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Miklós Váry

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Corvinus University of Budapest

Was There a Fiscal Free Lunch in Hungary between 1999–2019?

Miklós Váry[*, †]

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Abstract

This paper investigates whether there have been time periods between 1999 and 2019 in Hungary when government spending has been self-financing, i.e., when the government has faced a *fiscal free lunch*. By self-financing, it is meant that government spending, initially financed by issuing bonds, does not lead to an increase in the debt-to-GDP ratio due to improvements in the budget balance resulted in by stimulated economic activity. Some macroeconomists think that while government spending is arguably not self-financing in normal times, it could have become self-financing in the United States (US) during the Global Financial Crisis (GFC) due to 1) stronger fiscal multipliers, 2) stronger hysteresis effects, and 3) lower interest rates than usually. This paper estimates the parameters of a simple model of debt dynamics on Hungarian data to study whether these arguments also hold for an emerging small open economy, like Hungary, in which fiscal multipliers are thought to be weaker, and where interest rates increased during the GFC. It is found that government spending has not been self-financing in the short run before the GFC (1999Q1–2008Q3), has been at the edge of being expected to be self-financing in the long run, but has not actually turned out to be. During the GFC (2008Q4–2012Q4), it cannot be excluded to have been self-financing in the long run, and might have already been self-financing in the short run, as well. However, these findings are much less robust than those for the US. Between the GFC and the COVID recession (2013Q1–2019Q4), government spending was not self-financing in the short run, but was expected to be self-financing in the long run.

Keywords: fiscal free lunch, fiscal policy, government spending multiplier, hysteresis, Hungary

JEL: E12, E32, E62, H63, N14

[*]Corvinus University of Budapest – Institute of Economics, Fővám tér 8., H-1093 Budapest, Hungary (e-mail: `miklos.vary@uni-corvinus.hu`)

[†]HUN-REN Centre for Economic and Regional Studies – Institute of Economics, Tóth Kálmán utca 4., H-1097 Budapest, Hungary (e-mail: `vary.miklos@krtk.hun-ren.hu`)

1 Introduction

During the Great Recession that followed the Global Financial Crisis (GFC) of 2008, conventional monetary policy was constrained by the Zero Lower Bound (ZLB) on nominal interest rates in the United States (US). This led to a renewal of interest for fiscal policy as an alternative tool of macroeconomic stabilization policy. Empirical studies found evidence for an increased effectiveness of fiscal policy during recessions compared to expansions (Auerbach and Gorodnichenko, 2012), suggesting that fiscal policy may actually serve as a powerful substitute of conventional monetary policy in times when the ZLB is binding.

However, concerns about the costs of fiscal stabilization continued to exist, as a fiscal expansion can lead to an increase in the government debt-to-GDP ratio. This does not only put more tax burden on future generations, but may also result in investors losing their confidence in the sustainability of the government's financial position, causing interest rates on the government debt to rise, thereby, increasing the risk of sovereign default. If these concerns are justified, they question the desirability of using fiscal policy as a stabilization tool in spite of its increased effectiveness during recessions.

The sustainability of government debt has been the subject of research for a long time (Domar, 1944; Mellár, 2003). However, DeLong and Summers (2012) came up with a novel approach to argue that concerns about the costs of fiscal expansions were not justified in the US during the GFC. According to their arguments, government spending became *self-financing* in this time period, meaning that an increase in government spending, initially financed by issuing bonds, did not lead to an increase in the debt-to-GDP ratio. In other words, the US government faced the possibility of a *fiscal free lunch*. This happened because of the following three reasons.

1. Fiscal multipliers were stronger than during normal times, hence, a fiscal expansion was able to stimulate economic activity substantially, resulting in a considerable improvement in the primary budget balance. Three reasons can be listed to explain why multipliers got stronger during the GFC:
   (a) The ZLB was effective, hence, the Fed was not expected to raise the federal funds rate in response to a potentially rising inflation rate, provided that the fiscal stimulus did not pull the desired level of the nominal interest rate out of the negative range. In the absence of increasing interest rates, there was no reason to expect that a fiscal expansion would crowd out some of the private components of aggregate demand.
   (b) The share of credit-constrained households was high, and these households had higher marginal propensities to consume (MPCs)

than those who were able to smooth their consumption path. High MPCs imply large increases in consumption demand in response to rises in household's disposable income resulted in by the fiscal stimulus.

   (c) Productive capacities were underutilized, and producers have an easier job in adjusting to higher demand by increasing production in such a situation than in the case when capacity utilization is around the normal rate.

2. Hysteresis effects were in play, because of which the prevailing negative output gap pushed down the economy's potential growth path, causing long-run losses in aggregate output (Ball, 2014; Blanchard, Cerutti, and Summers, 2015). By mitigating the negative output gap in the present, a fiscal expansion can prevent output losses in the future, resulting in increased future tax revenues compared to the scenario without a fiscal intervention.
3. Interest rates on the government debt were exceptionally low, hence, the increased current and future tax revenues were able to cover the higher future interest payments easily (in per GDP terms).

Blanchard (2019) also argued in his Presidential Lecture at the 2019 annual conference of the American Economic Association that if US interest rates were lower than growth rates, then "*... the probability that the US government ... can issue debt and achieve a decreasing debt to GDP ratio without ever having to raise taxes later, is high*" (Blanchard, 2019: p. 1198).

This paper makes use of the model framework developed by DeLong and Summers (2012) to investigate whether the above-mentioned arguments also apply for an emerging small open economy, specifically, Hungary. The answer to this research question is not obvious for at least three reasons:

1. In Hungary, fiscal multipliers are usually thought of as being weaker than in the US, as in most small open economies (Ilzetzki, Mendoza, and Végh, 2011), primarily due to the *import leakage* effect. However, they probably got stronger during the GFC in Hungary, as well. Although the ZLB was not effective in the country, productive capacities were underutilized, just like in the US, and the share of credit-constrained households was also large.
2. There were indications of at least as strong hysteresis effects during the GFC in Hungary as in the US (Ball, 2014; MNB, 2016; Mellár and Németh, 2018; Váry, 2018). This increased the likelihood of a fiscal free lunch.
3. As opposed to the US, interest rates did not fall, they increased instead. This is illustrated by Figure 1, which compares the evolution of the overnight (O/N) interbank interest rate in some Central

and Eastern European (CEE) countries (Hungary, Poland, Romania, Turkey) and the United States during the GFC time period (2008M01–2012M12). While the O/N interest rate began to fall during 2008 in the US, ending up at the ZLB and staying there until the end of the recession, it shot up during the second half of 2008 in the selected CEE countries, staying above 3% throughout most of the recessionary period. The reason for this was that investors lost their trust in vulnerable emerging economies, like the selected ones, when the GFC turned serious after the Lehman Brothers bankruptcy, and these economies had to experience a sudden stop in capital inflows as a consequence. Monetary authorities had to raise policy rates in order to mitigate the depreciation of their domestic currencies, while the Fed was able to decrease the federal funds rate as investors had more trust in the US economy. Rising interest rates increased the costs of issuing debt for these CEE governments, making the possibility of a fiscal free lunch less likely than in the United States.

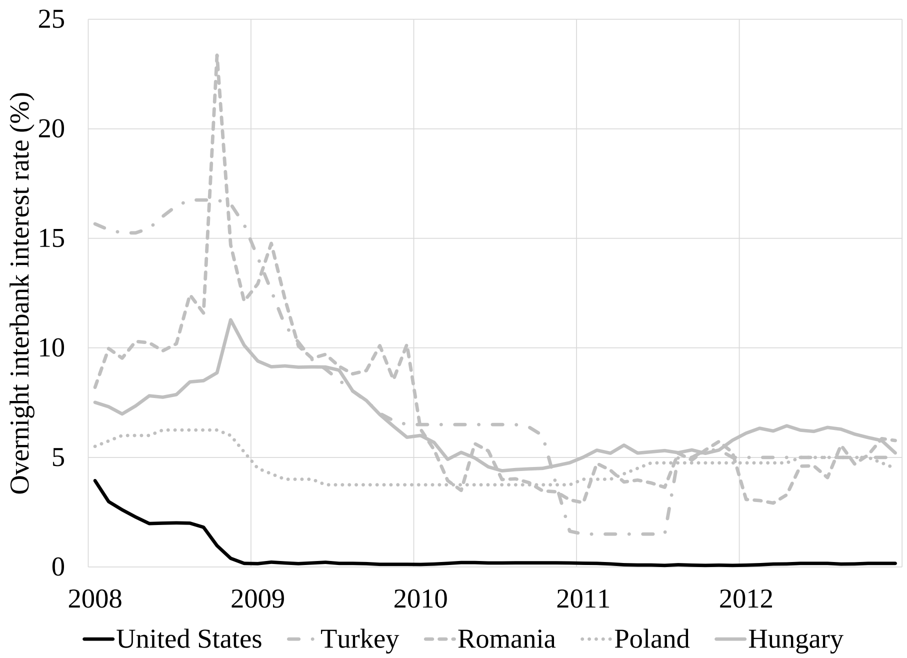

Figure 1: Overnight Interbank Interest Rates in Hungary, Poland, Romania, Turkey, and the United States (2008M01–2012M12)
Data source: OECD

The latter arguments imply that the paper's research question would be interesting to study for other CEE countries, as well, not just for Hungary.

Nevertheless, Hungary's case is particularly interesting because the share of households unable to face unexpected financial expenses was 75.2% in the country during 2009 according to Eurostat survey data, which was the highest value in the whole European Union[1], referring to the presence of serious liquidity constraints. This was largely the result of foreign currency – mostly, Swiss franc (CHF) – denominated overborrowing before the GFC, since a lot of the loans taken became nonperforming as the Hungarian forint (HUF) started depreciating against the CHF in the Fall of 2008. If such strong liquidity constraints were still not strong enough to raise the Hungarian government spending multiplier to a level high enough to compensate for the rising interest rates and allow for a fiscal free lunch, then there are good reasons to believe that government spending has not been self-financing in the other CEE countries highlighted on Figure 1, either. Although the Hungary-specific analysis presented in this paper cannot substitute country-specific analyses about other CEE countries, its results can be expected to have relevant lessons for them, as well, due to the similarities of their economies.

To the best of the author's knowledge, this is the first paper to study the possible self-financing nature of government spending in Hungary. Gábriel and Kaszab (2019) investigated a similar research question, but they analyzed the self-financing nature of Hungarian *tax cuts*, instead of that of government spending. They applied a structural general equilibrium model, conceptually very different from the reduced-form DeLong–Summers framework used in this paper. Their focus was on the budgetary consequences of the 2007–2011 Hungarian labor tax cuts and of a hypothetical 6 percentage-point labor tax cut in 2018. They found that both tax cuts had good chances for being self-financing, especially those that had actually been implemented between 2007–2011. The positive budgetary effects were made up of 1) the increasing tax base due to rising labor supply and more intense human capital accumulation, 2) rising additional tax revenues due to stimulated economic activity, and 3) the reduction of the shadow economy.

Crafts and Mills (2013) applied the same DeLong–Summers model as this paper to asses the long-run fiscal free lunch condition on historical macrodata from the 1930s' United Kingdom (UK). They found that a fiscal free lunch had been less likely around the Great Depression in the UK than around the GFC in the US. This had been mostly due to the smaller spending multiplier they estimated. However, they noted that the result was highly sensitive to the value of the multiplier, and the existence of a fiscal free lunch was not possible to exclude for the second half of the 1930s, when the gold standard had already been left by Britain. To the best of the author's knowledge, this is the third paper applying the DeLong–Summers framework to study if a fiscal free lunch can exist in a particular economy.

[1] See Eurostat table `ilc_mdes04`.

Instead of the highly developed countries analyzed in the previous two papers, the framework is applied for an emerging CEE economy this time.

The analysis presented in this paper divides the time period between 1999–2019 into three subperiods: pre-GFC (1999Q1–2008Q3), GFC (2008Q4–2012Q4), and post-GFC (2013Q1–2019Q4).[2] The five parameters of the DeLong–Summers model are estimated on Hungarian data for each period separately, some of them are allowed to vary from quarter to quarter within time periods, as well. The following main results are found on the basis of the estimates. Government spending was not self-financing in the short run before the GFC, was at the edge of being expected to be self-financing in the long run, but did not actually turn out to be, as the economy's actual long-run growth performance happened to be weaker than expected, while real government borrowing rates were high. During the GFC, government spending cannot be excluded to have been self-financing in the long run, and might have already been self-financing in the short run, as well. The key explanation for this is that the government spending multiplier is estimated to have grown to a size comparable to that in the US. Less importantly, hysteresis effects are found to have been substantial in Hungary, as well. These may have opened up the possibility of a fiscal free lunch in spite of the high interest rate environment. However, these findings are shown to be much less robust than those of DeLong and Summers (2012) for the US. It is sufficient to assume that the spending multiplier is slightly overestimated, and the fiscal free lunch result already disappears. Between the GFC and the COVID recession, government spending was not self-financing in the short run, but was expected to be self-financing in the long run according to the results, as the real government borrowing rate fell permanently below the economy's expected long-run trend growth rate. It cannot be determined yet if government spending made in this period has actually turned out to be self-financing because of the short amount of time spent since then.

