti-monopoly laws (Baldwin & Teulings, 2014; Storm, 2017).

However, higher public spending may result in larger deficits. When the liquidity trap is seen to be temporary, interest rates will eventually become positive and debt levels may enter on an unsustainable path (Krugman, 1998). Summers (2016a) believes, despite this, that future debt burdens at low interest rates are preferable than a stagnant society for future generations, should the liquidity trap become permanent. Moreover, Blanchard (2019) argues that the recent historical pattern of safe interest rates being below growth rates suggests that debt concerns are excessive, as debt may come at no fiscal cost. Yet, the proponents of the

[10] Krugman's theory gave rise to a number of papers that studied the implications of the ZLB on the optimal monetary policy. Among the most influential studies in later years is that of Eggertsson & Woodford (2003).

"debt overhang" alert that debt is not a "free lunch". First, low interest rates should not propel unproductive investments (Rogoff, 2016). Second, social security systems are also a liability, since governments borrow from the young and agree to repay with interest when they retire, increasing bailout risks (Rogoff, 2020). Third, although demand for government debt, reflected in low interest rates, may suggest insurance against tail risks, the next catastrophe can raise interest rates, increasing debt costs (Rogoff, 2020).

Regarding the safety trap, the most effective policies to reduce safe interest rates and restore equilibrium are those that allow the private sector to swap risky assets for safer ones (Caballero & Farhi, 2018). CBs successfully implemented such swap via QE programmes, such as FED during the subprime mortgage crisis and, later on, by the ECB when announcing outright monetary transactions in 2012 and effectively conducting QE policies subsequently. In contrast, FG is largely ineffective since it increases the future value of risky assets while lowering their present value, hence raising the risk premium (Caballero & Farhi, 2018). Additionally, Caballero et al. (2017) suggest policy mechanisms that reduce the demand for safe assets, such as an appreciation of the safe assets issuers' currencies, to increase the valuation of safe assets and to reduce the hoarding of safe asset by CBs or by the financial sector, which may possibly imply a rethinking of the regulatory framework; or to further increase the supply, through the issuance of private safe assets.

The pursuit of public spending to combat secular stagnation may also have close ties to the safety trap, according to Caballero et al. (2017). Given the persistence of the safe assets shortage, the US is expected to maintain its dominant position in the provision of safe assets, suggesting that the US will likely continue to run large current account deficits (Chinn, 2017). Nevertheless, Bernanke (2015b) argued that the international community shall "continue to oppose national policies that promote large, persistent current account surpluses". For that purpose, the IMF (2017) recommends the stimulus of domestic demand through fiscal policy in surplus countries. In turn, in the US, fiscal policy shall be used to improve productive capacity (IMF, 2017), instead of boosting demand, as it occurred in 2019 (IMF, 2019).

Therefore, future macroeconomic stabilisation will likely rely not merely on monetary policy, but as well on the choices taken by fiscal policymakers, particularly on the structural side. Low neutral rates do not imply that monetary policy is no longer relevant (Schnabel, 2021b), but rather that CBs need to weigh more carefully the evolving benefits and costs of lowering policy rates further, deploying new unconventional instruments or even re-

structuring their policy strategy frameworks. The next chapter is a synthesis and evaluation of the recent debate on monetary policy, in which we intend to show how academics, policymakers and CBs reacted to the structural changes that took place over the last decade, as well as to help to define the shape of the "new normal" of monetary policy.

3. The New Normal of Monetary Policy

In the wake of the GFC and of the ESDC, the "art" of central banking would come to evolve with unprecedented creativity. One of the greatest challenges posed by these crises was the inability to use short-term nominal interest rates for stabilisation purposes, since the likelihood of a ZLB episode increased (Brainard, 2019a). Kiley and Roberts (2017) demonstrated that monetary policy may be bound by the ZLB two-fifths of the time under a conventional policy rule and a nominal neutral rate of 3 percent (see also Williams (2009) and Chung et al. (2019)). Such loss of policy space will likely lead to inflation rates and expectations below the target (Williams, 2021). The international academic and central banking communities have introduced the debate on the "new normal" of monetary policy in this context. Throughout the years, the concept of "new normal" has shifted from characterising the post-GFC economic environment of advanced economies to the adequate monetary policy framework to deal with it.

Early in 2009, the bank PIMCO described the "new normal" as an economy with sluggish growth, high unemployment and in a phase of strong deleveraging after massive indebtedness (El-Erian, 2010). This perspective was used to counter the one dominant in markets and policymakers, in which industrial economies would return to their pre-GFC level, after the GFC (El-Erian, 2010). Gagnon et al. (2021) also used the term to describe the combination of low growth and low interest rates. Brainard (2016) defined it as the economic landscape with undershooting inflation, flattened Phillips Curve, greater labour market slack, global markets fragility, low neutral rates, and policy asymmetry. More recently, Bartocci et al. (2019) specified the "new normal" as the "economy with a low equilibrium real interest rate and a high probability of hitting the [ZLB] on the short-term policy rate".

The use of the term "new normal" relied on the assumption that monetary policy would return to conventional (Panetta, 2019). Nowadays, it is still used by analysts and policymakers to refer to the fundamental changes of the economic environment (e.g., Powell, 2019). However, the term "new normal" began to be used to describe the monetary policy

framework required to cope with the "lower for longer" environment (Panetta, 2019).[11] It is still unclear what the new framework refers to, though. Regarding the implementation of monetary policy, Kiley (2018), for instance, proposes the use of QE as the secondary instrument in a "new-normal approach to monetary policy." Regarding the monetary policy strategy, research emphasises the shifting from the inflation targeting regime or even a mandate enlargement. Therefore, the ongoing debate on the new normal cuts across all areas of monetary policy, including mandates, instruments, and the institutional design of CBs, as independent institutions of a new coordinated framework with governments. This chapter draws on theoretical and empirical literature, the majority of which was generated by or as a consequence of major CBs' strategy reviews. The chapter is structured as follows.

First, we will review how each key CB mandate has evolved in recent decades, which goals should be the most appropriate for each mandate in the new normal; and how strategies should evolve to best achieve mandate goals. Second, we will analyse the range of available instruments and assess which ones should be part of the new standard toolkit. Third, we will assess the doctrine of CBI, and whether independence should be maintained in the new normal, particularly in light of the complementarities between monetary policy, macro-prudential policy, and fiscal policy. Finally, we will summarise the findings of the major CBs' strategy reviews and conduct a comparative analysis in light of what the literature suggests.

3.1. Mandates

The GFC, the Great Recession, and the delayed recovery have sparked a growing discussion over CB mandates. Historically, CBs have functioned under a "hierarchical mandate" that prioritises price stability above other goals until the first is attained (Meyer, 2004). According to Thornton (2009), the hierarchy might come from a number of reasons. First, the monetary neutrality hypothesis, according to which money supply has no long-run effects on the economy. Second, supply shocks create a short-to-medium run trade-off between the stabilization of output and that of inflation. According to Bernanke (2004), "the periodic occurrence of shocks to aggregate supply (such as oil price shocks) forces policymakers to choose between stabilizing output and stabilizing inflation. Note that shocks to aggregate demand do not create the same trade-off, as offsetting an aggregate demand shock stabilizes both output and inflation." And third, the increased awareness that price

[11] See also Bayoumi et al. (2014), Friedman (2015), among others.

stability promotes real economic stability and greater long-term growth. However, the goals of maximum employment and financial stability are also strongly tied to monetary policy. In light of the above, this section will discuss the three key mandates refereed in the literature, including how their frameworks have evolved and the relevant aspects of their measurement.

