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Upcoming Working Paper

Government Debt and the Great Re-normalization?

Hamid Faruqee
Douglas Laxton
Haykaz Igityan

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Abstract

This study delves into the relationship between rising government debt and the world real interest rate using models pioneered by the IMF Research Department over the past 3 decades. Unlike DSGE models based on the standard infinite-horizon representative-agent framework, these DSGE models shed important light on many issues, such as fiscal policy, that hold significant value, especially during events like the Global Financial Crisis in 2008 and the aftermath of the COVID-19 pandemic in 2023. Key model results that will be relied upon include the models developed by Faruqee, Laxton and Symansky (1996), which extended Blanchard's 1995 framework with finite-planning horizons to incorporate life-cycle income profiles. Key conclusions of the paper suggest that there will be significant long-term repercussions associated with the massive levels of government debt. Specifically, we study a variety of assumptions and conclude that the 30 percentage point increase in OECD government debt since before the GFC could account for an increase in the global real interest rate somewhere between 90 and 150 basis points.

Additional authors include Asya Kostanyan, Naafey Sardar, Artyom Tovmasyan, Jared Laxton, Martin Galstyan, Armen Nurbekyan, Hayk Avetisyan, Angela Papikyan, Vahe Avagyan, and Hayk Karapetyan.

Hamid Faruqee and Douglas Laxton are retired from the IMF and are Senior Advisors at the Better Policy Project. We would like to thank a long list of people that provided important input into the development of these models over the years, but especially the Fund´s Directors of the Research Department that supported the development and use of the various multi-country models during our tenure in the Economic Modeling Division at the IMF. This list included Michael Mussa (1991-2001), Ken Rogoff (2001-2003), Raghuran Rajan (2003-2006), Simon Johnson (2007-2008), Olivier Blanchard (2008-2015) and Maurice Obstfeld (2015-2018). Other authors are students at the Global Forecasting School. For more information about BPP and the Global Forecasting School, see www.thebetterpolicyproject.org. Video presentations of the contents of this paper can be found at the BPP YouTube channel https://www.youtube.com/channel/UCzRCPVk6IE$_q rqY7GEZgdHg$.

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1 Introduction

"Nobody knows, but it seems to me we are in a different era than the era in the aftermath of the 2008 financial crisis"

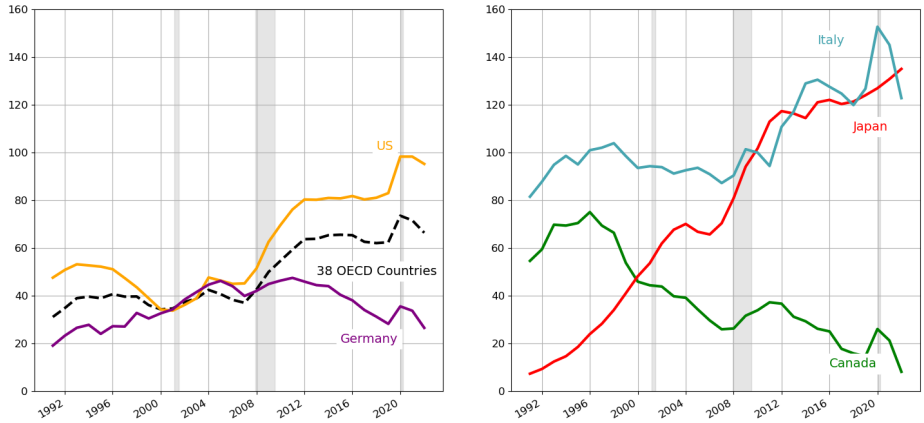
Lawrence Summers, Bloomberg TV, August 16, 2023

Evolution of Government Debt in the US and OECD Economies

Over the past several decades, the trajectory of government debt in both the US and OECD economies has undergone notable changes. In the US, the debt-to-GDP ratio began its upward climb in the 1980s, propelled by a passive response to disinflationary policies as well as fiscal spending and tax cuts. This momentum persisted into the early 2000s and was intensified by the global financial crisis (GFC) of 2008.

In the wake of the GFC, the US experienced an even steeper ascent in its debt levels. This was in response to the government implementing several stimulus packages aimed at reviving a staggering economy. By the close of 2019, US debt had soared beyond 23 trillion dollars, reaching an unprecedented peak.

Similarly, rising debt wasn't an anomaly reserved for the United States. Many OECD countries, particularly in Europe, encountered their own debt crises in the subsequent decade. Nations such as Greece, Italy, and Spain found themselves ensnared by mounting debt, leading to the adoption of stringent austerity measures and the negotiation of bailout packages. Yet, some OECD members, like Germany, managed to uphold relatively stable debt ratios. This was achieved by adhering to stringent fiscal rules and a pronounced emphasis on budgetary discipline.



Source: OECD Economic Outlook

Figure 1: General Government Net Financial Liabilities as a Percent of GDP

However, the 2020s presented a fresh set of fiscal challenges with the eruption of the COVID-19 pandemic. In efforts to counteract the economic down-

turn, governments globally, encompassing the US and several OECD countries, sanctioned unprecedented fiscal stimulus initiatives. Consequently, worldwide government debt scaled new heights, reigniting debates about the ramifications of such elevated debt levels and the optimal strategies for fiscal sustainability in a post-pandemic world.