The rest of the paper is organized as follows. Section 2 provides a brief overview of the Hungarian macroeconomic situation in the examined time period. Section 3 summarizes the model developed by DeLong and Summers (2012) to support their arguments for the US, and presents the two conditions that open up the possibility of a fiscal free lunch in the long run and in the short run, respectively. Section 4 estimates the parameters of the model on Hungarian data. Section 5 presents the main results based on the estimates. Section 6 discusses the results, and Section 7 concludes the paper.

[2] In Hungary, the effects of the GFC started being felt in 2008Q4 only, after the Lehman bankruptcy. This paper does not deal with the time period starting with the COVID-19 pandemic because of the numerous different types of shocks hitting the Hungarian economy and the too short period of time spent since then. These two factors do not allow for a large enough sample size, on which a reliable analysis could be based.

2 A Brief Overview of Hungarian Macroeconomic History between 1999–2019

This section places the analysis to be presented into context by providing a brief overview of Hungarian macroeconomic history between 1999–2019. See Tóth (2012) for a more detailed analysis about the history and the sustainability of Hungarian government debt dynamics between 1999–2010.

Figure 2 presents the quarterly time series of three key macroeconomic variables, the growth rates of real GDP and the Consumer Price Index (CPI) compared to the same quarter of the previous year, and the benchmark yield on 10-year government bonds in Hungary during the analyzed the time period. Figure 3 illustrates the evolution of the Hungarian economy's macro balance in the same time period by presenting the net lending flows of households, the corporate sector, and the government, as well as the total economy towards the rest of the world, as percentages of GDP.

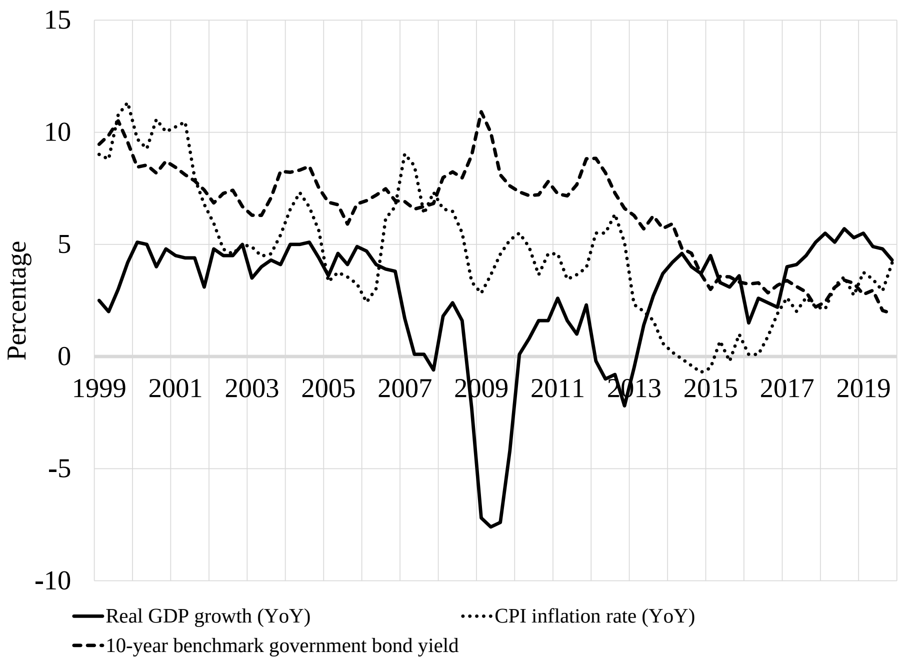

Figure 2: Real GDP Growth, CPI Inflation, and Long-Term Government Bond Yields in Hungary (1999Q1–2019Q4)

Notes: The monthly time series of CPI inflation and the 10-year benchmark government bond yield are aggregated to the quarterly frequency. YoY refers to the year-on-year growth rate.
Source: The author's own calculations based on data reported by the Eurostat and the Hungarian Government Debt Management Agency.

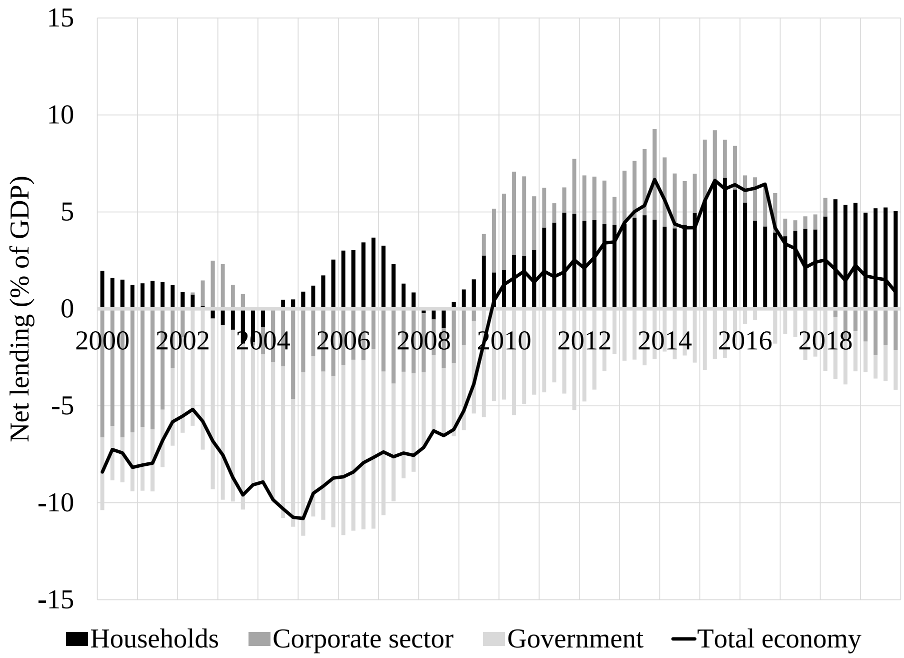

Figure 3: The Net Lending Flows of Households, the Corporate Sector, the Government, and the Total Economy in Hungary (2000Q1–2019Q4)

Notes: The figure presents cumulated four-quarter values. The household sector includes non-profit institutions serving households. The corporate sector is the aggregate of non-financial and financial corporations. The government sector refers to the general government.
Source: The author's own calculations based on data reported by the Eurostat.

Figures 2 and 3 illustrate the following story. By the millennium, the Hungarian economy had already gone through the major shocks of the transition to a market economy. The fiscal consolidation package of 1995 and the global economic expansion created the preconditions for achieving a stable 3.5–5% annual real GDP growth rate, while the crawling peg regime implemented by the Central Bank of Hungary (MNB – *Magyar Nemzeti Bank*) between 1995–2001 helped stabilizing the rate of inflation at around 5% by 2002. As government budget deficits were moderately low at around 3% of GDP, interest rates also fell, but 10-year government bond yields still remained relatively high at around 6–8%.

The Hungarian economy maintained strong economic growth even during and after the global economic recession of 2001–2002, but this came at the cost of increasing indebtedness in both the government and the household sector. The budget deficit rose to 7–9% of GDP between 2002–2006. This and the still relatively high rates of inflation contributed to the persistence of the high interest rate environment. Commercial banks reacted by relying on cheaper foreign currency financing, allowing them to provide low interest rate loans to households denominated in foreign currency (mostly, CHF). This contributed to a deterioration of net household savings, which even turned negative in some quarters of the time period. As a result of household and government overborrowing, the total economy's net borrowing from the rest of the world exceeded 10% of GDP in 2004.

The government had to implement fiscal austerity measures after the 2006 elections, which stopped economic growth, but households kept overborrowing, trying to maintain their consumption levels. As the budget deficit was reduced mainly by increasing the value added tax rate, the rate of inflation reached 9% again at the beginning of 2007.

The GFC hit the Hungarian economy in such a vulnerable state during the Fall of 2008. Foreign capital suddenly stopped flowing into the country and the government had to turn to the International Monetary Fund (IMF) in order to be able to finance the budget deficit. This is what led to the rise in interest rates during the GFC period that was presented on Figure 1. The HUF also depreciated against the CHF as a consequence of the sudden stop, causing a lot of CHF-denominated loans to default. As it was mentioned in Section 1, credit constraints tightened, which contributed to the deepening of the recession. The largest year-on-year drop in real GDP occurred in 2009Q2, amounting to 7.6%. In contrast to more developed Western European countries, the fall in aggregate demand did not bring about a fall in the Hungarian inflation rate because of the forint's depreciation and persistently high inflationary expectations. However, the private sector started deleveraging and the IMF's requirements, together with the European Union's (EU's) excessive deficit procedure (EDP), forced the government to cut the budget deficit. The economy's current account balance turned from negative into positive as a consequence.

The Hungarian economy experienced a further dip in economic activity during 2012, but a strong recovery followed. Economic growth was back above 4% in 2014 and even exceeded 5% between 2017Q4–2019Q1. Besides the global economic expansion, growth was also fueled by massive amounts of EU funds flowing into the country, while it was not accompanied by overborrowing this time, neither in the private, nor in the government sector. The current account surplus started reducing around the end of the 2010s only, as the corporate sector turned from a net lender into a net borrower in 2018, but the balance remained positive until the COVID-19 pandemic. Inflation finally fell in 2013 as a result of the government cutting household utility costs, which managed to break down inflationary expectations. In 2014–2015, Hungary also experienced deflation. This allowed the MNB to keep the policy rate low, and below-3% deficit-to-GDP ratios, together with a debt-to-GDP ratio falling from 80.3% of GDP in 2011 to

65.3% in 2019[3], also made it possible for the government to issue long-term debt at moderate nominal interest rates of around 2–3.5% in the second half of the 2010s.

3 The Model

This section summarizes the reduced-form model framework developed by DeLong and Summers (2012) to derive the short-run and the long-run conditions for a fiscal free lunch. Time is divided into two periods in the model: the first one is referred to as the *current period*, the *present*, or the *short run*; while the second one is called the *future period*, the *future*, or the *long run*. Primes will indicate the values of the relevant variables in the future period, while their values in the current period will have no primes. All variables will be measured as percentages of the economy's current potential GDP $\overline{Y}$. Changes in the variables will be expressed in percentage points of the current potential GDP.

Assume that the government increases its spending by ΔG in the present. If μ is the government spending multiplier, current output Y will change by

$$\Delta Y = \mu \Delta G.$$

Now, assume that the fiscal expansion is initially financed by issuing bonds. If the marginal net tax-and-transfer rate is τ, the required increase in the government debt D is

$$\Delta D = (1 - \mu\tau)\, \Delta G.$$

Note that $\Delta D \leq \Delta G$, since the stimulated performance of the economy improves the budget balance by $\tau \Delta Y = \tau\mu\Delta G$ already in the present, reducing the incremental deficit to be financed.

Assume that actual GDP is tied to its potential value in the long run, hence, $Y' = \overline{Y}'$. Suppose also that there are *hysteresis effects* in the economy, meaning that a negative output gap in the present will reduce potential output in the future. The strength of the hysteresis effect is captured by a hysteresis parameter η in the model that expresses the percentage change in future potential output in response to a 1% output gap in the present. In this case, the change in future output resulted in by the current fiscal expansion will be equal to the change in future potential output, which will be determined by the hysteresis effect according to

$$\Delta Y' = \Delta \overline{Y}' = \eta \Delta Y = \eta\mu\Delta G.$$

As the current fiscal expansion prevents some of the hysteresis losses in a recessionary environment, it will raise future tax collections by

$$\tau \Delta Y' = \tau\eta\mu\Delta G.$$

[3]Data source: Eurostat table `gov_10dd_edpt1`.

If r is the real interest rate on government debt and g is the economy's long-run trend (potential) growth rate, and if future tax collections were unchanged, the amount of the government debt, still expressed as a percentage of current potential GDP, would increase by

$$(r-g)\,\Delta D = (r-g)\,(1-\mu\tau)\,\Delta G$$

in the future.