3.1.1. Price Stability

During a Federal Open Market Committee (FOMC) meeting in 1996, Alan Greenspan defined price stability as the "state in which expected changes in the price level do not effectively alter business or household decisions". Inflation should be low enough that it would not constitute a matter of concern for people.[12] Although officially announced only in 2012, FED has secretly agreed in that meeting that its inflation objective was 2% (Summers et al., 2018). The FED was only following several CBs in the advanced world, which had widely settled on a target of around 2% since the 1990s, despite not deriving it from a specific scientific result but rather from a political and economic consensus. Accordingly, it acquired the "advantage of conventionality": "central bankers could not easily be accused of acting irresponsibly when they had the same inflation target as everyone else" (Krugman, 2014c).[13]

While adopting monetary policy regimes with an objective around 2%, policymakers weighed the costs of high inflation and the gains of escaping deflation (Summers et al., 2018). As a result, ZLB episodes would be infrequent, with lesser depth and duration (Coenen et al., 2004; Reifschneider & Williams, 2000). Even if the ZLB was a constraint, CBs could deploy non-conventional tools to enhance the effectiveness of conventional ones, providing the necessary stimulus to the economy (e.g., Bernanke, 2004). The post-GFC period raised doubts on this earlier research. CBs struggled to restore full employment and attain their 2% inflation targets (Mishkin, 2016), which raised fears that the prevailing policy framework would hinder the ability of CBs "to fight future recessions" (Summers et al., 2018).

3.1.1.1. Inflation Targeting

IT is a monetary policy strategy that consists of announcing a quantitative target for the inflation rate at a certain horizon, which provides the CB with a clear mandate for price

[12] Page 51 of the transcript, available at https://www.federalreserve.gov/monetarypolicy/files/fomc19960703meeting.pdf

[13] The most well-known indicators of inflation are the Consumer Price Index (CPI) and the Personal Consumption Expenditures Price Index or Deflator (PCE), in the US, and the Harmonised Index of Consumer Prices (HICP), in the EA. Inflation can be further distinguished between "headline" and "core" inflation, which excludes food and energy components.

stability (Bernanke & Mishkin, 1997). The first nation to officially embrace IT was New Zealand in 1990, followed by Canada, the United Kingdom, Australia, and Sweden in the early 1990s.Other CBs from advanced economies, as the ECB or the FED, did not explicitly adopt IT, as they did not establish an explicit numerical target and a clear statutory priority for price stability over their other objectives, such as maximum employment (Jahan, 2017). Nonetheless, they have adopted important elements of IT, such as the commitment to low and stable inflation (Jahan, 2017).

The main advantages pointed to the IT regime are the increased transparency and coherency of policymaking, the greater accountability of the CBs, the elimination of inflation bias and a greater focus in the long run (Bernanke & Mishkin, 1997; Svensson, 1997). In addition, IT constitutes an efficient nominal anchor for monetary policy. Once announced to the public, the inflation target anchors expectations by fencing the price level in a specific value at a future date (Bernanke et al., 2001). Well-anchored expectations mean that the public sets prices and wages with respect to the long-run expectation of inflation and does not react much to new incoming inflation data. It follows that inflation becomes more stable and supply shocks are less likely to create economic instability (Bernanke, 2007). Historically, IT and variants of IT did well at anchoring expectations (Goodfriend, 2007; Mishkin, 2007). However, following the GFC and the ESDC, the recurrent undershooting of the inflation target has impacted the anchoring of expectations, making it more difficult to meet the price stability objective and to avoid the ELB (Adam, 2020).

Given the fears that IT might hinder the action of CBs in future negative aggregate demand shocks, several authors have advocated raising the inflation target. Blanchard et al. (2010), Ball (2014a) and Ball et al. (2016), among others, suggested an increase from 2% to 4%, which anchors expectations at a higher level, and ultimately results in higher nominal interest rates and more room for CBs to cut policy rates (Bernanke, 2019). Recently, Andrade et al. (2019) estimated the relation between the steady-state natural equilibrium interest rate (r^*) and the optimal inflation target (π^*), finding that for several definitions of optimal inflation rate the relation varies and the slope of (r^*, π^*) approaches -1: a drop of 100 b.p. of r^* implies an optimal reaction of rising the inflation target by about 99 b.p.. Although modifying the target is easier to communicate and allows to keep the IT framework in place, it inflicts society with the costs of higher levels of inflation at all times (Woodford, 2009).

Nonetheless, according to Andrade et al. (2019), those costs are almost imperceptible at the margin, compared to the gains that can be achieved in terms of real stabilisation.

It has been noted, however, that it could prove difficult to raise average inflation to 3% or 4%, especially given the recent difficulties in generating inflation aligned with the 2% target (Summers et al., 2018). Moreover, Bernanke (2019) warned about problems of credibility, the low popularity of inflation, and the possibly destabilising effects of the required overheat of the economy. Overall, there could be the risk that the change was perceived as a tactical action instead of a permanent and irrevocable decision. Bernanke (2020) thus defends the use of new policy instruments, rather than raising the inflation target.

There is a vast literature that has argued that most CBs react more strongly to negative deviations of inflation from the target than to positive deviations, and that that could lead to average inflation rates and expectations below target, and higher likelihood of ZLB episodes (Mishkin, 2016). Such asymmetric response may be justified on the grounds that deviations above the target violate the principle of price stability (Rostagno et al., 2020). Maih et al. (2021) found evidence that the ECB had an asymmetric policy response until mid-2014, reacting more forcefully to inflation above 1.9% than below it. Since then, the evidence points to a more symmetric reaction, overshooting the target as often as it undershoots the target (Mishkin, 2016). This is in line with the ECB's first official announcement about the "commitment to symmetry in the inflation aim" (Draghi & De Guindos, 2019). Regarding the FED's approach, Maih et al. (2021) identified a different asymmetry, with a stronger response when inflation was running at low levels. Accordingly, some researchers have argued that the optimal monetary policy response, when the neutral interest rate is low and interest rates are constrained by the lower bound, would be an asymmetric rule (Clarida, 2020b). Hence, CBs would act more forcefully to inflation undershooting (Bianchi et al., 2021; Maih et al., 2021), which corrects the bias towards low inflation, enhances welfare and mitigates deflationary pressures (Bianchi et al., 2021).

Given the de-anchoring of expectations during the last decade, the question now is whether CBs should attempt to overshoot the target. In essence, whether the "flexible IT" strategy should be modified to include a commitment to make-up for any future deviations of inflation from the target. These strategies, discussed in the next sections, plan to overshoot the goal for some time, following periods when inflation underperforms the target, with the purpose of reversing past misses of the inflation objective. Ultimately, they seek to raise

inflation expectations to the actual target (Mertens & Williams, 2019). If those are taken as credible, "make-up" and "lower for longer" (L4L) strategies are preferable to raising the inflation target during times at the ZLB (Kiley & Roberts, 2017).

3.1.1.2. Price Level Targeting

The IT regime treats bygones as bygones, looking through temporary inflation changes without considering the performance of inflation in the past (Bernanke, 2019). In contrast, under a "make-up" strategy, CBs commit to look both backward and forward, by reversing any temporary shifts of inflation from target (Bernanke, 2019). In such approach, monetary policy is "history-dependent" (Woodford, 2004). If the target has been undershot, MP should endeavour to overshoot it at a future date, by keeping policy rates lower for longer than they would have been otherwise. If credible and clearly communicated, such approach would lead the public to expect future higher output and inflation, which should buffer the losses in output and inflation at the ZLB, by lowering the real interest rate (Bernanke, 2019).