Blanchard's $r < g$ Perspective on Fiscal Policy

Olivier Blanchard, in a recent 2022 book Fiscal Policy Under Low Interest Rates provides an intricate perspective on fiscal sustainability, particularly against the backdrop of low real interest rates. At the heart of his stance is the interplay between the real interest rate (r) and the real growth rate of the economy (g). When r falls below g ($r < g$), it suggests that governments could, in theory, maintain perpetual primary deficits without causing an unsustainable rise in the debt-to-GDP ratio. Such a scenario offers governments the latitude to employ fiscal policy more proactively, especially when monetary policy is tethered by the zero lower bound.

Summers' $r > g$ Perspective on Fiscal Policy

Larry Summers presents a contrasting viewpoint to that of Blanchard. Summers contends that we may be entering an era where the real interest rate (r) exceeds the real growth rate of the economy (g), a condition expressed as $r > g$. Should Summers' perspective hold true, it carries profound implications for fiscal sustainability not only in the United States, but by raising the world interest rate, it could have cataclysmic global implications by increasing the risks of fiscal and financial crises in countries with extremely high levels of government debt, rapidly aging populations and financial systems that have underpriced the implications of a sustained rise in interest rates.

A regime where $r > g$ implies that government debt could potentially spiral out of control unless actively managed. This is because the cost of servicing the debt, as indicated by the interest rate, would outstrip the rate at which the economy is growing. As such, to stabilize or reduce the debt-to-GDP ratio, governments would have to generate primary surpluses, achieved either through increasing tax revenues or trimming expenditures, both of which will be extremely difficult to achieve given pressure on the budget to deal with aging demographics and climate change.

This requirement for primary surpluses means that high levels of government debt can become increasingly burdensome. Should governments fail to adapt in a timely manner, they risk facing unsustainable debt trajectories that could necessitate sharp, often politically and socially painful, adjustments. In economic terms, these adjustments could stymie growth, increase unemployment, and strain social welfare systems, thereby exacting a heavy toll on their populations.

The repercussions are not limited to the US alone. If the US, with its reserve currency status and deep financial markets, finds itself in an environment where $r > g$, the implications for more vulnerable high-debt economies are even more

daunting. These economies, where interest rates are already significantly higher than growth rates, could find themselves in a far more precarious situation. The gap between their interest costs and growth could widen further, leading to even more stringent fiscal adjustments or, in extreme cases, debt crises. The Better Policy Project and the Global Forecasting School at the Central Bank of Armenia, offers daily reports on non-Ponzi game conditions. These reports provide daily updates on 10-year bond rates and their comparison to the sustainable nominal GDP growth rates in various countries.[1] At this point, a significant number of countries meet the non-Ponzi criteria, where interest rates exceed sustainable nominal GDP growth rates.[2]

Figure 2: Comparison of 10-year Bond Yield with Sustainable Nominal GDP growth in US, Italy and Japan

[1] In the United States, the sustainable nominal GDP growth stands at 3.7%, encompassing a 2% inflation target and 1.7% real GDP growth. Additionally, for Italy and Japan, the sustainable nominal GDP growth rates are 2.6% and 0.9%, respectively.

[2] For more information on non-Ponzi report visit www.thebetterpolicyproject.org

In the juxtaposition of Blanchard's and Summers' views, one finds the crux of the current debate on fiscal sustainability. The path forward remains uncertain, yet the importance of understanding these dynamics and preparing for potential scenarios is undeniable. The stakes, given the current levels of global debt, are exceedingly high.

This paper provides estimates of the long-run effects of increases in government debt in OECD countries since the aftermath of the GFC using the suite of models that have been developed at the IMF over the last few decades. To begin the discussion, Section II provides a review about how these models were used at the IMF to improve policy coordination during the GFC. It also provides a brief review of the various types of global economy models that were developed in the IMF research department over the last 3 decades, so that readers can perhaps better understand why policymaking institutions like the IMF place considerable emphasis on developing a suite of models for their Forecasting and Policy Analysis Systems. Section III discusses the accumulated levels of government debt in the advanced economies and its implications for real interest rates. Section IV then provides a brief review of the comparative statics from MULTIMOD Mark III and GIMF. Section V jumps back in time and revisits the calculations presented in the basic building block of MULTIMOD Mark III and GIMF that was first studied extensively and presented in Faruqee and Laxton (2000) and Faruqee, Laxton and Symansky (FLS: 1996). Interestingly, FLS focused on the effects of reducing government debt in the advanced economies on the world real interest rate, but they also included tables under various assumptions about the long-run effects for increases in government debt that are relevant for discussing the effects of today's levels of debt and potential future increases if measures are not taken to curtail it. Section VI updates the estimates of long-run effects of government debt in OECD countries. Escalating government debt in OECD countries has raised concerns about higher real interest rates and reduced capital and output, posing risks of fiscal and financial crises, with the G20's role in coordinating fiscal policies to address these challenges and maintain stability highlighted alongside the ongoing challenge of achieving fiscal consolidation amid rising interest rates.