However, if the increase in future tax collections is able to cover this amount, the transitory fiscal expansion will be become self-financing in the long run. This occurs if

$$\begin{aligned}(r-g)\,\Delta D &\leq \tau\Delta Y' \\ (r-g)\,(1-\mu\tau)\,\Delta G &\leq \tau\eta\mu\Delta G \\ (r-g)\,(1-\mu\tau) - \tau\eta\mu &\leq 0.\end{aligned}$$

Rearranging the last inequality yields the *long-run fiscal free lunch condition*.

The Long-Run Fiscal Free Lunch Condition. *A fiscal expansion in the present improves the government's budget balance in the future if*

$$r \leq g + \frac{\eta\mu\tau}{1-\mu\tau}. \tag{1}$$

The interpretation of condition (1) is straightforward. First, note that in the absence of hysteresis ($\eta = 0$), or if the spending multiplier is zero ($\mu = 0$), the condition collapses to $r \leq g$, which is the well-known stability condition of debt dynamics (Mellár, 2003). It says that the equilibrium debt-to-GDP ratio will remain stable, i.e., it will not increase in the long run in response to the current fiscal expansion, if the real government borrowing rate is below the economy's long-run trend growth rate. If there is hysteresis ($\eta > 0$) and the spending multiplier is positive ($\mu > 0$), the real government borrowing rate can even exceed the trend growth rate to some extent without endangering the stability of the debt-to-GDP ratio. In this case, all parameters affect the likelihood of a fiscal free lunch in an intuitive way. Government spending is more likely to be self-financing in the long run if

- The real government borrowing rate r is lower,
- The economy's long-run trend growth rate g is higher,
- The government spending multiplier μ is stronger,
- The net tax-and-transfer rate τ is higher,
- Hysteresis effects are stronger (η is higher)

ceteris paribus.

The analysis to be presented will distinguish between two types of a long-run fiscal free lunch: an ex ante and an ex post type. The government faces a long-run fiscal free lunch *ex ante* if condition (1) is expected to hold at the time when the government spends, while it actually experiences a long-run fiscal free lunch *ex post* if condition (1) turns out to have actually held when the bonds issued to finance the initial spending mature. Both cases are interesting. In the ex ante case, the results will inform about whether it was reasonable to expect government spending to be self-financing at the time when it was made. In the ex post case, the results will be informative about whether government spending made at a particular point in time has actually turned out to be self-financing.

However, condition (1) might actually be irrelevant to assess if the initial ΔD change in the government debt is nonpositive. This can happen if the fiscal expansion stimulates economic activity so strongly that the budget balance improves already in the short run, due to the increased tax revenues. Thus, the fiscal expansion might already be self-financing in the short run if

$$\Delta D = (1 - \mu\tau)\,\Delta G \leq 0.$$

Rearranging this inequality yields the *short-run fiscal free lunch condition*.

The Short-Run Fiscal Free Lunch Condition. *A fiscal expansion improves the government's budget balance already in the present if*

$$\mu \geq \frac{1}{\tau}. \tag{2}$$

According to condition (2), government spending will be self-financing in the short run if

- The government spending multiplier μ is very strong,
- The net tax-and-transfer rate τ is very high.

4 Parameters

The aim of this paper is to investigate whether there were time periods between 1999–2019 in Hungary, when at least one of the two fiscal free lunch conditions presented in Section 3 held. In order to do this, five parameters have to be estimated on Hungarian data:

1. r: the real government borrowing rate,
2. g: the long-run trend growth rate,
3. τ: the net tax-and-transfer rate,
4. η: the hysteresis parameter,
5. μ: the government spending multiplier.

When the DeLong–Summers model is taken to the data, a decision has to be made about which exact time horizon to consider as the *short run* (the first period), and what to mean by the *long run* (the second period). In the model, all the direct effects of government spending on GDP materialize in the first period. Therefore, the time horizon, during which government spending shocks have effects on the GDP (around 5–10 quarters, as will be shown in Subsection 4.5), will be considered as the short run, and everything occurring after that – in principle, the infinite horizon – should be meant by the long run. In practice, the Hungarian government does not issue perpetual bonds, hence, a decision has to be made about the exact government bond, the interest rate of which to consider in the analysis. The 10-year government bond is chosen for two reasons:

1. The 10-year time horizon is long enough to assume that all multiplier and hysteresis effects of a fiscal expansion materialize by its end.
2. Government bonds with maturities longer than 10 years did not have an auction in each quarter of the analyzed 1999–2019 time period.

The choice implies that the 10-year time horizon will be meant by the long run in the subsequent analysis.

The parameter estimations will be presented step by step, and they will be carried out for each of the analyzed subperiods separately: pre-GFC (1999Q1–2008Q3), GFC (2008Q4–2012Q4), and post-GFC (2013Q1–2019Q4). The values of r and g will be allowed to vary even more frequently, from quarter to quarter. In case of r, this is an obvious choice, but it is also important to make in case of g, since the Hungarian economy was in the phase of convergence after the market transition of the early 1990s, which is characterized by a falling trend growth rate. η and μ require multiple observations to be estimated, hence, their values will be assumed to be constant within each subperiod. τ could be allowed to change within subperiods, but it is not obvious how to set its value for a particular quarter, since government spending shocks will be shown to have persistent effects on GDP in Subsection 4.5, hence, they also affect the primary budget balance through multiple quarters. In Subsection 4.3, the net tax-and-transfer rate will be shown to be fairly stable over time, hence, it will be set to its constant period-specific average for each subperiod.

4.1 The Real Government Borrowing Rate

The future period is interpreted as the *long run* in the DeLong–Summers model, hence, parameter r has to be measured by a long-run real interest rate. The long-run *nominal* government borrowing rate is proxied by the average auction yield of HUF-denominated 10-year government bonds. The Hungarian government sometimes issues bonds denominated in foreign currencies (most importantly, in euros), as well. These are not considered because their ex ante real interest rate depends on the expected depreciation of the HUF, making the measurement more complicated.[4] Thus, the amount of government spending considered is assumed to be financed by issuing HUF-denominated bonds initially.

The Hungarian Government Debt Management Agency (ÁKK – *Államadósság Kezelő Központ*) reports data about the outcome of each government bond auction since 2000. The average auction yields for the year 1999 are also available in the MNB's database. These data are used to create a quarterly time series of the 10-year nominal borrowing rate faced by the Hungarian government. Auctions are matched to quarters according to the dates of the *financial settlements*, not according to the actual dates of the auctions, as the date of the financial settlement determines when the borrowing actually takes place.[5]

The nominal government borrowing rate i in quarter t is calculated as the weighted geometric mean of gross average auction yields within the quarter.

$$i_t = \left[\prod_{k=1}^{N_t} (1 + i_{t,k})^{\frac{Q_{t,k}}{Q_t}} - 1 \right] \times 100$$

where $i_{t,k}$ is the average auction yield in auction k within quarter t, $Q_{t,k}$ is the value of accepted bids in auction k within quarter t, N_t is the number of auctions in quarter t, and $Q_t = \sum_{k=1}^{N_t} Q_{t,k}$ is the total value of accepted bids in quarter t. The geometric means are unweighted for 1999, as only the average auction yields are available for that year, the values of the accepted bids are not.

Figure 4 presents the resulting quarterly time series of the 10-year nominal government borrowing rate. The benchmark yields in the secondary market of 10-year government bonds are also highlighted for the sake of comparison. These are calculated from the geometric means of the corresponding gross monthly benchmark yields.

The two time series are almost overlapping, which is not surprising, taking into account that investors would be able to take advantage of arbitrage opportunities if the difference between government bond yields in the primary and the secondary market was considerable. This implies that the benchmark yield could also be used to proxy the nominal government borrowing rate in the analysis, but strictly speaking, it is the auction yield that directly determines the cost, at which the government is able to finance its spending at a particular point in time. Note also that there was a non-negligible difference between the benchmark yield and the average auction

[4]It is difficult to make good assumptions about what the expected 10-year depreciation rate of the HUF was in each quarter of the 1999–2019 time period.

[5]The results are practically identical if the matching is carried out according to the auction dates.

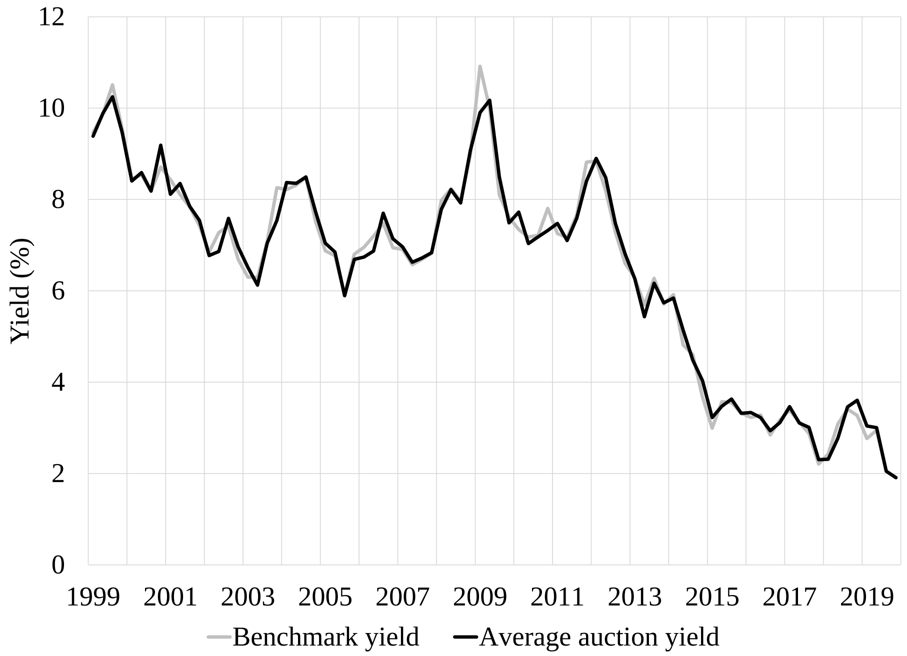

Figure 4: 10-Year Nominal Government Borrowing Rates Based on Average Auction Yields and the Benchmark Yields of 10-Year Government Bonds in Hungary (1999Q1–2019Q4)

Source: The author's own calculations based on data reported by the Hungarian Government Debt Management Agency and the Central Bank of Hungary.

yield at the onset of the GFC[6], which is exactly the time period, for which it is crucial for the purpose of this paper to measure the government borrowing rate correctly. Using the benchmark yield would overestimate the government's borrowing cost at the GFC's onset, making it incorrectly less likely to obtain a fiscal free lunch result. Therefore, the average auction yield is used to proxy the nominal government borrowing rate in the rest of the paper.

Parameter r is the *real*, not the *nominal* borrowing rate in the model. When assessing the *ex post* long-run fiscal free lunch condition, it will be considered as the ex post real government borrowing rate, while it will be the ex ante real rate while evaluating the *ex ante* long-run fiscal free lunch condition. Hence, both types of the real government borrowing rate will be calculated.

The Fisher equation can be made use of for performing the calculations:

$$r_t^j = \left(\frac{1 + i_t}{1 + \pi_t^j} - 1 \right) \times 100 \tag{3}$$

where π_t^j is the inflation rate in quarter t and $j \in \{a, e\}$.

- If $j = a$, then $\pi_t^j = \pi_t^a$ is the *actual* inflation rate, hence, r_t^a is the *ex post* real government borrowing rate.
- If $j = e$, then $\pi_t^j = \pi_t^e$ is the *expected* inflation rate, hence, r_t^e is the *ex ante* real government borrowing rate.

The actual π_t^a inflation rate is measured by the average annual growth rate of the GDP-deflator during the 10 years that follow quarter t, as government debt is expressed as a percentage of GDP. The average annual growth rate of the CPI, measured by the Eurostat's Harmonized Index of Consumer Prices, during the same time period is also used as an alternative measure of π_t^a, since historical forecasts of the inflation rate are only available for the CPI, hence, it will allow for a better comparison between the calculated ex post and ex ante real interest rates. Data about π_t^a is available until 2014Q1 only, as 10 years had not been spent since more recent quarters by the time when the calculations were made.[7] This implies that the time series of the ex ante real government borrowing rate will also last until 2014Q1 only.

The expected π_t^e inflation rate is the average annual rate of inflation *expected* in quarter t for the next 10 years. It is approximated using the MNB's forecasts of CPI inflation reported in its quarterly Inflation Reports. These reports contain inflation forecasts starting with 2001Q3, hence, this

[6] A possible reason is that there was only one single auction in 2008Q4 (October 9) and another single one in 2009Q1 (February 12), as well.