The price-level targeting (PLT) regime is one type of history dependent policy considered as a near optimal policy at liquidity traps. Early studies include Krugman (1998), Svensson (1999), Eggertsson and Woodford (2003) and Woodford (2004). A price-level target is the path of the price level that CBs should strive towards within a certain time horizon (Evans, 2012). Unlike the IT, which aims to keep inflation in a stationary trend around a particular rate, PLT aims to maintain the overall price level on the announced path. The slope of the price path corresponds to the target rate of increase in prices, which could be over(under)shot whenever the change in prices put them below(above) the target level.

The PLT mechanism may be explained with Figure 4, from Evans (2012), in which the targeted price level increases at a 2% rate. In that example, the price level is falling short of target, which is the same to say that inflation is running under its path. To reattain the path, prices should increase at a rate higher than 2%, and so the CB should strive for a period of inflation exceeding the 2% target (Evans, 2012). Ultimately, the return of price level to its path is equivalent to having an average inflation of at least 2%, over that span (Bernanke, 2019). CBs offset periods of below-target inflation with periods of above-target inflation by overshooting the target, and *vice versa* (Summers et al., 2018). Inflation expectations become state-dependent, with mean inflation at the target (Mertens & Williams, 2019).

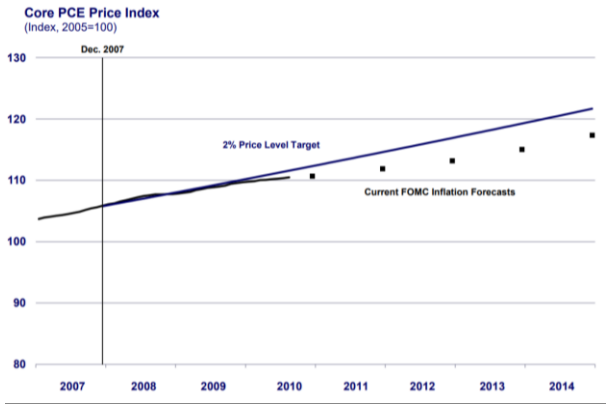

Figure 4 - PLT mechanism, source: Evans (2012)

Despite Sweden having been the only to implement an explicit PLT, in the 1930s, this approach has a number of advantages over raising the inflation target, including greater price level predictability and output and inflation stability (Kahn, 2009). In addition, PLT is consistent with the price stability mandate because it delivers low average inflation over the medium term, also benefiting from the "make-up" feature of the optimal theoretical policy response (Bernanke, 2019; Brainard, 2019a). Lastly, PLT can enhance the benefits of forward guidance, by raising output and inflation with minor welfare losses (Cole, 2018).

Withal, the strategy comes with important drawbacks. First, it would require a fundamental shift in the CBs policy structure and reaction function, involving a difficult explanation to the public and financial markets (Bernanke, 2019). Importantly, in the event of a supply shock, CBs must promise to keep monetary policy tight to reverse the path of inflation (Summers et al., 2018). The reaction can be painful and induce harmful effects on output and employment, unless economic agents have fully credibility (Bernanke, 2019). And finally, a flattened Phillips Curve may erase the benefits of PLT, if inflation is not very responsive to economic slack.

Indeed, this type of policy relies on the assumption of full credibility to be effective. If imperfectly credible, L4L policies are likely to be less effective and can lead to unanchored expectations and unexpected financial risks (Bernanke et al., 2019). Therefore, PLT is strongly dependent on inflation expectations since, faced with a disinflationary or deflationary shock near the lower bound, CBs actions must generate an upsurge in expected inflation, that will reduce real rates and stimulate real economy and inflation. For that reason, (Gaspar et al., 2010) conclude that inflation expectations must be created through a more forward-looking mechanism, in order to enhance the effectiveness of PLT.

3.1.1.3. Temporary Price Level Targeting

Bernanke (2019) proposes temporary price level targeting (TPLT) to overcome the aforementioned challenges to PLT, which consists of applying the price level target only during ZLB episodes, and else preserving the IT framework during normal times. Thus, at the ZLB with inflation below target, CBs would stick to lower rates for longer and follow a price level target, aiming for a period of inflation above its target. Once the price level had returned to its target path, CBs could raise policy interest rates, returning to the IT strategy.

According to Bernanke (2019), this alternative has two advantages over PLT. First, TPLT would not require a major shift of the policy framework, since CBs would preserve the IT framework in normal times. TPLT could be communicated as being part of the IT framework, as it is analogous to pursuing the average inflation rate throughout the ZLB period. Second, TPLT would not require the CBs to revert temporary inflationary shocks that occur away from the ZLB. According to Bernanke (2019), had this policy been in place prior to 2008, the actual level of monetary policy accommodation would have been greater, and inflation would have been higher, as the intention of accommodation would have already been communicated. Not only the duration, but also the frequency and the duration of the ZLB on nominal interest rates would be reduced.

However, attaining the average inflation target is a required but insufficient condition (Bernanke, 2019). First, policymakers must guarantee that the criterion is satisfied on a sustained basis, rather than as a consequence of a transitory disinflationary or deflationary shock or measurement error. Second, policymakers must consider the complex real economic circumstances when deciding whether to switch back from TPLT to IT. In particular, the lift-off must be delayed until policymakers find or expect healthy labour market conditions, despite the average inflation criterion being met. At the same time, Bernanke et al. (2019) suggest that policymakers must avoid overshooting inflation after the ZLB period ends, limiting their "look-back" periods to 3 or to 1 year.

3.1.1.4. Average Inflation Targeting

Average-inflation targeting (AIT) is another "make-up" strategy that has been under review to improve policy responses near the ZLB (Amano et al., 2020; Budianto et al., 2020; Svensson, 2020). Indeed, PLT can be understood as an equivalent strategy to AIT when the averaging window is infinitely long (Budianto et al., 2020). In other words, the AIT is closely

related to PLT, but unlike PLT, AIT has a finite averaging window – CBs only go back for a certain period of time over which they calculate the average inflation (Summers et al., 2018).

Following a period of inflation below target, it is likely that PLT requires an inflation rate above the average for longer than would be required under AIT, as in the latter policymakers look only at last 2 or 3 years of inflation. For example, Amano et al. (2020) found that average inflation rate should be calculated in an averaging window of approximately 2 years. Hence, under the AIT, CBs are in a better position to preserve the credibility of their inflation target, since a longer period of reversing past inflation misses could potentially undermine agent's beliefs (Summers et al., 2018).

In addition, according to Mertens and Williams (2019), AIT implicitly aims for above-target inflation whenever monetary policy is unconstrained by the ZLB, while PLT aims at raising inflation expectations when monetary policy is at the ZLB. Comparatively, AIT allows to anchor inflation expectations at the target level, correcting for the downward bias in expectations during periods when monetary policy is out of the ZLB. However, PLT raises inflation expectations, which anchors at the target, while it might be able to reduce the effects of the ZLB in the economy. Therefore, PLT dominates AIT. However, clear communication and the belief of economic agents is fundamental for these strategies to work as in theory. Indeed, Nessén and Vestin (2005) showed that in entirely forward-looking models PLT dominates AIT, but in a micro-founded model where Phillips curve presents forward- and backward-looking elements, AIT offers more efficient results than PLT and IT.[14]

3.1.1.5. Assessment of the Effects of Alternative Policy Rules

We turn now to an account of the effects of alternative policy rules on macroeconomic performance. Bernanke et al. (2019) studied the economic performance of traditional policy rules, such as Taylor rules, which link the policy interest rate to the inflation gap and the output gap, and three other groups of L4L rules: three variants of flexible PLT, three variants of TPLT (also known as threshold strategies), and two variants of shadow-rate policies.[15] The tables below present the simulation results using the FBR/US model, with low nominal

[14] Conclusions of Mertens and Williams (2019) and Nessén and Vestin (2005) are model-dependent.