2 Development of Multicountry Models in IMF

In the wake of the 2008 global financial crisis, the importance of state-of-the-art global economy modeling, such as the IMF's Global Integrated Monetary and Fiscal model (GIMF), became starkly evident in coordinating both domestic and international monetary and fiscal policy responses. These models enabled a comprehensive understanding of the impacts of diverse fiscal instruments, including government consumption, government investment, consumption taxes, and direct taxes on labor and capital.

The adaptability of the GIMF model allowed for nuanced analysis of policy effectiveness based on the specific fiscal instrument used and the unique struc-

tural characteristics of each economy. The model's capacity to consider both short-term and long-term implications of fiscal and monetary policy actions, particularly in a zero interest rate environment, was indispensable.

A critical aspect of our work during the crisis was to initially coordinate and then eventually quantify the effects of the G20's fiscal expansion in 2009 and 2010. This required a detailed decomposition of changes in the aggregate deficit into various fiscal instruments. The necessity of such granular modeling became clear as it played a vital role in guiding the policy responses to one of the largest economic challenges in recent history.

These findings have been outlined in two significant papers. The first, published in the Journal of Monetary Economics, provides a detailed examination of the actual fiscal expansion that took place in each G20 economy in 2009 and 2010. The second, an IMF staff position note by Freedman and others (2009) builds upon this analysis to show the international implications of a coordinated expansion of fiscal and monetary policies.

As we delve further into the models and results in the sections that follow, it's important to underscore the crucial role such advanced tools played during the global financial crisis. They were not only essential for navigating the immediate fallout from the crisis, but also in understanding the longer-term economic implications, thereby shaping both current and future policy decisions. Before taking people through the nuts and bolts of 2 of these models that were focused on fiscal policy, it might be useful to provide a summary of all the global modeling tools that were developed when we[3] were there so that readers can see how these two models with fiscal policy fit into a Forecasting and Policy Analysis System based on a suite of models. Readers more interested in the basic calculations about the effects of government debt on the world real interest rate can skip ahead to sections 3, 4 and 5 where it is summarized quite succinctly.

Evolution of Multi-Country Models in the IMF's Research Department

The IMF's Research Department has been at the forefront of developing advanced macroeconomic models for several decades. The aim has been to understand intricate global economic interactions, particularly when it comes to fiscal policy implications on global economies. This section traces the evolutionary journey of these models, underscoring their relevance and highlighting modifications made over time.

2.1 MULTIMOD: The Pioneer Model

MULTIMOD, initially developed by Masson, Symansky, and Meredith (1990), marked the first multi-country model of the Research Department. Our work with Multimod started with MULTIMOD Mark III, which was especially notable for being the first version to incorporate more realistic life-cycle income

[3]Douglas Laxton retired from the IMF in 2018 and Hamid Faruqee retired in 2022. Both are now senior advicers in The Better Policy Project.

profiles into the modeling paradigm. Our work with MULTIMOD Mark III was documented in Laxton and others (1998) and was the beginning of taking foundational models such as Blanchard (1985) and then adding a few more real-world features to understand policy tradeoffs and the types of basic calculations presented later in this paper. MULTIMOD´s significance can be gauged by subsequent extensions such as FSGM, which in many ways goes back to the flexibility offered by semi-structural models especially for multi-purpose workhorse models used in places like the IMF. Laxton and others (1998) also showed among other things that real-world features such as life-cycle income profiles and myopia were essential to assess the crowding-out effects due to high levels of government debt.

2.2 GIMF: A Shift to Microfoundations

The Global Integrated Monetary Fiscal model (GIMF) marked a transition towards models underpinned by dynamic optimization theory. However, its tight theoretical structure, a consequence of its dynamic optimization framework, posed challenges for comprehensive macroeconomic modeling, especially when attempting to formulate risk-based scenarios. But it remains our model of choice for many fiscal calculations because of the meticulous choices that went into its specification and calibration. This included intensive work calibrating the model by some very seasoned economists that had considerable hands-on experiences and knowledge of the relevant literature and historical narratives. It was also used extensively as a workhorse tool for both multilateral and bilateral surveillance, and consequently received considerable feedback and real-world testing as the model was employed extensively in the Fund's surveillance.

2.3 FSGM: Balancing Microfoundations with Flexibility

Responding to the constraints posed by earlier models, the Flexible System of Global Models (FSGM) was birthed. It amalgamated the microfounded components from its predecessors with a pragmatic approach towards specifying trade, unemployment, and bonds of varied maturities. FSGM has proven to be a crucial tool, apt for producing real-world scenarios brimming with complexity, far surpassing the capabilities of purely microfounded models.