[7] They were made in June 2024.

is the first quarter, for which an ex ante real interest rate can be calculated this way. CPI inflation is definitely not the most appropriate measure of inflation in the context of the model, but this is what historical forecasts are available about. The difficulty is that the MNB's inflation forecasts are for a 2-year horizon at most, hence, assumptions have to be made about the expected rate of inflation after the end of the forecast horizon.

π_t^e is approximated the following way for each quarter t. First, the forecasted inflation rates are taken from the Inflation Report published in that quarter. In the case of quarters within the forecast horizon, the expected inflation rates are set equal to the forecasted values. In the case of quarters beyond the forecast horizon, the following approach is taken.

1. If the forecast reaches the inflation target π_t^T until the end of the forecast horizon, it is assumed that $\pi_{t+k}^e = \pi_t^T$ for $\forall k$ between the end of the forecast horizon and the end of the tenth year. This is the case for most quarters.
2. If it does not reach π_t^T until the end of the forecast horizon, but converges to it, it is assumed to keep converging at the same average rate as during the last 4 quarters of the forecast horizon.
3. If it does not even converge to π_t^T during the forecast horizon, then π_t^T is assumed to be reached 8 quarters after the end of the forecast horizon, following linear convergence.

The validity of this approach crucially depends on the credibility of the central bank's inflation target. However, when agents have to form expectations about very long run inflationary tendencies in an economy with an inflation targeting central bank, they arguably cannot do better than to expect that inflation will sooner or later evolve around its target rate. Figure 5 presents the time series of the annualized expected average 10-year CPI inflation rate calculated according to the above-described procedure.

After the GFC, the calculated expected inflation rate got anchored to the MNB's 3% inflation target very well. This is not surprising, taking into account the procedure to proxy these long-term inflationary expectations. However, expected inflation was more volatile before the GFC according to the same approach, and its level was also higher. This can be explained by two reasons:

1. The short-term inflation forecasts were more uncertain.
2. The inflation target itself was also changed: it was gradually decreased from 4.5% (set in June 2001) to 3% (set in August 2005) (MNB, s.a.).

With the nominal government borrowing rates, the actual inflation rates, and the proxied time series of expected inflation in hand, it is possible to calculate three different time series of the real government borrowing rate using equation (3). The first one is that of the ex ante real borrowing rate

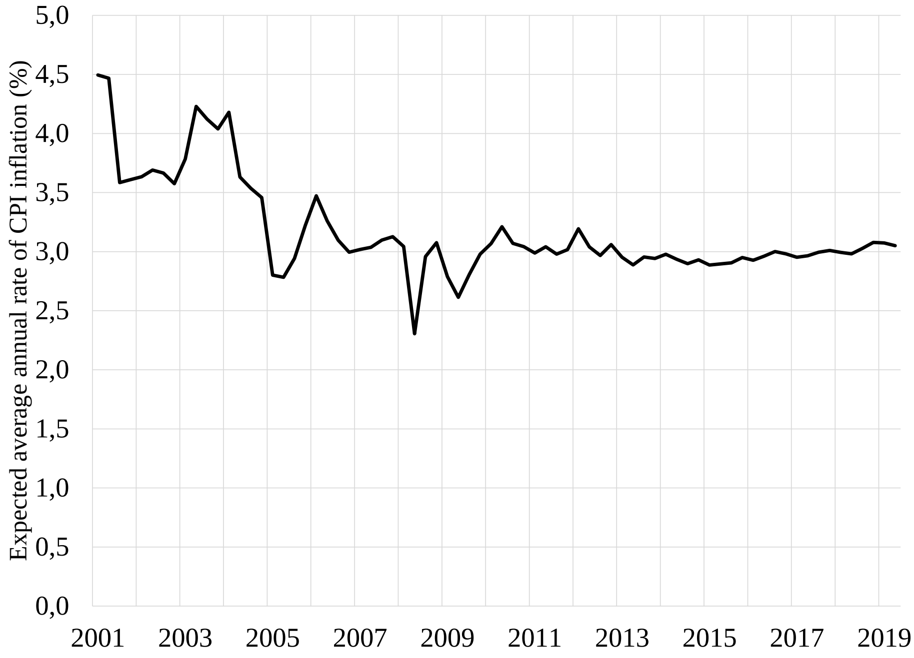

Figure 5: Annualized Expected Average 10-Year CPI Inflation Rates in Hungary (2001Q3–2019Q4)

Source: The author's own calculations based on the inflation forecasts published in the quarterly Inflation Reports of the Central Bank of Hungary.

based on expected CPI inflation, the second one is that of the ex post real borrowing rate based on the GDP-deflator, and the third one is the ex post real borrowing rate based on the CPI. Figure 6 presents the resulting time series.

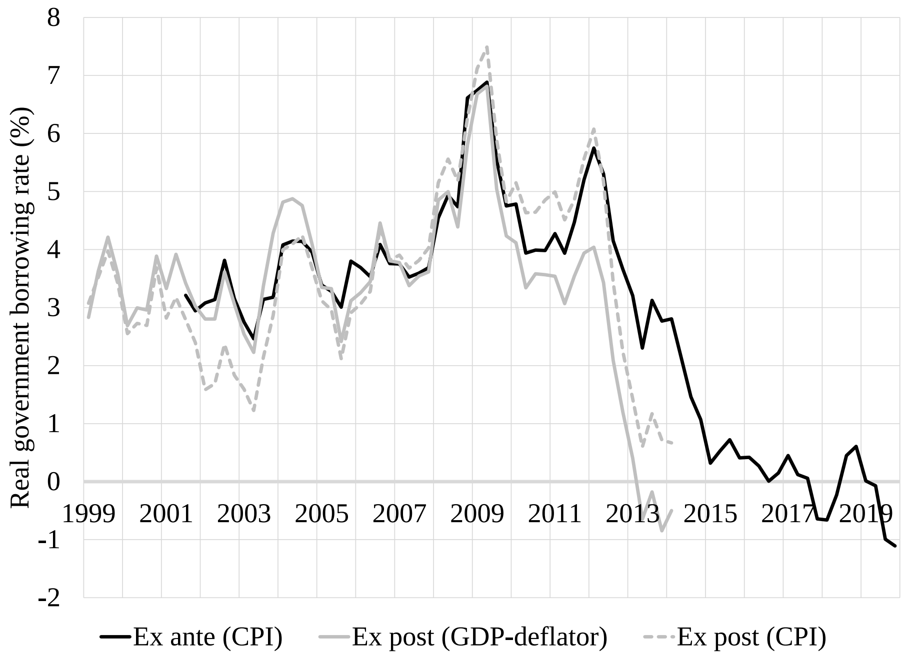

Figure 6: Three Estimated Time Series of the 10-Year Real Government Borrowing Rate in Hungary (1999Q1–2019Q4)

Source: The author's own calculations based on data reported by the Hungarian Government Debt Management Agency, the Central Bank of Hungary, and the Eurostat, and on the inflation forecasts published in the quarterly Inflation Reports of the Central Bank of Hungary.

All the three proxies of the real government borrowing rate confirm that the Hungarian government had to face high real interest rates before the GFC, which shot up to even higher levels at the onset of the GFC, and started decreasing gradually only when the recession ended. During the boom in the second half of the 2010s, the ex ante real rate was permanently low near zero and might have even turned negative for some quarters.[8] The CPI-based ex post real interest rate was below its counterpart based on the GDP-deflator before the GFC, while the opposite was true during the GFC. The overall tendencies in the three real interest rate measures are still similar.

[8] See Section 2 for the conventional explanations.

4.2 The Long-Run Trend Growth Rate

In the model, parameter g is the long-run growth rate of the *potential* GDP, strictly speaking. However, actual GDP growth is assumed to be tied to potential GDP growth in the long run. In the data, the average growth rates of actual and potential GDP necessarily differ, as sample sizes are finite. Hence, g will be estimated on the basis of Hungary's actual real GDP data, as well as on the basis of some estimates of its potential growth path, and the different estimates will be compared to each other. Just like in case of the real government borrowing rate, the ex ante and the ex post variants of the long-run trend growth rate will be distinguished.

The source of the ex post real GDP data is the Hungarian Central Statistical Office (KSH – *Központi Statisztikai Hivatal*). Ex post potential real GDP is measured by combining the MNB's output gap estimates from its 2024Q2 Inflation Report[9] with the KSH's real GDP data to calculate the implied potential growth path. The *ex post* value of g relevant for government spending made in quarter t is calculated as the average annual growth rate of actual or potential real GDP during the 10 years that follow quarter t.

The ex ante long-run trend growth rate of actual GDP is approximated using historical forecasts of *actual* economic growth from past editions of the IMF's World Economic Outlook (WEO). The IMF WEO is published twice per year: it has a Spring and a Fall edition, which become available in the second and the fourth quarter of each year, respectively. They contain forecasts of annual real GDP growth on 5-year horizons, but 10-year forecasts are needed for the purpose of this analysis to maintain consistency with the 10-year real government borrowing rates calculated in Subsection 4.1. Another issue is that the forecasts are about annual growth, while the time frequency of this analysis is quarterly. The two problems are handled the following way:

1. The growth forecast for the final, fifth year of the forecast horizon is extrapolated to all years between the sixth and the tenth. This seems to be an acceptable assumption, as predicted growth rates typically converge by the end of the forecast horizon.
2. A particular quarter t's expected growth rates are assumed to be based on the last semiannual forecast available in that quarter. Annual growth predicted for the years following quarter t is assumed to be expected to realize at uniform quarterly rates.

Based on the above assumptions, it is possible to calculate an expected 10-year growth rate for each quarter, which is annualized in the final step. The obtained value is considered as the ex ante long-run trend growth rate g of actual real GDP in quarter t.

[9] The most recent one at the time of making the calculations.

A similar procedure is followed to approximate the ex ante long-run trend growth rate of potential GDP. The European Union's CIRCABC platform publishes the European Commission's (EC's) historical forecasts of *potential* economic growth[10], which are available for Hungary from the Fall of 2004. These forecasts are also published twice per year with a Spring and a Fall edition[11], but an important difference from the IMF WEO is that the horizon of the Spring forecast includes only four years beyond the ongoing one. The Fall forecast's horizon is similar to that in the IMF WEO in the sense that it includes the ongoing year plus the next five years. Hence, the last year's predicted growth rate is extrapolated to all years between the fifth and the tenth in case of the Spring forecasts, and to all years between the sixth and the tenth in case of the Fall forecasts. Everything else is done the same way as in case of approximating the ex ante values of g based on the IMF's forecasts of actual GDP growth, but the obtained values are based on the EC's forecasts of potential GDP growth this time.

Figure 7 presents the four calculated time series of the long-run trend growth rate g. Comparing the ex ante and the ex post time series, forecasters seem to have been too optimistic about the long-run growth prospects of the Hungarian economy in the first half of the examined time period, when economic growth was actually strong in the country. The EC seems to have turned into too pessimistic about long-run potential growth in 2008Q4, at the onset of the GFC, while the IMF did the same about actual long-run trend growth in 2012Q1, around the second dip of the double-dip recession. Both institutions stayed overly pessimistic until 2014Q1. The dynamics of the two ex ante time series is similar, but the EC tended to be more pessimistic about the Hungarian economy's long-run growth prospects than the IMF. This pattern switched in 2017Q4. However, some caution is required when comparing these two time series, since the IMF's forecasts are about actual, while the EC's are about potential GDP growth. The ex post time series of long-run potential growth looks like a smoothed version of that of long-run actual growth, highlighting the same realized growth tendencies. The decreasing trend in long-run trend growth predicted by the IMF is consistent with the fact that the Hungarian economy was in the phase of convergence during the examined time period, pointing out the importance of letting g vary within subperiods.

The long-run fiscal free lunch condition will be assessed under each of the four calculated time series of the long-run trend growth rate.

[10] https://circabc.europa.eu/ui/group/671d465b-0752-4a2e-906c-a3effd2340ba

[11] Winter forecasts were also published in a few years, but those are disregarded for simplicity.