[15] Shadow-rate policies define a notional interest rate which represents the monetary policy accommodation forgone because of the ZLB. Bernanke et al. (2019) consider a variant proposed by Reifschneider and Williams (2000), in which the Taylor rule policy rate is reduced by the additional forgone accommodation until the scope of reduction is exhausted; and a variant of Kiley and Roberts (2017), in which policy rate is equal to the shadow-rate when the latter is non-negative, and equal to zero, otherwise.

neutral interest rates, under "model-consistent expectations" (MCE), in which all private agents are expected to comprehend and believe the policy rule as well as the structure of the economy, and under the case where only asset-market participants have "model-consistent expectations" (MCAP). MCE appears appropriate when a strategy has been in force for a certain period. MCAP seems better suited in a transition to a new monetary policy rule. Results presented in tables 2 and 3 show the frequency an economy is caught at the ELB, the mean duration of an ELB episode, the mean output gap, the mean inflation rate, the root-mean-square deviation (RMSD) of the output gap from zero, and the RMSD of inflation from its target of 2%. The last column records an overall loss measure.[16]

	ELB frequency (percent)	Mean duration of ELB (quarters)	Mean output gap	Mean inflation rate	RMSD of output gap	RMSD of inflation rate	Loss
1. Taylor	38.3	10.9	−1.1	1.2	3.5	2.2	17.2
2. Taylor (inertial)	33.6	20.7	−1.4	1.0	3.9	2.4	20.7
3. Flexible price-level target	32.6	8.5	−0.4	2.0	3.6	1.5	15.2
4. Flexible price-level target (inertial)	24.6	13.8	−0.6	2.0	4.4	1.5	21.8
5. Flexible temporary price-level target	17.6	12.9	0.3	2.4	3.4	1.6	14.5
6. Temporary price-level target	16.3	12.5	0.0	2.3	3.1	1.7	12.6
7. Temporary price-level target (3 yr memory)	15.6	11.2	0.3	2.4	2.7	1.6	9.6
8. Temporary price-level target (1 yr memory)	15.1	9.4	0.2	2.3	2.5	1.5	8.5
9. Reifschneider-Williams	28.1	10.1	0.2	2.1	2.4	1.6	8.0
10. Kiley-Roberts change rule	37.0	16.9	−0.1	2.1	1.9	1.4	5.7

Notes: Results based on 500 simulations of 100 quarters each. Loss = $\frac{1}{N}\frac{1}{K}\sum_{j=1}^{K}\sum_{t=1}^{N}\left[(\pi_{t,j}-\pi^{*})^{2}+\hat{y}_{t,j}^{2}\right]$ for t, j period-simulations.

Source: Authors' calculations.

Table 2 - Stochastic simulation results under MCE, source: Bernanke et al. (2019)

	ELB frequency (percent)	Mean duration of ELB (quarters)	Mean output gap	Mean inflation rate	RMSD of output gap	RMSD of inflation rate	Loss
1. Taylor	39.1	13.3	−1.4	1.6	3.6	1.5	15.2
2. Taylor (inertial)	39.6	30.1	−2.2	1.4	4.9	1.8	27.4
3. Flexible price-level target	36.1	14.1	−0.1	2.0	5.7	1.5	34.3
4. Flexible price-level target (inertial)	44.0	34.2	−2.8	1.0	7.4	2.4	60.3
5. Flexible temporary price-level target	20.8	22.0	1.0	2.3	5.0	1.7	25.0
6. Temporary price-level target	21.7	16.1	0.2	2.2	3.8	1.3	16.1
7. Temporary price-level target (3 yr memory)	8.3	7.8	1.6	2.6	3.8	1.3	16.2
8. Temporary price-level target (1 yr memory)	11.2	8.6	1.0	2.4	3.0	1.2	10.7
9. Reifschneider-Williams	19.4	9.3	0.5	2.3	3.2	1.2	11.4
10. Kiley-Roberts change rule	42.3	21.8	0.0	2.0	2.1	1.0	5.3

Notes: Results based on 500 simulations of 100 quarters each. Loss = $\frac{1}{N}\frac{1}{K}\sum_{j=1}^{K}\sum_{t=1}^{N}\left[(\pi_{t,j}-\pi^{*})^{2}+\hat{y}_{t,j}^{2}\right]$ for t, j period-simulations.

Source: Authors' calculations.

Table 3 - Stochastic simulation results under MCAP, source: Bernanke et al. (2019)

As expected, Taylor rules perform relatively poorly, compared to L4L rules. Likewise, the introduction of the price level gap in traditional rules as a determinant of policy interest rates, in lines 3-5, do not improve the policy performance, since with regard to the loss function, lines 3-4 do not significantly outperform Taylor rules under MCE. Moreover, flexible PLT exhibits macroeconomic volatility through higher RMSD of output gap, despite

[16] Conclusions of Bernanke et al. (2019) are model-dependent.

the near targeting of output and inflation rate. Under MCAP, PLT performs even poorer than Taylor rules, with higher loss, due to the inability of the public to adjust expectations to the new regime. In contrast, TPLT rules perform relatively well under the two types of expectations. The variants of TPLT with shorter "look-back" periods, and particularly the TPLT with 1 year of memory, achieve the best results, under both MCE and MCAP. A reasonable explanation might be that a shorter memory prevents significant inflation overshoots. Similarly, these restrictions result in shorter average ELB episodes, which might be appealing for CBs with financial instability concerns. Finally, shadow-rate policies also perform reasonably well, with the Reifschneider-Williams rule performing similarly to the TPLT strategies with shorter "look-back" periods, and Kiley-Roberts change rule performing very well. Overall, L4L polices dominate traditional rules, despite the fact that the advantage, albeit considerable, is reduced under MCAP.

Thus far, the policy framework is robust if, first, it provides appropriate stimulus at the lower bound, and second, the stimulus is designed to avoid overly large output and inflation overshoots after lifting-off from the ELB. Therefore, monetary policymakers must be aware that imperfect credibility diminishes but does not erases the benefits of L4L rules. Also, the choice of a strategy must account for the ease of explaining and communicating the rule, as well as the implicit costs of transitioning between regimes.

3.1.2. Maximum Employment

Maximum employment, otherwise known as full employment, is the highest amount of employment an economy can sustain without creating inflationary pressures. Historically, the FED is one of the few CBs with a stated employment mandate that, in principle, carries the same weight as their price stability mandate (Brainard, 2021). Reserve Bank of Australia and the Reserve Bank of New Zealand are the others, whereas for most CBs price stability is either the sole objective of monetary policy – as for the Bank of Canada, the Riksbank and the BoJ – or the priority objective – as for the ECB and the Bank of England (BoE). As noted by Rosengren (2014), the FED's dual mandate has provided a clear and transparent way to communicate monetary policy actions.

Nevertheless, maximum employment cannot be directly measured and has to be inferred from a variety of indicators and models (Brand et al., 2021). Overall, the wide range of results suggests considerable uncertainty regarding the level of labour market slack, i.e., the gap between employers' demand for labour and the available supply of employees

(Gilchrist & Hobijn, 2021). Contrary to price stability, which ultimately is a monetary phenomenon, maximum employment cannot be affected by monetary policy; rather, it is determined by factors outside the power of monetary policy, including governmental policies, demography, and the structure of economy (Aaronson, 2020; Thornton, 2012). As a result, full employment cannot be defined by a numerical objective (Thornton, 2012).

