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ASSESSING THE SENSITIVITY OF HUNGARIAN DEBT SUSTAINABILITY TO MACROECONOMIC SHOCKS UNDER TWO FISCAL POLICY REACTIONS

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by Pierre Beynet and Edouard Paviot

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ABSTRACT/RESUMÉ

Assessing the sensitivity of Hungarian debt sustainability to macroeconomic shocks under two fiscal policy reactions

Hungarian debt level has steadily increased since 2001, with the debt-to-GDP ratio reaching about 84% at end-2011. This high level combined with significant volatility of macroeconomic variable influencing potential future debt paths – GDP growth, exchange rate and interest spreads – put Hungarian debt sustainability at risk. To assess debt sustainability over a 5-year horizon, a stochastic debt simulation has been conducted by applying random shocks derived from historical volatility to a baseline scenario. These simulations are used to derive fan charts showing the distribution probability of debt under different sets of assumptions regarding *i)* the nature of shocks – temporary or permanent – and *ii)* fiscal policy reactions, i.e. either allowing automatic stabilizers to operate or not. Results indicate that the probability of a debt ratio going beyond 90% of GDP in the next five years – a level beyond which debt is likely to hurt growth – is non-negligible (at least 25% in the most favourable scenario), especially if volatility turns out to be higher than observed in the past. The main risks to debt sustainability lie in growth shocks, whose volatility is high in Hungary. This highlights the crucial role of growth for debt sustainability. The impact of exchange rate depreciation can also be important, especially if shocks are permanent, while the rise in interest spreads would have a much more limited impact as debt is only progressively rolled over. Finally, fiscal policy reaction matters. Offsetting the impact of automatic stabilizers significantly reduces the width of potential debt paths over the five-year horizons.

This Working Paper relates to the 2012 *OECD Economic Survey of Hungary* (www.oecd.org/eco/surveys/hungary).

JEL classification: H62, H63, C15, E62

Keywords: Hungary; public debt sustainability; risk analysis; fan charts; fiscal reaction function

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Évaluer la sensibilité de la viabilité de la dette publique hongroise aux chocs macroéconomiques selon de deux réactions de politique budgétaire

La dette de la Hongrie n'a cessé de s'accroître depuis 2001 et le ratio de dette sur PIB a atteint environ 84 % fin 2011. Ce niveau élevé, conjugué à la grande volatilité de variables macroéconomiques influant sur les profils possibles d'évolution de la dette à l'avenir – croissance du PIB, taux de change et écarts de taux d'intérêt – hypothèquent la viabilité de la dette publique hongroise. Pour évaluer la viabilité de la dette sur un horizon de cinq ans, une simulation stochastique a été effectuée, dans laquelle des chocs aléatoires basés sur la volatilité historique de la dette ont été appliqués à un scénario de référence. À partir de ces simulations, des graphiques ont été construits en éventail illustrant les évolutions probables de la dette en fonction de différentes hypothèses relatives *i)* à la nature des chocs – temporaires ou permanents – et *ii)* à la réaction de la politique budgétaire, à savoir, laisser ou non opérer les stabilisateurs automatiques. Les résultats font apparaître une probabilité non négligeable (d'au moins 25 % dans le scénario le plus favorable) que le ratio dette/PIB dépasse 90 % – niveau au-delà duquel l'endettement risque d'entraver la croissance – d'ici cinq ans, surtout si les paramètres étudiés se révèlent plus instables encore que par le passé. Les principaux risques qui pèsent sur la viabilité de la dette résident dans l'évolution de la croissance, laquelle affiche une forte volatilité en Hongrie. Il apparaît donc que la croissance joue un rôle déterminant dans la viabilité de la dette. L'incidence d'une dépréciation du taux de change peut également être importante, notamment si ce choc est permanent, alors que l'augmentation des écarts de taux d'intérêt aurait un effet bien moindre, du fait du refinancement progressif de la dette. Enfin, la réaction de la politique budgétaire a, elle aussi, son importance. En compensant l'impact des stabilisateurs automatiques, on réduit sensiblement l'éventail des trajectoires envisageables de la dette sur un horizon de cinq ans.