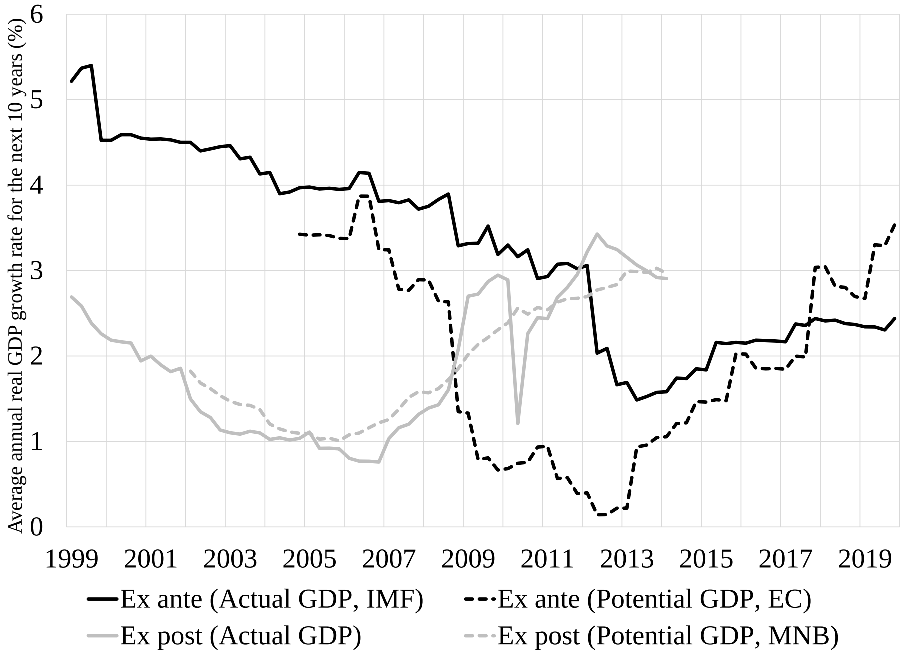

Figure 7: Four Estimated Time Series of the 10-Year Long-Run Trend Growth Rate of Real GDP in Hungary (1999Q1–2019Q4)

Notes: The ex ante trend growth rate in a particular quarter is the average annual real GDP growth rate expected in that quarter for the next 10 years. One of its time series is based on the IMF's historical forecasts of actual real GDP growth, the other one is based on the European Commission's (EC's) historical forecasts of potential real GDP growth. The ex post trend growth rate in a particular quarter is the average annual real GDP growth rate realized during the next 10 years. One of its time series is based on the actual real GDP data, the other one is based on the Central Bank of Hungary's (MNB's) estimates of potential real GDP.
Source: The author's own calculations based on data reported by the Hungarian Central Statistical Office, on the Central Bank of Hungary's estimates of the output gap from its June 2024 Inflation Report, on the IMF's historical forecasts of GDP growth from past editions of the World Economic Outlook, and on the European Commission's historical forecasts of potential GDP growth.

4.3 The Net Tax-and-Transfer Rate

In the model, the net tax-and-transfer rate is defined as the percentage-point change in the primary budget balance for a one percentage-point increase in output, where both variables are expressed as percentages of current potential GDP. Letting X denote the primary balance, the net tax-and-transfer rate is defined as

$$\tau = \frac{\Delta X}{\Delta Y}. \tag{4}$$

Assume for simplicity that τ is independent of the initial GDP Y and the initial primary balance X, at which the changes ΔY and ΔX occur, i.e., that the relationship between Y and X is linear. In this case, the initial GDP and the initial primary balance can be set to arbitrary values, e.g., they can be set to $\overline{Y}$ and $\overline{X}$. $\overline{Y}$ denotes the current potential GDP, which is equal to 1, as all variables are expressed in terms of $\overline{Y}$. $\overline{X}$ denotes the *cyclically adjusted primary budget balance*, i.e., the primary balance that would prevail if the output gap was zero and the economy was on its potential growth path.

Under these assumptions, ΔY must be equal to the output gap and ΔX must be the cyclical component of the primary budget balance:

$$\Delta Y = Y - \overline{Y} \tag{5}$$

$$\Delta X = X - \overline{X}. \tag{6}$$

The OECD and the EC both report annual estimates of the potential GDP and the cyclically adjusted primary balance, as well as data about the actual real GDP and the actual primary balance. The EC's estimates and its reported data are available in the AMECO database. They make it possible to back out the net tax-and-transfer rates implicit in the OECD's and the EC's estimates of the cyclically adjusted budget balance for each year between 1999–2019, using equations (4), (5), and (6). Then, the average of the resulting τ values is calculated for each of the three time periods. The results are reported in Table 1.

The net tax-and-transfer rate seems to be quite stable across time periods, and there is not much variation in its value across different years, either.[12] However, systematically higher τ values are obtained on the basis of the OECD sample than on that of the AMECO sample. The values implied by the AMECO estimates will be used in the rest of the paper in order to take a conservative approach, that is, to minimize the likelihood of obtaining a fiscal free lunch result. They suggest that a 1% positive output gap tends to improve the primary budget balance by around 0.40–0.45 percentage point of the potential GDP in Hungary, depending on which time period is considered.

[12]The calculated annual values are available from the author upon request.

	Average τ	
Time Period	OECD	AMECO
1999–2008	0.497	0.417
2009–2012	0.483	0.459
2013–2019	0.475	0.452
1999–2019	0.487	0.437

Table 1: Average Net Tax-and-Transfer Rates in Hungary

Note: τ denotes the net tax-and-transfer rate.
Source: The author's own calculations based on data and estimates reported in the OECD Stats and the AMECO databases.

4.4 The Hysteresis Parameter

As in Váry (2021) and Váry (2022), the full-sample estimate of the hysteresis parameter η comes from estimating the following equation by Ordinary Least Squares (OLS) on the full sample.

$$\Delta \log \overline{Y}_t = \alpha + \eta \widehat{Y}_{t-1} + \epsilon_t \tag{7}$$

where $\widehat{Y}_t = \left(Y_t - \overline{Y}_t\right) / \overline{Y}_t$ is the output gap, Y_t is the actual real GDP, $\overline{Y}_t$ is the potential real GDP, α is a constant, and ϵ_t is the error term.

η measures the percentage-point change in the potential growth rate in response to a 1% positive output gap in the previous period, which will be assumed to be a quarter. Higher-order lags of the output gap could also be included in the right-hand side of equation (7), since it is in principle possible that hysteresis effects materialize within more than one quarter. However, none of those higher-order lags have turned out to be significant in practice, this is why the preferred specification contains one lag only.

$\widehat{Y}_t$ is measured by the MNB's quarterly output gap estimates from the June 2024 Inflation Report[13]. The time series of $\overline{Y}_t$ is calculated from these output gap estimates as the sequence of potential GDP values that makes the output gap estimates consistent with the KSH's actual real GDP data, which is seasonally and calendar adjusted. The output gap time series is available from 2002Q1. One additional observation is lost due to first-differencing the log of potential GDP and lagging the output gap, hence, the full sample, on which equation (7) can be estimated, consists of the time period between 2002Q2–2019Q4. The pre-GFC subsample also shortens to 2002Q2–2008Q3. It will have to be assumed during the empirical evaluation of long-run fiscal free lunch condition (1) that the η value estimated for 2002Q2–2008Q3 is valid for 1999Q1–2002Q1, as well.

[13]It is the most recent Inflation Report available at the time of making the calculations.

Equation (7) only allows for a full-sample estimation of the hysteresis parameter, but the following specification makes it possible to estimate different η values for each of the three subperiods.

$$\Delta \log \overline{Y}_t = \alpha + \sum_{j=1}^{3} \eta^j I_t^j \times \widehat{Y}_{t-1} + \epsilon_t \tag{8}$$

where I_t^j is a dummy taking the value of 1 in time period j. The possible values of j are the following:

- $j = 1$ between 2002Q1–2008Q3,
- $j = 2$ between 2008Q4–2012Q4,
- $j = 3$ between 2013Q1–2019Q4.

Notice the j superscript of η^j, which refers to the fact that the hysteresis parameter is specific for time period j in specification (8).

Table 2 presents the results of estimating equations (7) and (8) by OLS. The full-sample estimate of η is marginally significant and equal to 0.075, suggesting that a 1% positive (negative) output gap is expected to increase (decrease) the quarter-on-quarter (QoQ) *growth rate* of potential GDP by 0.075 percentage point in the next quarter. As higher-order lags of the output gap have not turned out to be significant, this is equivalent to a 0.075% permanent change in its *level*, as well.

This point estimate, however, masks important heterogeneity across time periods. When the full sample is split into the three subperiods, it turns out that there have been no significant hysteresis effects in the Hungarian economy before and after the GFC. In addition, the pre-GFC point estimate of η has a counter-intuitive negative sign. This implies that all the significant hysteresis effects unveiled in the full sample come from the GFC period where the hysteresis parameter is highly significant, and its point estimate is equal to 0.247. This means that a 1% negative output gap has permanently decreased the Hungarian economy's potential GDP by 0.247% in an average quarter of that recessionary time period. This indeed refers to the presence of strong hysteresis effects.

The results suggest that the Hungarian government was only able to rely on hysteresis in generating a potential fiscal free lunch during the GFC, and not in the two other time periods. Luckily, the GFC period was the one when a fiscal free lunch was the most needed.

4.5 The Government Spending Multiplier

The literature already reports a number of estimates of the government spending multiplier for Hungary. These are summarized in Table 3. The estimates vary substantially with respect to the time period considered and

	Potential Growth Rate (QoQ)	
Output Gap$_{-1}$	0.075*	
(2002Q2–2019Q4)	(0.040)	
Output Gap$_{-1}$		-0.085
(2002Q2–2008Q3)		(0.084)
Output Gap$_{-1}$		0.247***
(2008Q3–2012Q4)		(0.063)
Output Gap$_{-1}$		0.008
(2013Q1–2019Q4)		(0.069)
Constant	0.006***	0.007***
	(0.001)	(0.001)
Observations	71	71
R^2	0.049	0.189

Table 2: OLS Estimates of the Hysteresis Parameter in Hungary

Notes: The dependent variable is the quarter-on-quarter (QoQ) log-change in the potential GDP. The first column presents the estimate of η in the full (2002Q2–2019Q4) sample, while the second column presents the same for the pre-GFC (2002Q2–2008Q3), the GFC (2008Q4–2012Q4), and the post-GFC (2013Q1–2019Q4) time periods, separately. Standard errors are in parentheses. * – significance at $p < 0.10$, ** – significance at $p < 0.05$, *** – significance at $p < 0.01$.
Source: The author's own calculations based on data reported by the Hungarian Central Statistical Office, and on the Central Bank of Hungary's output gap estimates from its June 2024 Inflation Report.

the methodology applied. However, some general patterns can still be observed. Estimates for the time period preceding the GFC are typically very low, often not even significantly different from zero. Multipliers estimated for time periods that include or are restricted to the GFC tend to be larger, but their extent varies a lot.

None of the available estimates is for the three exact time periods considered in this analysis. Therefore, this subsection presents novel estimates for the government spending multiplier in Hungary before, during, and after the GFC. A structural vector autoregressive (SVAR) model is applied and the Blanchard–Perotti identification scheme (Blanchard and Perotti, 2002) is made use of to recover the response of GDP to a structural government spending shock.

Specifically, the following $SVAR(1)$ model is used to estimate the government spending multiplier:

$$\mathbf{B}_0 \mathbf{x}_t = \mathbf{B}_1 \mathbf{x}_{t-1} + \boldsymbol{\epsilon}_t \tag{9}$$

where $\mathbf{x}_t = (\Delta \log T_t, \Delta \log G_t, \Delta \log Y_t)'$ is the vector of log-differenced endogenous variables with T_t denoting net taxes, G_t referring to government spending, and Y_t denoting the GDP. $\boldsymbol{\epsilon}_t = \left(\epsilon_t^T, \epsilon_t^G, \epsilon_t^Y\right)' \sim (\mathbf{0}, \boldsymbol{\Sigma}_\epsilon)$ is the vector of structural shocks with zero means and covariance matrix $\boldsymbol{\Sigma}_\epsilon$, while $\mathbf{B}_0$ and $\mathbf{B}_1$, as well as $\boldsymbol{\Sigma}_\epsilon$, are the matrices of structural coefficients to be estimated. The endogenous variables will be demeaned before estimation, which explains the lack of a constant term.

Note that SVAR specification (9) includes only one lag of the endogenous variables. It would be possible to select the optimal lag length based on some kind of an information criterion, but the small number of observations in the three subsamples – the GFC subsample (2008Q4–2012Q4) contains only 17 observations – justifies the use of 1 lag in order to preserve as many degrees of freedom as possible. Besides government spending and the GDP, SVAR model (9) also contains net taxes as an endogenous variable. The reason for this is that changes in government spending and net taxes are strongly correlated, hence, it is crucial to isolate the structural shocks hitting these two variables in order to be able to estimate the ceteris paribus effect of government spending on GDP.