Alternatively, policymakers might compare the unemployment rate to the natural rate of unemployment, usually understood as the non-accelerating-inflation-rate of unemployment (NAIRU) (Staiger et al., 1997).[17] Standard estimating models frequently use a common assumption that the unemployment gap averages zero over time, meaning that unemployment fluctuates symmetrically around the NAIRU (Dupraz et al., 2022). Friedman (1964, 1993) questioned this view with the "plucking theory", in which unemployment varies consistently above its natural level. Accordingly, full employment would be an upper limit from which employment dips during recessions and rebounds during recoveries, with unemployment gaps positive on average. Dupraz et al. (2022) examined the dynamics of the US unemployment rate and found evidence consistent with the plucking model, suggesting that policy should have an asymmetric approach to achieve the unemployment objective.

An alternative monetary policy regime that avoids the estimation of equilibrium unemployment (or output, as both as closely related *via* Okun's Law) and collapses the FED's dual mandate into a single measure would be to target the growth rate of nominal GDP. Summers et al. (2018) argue that targeting nominal GDP growth would ease communication, allow CBs to manage just one target instead of two indicators, and avoid their need to use imprecise estimates of the NAIRU (or natural output) which is an advantage over IT regimes (McCallum, 1999).

Rather, CBs might aim a certain level of nominal GDP. This framework, first proposed by Meade (1978) and later followed by McCallum (1987, 1988), presents the same "make-up" features for past deviations of PLT (Summers et al., 2018). Garín et al. (2016) suggested that targeting the level of nominal GDP is comparable to targeting the price level in the long term, since the long run level of real GDP is not driven by monetary forces. One advantage would be that, in the short run, nominal GDP targeting might be more flexible than PLT as

[17] As noted by Brainard (2021), the unemployment rate can hide important dimensions of labour market slack, so it must be complemented by a broad set of aggregated and disaggregated indicators that distinguishes group of workers, races, ethnises, changes in the LFPR or measures of compensation.

it allows for both price and real output level deviations from targets, which is critical if the economy features sticky wages and prices. With respect to measurement, this strategy shares, however, some vices of PLT: recurring and large nominal GDP data revisions may represent a technical constraint to utilizing the nominal GDP targeting (Summers et al., 2018).

3.1.3. Financial Stability

Turning now to the third mandate – financial stability – the effects of excessive risk-taking and excessive credit expansion are high on policymakers' agendas since the aftermath of the GFC. In fact, before the GFC, the Greenspan legacy prevailed, which held that monetary policy should not attempt to avoid financial booms, but rather "mop-up" the economy after the bubble bursts. However, the crisis made it clear that price stability is insufficient to provide financial stability (Badarau & Popescu, 2014) and that monetary policy alone could not ensure financial stability. In this context, CBs designed a new macro-prudential approach to safeguard the stability of the overall financial system. The ECB, for example, has reinforced its mandate to deal with this new priority.[18]

Although it dates back to the 1970s, the term "macro-prudential" has entered the mainstream vocabulary of CBs when Sir Andrew Crockett (2000), at the time BIS General Manager, advocated for a "macro-prudential" approach to guarantee financial stability. He contrasted the macro-prudential dimension of financial stability – the stability of the whole financial system – with the micro-prudential one – the stability of individual institutions (BIS, 2018). In particular, macro-prudential policies focus on bolstering the regulatory structure of the banking sector, and, in a more ambitious way, to smooth out the financial cycle (Constâncio et al., 2019). There is, however, some relation of the macro-financial stability framework with monetary policy. Interest rates have a direct impact on asset prices, the willingness and capacity to take on leverage, and agents' risk-taking (BIS, 2018). Monetary and macro-prudential authorities must consider the actions of the other when making decisions. Should monetary policy include, to some extent, financial stability in its mandate? This is still an ongoing debate, centred on the "leaning against the wind" (LAW) view of monetary policy, according to which it should address financial imbalances, asset price

[18] Refer to Article 127(5) of the Treaty on the Functioning of the European Union: "The European System of Central Banks (ESCB) shall contribute to the smooth conduct of policies pursued by the competent authorities relating to the prudential supervision of credit institutions and the stability of the financial system."

overvaluations, and excessive lending. Overall, the literature presents two different approaches.

On the one hand, monetary policy might support financial regulation as the main policy tool for addressing financial stability (Blot et al., 2020), by using standard tools such as interest rates to inhibit financial imbalances (Woodford, 2012), or the CB's balance sheet to provide liquidity and avoid the creation of risky assets (Greenwood et al., 2019). Borio and Lowe (2002) claim that this could be a systematic strategy to follow. Actually, "interest rate smoothing (IRS)" – a well-established practice of CBs discussed in earlier literature – could be a form of implementing such approach. In fact, CBs prefer to implement series of gradual, small adjustments of short-term policy rates, in the same direction and for a period of months, rather than an immediate and definite response (Woodford, 2003). Such gradualism allows CBs to communicate their policies to financial markets and manage expectations more effectively, reduces the risk of excessive changes in policy rates that could cause financial instability (Goodfriend, 1987, 1991), deals with the uncertainty regarding the state and structure of the economy (e.g., Orphanides, 2003) and avoids frequent policy reversals that would harm the policymaker's credibility.

On the other hand, leaning against financial vulnerabilities can be counterproductive and fail to be significantly beneficial. According to Svensson (2014, 2017), LAW appears to have insignificant effects in reducing financial stability risks but does increase unemployment and decrease inflation below desired levels. Constâncio et al. (2019) present three main reasons why monetary policy should not be the first instrument to address financial instability in asset markets. First, the cyclical state of the economy and financial stability could call for opposite changes in the stance of monetary policy. Second, the effectiveness of monetary policy in targeting asset market prices through policy rates is not clear. And finally, monetary policy is global in the sense that it impacts all sectors of the economy simultaneously, which makes it inefficient to cope with specific financial imbalances.

3.2. Instruments

Following the GFC, monetary policymakers had to turn to alternative policy instruments to achieve inflation and employment objectives, including large scale purchase of assets, forward guidance, and, outside the US, negative interest rates and yield curve

control.[19] In this section, we will review their performance during the GFC and its aftermath, and the issues pertaining to their use in the future. We will follow the approach of Bernanke (2020) by discussing the policy instruments aimed primarily at macroeconomic stabilization, excluding policies designed to stabilise malfunctional financial markets.[20]

3.2.1. The Macroeconomic Effects of the New Monetary Policy Instruments

Perhaps the most well-known form of unconventional monetary policy (UMP) adopted in the last decade is (QE), in which CBs purchase large quantities of longer-term assets in the open market through the creation of CB reserves (Bernanke, 2019). The FED engaged in three rounds of QE beginning in March 2009, while the ECB only initiated its Asset Purchase Program in mid-2014. The BoE, the Riksbank and BoJ have also implemented forms of QE (Bernanke, 2019). Several event studies on the effects of QE in the US showed that the first round of QE (QE1) had stronger announcement effects than later rounds. For example, Gagnon et al. (2011) demonstrated that QE1 reduced the 10-year Treasuries yield by 1 p.p. and mortgage-backed securities yields in more than 1 p.p.. Event studies of later QE announcements have often found far less significant effects (e.g., Krishnamurthy & Vissing-Jorgensen, 2011), which might be explained by calmer market conditions and better anticipation of QE announcements by investors (Bernanke, 2020). Also, controlling for market expectations, ECB's QE reduced the average 10-year government debt yield in the EA by 63 b.p. one year after its introduction, which De Santis (2020) found similar to estimates from event studies of early QE initiatives in the US and the United Kingdom. Therefore, QE proved effective in different financial distress environments.