2.4 The Evolution and Challenges of the Global Economy Model (GEM)

The inception of the International Monetary Fund's (IMF) Global Economy Model (GEM) can be traced back to the arrival of Ken Rogoff at the IMF. Recognizing the need for a robust analytical framework that would bridge the gap between academic theory and practical policy analysis, the IMF, under Rogoff's guidance and building on the foundational work pioneered by Obstfeld and Rogoff (1995, 1996), set in motion the development of the GEM. The aim was clear: to provide a rigorous and state-of-the-art framework for forward-looking policy analysis in an intricate global landscape.

The GEM quickly garnered attention, and Figure 3 showcases the rising number of modeling applications leveraging the GEM both inside and outside the IMF. In particular, Faruqee and others (2005) developed a version to study current account imbalances in their paper before GFC that considers scenarios that involved smooth landing or crashes.

As the GEM's development progressed, a collaborative effort with Michel Juillard resulted in the creation of Dynare, a software platform designed to offer an enhanced marriage between academic rigor and practical policy modeling. This collaboration intended to foster a deeper connection between academic research and policymaking institutions.

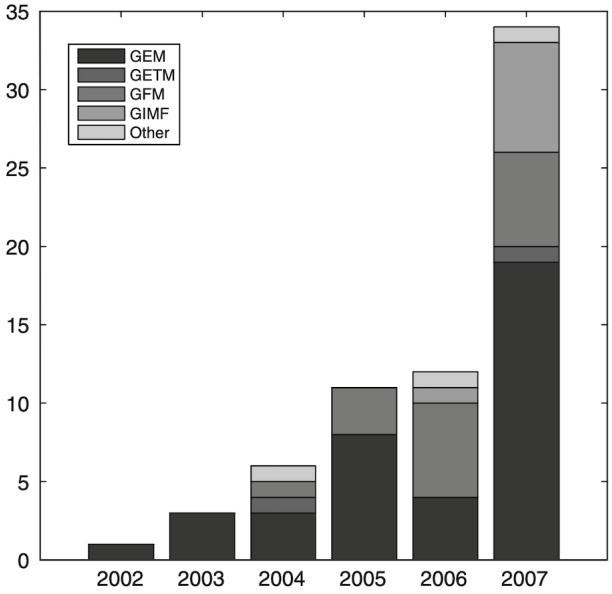


Figure 3: Papers Using or Extending the Modeling Unit's DSGE Models

However, despite these ambitious strides, challenges soon emerged. The rigorous analytical approaches championed by the academic world often demanded certain simplifying assumptions. Policymaking institutions found themselves grappling with models that, while theoretically sound and publishable in esteemed academic journals, were constrained by these same assumptions—most notably, the reliance on local approximations of representative agent models. This tendency detracted from the broader potential of using models to explore alternative scenarios and understanding the implications of uncertainty for policy decisions.

The dichotomy between academic precision and real-world applicability highlighted a fundamental tension: the need for models that both met rigorous academic standards and were sufficiently adaptable and holistic to inform nuanced

policy decisions. As institutions continue to navigate this complex landscape, there remains a call for models that seamlessly integrate the depth of academic frameworks, like those advanced by Obstfeld and Rogoff, with the practical demands of global fiscal policymaking.

2.5 GPM: The Global Projection Model

The last in this evolutionary journey is the Global Projection Model (GPM). Distinct as a quarterly model, GPM played a pivotal role in coordinating and ensuring macroeconomic consistency within the World Economic Outlook. Its application was essential in harmonizing international economic projections and guaranteeing a cohesive global perspective.

2.6 Conclusion

These models, while crafted with the intention of understanding fiscal policies, have transcended the role of mere forecasting tools. They've produced scenarios based on World Economic Outlook projections and have been pivotal in evaluating the ramifications of various policy alternatives, whether they address domestic aims or broader global objectives, such as tackling the challenges of the Global Financial Crisis.

Subsequent sections will further explore the mechanics, applications, and prospective paths of these models in the sphere of global macroeconomic research.

3 The Role of Global Economy Models in Policy Coordination During the GFC

The G20 nations played a pivotal role in the fiscal landscape of the 2000s, especially with their expansive fiscal measures in 2009 and 2010. This section provides a comprehensive review of these fiscal interventions, the subsequent accumulation of fiscal deficits and debt up to the onset of the COVID-19 pandemic, and the potential consequences of these elevated debt levels on global real interest rates.

The Great G20 Fiscal Expansion (2009-2010)

- **Beneficial Outcomes:** The expansive fiscal measures during 2009 and 2010 provided an essential safety net for economies reeling from the aftermath of the global financial crisis. By stimulating aggregate demand, ensuring liquidity, and preventing a more severe recession, the G20 fiscal interventions proved crucial.

The Era of Debt Accumulation (Post-2010 to Pre-COVID)

- **Emergence of Deficits:** The recovery and stabilization measures, while effective, culminated in escalating fiscal deficits in the years that followed.

- **Debt Proliferation:** As a direct consequence of these deficits, government debt surged across G20 countries. This trend is exemplified by the U.S., where debt as a percentage of GDP grew from 45% in 2007 to 83% in pre-Covid 2019.