Ce Document de travail se rapporte à l'Étude économique de l'OCDE de la Hongrie, 2012 (www.oecd.org/eco/etudes/hongrie).

Classification JEL: H62, H63, C15, E62

Mots-clés: Hongrie ; viabilité de la dette publique ; analyse de risques ; graphiques en éventail ; fonctions de réaction budgétaires

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ASSESSING THE SENSITIVITY OF HUNGARIAN DEBT SUSTAINABILITY TO MACROECONOMIC SHOCKS UNDER TWO FISCAL POLICY REACTIONS

by Pierre Beynet and Edouard Paviot [1]

Introduction

Hungarian public debt has steadily increased since 2001, from 53% of GDP to about 84% of GDP at end-2011 (OECD, 2011). The increase in the debt ratio reflects mainly fiscal deficits but also temporary and permanent shocks to the economy, such as changes in nominal GDP, interest payments, and exchange rates. As around half of Hungarian debt was denominated in foreign currency at end-2011, the debt ratio is particularly sensitive to fluctuations in exchange rates.

The Hungarian fiscal framework specifies that the debt-to-GDP ratio should decline over time. The debt rule adopted in the fiscal responsibility law of 2008 specified that the budget should be consistent with a debt-to-GDP ratio constant in real term, *i.e.* a debt ratio declining at the speed of real GDP growth (OECD, 2009). In Spring 2011, the government adopted a new constitutional debt rule stipulating that gross public debt should eventually be cut below 50% of GDP, backed by the requirement that the budget be consistent with a reduction in the debt ratio each year, as long as it is above the target level. A cardinal law adopted in late December 2011, which repealed the law on fiscal responsibility, specified that public debt can increase only by expected inflation minus half of expected real GDP growth from 2016 onwards.

In practice, whether a debt-to-GDP ratio will follow a declining path is highly dependent on unexpected shocks affecting the economy (Chalk and Hemming, 2000). To analyse the potential impact of such shocks, an analysis of potential debt paths subject to macro-economic shocks has been conducted using random shocks drawn from the variance of historical shocks. This allows fan charts to be constructed illustrating the most likely debt paths for the next years. These fan charts are then used to analyse the impact of different sets of assumptions: *i)* whether macro-economic shocks are temporary or permanent, and *ii)* whether fiscal policy allows the automatic stabilizers to operate or not.

While the two fiscal reaction scenarios envisaged are simple, they are likely to encompass fiscal policy options in the coming years, as the sovereign debt crisis is likely to limit policy choices. Recent downgrades of Hungarian debt and some failed debt auctions towards end-2011 and early 2012 highlighted limited fiscal policy space: ensuring the credibility of fiscal policy will most likely require sticking to the medium-term fiscal targets, even in the event of unforeseen macro-economic shocks, allowing at best the automatic stabilisers to operate.


Methodology

The methodology used to run stochastic debt simulations follows Di Giovanni and Edward (2008). This methodology is a simplified version of more sophisticated stochastic methods to analyze debt sustainability, such as those by Celasun, Debrun and Ostry (2006). Instead of directly simulating stochastic debt paths, the methodology builds confidence intervals around a baseline scenario by applying random shocks to the debt accumulation equation. The main differences from Di Giovanni and Edward (2008) lie in the introduction of random shocks to the exchange rate, the comparison between two alternative fiscal policy reactions, and feedback on activity of changes in the fiscal balance related to automatic stabilizers. This paper also analyzes the impact of each variable shock separately. The projections of the debt paths are limited to 5 years since projecting beyond 5 years would give increasingly unlikely debt paths owing to the relatively simple macro-economic projections and fiscal policy alternative assumed here.