Identification of the structural parameters is carried out applying short-run exclusion restrictions. The Blanchard–Perotti identification scheme (Blanchard and Perotti, 2002) is used, according to which the restricted structural coefficient matrices are

$$\mathbf{B}_0 = \begin{bmatrix} 1 & 0 & -b_0^{13} \\ 0 & 1 & 0 \\ -b_0^{31} & -b_0^{32} & 1 \end{bmatrix} \qquad \boldsymbol{\Sigma}_\epsilon = \begin{bmatrix} \sigma_\epsilon^{11} & 0 & 0 \\ \sigma_\epsilon^{21} & \sigma_\epsilon^{22} & 0 \\ 0 & 0 & \sigma_\epsilon^{33} \end{bmatrix}.$$

The key identification restriction is that $b_0^{23} = 0$, i.e., that government spending does not react to the GDP contemporaneously. The restriction

Source	Estimate	Time Period	Model	Note
Horváth et al. (2006)	0.62	?	Macro-econometric	% response of GDP to an increase in government consumption of 1% of GDP.
Lendvai (2007)	< 0	1997Q1–2005Q4	SVAR	The multiplier is not calculated from the IRFs.
Cuaresma, Eller, and Mehrotra (2011)	0.01	1995Q1–2009Q4	SVAR	Cumulative % response of GDP to a 1% government spending shock.
Pusch (2012)	1.18	2005	Input-output	
Kotosz and Peák (2013)	< 0	1960–2011	SVAR	The multiplier is not calculated from the IRFs.
Baksa, Benk, and Jakab (2014)	0.30	1995–2008	DSGE	
Stanova (2015)	0.42	1999Q1–2013Q4	Nonlinear SVARX	Cumulative % response of GDP to a gov. spending shock of 1% of GDP.
Combes et al. (2016)	0.07	1999Q1–2013Q3	PVECM	
Krajewski (2017)	2.90	2015	DSGE	Impact multiplier.
Mirdala and Kameník (2017)	0.06	1995Q2–2015Q3	TVAR	In expansions.
	0.52			In recessions.
Kameník, Ruščáková, and Semančíková (2018)	0.15	1999Q1–2015Q3	SVAR	
Krajewski and Szymańska (2019)	7.08	1999Q1–2016Q4	SVAR	
	0.72	1999Q1–2008Q3		
	8.07	2008Q4–2016Q4		
Szymańska (2019)	1.02	2002Q1–2018Q1	SVAR	
Górnicka et al. (2020)	0.70	2009	Ex ante multipliers implicit in	
	0.40	2012	the EC's EDP recommendations.	
MNB (2020)	0.77	?	?	Impact multiplier of government investment.

Table 3: Estimates of the Output Effect of a Government Spending Shock in Hungary

Notes: The reported estimates correspond to or can be interpreted similarly as the ex post cumulative government spending multiplier, unless noted differently. See Spilimbergo, Symansky, and Schindler (2009) for a comparison of different multiplier concepts. Abbreviations: DSGE = Dynamic Stochastic General Equilibrium, EC = European Commission, EDP = Excessive Deficit Procedure, IRF = Impulse Response Function, PVECM = Panel Vector Error Correction Model, STVAR = Smooth Transition Vector Autoregressive, SVAR = Structural Vector Autoregressive, SVARX = Structural Vector Autoregressive with Block Exogeneity, TVAR = Threshold Vector Autoregressive.
Source: The author's own collection.

is justified by the use of quarterly data: by the time the GDP observation of a particular quarter gets published, the government must have already decided about the amount of its spending in the same quarter. This is not true at the annual frequency, this is why it is crucial to rely on quarterly data when applying the Blanchard–Perotti identification scheme. Following Krajewski and Szymańska (2019), the elasticity of net taxes to GDP is calibrated to $b_0^{13} = 1.43$ based on Baranowski et al. (2015). The endogeneity between government spending and net taxes is handled by letting σ_ϵ^{21} differ from 0. An alternative solution would be to restrict it 0, while letting σ_ϵ^{12} differ from it. The multipliers estimated on the basis of the latter assumption are marginally larger than those estimated on the basis of the former, except for the post-GFC period, for which the opposite is true. The preferred choice is again a conservative one that minimizes the chances for getting a fiscal free lunch result. Thus, b_0^{13}, b_0^{31}, b_0^{32}, σ_ϵ^{11}, σ_ϵ^{21}, σ_ϵ^{22}, and σ_ϵ^{33} are the subjects of estimation under the applied identification scheme.

The data used to estimate the unrestricted coefficients of model (9) come from the Eurostat[14] at the quarterly frequency. Government spending G and net taxes T are measured as

$$\begin{aligned}
G = {} & \text{Government final consumption expenditure} \\
& + \text{Government gross fixed capital formation} \\
T = {} & \text{Taxes on production and imports} \\
& + \text{Current taxes on income and wealth} \\
& + \text{Capital taxes} + \text{Net social contributions} \\
& + \text{Capital transfers receivable} + \text{Other current transfers receivable} \\
& - \text{Social benefits} - \text{Subsidies} - \text{Capital transfers payable} \\
& - \text{Other current transfers payable.}
\end{aligned}$$

That is, the measure of government spending corresponds to government purchases, i.e., it only includes government spending on goods and services. The measure of net taxes takes into account all possible types of tax revenues and transfers received, as well as transfers payed by the government.[15]

All variables are deflated by the GDP-deflator and they are seasonally adjusted. In case of the GDP, the data come seasonally adjusted from the Eurostat database, while in case of government spending and net taxes, the seasonal adjustment is done using the TRAMO/SEATS filter. The resulting time series are logged and tested for the presence of unit roots using the augmented Dickey–Fuller test. Table 4 presents the results, according to which the null hypothesis of a unit root cannot be rejected in case of the

[14]Specifically, from Eurostat table `gov_10q_ggnfa`.

[15]The calculation of the measure of net taxes follows Kameník, Ruščáková, and Semančíková (2018).

levels of the time series, but it can be in case of their first differences. This justifies the inclusion of log-differenced variables in SVAR model (9).

	Net Taxes	Government Spending	GDP
		Level	
ADF test statistic	-0.638	-1.161	-0.926
	(0.855)	(0.688)	(0.775)
		First Difference	
ADF test statistic	-9.674***	-12.955***	-5.558***
	(0.000)	(0.000)	(0.000)

Table 4: The Results of Augmented Dickey–Fuller Tests of Unit Roots in the Logged Time Series of Net Taxes, Government Spending, and the GDP (Hungary, 1999Q1–2019Q4)

Notes: All time series are deflated by the GDP-deflator and they are seasonally adjusted. The test equations include an intercept and the lag selection is based on the Schwarz Information Criterion. ADF = Augmented Dickey–Fuller. MacKinnon's one-sided p-values are in parentheses. * – significance at $p < 0.10$, ** – significance at $p < 0.05$, *** – significance at $p < 0.01$.
Source: The author's own calculations based on data reported by the Eurostat.

After estimating the coefficients of $SVAR\,(1)$ model (9), it is used to simulate impulse response functions (IRFs) to one standard deviation structural government spending shocks. The government spending multiplier is calculated from the IRFs according to the concept of the *cumulative multiplier*[16] at the 20-quarter horizon.

$$\mu = \frac{\sum_{k=1}^{20} \Delta \log Y_k^{IRF}}{\sum_{k=1}^{20} \Delta \log G_k^{IRF}} \times \frac{Y}{G} \tag{10}$$

The cumulative multiplier recognizes that the effects of government spending on economic activity are persistent, therefore, it relates the area below the IRF of $\Delta \log Y$ to the area below the IRF of $\Delta \log G$ to quantify the spending multiplier. If the horizon, at which the IRFs are accumulated, is chosen long enough to ensure that all the effects of the shock realize, then all the persistence in the GDP's response will be taken into account by the cumulative multiplier. 20 quarters are always sufficient for the effects to realize. The first factor in the right-hand side of equation (10) is the GDP's elasticity to government spending, which can be transformed into a multiplier by multiplying it by the GDP's mean ratio to government spending (Y/G) in the sample considered.

[16]See Spilimbergo, Symansky, and Schindler (2009) for a summary about different concepts of the spending multiplier.

Figure 8 presents the cumulative spending multipliers at different horizons in the full sample, as well as in the three subsamples.[17] Their 68% confidence bands are also highlighted, which are calculated by bootstrapping, applying Kilian's adjustment that corrects for the small-sample bias in the OLS estimates of the reduced-form parameters[18]. Blanchard and Perotti (2002) are followed by choosing the 68% confidence bands instead of the 95% ones.[19] Kilian and Lütkepohl (2017) also argue that 68% intervals are more useful for assessing the statistical significance of estimates from largely unrestricted VAR models, estimated on relatively short samples.

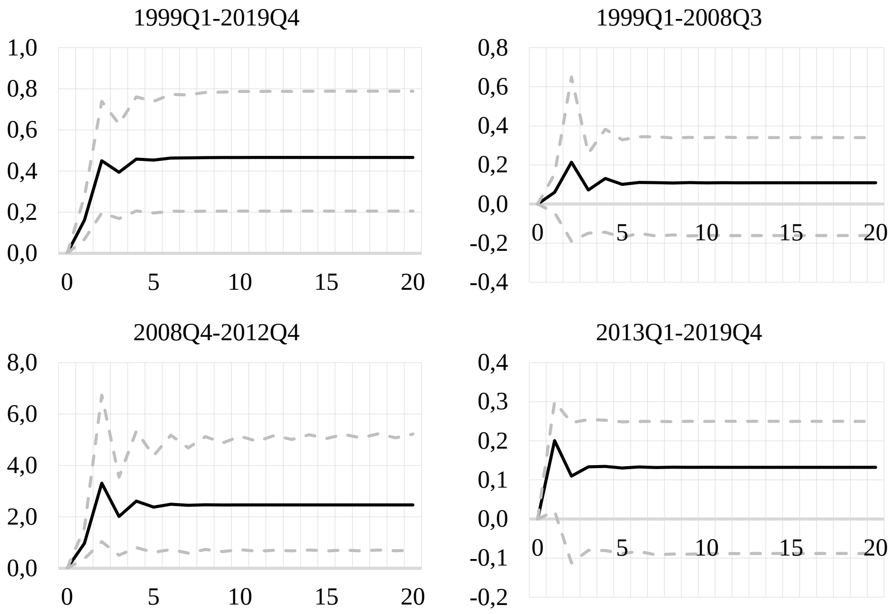

Figure 8: Cumulative Government Spending Multipliers for Hungary at Different Horizons

Note: The solid lines are the cumulative government spending multipliers, while the dashed lines represent Kilian's bias-adjusted 68% bootstrap confidence bands around them. Number of bootstrap replications = $1,000$. The horizontal axis represents the forecast horizon in quarters. The shock is assumed to arrive in the first quarter.

Source: The author's own calculations based on data reported by the Eurostat.

The cumulative multipliers seem to vary until around the fifth-tenth quarters of the forecast horizon, but they definitely converge by the twen-

[17]Note that the vertical axes of the four panels are scaled differently.

[18]See Kilian and Lütkepohl (2017) for the technical details.

[19]Blanchard and Perotti (2002) use one standard error confidence bands, which correspond to the 68% confidence interval under the assumption of normality. However, the latter is the more appropriate choice if normality cannot be assumed.

tieth quarter in all subsamples, as well as in the full sample. This justifies considering the cumulative government spending multiplier at the 20-quarter horizon. Its value in each sample is presented in Table 5, together with its 68% confidence band.

		68% Confidence Band	
Time Period	Multiplier	Lower Bound	Upper Bound
1999Q1–2008Q3	0.109	−0.161	0.340
2008Q4–2012Q4	2.465*	0.706	5.219
2013Q1–2019Q4	0.132	−0.088	0.250
1999Q1–2019Q4	0.466*	0.205	0.788

Table 5: Cumulative Government Spending Multipliers for Hungary at the 20-Quarter Horizon

Note: The 68% confidence bands were calculated by bootstrapping, applying Kilian's adjustment for small-sample bias. Number of bootstrap replications = $1,000$. * denotes that the confidence band does not contain 0.
Source: The author's own calculations based on data reported by the Eurostat.

The estimated multipliers are positive, but very weak in the pre-GFC and the post-GFC subsamples with values around 0.1. These values are not significant statistically in the sense that their 68% confidence bands contain 0. The finding is in line with existing estimates reported in Table 3, as well as with the results of Ilzetzki, Mendoza, and Végh (2011), according to which fiscal multipliers tend to be small in small open economies.