The Pandemic Epoch: Renewed Fiscal Stimulus

- **Resurgence of Fiscal Measures:** The unforeseen challenges posed by COVID-19 necessitated yet another wave of large-scale fiscal interventions.
- **Debt Amplification:** With these additional fiscal policies and pandemic-induced economic disruptions, the already towering debt figures intensified for many G20 nations.

Ramifications for the Global Real Interest Rate

- **Debt's Overarching Influence:** The profound accumulation of government debt post the G20 fiscal initiatives and throughout the COVID era is poised to impact global financial dynamics.
- **Potential Interest Rate Shifts:** Such significant debt levels evoke projections of changes in global real interest rates. The interplay between debt, interest rates, investor sentiments, monetary policies, and worldwide economic scenarios will be instrumental in charting the future financial course.

To encapsulate, the G20's timely fiscal interventions in 2009 and 2010, while pivotal for immediate recovery, paved the way for a notable accumulation of global debt. The ramifications of this debt, particularly concerning global real interest rates, present a paramount concern for future economic trajectories.

4 Higher Debt in MULTIMOD Mark III and GIMF

4.1 The Global Crowding-Out Effects of Government Debt

In the realm of modern macroeconomic models, fiscal crowding out due to government debt increases largely hinge on three pillars: consumers' perception of government bonds as net wealth, the relationship between overall consumption and disposable income, and the responsiveness of overall consumption to fluctuations in interest rates. A key idea underlying this is the Ricardian equivalence hypothesis. It suggests that should consumers be connected across generations through active intergenerational transfers, government debt escalations would not displace private investment. Instead, consumers would modulate their present-day savings in anticipation of future tax commitments.

MULTIMOD Mark III departs from this idea, suggesting instead that households only partially adjust their savings in reaction to the future tax implications

of burgeoning government debt. The model posits that people tend to view a segment of their government bond holdings as actual wealth. Two crucial justifications for the absence of full Ricardian equivalence within the Mark III are the inability of a significant proportion of consumers to leverage their future labor income and the assumption that wealth-constrained consumers don't completely factor in future tax burdens. This results in an inclination to overspend available resources, leading to an elevation in real interest rates and, consequently, a drop in the capital stock and sustainable real income and consumption levels.

	Without an Increase in Distortionary Taxes on Capital	With an Increase in Distortionary Taxes on Capital
Output (in percent)	-1.1	-1.6
Consumption (in percent)	-1.0	-1.4
Capital stock (in percent)	-3.4	-4.7
Real interest rate (basis points)	31	32

Source: Laxton, Isard, Faruqee, Prasad, and Turtelboom (1998)

Table 1: Steady-State Effects of Simultaneous 10 Percentage Point Increases in Ratios of Government Debt to GDP of All Industrial Countries

To exemplify these effects, consider simultaneous 10 percentage point amplifications in the ratios of government debt to GDP across all industrialized nations. When the basic tax rate on nominal GDP is elevated, leaving the capital tax rate consistent, the real interest rate is heightened by 31 basis points. This leads to a 3.4 percent drop in the capital stock, trimming potential output by 1.1 percent and diminishing the sustainable consumption level by 1.0 percent. Distortionary capital taxes, if utilized to partially fund the augmented debt-service obligations, intensify these crowding-out effects.

4.2 Long-Run Impacts in the GIMF Framework

Shifting our lens to the Global Integrated Monetary Fiscal (GIMF) model, we investigate the long-term repercussions of a perennial 0.5 percent upswing in interest-inclusive deficits that elevate long-run government debt by 10 percent of GDP. GIMF's calibration suggests that a one percentage point growth in the U.S. government-debt-to-GDP ratio results in a roughly one basis point surge in both U.S. and global real interest rates. Notably, this is at the lower threshold of estimates documented by empirical studies.

Distinct from the MULTIMOD simulations, in GIMF, deficits initially surge due to tax reductions or augmentations in transfers. But as debt and interest charges swell, the primary deficit is adjusted to maintain the 0.5 percent GDP deficit increase, achieved through balancing tax hikes or transfer cuts.

Table 2 details these shifts' impact on real GDP, both in the U.S. and globally. Global long-run real GDP dips between 0.3 and 0.7 percent due to the uptick in world real interest rates caused by investment in added government

debt pushing out savings in tangible assets and net foreign assets. The repercussions on the U.S. GDP are markedly more pronounced, attributable to various factors including interest charges on foreign liabilities and the crowding-out effect on the stock of liabilities.

Considering different tax scenarios, the U.S. GDP effect is most severe with corporate income taxes at -0.71 (and -0.23 in the rest of the world), followed by labor income taxes and consumption taxes. This ordering mirrors the hierarchy of tax distortions detailed in public finance literature. Notably, the concept of long-run crowding out used throughout this paper carries a precise connotation within the models deployed, separating it from more conventional, short-term notions of crowding out.

5 Some Important Assumptions in Faruqee, Laxton and Symansky (1996)

The main results of the 1996 paper by Faruqee, Laxton, and Symansky present government debt dynamics in detail. However, comprehensive understanding can only be achieved by examining the implications of variation in the numerical parameters of our assumptions. This section is dedicated to go back in time and re-explore these parameters, measuring the robustness of our initial results under alternative settings.