The baseline scenario is derived from the *OECD Economic Outlook 90* until 2013. From 2014 onwards, underlying macro-economic projections follows the OECD medium-term analysis (see below). In addition, it is assumed that the fiscal primary balance from 2014 onwards is consistent with a proposal by the European Commission that the debt ratio declines by $1/20^{th}$ each year as long as it is above 60% of GDP. The rule suggested by the European Commission is consistent with the Hungarian requirement that the debt ratio should be declining as long as it is over 50% of GDP. The debt ratio is defined as the Maastricht debt. It should be noted that the baseline scenario based on the European Commission proposal is quite ambitious since it implies that the debt-to-GDP ratio decreases by about 1.2 p.p. per year on average over 2014-2016, which would be quite a dramatic turnaround compared to the 2002-11 period, when the debt ratio increased on average by 3.2 p.p. per year. The figure below shows the evolution of debt from 2001 and the baseline scenario from 2012 to 2016.

Figure 1. **Evolution of general government gross debt**
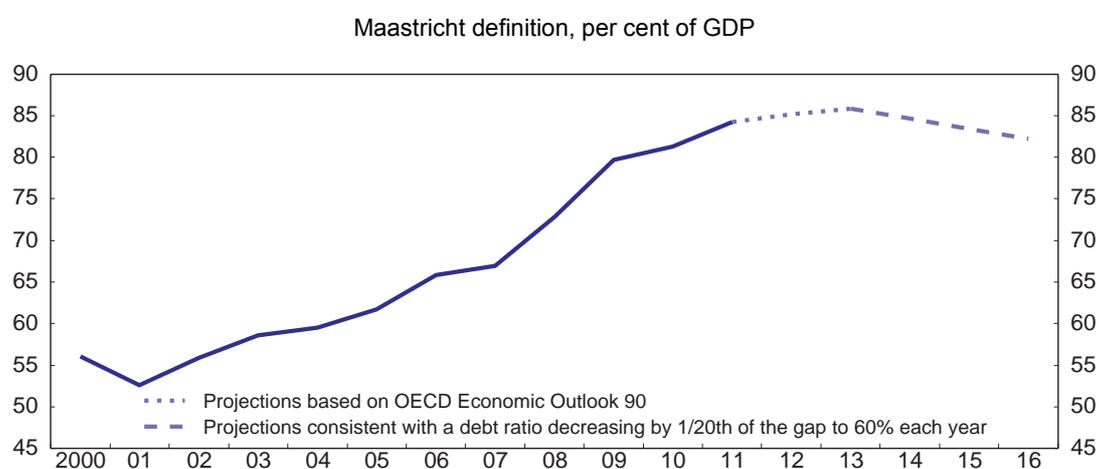
Maastricht definition, per cent of GDP

Source: OECD (2011), *OECD Economic Outlook: Statistics and Projections* (database), December and OECD calculations.

The baseline scenario follows OECD medium-term projections. This medium-term scenario is built around a potential growth estimate based on OECD methodology and assumes that the output gap has mostly closed within five years with GDP growth converging towards potential GDP (OECD, 2012). As a result, real GDP growth projections from 2014 to 2016 are above potential GDP. The GDP deflator is assumed to converge to the central bank inflation target of 3% from 2014 onwards. Interest rates of the different currencies are based on the most recent available data and kept constant. Since almost all debt in foreign currency is swapped into euros, debt in foreign currency is assumed to be in euro only. Finally, the primary balance is projected from 2014 onwards so as to ensure a decline of the debt ratio by 1/20th of the gap to 60% each year, as explained above. The table below summarizes the value of the main variables (GDP growth, inflation, primary fiscal balance, interest rate on debt) of the baseline scenario.