FG or "open mouth operations" (Guthrie & Wright, 2000) is a second unconventional tool deployed by major CBs. It defines to the communication of how monetary policymakers anticipate the economy and policy to develop, including policy rates and asset purchases. FG can be implemented in different ways. Either through simple statements of how the economy and interest rates are anticipated to develop in the future (Delphic guidance), incorporating promise or commitment to future policy actions (Odyssean guidance), outlining specific

[19] Several other instruments were used to maintain price stability. The ECB and the BoE, respectively, have offered cheap long-term loans to banks, to lend to the real economy, through Targeted Long-Term Refinancing Operations (TLTRO) and the Funding for Lending Scheme. Others, including the BoJ, have acquired a variety of private assets, such as corporate debt, commercial paper and equities (Bernanke, 2020).
[20] Examples of policies that will be excluded from our analysis are the FED's emergency credit facilities and currency swaps and the ECB's Securities Markets Program.

economic conditions that would cause a policy change (qualitative or quantitative guidance) or specifying a certain date (calendar guidance) or a certain threshold (state-contingent guidance) for policy change (Bernanke, 2019). Bernanke (2020) used an event study methodology to show that the first two FED's calendar guidance announcements drove interest rates down considerably, and were also related to a deterioration in the US dollar and an increase in equity prices. Del Negro et al. (2012) found that FG had a favourable effect on inflation and growth expectations, whereas Carvalho, Hsu, et al. (2016) suggested that unforeseen FED announcements affected longer-term interest rates. The ECB's FG has likewise consistently reduced rates throughout the term structure (Hubert & Labondance, 2018). The growing body of data indicates that FG has the capacity to alter public expectations, decrease perceived uncertainty, and reduce risk premia. However, it relies on institutional credibility to raise inflation expectations. The constant failure to achieve stated targets imposes severe constraints on the conduct of policy, as for the BoJ (Gertler, 2017).

Recently, the BoJ and the ECB, among others, have also implemented negative interest rate policies (NIRP), which are often considered an UMP (though merely an unconventional use of conventional tools by some observers and researchers). By adopting NIRP, CBs tax banks for their excess reserves, discouraging for hoarding cash (Arteta et al., 2018). NIRP appeared to be reflected in declining money market rates, bank lending rates and sovereign bond yields (Arteta et al., 2018), with positive, albeit modest, effects on domestic monetary conditions (Dell'Ariccia et al., 2017). Nevertheless, their implementation was controversial, as they were often associated with financial stability risks, due to their effect on bank's willingness to lend possibly resulting in inflated asset prices and delayed macroeconomic and structural reforms (Arteta et al., 2018). However, recent evidence does not suggest major effects of NIRP on bank profitability and risk-taking (Gros & Shamsfakhr, 2021).

Finally, the BoJ have also implemented the alternative UMP program termed "yield curve control" (YCC). In YCC, CBs target the price of bonds or the interest rate, buying or selling as many bonds as necessary to achieve the target rate for each maturity – which is different from setting the quantity of bonds to be purchased as in QE (Bernanke, 2020). YCC targets lower interest rates throughout the term structure and tries to influence financial conditions more precisely across the maturity spectrum. YCC has been well-succeeded in Japan due to its credibility and the lower price-sensitiveness of many private holders of Japanese Government Bonds (Bernanke, 2020).

Overall, the literature suggests that the new monetary policy instruments were successful in overcoming the limitations imposed by the ZLB. A valuable method for measuring the impact and efficacy of the new tools associated to UMP is the shadow interest rate (e.g., Claus et al., 2014). Through models of the term structure, shadow rates measure the notional value of the short-term interest rate based on the behaviour of the whole spectra of interest rates, had it not been constrained by the ZLB (Sims & Wu, 2020). Wu and Xia (2016) produced a renowned shadow rate series for the US, which reached a minimum of nearly -3 p.p. in 2015, indicating that the unconventional policies provided significant stimulus, equivalent of pushing the federal funds rate significantly below zero (Sims & Wu, 2020). Moreover, Mouabbi and Sahuc (2019) estimated a medium-scale DSGE model in which the policy rate is replaced by the shadow rate for the EA. In the absence of accommodative policies, year-on-year inflation and GDP growth would have fallen by 0.26% and 0.51%, respectively, during 2008Q1-2017Q2, and 0.61% and 1.09%, respectively, with the implementation of purchase programs (2014Q1-2017Q2).

3.2.2. The Use of the New Monetary Policy Instruments in the Future

Having reviewed to what extent the new tools helped the recovery from the Great Recession, we now move on to discuss how much additional room the UMP may offer in the future. Several authors, including Bernanke (2020), Kiley and Roberts (2017) and others, have pointed out that the additional space granted by UMPs is significantly influenced by the prevailing level of the neutral interest rate. Bernanke (2020) suggested that QE and FG appear to be able to add around 3 p.p. of policy space at the ZLB with a nominal neutral interest rate of 2%-3% or higher. However, Bernanke (2020) found that when the nominal neutral interest rate is significantly lower than 2%, even though UMPs still add valuable space, CBs may need additional measures to fully compensate for the constraint imposed by the ZLB, such as a raise in inflation target or increasing emphasis on fiscal policy for stabilisation purposes.

It must be emphasized, at this point, that UMPs are typically evaluated from the perspective of aggregate demand, which neglects the influence of lower and negative policy rates on aggregate supply. Low or negative interest rates and easy access to credit, however, have been linked in several studies to slower productivity development (Gros & Shamsfakhr, 2021). For example, Cette et al. (2016) suggest that a decline in real interest rates can impair resource reallocation and reduce TFP, which may be behind the case of "great unlearning"

of southern countries of the EA (Hassan & Ottaviano, 2013). Due to a financial friction and information asymmetries, banks are more inclined to support marginally less productive enterprises than more productive ones, as they allocate credit in part as a function of collateral. As a result, when interest rates decline, there is a tendency for banks ending up supporting investments of less efficient companies.

3.3. Institutions

The future of monetary policy also rests on the institutional setting in which CBs are rooted. In particular, it rests on how the above-mentioned unprecedented challenges will interfere with CBI. What follows, in this section, is an account of the most recent pressures on CBI and the reasoning for CBI in the current and foreseeable environment of monetary policy. Given our discussion in section 2.5, we question, in particular, whether CBI will remain a central tenet of monetary policymaking in the new normal.

CBI became a globally accepted institutional feature of monetary policy in the late 20th century. It is considered a safeguard to overcome possible inflation bias by public authorities resulting from the incentives to achieve higher output and lower unemployment in the short term at the expense of higher future inflation. To explain the high inflation of the 1970s, Kydland and Prescott (1977) first formalized such incentives in their theory of the dynamic inconsistency of a low inflation monetary policy. The subsequent research showed that independent and conservative CBs may mitigate the inflationary bias stemming from the credibility problem – a rationale that ultimately provided the theoretical underpinnings for CBI. More recently, Bernanke (2019) provided further arguments for delegating monetary policy to an independent, technocratic institution, including technical expertise, institutional credibility, and the need of adopting a longer-term approach.

The expanding roles and mandates of CBs contributed to the reopening of a debate on their independence. Critiques of the CBs' conduct in the aftermath of the GFC pointed several challenges for CBI, including insufficient accountability, conflicting policy targets stemming from new mandates, risks arising from policy coordination with fiscal authorities and income and wealth distributional effects (Vonessen et al., 2020). We find the policy coordination with fiscal authorities particularly relevant in the context of this dissertation.