5.1 Base Parameters and Results

Before looking at all the various factors, it's important to look at the base numerical parameters and associated outcomes from the 1996 paper. First and foremost, the paper adjusted the age-dependent lifetime income profile with constant growth into something more akin to a hump shaped income profile, which is more associated with reality. In the previous income age-dependent lifetime income profile, there were members of society who are very old, but also possessed the largest amount of wealth. The new income profile resembled a hump, with income peaking at age 50, and decreasing towards old age. With regards to liquidity constraints, 20% of the population was constrained, representing the new young generation who is coming up, and is not able to effectively leverage and borrow from their future income. Finally, the model assumed steady state growth to be powered solely by 2% productivity gain. The results of the model using these calibrations showed a 147 basis point decrease in interest rate resulting from a 40 percentage points decrease in government debt-to-GDP ratio. This number is important to remember as results from changes in the model will be compared against the 147 found in Faruqee, Laxton and Symansky.

5.2 Sensitivity to Liquidity Constraints

The 1996 paper indicates a sensitivity to liquidity constraints of around 0.37. When the percentage of the liquidity constrained population is adjusted by

10% up or down, the results show significant changes in the interest rate. By adjusting the liquidity-constrained population to 30%, the model shows a 163 basis point decrease in interest rates as a result of the identical 40 percentage points decrease in debt-to-GDP ratio. On the flip side of the coin, if the liquidity-constrained population is decreased to 10%, the results indicate a 135 basis point decrease in interest rate. What these results show is that a higher ratio of liquidity-constrained people increases the effect of permanent increase of debt on the interest rate.

5.3 Adjustments to the Age-Dependent Wage Income Profile

Keeping in mind the previous age-dependent wage income profile where income peaked at 50, the maximum point of income was changed to see its impacts on debt dynamics. The peak of lifetime income was varied by 10 in either direction. When income peaked at 60 years, the change in interest rate fluctuated by 5 basis points compared to the base model, indicating a contraction of 142 basis points from the 40% decrease in the debt-to-GDP ratio. When lifetime income was made to peak at age 40, the interest rate change again fluctuated by 5 basis points, resulting in a 152 basis point decrease in interest rate. We now have an updated calibration, which is discussed in the next section.

5.4 Introducing Population Growth

The final factor that was changed in the model was population growth. In the 1996 paper, it is noted that Ricardian Equivalence can decrease or even break down if population growth is added to the model. By repeating the previous experiment with a 1% annual population growth, the result shows a 163 basis point cutback in interest rate. This means that the presence of positive population growth heightens the interest rate's reactivity to changes in debt dynamics. We are currently in the process of developing the model with age-specific mortality so that the model can be used to study pension and other age-dependent issues.

6 Some Updates of the Long-Run Effects of Government Debt

As previously mentioned, the current net public debt stands at approximately 70 percent of the GDP. To establish an initial benchmark, we have calculated a steady-state solution, assuming that this debt ratio remains constant forever. Subsequently, we have compared this steady-state scenario with two alternative scenarios. In the first scenario, we explore the long-term implications of completely eliminating all government debt in OECD countries, which would result in a reduction of the debt-to-GDP by 70 percentage points. We also examine various intermediate cases within this scenario. In the second scenario,

we consider the possibility that the debt-to-GDP continues to increase by an additional 30 percentage points. This scenario effectively simulates a situation similar to the trends observed over the past decade.

In our simulations, we utilize a grounded life-cycle income profile, characterized by three exponential functions, as outlined in Faruqee and Laxton (2000) and extensively elaborated in MULTIMOD Mark III. The chosen parameters ($\alpha_1 = 0.078$, $\alpha_2 = 0.121$, $\alpha_3 = 0.091$) have been meticulously selected to accurately mirror empirical lifetime income profiles. We initiate our analysis with a key simplifying assumption: the intertemporal elasticity of substitution ($\frac{1}{\sigma}$) is set to one. Although this figure might appear implausibly large, we use it as a starting point because of its extensive application in modeling and its tractability. We posit a long-term productivity growth rate of 1.5 percent. Within the production function, the capital share stands at 0.35, consistent with prevalent values for advanced economies. Notably, within this framework, nominal variables are omitted, and the real interest rate is determined in the capital market as the marginal return on capital, adjusted for the equity premium.

Furthermore, in the initial simulation exercise, we assume a planning horizon for individuals of 20 years, which corresponds to a parameter value of $p = 0.05$. Drawing from detailed and aggregate time-series evidence regarding excess sensitivity, we assume that 20 percent of the population faces liquidity constraints. Lastly, we calibrate the time preference parameter to achieve a real interest rate of 2.5 percent under a debt-to-GDP of 70 percent.