However, the spending multiplier is estimated to have been substantially larger in the GFC period than during normal times. Its estimated value of 2.47 suggests that a 1 HUF increase (decrease) in government spending was expected to increase (decrease) the Hungarian GDP by around 2.5 HUF during the GFC. The 68% confidence band around the point estimate does not contain 0, hence, it can be considered as significantly different from it. The estimated value is at the upper bound of the range considered as plausible by DeLong and Summers (2012) for the US during the GFC time period, and is practically the same as the average spending multiplier of 2.5 estimated by Auerbach and Gorodnichenko (2012) for recessionary periods of the US economy. These results suggest that although the spending multiplier is weaker in Hungary than in the US during normal times, it may have increased to a value comparable to that in the US during the Great Recession. As opposed to the US, the rise in the multiplier cannot be explained by an effective ZLB in Hungary, but it can be explained either by the large share of credit-constrained households, or by the low rate of capacity utilization, the possible reasons of which were summarized in Section 2. The fact that the multiplier is estimated to have increased during the

GFC is also consistent with the available estimates summarized in Table 3.

Finally, the full-sample estimate of the spending multiplier is 0.47, which is significantly different from 0, but it masks important heterogeneity across time periods.

Based on the results of this subsection, the government spending multiplier μ will be set to 0.109 for the pre-GFC period, to 2.465 for the GFC period, and to 0.132 for the post-GFC period, while evaluating fiscal free lunch conditions (1) and (2) empirically.[20]

5 The Main Results

Based on the parameter estimations of Section 4, this section studies if fiscal free lunch conditions (1) and (2) have held in Hungary during the three considered time periods.

5.1 The Short-Run Fiscal Free Lunch Condition

The short-run fiscal free lunch condition (2) is examined first, according to which government spending is self-financing already in the short run, while government spending shocks exert their effects on real GDP, if $\mu \geq 1/\tau$. Table 6 compares the values of μ and $1/\tau$ for each of the three time periods.

Time Period	μ	$1/\tau$	Free Lunch
1999Q1–2008Q3	0.109	2.401	No
2008Q4–2012Q4	2.465	2.180	Yes
2013Q1–2019Q4	0.132	2.211	No

Table 6: Evaluation of the Short-Run Fiscal Free Lunch Condition for Hungary

Note: μ denotes the government spending multiplier and τ denotes the net tax-and-transfer rate. Their values were estimated in Section 4. The short-run fiscal free lunch condition holds if $\mu \geq 1/\tau$.

A fiscal free lunch was definitely not possible in the short run before and after the GFC. However, it might have been possible during the GFC, as the estimated value of this period's spending multiplier is so high that it exceeds the inverse of the net tax-and-transfer rate. Still, it does not exceed τ by a lot. If the spending multiplier is overestimated a little for the GFC period, and $\mu < 2.18$ in reality, which certainly cannot be excluded according to the confidence band presented in Table 5, then the short-run

[20] The pre- and the post-GFC multipliers could also be set to 0, arguing that they are insignificant, but Section 5 will make it clear that this choice does not make a difference.

fiscal free lunch result already disappears. The conclusion is that Hungarian government spending cannot be excluded to have been self-financing during the GFC already in the short run, but this is a very fragile finding that is not robust to the estimate of the spending multiplier.

5.2 The Long-Run Fiscal Free Lunch Condition

According to long-run fiscal free lunch condition (1), government spending is self-financing in the long run if the real government borrowing rate r does not exceed a certain threshold value given by $g + \eta\mu\tau / (1 - \mu\tau)$. Figure 9 makes it possible to evaluate the *ex ante* variant of the condition by comparing the ex ante real government borrowing rates with their threshold values based on the ex ante long-run trend growth rates. Figure 10 compares the *ex post* real government borrowing rates with their threshold values that are based on the ex post long-run trend growth rates.

Considering the pre-GFC period, Figure 9 suggests that the possibilities for an ex ante long-run fiscal free lunch were well exploited, which is consistent with the large budget deficits presented on Figure 3. However, it is not possible to fully exclude that government spending was expected to be self-financing in some quarters of the time period. This is in spite of the high ex ante real interest rates, since trend growth was also expected to be strong in the Hungarian economy. Figure 10, however, makes it clear that government spending before the GFC did definitely not turn out to be self-financing ex post, as the Hungarian economy's actual long-run growth performance fell short of previous expectations, pushing the threshold below the ex post real government borrowing rate. The broad conclusions hold under any possible threshold highlighted on the figures.

Contrary to the US, where interest rates fell to historical lows during the GFC, the Hungarian government's real borrowing rate reached its peak values in this time period within the full sample. In spite of this, government spending is still found to have been self-financing in the long run according to the baseline results, as it was found to had been be self-financing already in the short run. This is why the threshold value of r is set to ∞ for the GFC period on Figures 9 and 10: if government spending is self-financing in the short run, it will automatically be self-financing in the long run, as well. This result holds for both the ex ante and the ex post case. Thus, it was actually possible that the rise in the Hungarian government spending multiplier compensated for the peak in the real government borrowing rate, creating a fiscal free lunch for the government.

After the GFC, interest rates reached historical lows in Hungary, as well, while long-run growth prospects improved. This resulted in the ex ante real government borrowing rate to fall below its threshold value by the end of 2014, maintaining the possibility of an ex ante fiscal free lunch in the long run. Remember, however, that government spending has not turned

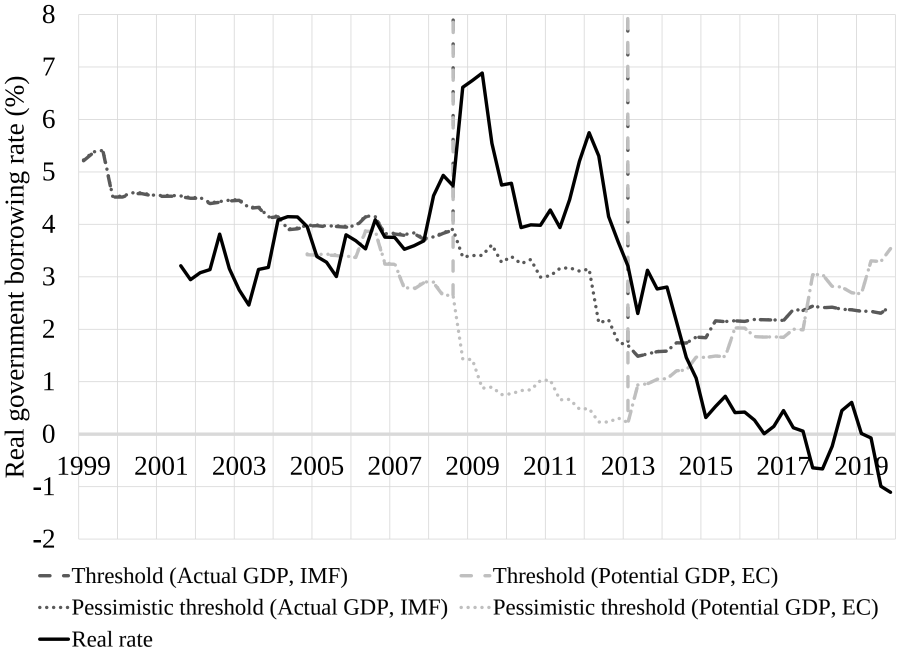

Figure 9: Evaluation of the Ex Ante Long-Run Fiscal Free Lunch Condition for Hungary (1999Q1–2019Q4)

Notes: The solid line is the time series of the ex ante real government borrowing rate based on the Central Bank of Hungary's forecasts of consumer price inflation. The dashed and the dotted lines represent the threshold values of the real government borrowing rate, which are calculated as $g + \eta\mu\tau / (1 - \mu\tau)$, where g is the long-run trend growth rate, τ is the net tax-and-transfer rate, η is the hysteresis parameter, and μ is the government spending multiplier. For the dark gray thresholds, g is based on the IMF's forecasts of actual GDP growth. For the light gray ones, it is based on the European Commission's (EC's) forecasts of potential GDP growth. For 2008Q4–2012Q4, the thresholds are set to ∞, as $1 - \mu\tau < 0$ in this period, i.e., government spending is self-financing already in the short run. The pessimistic thresholds assume that μ is equal to the lower bound of its 68% confidence band and η is one standard error lower than its point estimate. If the real rate falls below a threshold line, it refers to the existence of a fiscal free lunch in the long run.

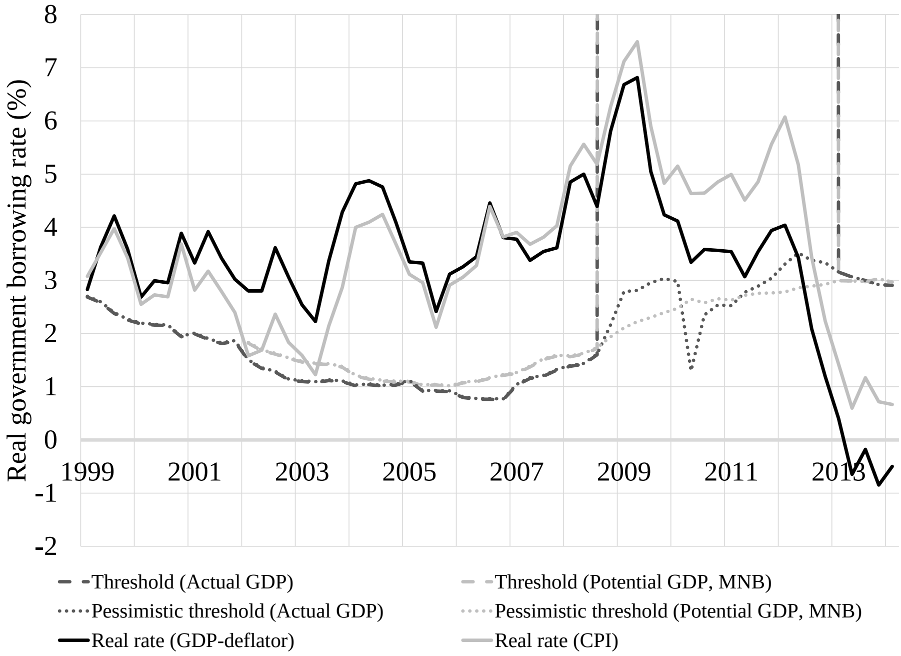

Figure 10: Evaluation of the Ex Post Long-Run Fiscal Free Lunch Condition for Hungary (1999Q1–2014Q1)

Notes: The solid black line is the time series of the ex post real government borrowing rate based on the GDP-deflator, while the solid gray line is that based on the Consumer Prices Index (CPI). The dashed and the dotted lines represent the threshold values of the real government borrowing rate, which are calculated as $g + \eta\mu\tau / (1 - \mu\tau)$, where g is the long-run trend growth rate, τ is the net tax-and-transfer rate, η is the hysteresis parameter, and μ is the government spending multiplier. For the dark gray thresholds, g is based on actual GDP growth. For the light gray ones, it is based on the Central Bank of Hungary's (MNB's) estimates of potential GDP growth. For 2008Q4–2012Q4, the thresholds are set to ∞, as $1 - \mu\tau < 0$ in this period, i.e., government spending is self-financing already in the short run. The pessimistic thresholds assume that μ is equal to the lower bound of its 68% confidence band and η is one standard error lower than its point estimate. If the real rate falls below a threshold line, it refers to the existence of a fiscal free lunch in the long run.

out to be self-financing in the short run during this time period. Not much can be said about the ex post case, as 10 years have not been spent since most of the post-GFC period yet. The only conclusion possible to make on the basis of Figure 10 is that the ex post real rate was below its threshold value in 2013, thus, government spending made in this year is found to have actually been self-financing in the long run.

To sum up, Hungarian government spending has not been found to have been self-financing before the GFC in the short run, it was at the edge of being expected to be self-financing in the long run, but did not actually turn out to be. It has been found to have been self-financing during the GFC in the long run, and perhaps also in the short run. Finally, it has been found to have been expected to be self-financing after the GFC in the long run, but not in the short run.

5.3 Robustness to the Government Spending Multiplier and the Hysteresis Parameter

The most uncertainly estimated parameters of the DeLong–Summers model are arguably the government spending multiplier and the hysteresis parameter. This subsection is therefore devoted to analyzing how robust the results presented in Subsections 5.1 and 5.2 are to their values.

Figures 9 and 10 present some alternative, pessimistic thresholds that can be interpreted similarly as the baseline thresholds, but are based on different assumptions. Specifically, the government spending multiplier is set to the period-specific lower bound of its 68% confidence band for calculating them. The period-specific lower bounds are presented in Table 5. In addition, the hysteresis parameter is set one period-specific standard error below its period-specific point estimate. See Table 2 for the point estimates and the standard errors. Thus, the pessimistic thresholds are still based on realistic parameter values, but those reduce the chances of obtaining a free lunch result compared to the baseline calibration.