As mentioned in the previous chapter, fiscal policy has assumed a greater role as a stabilization tool, given the ineffectiveness of monetary policy at the ZLB owing to the forces of secular stagnation. In such case, monetary-fiscal coordination may foster CBI, provided

that their goals are compliant with the CB's mandate, they are not attainable without coordination, and the CB regularly monitors whether coordination respects its mandate (Bernanke, 2019). In light of this, it has been argued that when the economy faces deflationary risks, CBI should deliberately be sacrificed to achieve the desired higher inflation (Eggertsson, 2013). Indeed, for stimulus purposes, governments look for cost-effective ways to finance their expansionary policies and their rising indebtedness (Schnabel, 2020) . A significant part of government debt will then be held by CBs.

What is then the reasoning for CBI in this setting? CBI is important to protect monetary policy from further political interference and bring inflation under control once it rises (Rogoff, 1985). History suggests that a regime of monetary dominance and CBI is more beneficial for society (e.g., see Cukierman, 2008 for a review of 25 years of research on the subject). However, although *de jure* independence remained stable in recent years, *de facto* independence may have deteriorated, according to Vonessen et al. (2020). Most interferences come from governments' pressure for CBs to focus on growth objectives.

High levels of public debt can thus pose significant threats to CBI, given the very large balance sheets of CBs and their complexity. The current link between sovereign debt and monetary policy is stronger than before the GFC (Landau, 2020). High public debt and large monetary balance sheets may limit the ability of CBs to raise interest rates or reduce balance sheets to fulfil the price stability mandate in times if high inflation. This is equivalent to fiscal dominance, described as situations in which interest rates are pegged at low levels to decrease the costs of servicing public debt (Romelli, 2022). In the current landscape of low neutral rates, worries about the health of public finances are reinforced by the structural headwinds related to the deteriorating demographic outlook, as well as to the significant public investment needs associated with the transition towards the green economy (Schnabel, 2020) .

These findings reinforce the need to defend CBI. Decisions of tightening monetary policy could be nefarious for the fiscal support and the structural reforms discussed in section 2.5 if the period of negative interest rate-growth (r-g) differentials is followed by a period with positive r-g due to rising inflation. Governments have then to regain fiscal space by cutting budget deficits and giving priority to productive investment that boosts potential growth (Schnabel, 2020). Whether it is sufficient to answer Lagarde (2020) question of how

policymakers should set policy "in a world of possibly permanently higher levels of public debt" it will certainly depend on how monetary and fiscal policies interact in the future.

3.4. Strategy Reviews of Major Central Banks

So far, we have recognized that neutral interest rates are mostly determined by non-monetary factors. Yet, the level of neutral interest rates has substantial consequences for the formulation of monetary policy: the policy rate is more likely to be bound by its ELB (Clarida, 2020b), and monetary policy must be ultimately adjusted relative to the underlying equilibrium rate. A decade after the end of the GFC, these fundamental economic changes prompted the major CBs to re-evaluate their policy frameworks through public reviews of monetary policy strategies, tools, and communication. What follows is an account of the recent strategy reviews undertaken by the FED and the ECB and a review of whether the new frameworks' major elements connect to the literature reviewed previously.

On August 27th, 2020, the FOMC announced the revision of its Statement on Longer-Run Goals and Monetary Policy Strategy.[21] During 2019 and the first half of 2020, the FED undertook a series of 15 "FED Listens" events (community listening sessions), one research conference with prominent academic experts and five Committee's discussions, as part of its first public review of the US monetary policy framework. Among the most significant changes to the framework are those pertaining to the FED's mandate.

Concerning maximum employment, the FOMC stressed that the maximum employment goal is broad-based and inclusive, impacting all sectors of the labour market and not just a subset of them. The revised statement also indicates that monetary policy decisions will aim to reduce employment shortfalls, rather than deviations from the maximum sustainable level (as in the prior statement). With this second adjustment, the FOMC emphasises that it will react to high unemployment, but not to low unemployment, unless inflation poses a threat to the economy. On price stability, the new approach is known as flexible average inflation targeting. The FOMC will seek to attain an average inflation rate of 2% over time – which should help to stabilise inflation expectations over the longer run at 2%. To this end, the FOMC will aim for inflation to run moderately above than 2% for a period of time to make up for prior inflation shortfalls. According to Clarida (2020a), the

[21] FED Chair Jerome Powell announced the new framework during a speech at the Kansas City FED's economic policy symposium in Jackson Hole, Wyoming. See the FOMC's latest "Statement on Longer-Run Goals and Monetary Policy Strategy" on https://www.federalreserve.gov/monetarypolicy/files/FOMC_LongerRunGoals.pdf

FOMC chose a 1-year memory for the inflation threshold that must be met before the lift-off, despite indicating that it expects to delay the lift-off only until inflation averages 2% for some time. In normal times, however, when inflation is close to goal and the ELB is not binding, the FED will continue to use flexible inflation targeting and will not attempt to compensate for periods of excessive inflation.

This framework may be summarized as TPLT at the ELB, that reverts to flexible IT once the conditions for the lift-off have been met (Clarida, 2020a). Such a framework has been analysed by Bernanke et al. (2019) and Bernanke (2019) (see sections 3.1.1.3 and 3.1.1.5). Indeed, a policy that delays the lift-off from the ELB until the average inflation threshold is attained over a longer-period is one with features of a TPLT strategy. The goal is to return inflation to its target but not to push it above target, which may be considered akin to an asymmetric monetary policy to achieve symmetric outcomes. Moreover, average inflation is an *ex-ante* goal, not an account of a mechanical response function or a commitment to a rule, in line with the TPLT with 1-year memory of Bernanke et al. (2019). For example, at the time of the lift-off, in addition to achieving price stability, the labour market conditions must also have reached levels commensurate with the FOMC's assessment of full employment (Clarida, 2020a). Ultimately, a stable financial system is required to sustainably attain the dual mandate. The revisited framework also refers to financial stability as an essential factor in policy choices. Moreover, the FOMC officially highlighted that it is prepared to use all available tools to attain its dual-mandate goals, hence UMPs should no longer be regarded as unconventional.

On July 8th, 2021, it was the ECB's turn to announce a new monetary policy strategy, which helped in part to systematize policy adjustments that had already been adopted over the past decade.[22] The main adjustments comprise the definition of price stability, the conduct of monetary policy near the ELB and the consideration of new major challenges that might condition price stability. As discussed in section 3.1.1.1, the ECB seems to have had an asymmetric policy response until mid-2014, by reacting more forcefully to inflation above 1.9% than below it, consistently with the "below, but close to, 2 percent" target. The 2021 review replaced the previous goal with a clear 2% inflation target, with a symmetrical

[22] See the ECB's latest monetary policy strategy statement on https://www.ecb.europa.eu/home/search/review/html/ecb.strategyreview_monpol_strategy_statement.en.html and an in depth overview of the monetary policy strategy on https://www.ecb.europa.eu/home/search/review/html/ecb.strategyreview_monpol_strategy_overview.en.html

application and a medium-term orientation. Thus, downside and upside deviations are equally undesirable and will be corrected. Moreover, the ECB intends to incorporate owner-occupied housing in the HICP to more accurately depict actual consumption expenditure and reflect monetary policy transmission, and has the intention to discount the more volatile components of HICP, such as energy prices (Reichlin et al., 2021; Schnabel, 2021a).