	Debt-to-GDP Ratio										
	0	10	20	30	40	50	60	70	80	90	100
Consumption (in percent)	1.2	1.0	0.8	0.7	0.5	0.3	0.2	0	-0.2	-0.3	-0.5
Output (in percent)	2.0	1.7	1.4	1.1	0.8	0.6	0.3	0	-0.3	-0.5	-0.8
Capital (in percent)	5.9	5.0	4.1	3.3	2.4	1.6	0.8	0	-0.8	-1.5	-2.3
Interest rate (basis points)	-46	-39	-32	-26	-19	-13	-6	0	6	13	19

[$\mu = 0.015$, $\frac{1}{\sigma} = 1$, $p = 0.05$, $\lambda = 0.2$, $\alpha_1 = 0.078$, $\alpha_2 = 0.121$, $\alpha_3 = 0.091$]

Table 2: Steady-State Effects of Government Debt in the Life-Cycle Income Model. Change from an Initial Steady State with a Debt-to-GDP Ratio of 70 Percent.

Table 2 offers a concise summary of the simulation results, grounded in the calibration parameters we discussed earlier. Specifically, when government debt increases by 10 percentage points of GDP, it leads to a modest rise in interest rates, amounting to just 6 basis points, which may be considered relatively negligible. However, a contrasting scenario emerges when government debt is entirely eradicated in OECD countries, resulting in a notable reduction

of interest rates by 46 basis points. In this particular scenario, the long-term crowding-out effects attributable to debt are substantially muted, culminating in a 5.9 % upsurge in the level of capital and a 2.0% augmentation in the level of output.

It is imperative to recognize that the outcomes presented here are subject to sensitivity based on certain assumptions used in the model calibration. However, our study also delves into a more realistic estimate of 0.5 for the intertemporal elasticity of substitution. This estimate notably leads to much larger crowding-out effects from government debt. The reason being, it necessitates a significantly larger shift in the real interest rate to re-balance global savings and investment. Fundamentally, the extent of crowding out should hinge on how responsive consumption is to fluctuations in the real interest rate. When a portion of government debt is perceived as net wealth due to consumers excessively discounting future tax obligations, there tends to be an inclination toward 'overconsumption.' Consequently, this necessitates an increase in the real interest rate to restore a new steady-state equilibrium. Conversely, if consumption exhibits high sensitivity to real interest rate changes, only a marginal adjustment in the real interest rate is required.

In our second policy experiment, we manipulate the time preference parameter to achieve the same 2.5% steady-state interest rate as in the previous scenario, while maintaining a 70% debt-to-GDP ratio under 0.5 intertemporal elasticity of substitution. The calibration of all other parameters, including the planning horizon or the probability of death, remains unchanged.

	Debt-to-GDP Ratio										
	0	10	20	30	40	50	60	70	80	90	100
Consumption (in percent)	6.7	5.8	4.9	3.9	2.9	2.0	1.0	0	-1.0	-2.0	-2.9
Output (in percent)	13.3	11.2	9.2	7.2	5.3	3.5	1.7	0	-1.6	-3.2	-4.8
Capital (in percent)	42.9	35.5	28.5	22.0	15.9	10.3	5.0	0	-4.6	-9.0	-13.0
Interest rate (basis points)	-259	-224	-188	-152	-115	-77	-39	0	39	79	119

$[\mu = 0.015,\ \frac{1}{\sigma} = 0.5,\ p = 0.05,\ \lambda = 0.2,\ \alpha_1 = 0.078,\ \alpha_2 = 0.121,\ \alpha_3 = 0.091]$

Table 3: Steady-State Effects of Government Debt in the Life-Cycle Income Model. Change from an Initial Steady State with a Debt-to-GDP Ratio of 70 Percent.

As evident from the results (Table 3), a lower value for the intertemporal elasticity of substitution results in a substantially higher change in the real interest rate in response to a 10% permanent rise in government debt-to-GDP. This translates to a 39 basis point change in interest rates, representing the cost associated with increasing government debt from 70% to 80% of GDP. The complete elimination of government debt across OECD countries would lead to

a reduction in the real interest rate to 0% and an elevated level of output by 13 percent.

	Planning Horizon (Years)								
	10	15	20	25	30	35	40	45	50
Consumption (in percent)	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.8	-0.8	-0.7
Output (in percent)	-2.0	-1.8	-1.6	-1.5	-1.4	-1.4	-1.3	-1.3	-1.2
Capital (in percent)	-5.7	-5.1	-4.6	-4.2	-4.0	-3.8	-3.7	-3.6	-3.5
Interest rate (basis points)	49	43	39	36	34	32	31	30	29

[$\mu = 0.015$, $\frac{1}{\sigma} = 0.5$, $\lambda = 0.2$, $\alpha_1 = 0.078$, $\alpha_2 = 0.121$, $\alpha_3 = 0.091$]

Table 4: Steady-State Effects of Government Debt in the Life-Cycle Income Model. Change from an Initial Steady State with a Debt-to-GDP Ratio of 70 Percent to 80 Percent.

An additional facet of this discussion pertains to variations in the planning horizon. In the context of a shorter planning horizon, such as 15 years, the associated cost increases to 43 basis points, as opposed to the previously mentioned 39 points. Should we contemplate scenarios where the average American displays an even shorter planning horizon, indicating a limited concern for their economic future beyond a decade, the cost further rises to 49 basis points. These findings underscore the inherent sensitivity within these calculations.