The pessimistic thresholds only marginally differ from the baseline in the pre- and the post-GFC time periods. The reason for this is that the baseline values of the multiplier and the hysteresis parameter are already close to 0. Hence, the results of Subsection 5.2 survive in these two subperiods after reducing μ and η to their pessimistic values. The results of Subsection 5.1 also survive for the pre- and the post-GFC periods: as the baseline value of the spending multiplier is already too small to allow for a short-run fiscal free lunch in these two samples, its lower, pessimistic value must also be too small.

However, the results of Subsections 5.1 and 5.2 for the GFC period are not robust at all to the values of μ and η. The pessimistic value of the spending multiplier (0.706) is below the inverse net tax-and-transfer rate (2.180) between 2008Q4–2012Q4, hence, the short-run fiscal free lunch result fails.

In this case, the real interest rate threshold in the long-run fiscal free lunch condition becomes finite, and it actually turns out to fall below the real government borrowing rate in both the ex ante and the ex post case. The drop in the spending multiplier can be shown to be already sufficient to eliminate the free lunch, even if the hysteresis parameter is kept at its baseline value.[21] Hence, the hysteresis parameter's value does not really matter for the main results of the paper.

To sum up, if one is less optimistic about the extent of the rise in the Hungarian government spending multiplier during the GFC, then it may have been insufficient to compensate for the increase in the real government borrowing rate. The baseline results cannot exclude the possibility of a fiscal free lunch during the GFC time period in Hungary, but these results are much less robust to the value of the spending multiplier than those obtained by DeLong and Summers (2012) for the US.

6 Discussion

6.1 Why Did the Hungarian Government Not "Eat" the Fiscal Free Lunch If It Existed during the Global Financial Crisis?

According to the baseline results presented in Subsections 5.1 and 5.2, a fiscal free lunch was possible in Hungary during the GFC. Still, Figure 3 pointed out that the Hungarian government had mostly carried out fiscal restrictions instead of expansions in this time period, and the seasonally adjusted measure of real government spending used to estimate $SVAR(1)$ model (9) also fell by 8.59% from 2008Q3 to 2012Q4. Taking the baseline results as given, they imply that the fiscal austerity measures carried out by Hungarian governments during the GFC must have been *self-defeating*: they must have increased the debt-to-GDP ratio instead of decreasing it as intended. This raises the obvious question: why did the Hungarian government not "eat" the fiscal free lunch by spending more? It requires further research to come up with the right answer, but this subsection still attempts to list the possible ones.

The first, obvious possibility is that the question is wrong: there was actually no fiscal free lunch during the GFC because the baseline result is not robust, as it has been shown in Subsection 5.3. However, one can come up with some potential answers for the question even if one accepts the baseline result.

A second possibility is that the Hungarian government was not allowed to "eat" the free lunch by spending more. Real government borrowing rates were already rising, reflecting investors' perceptions of increased riskiness of Hungarian government bonds. In addition, the Hungarian government

[21] The results are available from the author upon request.

had to ask for an IMF loan in the Fall of 2008, and the country was also under the EU's excessive deficit procedure. Both international institutions required the government to cut the budget deficit, making it impossible to take advantage of the free lunch. The EU's fiscal rules may also explain why expectations of a long-run fiscal free lunch persisted between the GFC and the COVID-19 pandemic.

But the previous possible answer raises a further question: were investors, the IMF, and the EU not aware that spending more during the GFC would have actually reduced the Hungarian government's debt-to-GDP ratio? It is actually possible that they were not. In addition, even the government may not have been aware, and this is the third possible answer to the original question. Many years later, it is relatively easy to estimate the parameters determining the existence of a fiscal free lunch, but their values were very difficult to know in real time. The empirical and the theoretical results, according to which fiscal multipliers can increase substantially in recessions, were not available back then, and the economic literature of hysteresis was not in the forefront, either. It would be nice to estimate *ex ante* government spending multipliers and hysteresis parameters, and use them to calculate the ex ante real interest rate thresholds presented on Figure 9, but it would require reducing the already small subsample sizes. Even in case of doing so, it would be ambiguous if the estimates reflected economic agents' actual ideas at the time of the GFC, this is why the ex post estimates of μ and η have been used for calculating the ex ante thresholds, as well.

However, Górnicka et al. (2020) provided some idea about what the government spending multiplier could have been expected to be around 2008–2012. The authors backed out the *ex ante* multipliers implicit in the EC's forecasts of the output effects of fiscal consolidations required within the EU's EDP. They found that the EC had calculated with a government spending multiplier of 0.7 for Hungary in 2009, while it calculated with a multiplier of 0.4 in 2012. These are considerably lower than the *ex post* multiplier estimated for the 2008Q4–2012Q4 time period in Subsection 4.5. It has already been shown in Subsection 5.3 that the fiscal free lunch result fails for the GFC time period under a multiplier of 0.706. Thus, it was not possible to expect government spending to turn out to be self-financing under the spending multipliers expected by the EC at the time of the GFC, which might explain why investors and international institutions did not let the Hungarian government spend more, or why the government itself did not realize the free lunch. Note that this argumentation does not concern the *ex post* baseline results, according to which government spending during the GFC has turned out to be self-financing.

A final, fourth possible answer to the question of why the Hungarian government did not spend more during the GFC is that the DeLong–Summers model misses some important elements, because of which this paper's analysis has underestimated the costs of increased government spending. These possible elements are mentioned in Subsection 6.2.

6.2 Limitations

It is important to draw attention to some limitations of the results presented in Section 5. First, the framework developed by DeLong and Summers (2012) is a reduced-form model, which has advantages and disadvantages at the same time. The advantage is that it is relatively theory-independent: it can be compatible with any structural macro model that leads to the particular reduced form presented in Section 3. The disadvantage is that the model's parameters are not invariant to policy changes, thus, the Lucas critique (Lucas, 1976) applies. Specifically, if the government increases its spending,

1. The real government borrowing rate r may go up, e.g., due to crowding out, monetary policy responses to the inflationary effects of the fiscal expansion, or the increased risk of sovereign default.
2. The government spending multiplier μ may fall if the fiscal expansion occurs in a recession, which is brought to an end by the government's stimulus. This is the point made by Erceg and Lindé (2014): if the fiscal expansion is large enough to take the economy out of a liquidity trap, the multiplier may fall towards its normal value, potentially preventing the occurrence of a fiscal free lunch.
3. The hysteresis parameter η may also fall due to similar arguments. The results of Subsection 4.4 suggest that significant hysteresis effects have only been observable during a recessionary time period of the Hungarian economy. If the fiscal expansion is large and effective enough to take the economy out of the recession, the hysteresis parameter may fall towards zero.

All this points to the most important limitation of the paper's results: they only hold for government spending that *actually took place*, and the effects of which are therefore reflected in the data. There is no guarantee that they also hold for additional hypothetical changes in government spending, which could have been carried out at some point in time during the sample period. However, they might also hold for such changes, as long as it can be argued that they would not have changed the parameter values by "too much". This can be the case, for instance, if the size of the change in government spending is sufficiently small.

Second, it has to be emphasized that *self-financing* government spending is not equivalent to *welfare-improving* government spending. The possibility of a fiscal free lunch only implies that the government does not have to worry about the budgetary consequences of increasing its spending. This is already an important point because a standard argument against expansionary fiscal policy during the Great Recession was that it would have endangered the sustainability of public finances. If there was actually a fiscal free lunch in that time period, it invalidates this argument. However, a fiscal free lunch does not necessarily imply that the government is able to increase social welfare by carrying out expansionary fiscal policy. E.g., it might still distort factor prices and capital accumulation by doing that. Blanchard (2019) argued that these potential welfare costs had been dominated by the benefits of larger government spending during the second half of the 2010s in the US, hence, self-financing increases in government spending had also been welfare-improving. But this paper does not examine if the same also applies for Hungary, it only focuses on the budgetary consequences of Hungarian fiscal policy.

Third, the DeLong–Summers model framework does not deal with the inflationary effects of the fiscal expansion, which may lead to economic downturns in the future for at least two reasons:

1. High inflation may initiate a fiscal contraction, depressing economic activity, resulting in a policy-driven boom-bust cycle eventually (Wang and Wen, 2013).
2. They may result in a revaluation of banks' assets by causing the real interest rates on outstanding loans to fall. Banks may respond to this by increasing credit spreads, which may eventually lead to a drop in macroeconomic investment activity (Andrade and Berriel, 2016).

These future economic downturns caused by the inflationary effects of the current fiscal expansion might prevent the emergence of a fiscal free lunch, even if it would otherwise occur. Taking them into account would require substantial modifications of the DeLong–Summers model, which is out of the scope of this paper.

Fourth, van Wijnbergen, Olijslagers, and de Vette (2020) argued that the value of government debt could be viewed as a claim on future primary surpluses, hence, it was determined as the present value of their expected sum. If the safe rate of interest is below the economy's long-run growth rate, the value of the government debt becomes infinite, and this is what gives rise to a fiscal free lunch according to conventional analysis. However, they argued that future primary surpluses were stochastic and procyclical, therefore, the appropriate interest rate used to discount them had to contain a risk premium. They applied an asset pricing model to derive the appropriate risk premium and found that the risk-adjusted real government borrowing rate had always exceeded the long-run trend growth rate in the Netherlands, even when the unadjusted one had fallen short of it. This had ruled out the possibility of a fiscal free lunch in their interpretation. However, the asset pricing model they used is not a macroeconomic model: it does not take into account hysteresis effects and the cyclical variations in the government spending multiplier. These two considerations may question their conclusions.

The limitations listed in this subsection draw attention to the importance of more research about how to correctly evaluate the possibility of a fiscal free lunch empirically.

7 Conclusions

DeLong and Summers (2012) argued that the US government was very likely to face a fiscal free lunch during the Great Recession in the sense that increases in its spending stimulated current and future economic activity enough to produce sufficient additional tax revenues for preventing the debt-to-GDP ratio from rising in the long run. They explained their result by arguing that fiscal multipliers and hysteresis effects were stronger, and interest rates were lower in those times than normally. This paper studied if the same arguments were applicable for an emerging small open economy, Hungary, in which fiscal multipliers are thought to be weaker than in the US, and where interest rates rose during the GFC.

It was found that government spending had not been self-financing in the short run, had been at the edge of being expected to be self-financing in the long run, but had not actually turned out to be between 1999Q1–2008Q3, in a mostly expansionary time period of the Hungarian economy. For the GFC period between 2008Q4–2012Q4, the Hungarian government's spending was found to had been self-financing in the long run, with the addition that it might had already been self-financing in the short run, as well. The result was primarily explained by a much larger government spending multiplier than in normal times, the size of which was estimated to be comparable to that of multiplier estimates for the recessionary periods of the US economy, and less importantly, by significant hysteresis effects of a magnitude at least as large as in the US. These two factors may have given rise to a fiscal free lunch in Hungary, as well, in spite of the fact that real government borrowing rates peaked during the GFC within the full sample period. However, these results were shown to be much less robust than those of DeLong and Summers (2012) for the US. They are particularly sensitive to the value of the spending multiplier. The short-run fiscal free lunch result is extremely fragile, but the long-run result also gets invalidated if the multiplier is assumed to be a little overestimated. For the expansionary time period between 2013Q1–2019Q4, Hungarian government spending was not found to had been self-financing in the short run, but it was found to had been expected to be self-financing in the long run. The spending multiplier was estimated to had become weak again, but ex ante real government borrowing rates had reached historical lows in 2010s' Hungary, as well, falling considerably short of the economy's expected long-run trend growth rate.

The results suggest that the possibility of a fiscal free lunch cannot be excluded in an emerging small open economy, like Hungary, either. However, it requires special circumstances that come with either exceptionally strong multiplier effects, hysteresis effects, or exceptionally low government borrowing rates, or some combination of all these. In addition, the likelihood of a fiscal free lunch was shown to be smaller in Hungary than in the United States, which is a more advanced, bigger, and less open economy. The most important reason behind this finding is that big advanced economies have lower probabilities of facing sudden stops in foreign capital inflows, hence, increasing interest rates in crisis situations. Fiscal policymakers of emerging economies must carefully consider all these aspects when trying to take advantage of a potential free lunch in practice.

Although the results for Hungary may come with important lessons for the policymakers of other emerging CEE countries, like those highlighted on Figure 1, as well, they cannot perfectly substitute further country-specific analyses. Hence, an obvious direction of future research is to repeat the analysis for other countries. Another potentially fruitful direction would be to extend the DeLong–Summers framework in order to address some of its limitations mentioned in Subsection 6.2, allowing it to come up with more precise conclusions about the possibility of a fiscal free lunch. It would be especially relevant for fiscal policymakers of emerging countries to find an appropriate way for assessing the self-financing nature of government spending initially financed by foreign currency denominated borrowing.

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