Unlike the FED, the ECB will not adopt a make-up strategy, even though it will retain flexibility to deviate from the target, thanks to its medium-term orientation subject to a proportionality assessment. According to Schnabel (2021a), this assessment includes a systematic cost-benefit analysis of its actions, taking into consideration their efficacy, side effects, and the potential of destabilising inflation expectations. At the ELB, this may even suggest a brief period of inflation moderately above 2%. This is one of the three changes regarding the conduct of monetary policy at the ELB. Other change pertains to the integration of the spectrum of policy tools used over the last decade into a more comprehensive toolset for the future.. Finally, the ECB explicitly acknowledges that fiscal and structural policies are important macroeconomic stabilisers and productivity propellers, especially near the ELB, thus amplifying the effectiveness of monetary policy. These considerations are in line with the policy implications of lower neutral rates, set in section 2.5. However, the ECB did not address the implications of large balance sheets, set out in section 3.3., despite the threats for its independence that they may represent.

Finally, regarding the major challenges that might condition the pursuit of price stability, the ECB gave particular attention to financial stability. This is referred to as a prerequisite for price stability and it will be featured in the ECB's evaluation of price stability and proportionality analysis, which will be built on a modified monetary and financial analysis, as well as on an economic analysis (Schnabel, 2021a). Accordingly, the ECB seems to consider that macro-prudential policies do not yet provide adequate protection against financial vulnerabilities, so its aim is to assess the longer-term accumulation of financial imbalances and their potential future effects on output and inflation tail risks. Such framework does not imply that the ECB will engage in "leaning against the wind" policies, but rather that it will adopt a flexible strategy in accounting for financial stability concerns (Schnabel, 2021a). Therefore, the monetary and financial analyses place now a greater emphasis on financial stability. Structural trends and their consequences for inflation, potential output, and neutral interest rates will be in the scope of economic analysis.

Relatedly, the ECB also gave more emphasis to climate change, with a commitment to a climate-related plan and to an adaption of its monetary policy operational framework.

In summary, our review highlights that some of the issues pertaining to the new normal of monetary policy – such as the operational framework of the new strategies and fiscal-monetary interactions – have still to be tackled in the future. As noted by Reichlin et al. (2021), monetary policy strategies must evolve as economic circumstances do. In this way, the FED intends to undertake a public review of its monetary policy strategy roughly every 5 years, and the ECB follows a similar approach, expecting an assessment of its strategy in 2025. This period will be a vital test for how successfully the recent adjustments address the structural challenges that have resulted in much lower neutral interest rates.

4. Conclusion

Low neutral interest rates have challenged the policy agendas of major CBs since the aftermath of the GFC. At a positive level, the neutral interest rate has a pivotal role in the policy rule literature as it provides a benchmark for gauging the monetary policy stance (Laubach & Williams, 2003). At a normative level, low neutral rates reduce the space for monetary policy to revive economies affected by strong unfavourable shocks. In this context, odds are that in the near future there will not be an adequate room for monetary policy, as policy rates are more likely to be driven to the lower bound than before (Obstfeld, 2019). Since it is unlikely that the downward trend of neutral interest rates is reversed (e.g., Rachel & Smith, 2017), a major rethinking of macroeconomic policy is arguably required (Krugman, 2014a).

Against this background, the purpose of this dissertation is to review recent research on the structural changes that might explain the low levels of neutral interest rates, and to assess how monetary policy should adapt its framework to deal with such challenges. The dissertation was based on an extensive literature review, which ultimately tries to establish an in-depth and amplified theoretical narrative of such recast of monetary policy.

Chapter 2 presents a number of challenges that have likely contributed to the downward trend in neutral rates. To this end, we build an integrative review of three major theoretical explanations that include secular stagnation, the global savings glut and safe assets shortage and the problem of debt overhang and deleveraging. Then, we present the main empirical conclusions on the measurement of the neutral rate, where demographic trends, a reduction in the rate of productivity growth, and an increase in the demand for safe assets

are identified as major determinants of low neutral rates over the last decades. Finally, we cover the policy implications of persistent low neutral interest rates according to each theoretical explanation, concluding that future macroeconomic stabilisation will rely not only on monetary policy, but also on the decisions made by fiscal policymakers, namely on the structural side of the economy.

Following the policy challenges reviewed in chapter 2, chapter 3 is a synthesis and evaluation of the most recent debates on monetary policy led by academics, policymakers, and CBs. First, we discuss the price stability, maximum employment and financial stability mandates, including their historical and theoretical evolution and the relevant aspects of their measurement. Second, we review the performance of unconventional monetary policies during the GFC and its aftermath, as well as questions related to the future use of the new tools. Third, we give an account of the most recent pressures on CBI and the reasoning for CBI in the current environment. And finally, we analyse the recent monetary policy strategy reviews undertaken by the FED and the ECB and review whether the new frameworks' major elements connect to the literature reviewed in the previous sections.

Overall, this dissertation has shown that conventional monetary policy has lost its stabilising power. We conclude that the new policy framework must provide sufficient stimulus at the lower bound and avoid overly large overshoots in output and inflation after lifting-off from the ELB. Furthermore, the new tools should be able to provide additional policy space, although CBs must consider their impact on resource reallocation and productivity. Importantly, the monetary policy challenges that explain the downward trend of neutral interest rates showed that monetary policy must enable sustained private and public spending (Schnabel, 2020). In particular, future monetary-fiscal coordination is essential for stabilization purposes and to counter the structural forces of stagnation; therefore, this macroeconomic policy mix should be the keystone of the new normal of monetary policy.

Notwithstanding, considerably more work will be needed to improve monetary-fiscal coordination and the governance structure of overall macroeconomic policy under a low neutral interest rates environment. In particular, monetary and fiscal interactions open avenues for further investigation regarding debt sustainability, financial stability, and CBI. For example, what are the institutional changes needed to offer a coordinated response to the secular forces of stagnation? How to defend CBI in an era of large fiscal footprints

reflected in large CBs balance sheets? Moreover, apart from the low neutral interest rate, monetary policy strategy reviews and the related debate among academics and policymakers opened ways to discuss climate change and inequality, regarding the distributional and societal consequences of unconventional monetary policy. Two questions stand out from this debate: should CBs support a faster transition to a greener economy? And should CBs assess the distributional consequences of its measures when calibrating policy options?

Finally, it is worth noting that the literature reviewed in this dissertation was developed in an environment of simultaneously low inflation and low interest rates. However, since mid-2021, the aftermath of the COVID-19 pandemic and geopolitical tensions have caused a surge in inflation across advanced economies (Jordà et al., 2022). CBs are already adjusting monetary policy, removing last years' accommodation to control inflation. For instance, the ECB raised interest rates for the first time in eleven years in July 2022 and has been steadily doing so as this dissertation was being finalized.

Nevertheless, as our literature review suggests, there are strong reasons to believe that the underlying trend of low neutral interest rates will persist in the medium to long term. Hence, monetary policy may plausibly return in some more or less near future to an era of low interest rates, with high likelihood of a binding ELB. Recently, for instance, Krugman (2022) and Blanchard (2021) are supportive of this view. According to Krugman (2022), the recent constraints to globalisation (often termed de-globalisation) are likely to intensify the causes of secular stagnation: negative demographic trends are likely to deepen in part due to the drop in the immigration rate. Moreover, international political tensions and the resulting protectionism in international trade may endure. In addition, while long-term interest rates are above their pandemic levels, they are still about their levels in the pre-pandemic years (Krugman, 2022), the time frame to which most of our empirical literature review in section 2.4 refers. Therefore, despite recent developments, the debate on the new normal of monetary policy in the context of low neutral interest rates is far from being over and recent monetary policy strategy reviews will have to be evaluated ex-post. Only future research will tell if we have entered a new era of macroeconomic policy.

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