7 Conclusion

Challenges have undoubtedly emerged in OECD countries over recent decades due to escalating government debt. This has led to higher real interest rates and diminished capital and output. Through various model calibrations, our paper quantifies these effects. A primary concern is the risk of interest rates surpassing the sustainable economic growth rate, represented as $r > g$. This scenario implies that, unless actively managed, government debt could spiral out of control, potentially triggering fiscal and financial crises in countries with excessive levels of government debt. The heart of the problem is the cost of servicing the debt – with the interest burden on debt outstripping the pace of economic growth, the challenge of excessive primary deficits is intensified.

The G20's pivotal role in easing the debt burden becomes clear when addressing these intricate issues. The G20's ability to coordinate becomes paramount. Harmonized fiscal policies among member nations result in a substantially more potent collective impact. Such coordinated actions bolster economic multipliers,

leading to a pronounced overall effect on the economy. Navigating the intricacies of the contemporary global economy necessitates this kind of coordination.

In summary, coordination is of utmost importance. By joining forces, G20 nations can reap more significant benefits. The analytical framework cultivated by the IMF over the years sheds light on the perks of a united approach. It demonstrates that coordinated actions magnify the ensuing benefits, fostering both fiscal and financial stability amidst the complexities of the global economic milieu.

The G20's coordinated global fiscal and monetary expansion in 2009 and 2010 was a crucial intervention, preventing an even more profound recession and a potential crisis if the dip in confidence had led to a collapse in equity prices and debt deflation. With current interest rates potentially surpassing growth rates, there's mounting pressure to tighten fiscal policies to counteract the explosive dynamics associated with high government debt levels. The challenge lies in achieving adequate fiscal consolidation without instigating a vast global recession and prolonged economic stagnation.

References

[1] Andrle, M., Blagrave, P., Espaillat, P., Honjo, K., Hunt, B., Kortelainen, M., Lalonde, R., Laxton, D., Mavroeidi, E., Muir, D., Mursula, S., and Zhang, F., 2015. "The Flexible System of Global Models – FSGM". IMF Working Paper No. 15/64

[2] Blanchard, O., 1985. "Debt, Deficits, and Finite Horizons". Journal of Political Economy, 93(2), pp. 223-247

[3] Blanchard, O. J., and Abel, A. B., 1988. "Consumption and Investment: Theory and Evidence". Carnegie-Rochester Conference Series on Public Policy, 29, pp. 3-60

[4] Blanchard, O. J., 2022. "Fiscal Policy Under Low Interest Rates". MIT Press

[5] Coenen, G., Erceg, C., Freedman, C., Furceri, D., Kumhof, M., Lalonde, R., Laxton, D., Lindé, J., Mourougane, A., Muir, D., Mursula, S., de Resende, C., Roberts, J., Roeger, W., Snudden, S., Trabandt, M., and in't Veld, J., 2012. "Effects of fiscal stimulus in structural models". American Economic Journal: Macroeconomics, 4(1), pp. 22-68

[6] Faruqee, H., Laxton, D., and Symansky, S., 1996. "Government Debt, Life-Cycle Income and Liquidity Constraints: Beyond Approximate Ricardian Equivalence". IMF Working Paper 96/140

[7] Faruqee, H., and Laxton, D., 2000. "Life-Cycles, Dynasties, Savings: Implications for Closed and Small, Open Economies". IMF Working Paper 00/126

[8] Faruqee, H., and Laxton, D., Muir, D., and Pesenti, P., 2005. "Smooth Landing or Crash? Model-Based Scenarios of Global Current Account Rebalancing". NBER Working Paper 11583

[9] Freedman, C., Kumhof, M., Laxton, D., and Lee, J., 2010. "The Case for Global Fiscal Stimulus". IMF Staff Position Note SPN/10/03

[10] Kumhof, M., and Laxton, D., 2007. "A Party without a Hangover? On the Effects of U.S. Government Deficits". IMF Working Paper 07/202

[11] Laxton, D., Isard, P., Faruqee, H., Prasad, E., and Turtelboom, B., 1998. "MULTIMOD Mark III: The Core Dynamic and Steady-State Models". IMF Occasional Paper No. 164

[12] Laxton, D., and Pesenti, P., 2003. "Monetary rules for small, open, emerging economies". Journal of Monetary Economics, 50(5), pp. 1109-1146

[13] Laxton, D., 2008. "Getting to Know the Global Economy Model and Its Philosophy", IMF Staff Papers, Volume 55, No. 2

[14] Masson, P., Symansky, S., and Meredith, G., 1990. "MULTIMOD Mark II: A Revised and Extended Model". IMF Occasional Paper No. 71

[15] Obstfeld, M., and Rogoff, K., 1995, "Exchange Rate Dynamics Redux", Journal of Political Economy, 103, 624-660

[16] Obstfeld, M., and Rogoff, K., 1996, "Foundations of International Macroeconomics", Cambridge: MIT Press