Table 1. **Main assumption underlying the baseline scenario**

	Real GDP growth	Inflation (GDP deflator)	Primary balance (in % of GDP)	Average interest rate on debt	*Of which: interest rate on debt in HUF*	*Of which: interest rate on debt in EUR*
2011	1.5	2.0	7.9	5.3		
2012	-0.6	4.0	0.7	5.4	6.4	4.8
2013	1.2	2.4	0.9	5.6	6.4	4.8
2014	2.5	3.0	1.4	5.6	6.4	4.8
2015	2.4	3.0	1.4	5.6	6.4	4.8
2016	2.4	3.0	1.3	5.6	6.4	4.8

Source: OECD (2011), *OECD Economic Outlook: Statistics and Projections* (database), December, OECD (2012), *Long-Term economic growth*, forthcoming WP1 paper; Thomson (Datastream).

The stochastic confidence intervals around the baseline scenario are determined by applying random shocks to the debt accumulation equation. The shocks are derived from the variance-covariance matrix of shocks of the last ten years (*i.e.* 2002-11). The implicit assumption is that the volatility of macro-economic variables during the simulation period (next five years) will be similar to the volatility observed in the last 10 years. While the 2002-11 period incorporates one episode of high financial stress (2009), volatility in the next 5-year could in practice be higher than observed in the past. Each shock is constructed as the first difference of the quarterly variable x:

$$\varepsilon_q^x = x_q - x_{q-1}$$

Table 2 summarizes the volatility of shocks over the period 2002-11. The volatility of shocks is very high for nominal GDP, with an annualized standard deviation almost identical to average (annual) nominal growth, both because of high real GDP and price volatility. Annualized volatility is less marked for the interest rate, being the strongest for EUR and the weakest for HUF. It should be noted that interest rates in forint and euro are those of Hungarian bonds in the secondary markets and, hence, incorporate spreads. Interest rates of forint are those of a 5-year maturity bond and those in Euros of a 10 years maturity bond, since they are close to the average maturity of Hungarian public debt in each of these currencies. Finally, exchange rate demonstrates the weakest volatility compared to average value.

Table 2. **Standard deviation of shocks**

2002-11

	Standard deviation of shocks (quarterly)	Standard deviation of shocks[1] (annualized)	Average value of variables (annual)
Nominal GDP growth	3.03	6.05	7.03
Interest rate in HUF	1.00	2.00	7.77
Interest rate in EUR	0.85	1.71	4.62
Exchange rate (1 EUR = n HUF)	14.32	28.60	259

1. Annualized standard deviations of shocks are assumed to be twice as big as quarterly deviations. *Source*: OECD calculations based on OECD (2011), *OECD Economic Outlook: Statistics and Projections* (database) and Thomson (Datastream).

The correlation between different variables is consistent with what can be expected based on stylized facts or intuition. Shocks to interest rates are negatively (and weakly) correlated to shocks to Hungarian growth. This is also true of the interest rate in euro, most likely reflecting the high correlation between the interest rates in forint and euro (which is consistent with the fact that interest rates in euros are those of Hungarian bonds in the secondary market) but also the high leverage in foreign currency of the Hungarian economy. Shocks to exchange rate have no impact on nominal growth, which is likely to be related to a delayed impact on activity of exchange rate variations. Finally, shocks to HUF or EUR interest rate and EUR/HUF exchange rate are highly correlated. The sign of the correlation indicates that a positive change in interest rates is correlated with currency depreciation, which may seem counter-intuitive. In fact, the explanation is that shocks to interest rate are essentially driven by spreads, which are positively correlated with exchange rate. For example, a period of financial stress leads to a simultaneous rise in spreads and depreciation of the exchange rate.

Table 3. **Correlations of shocks**

2002-11

	Growth	Interest rate in HUF	Interest rate in EUR	EUR/HUF exchange rate
Growth	1	. .	. .	. .
Interest rate in HUF	-0.14	1	. .	. .
Interest rate in EUR	-0.15	0.48	1	. .
EUR/HUF exchange rate	-0.02	0.50	0.52	1

Source: OECD calculations based on OECD (2011), *OECD Economic Outlook: Statistics and Projections* (database) and Thomson (Datastream).

The Monte Carlo simulation is done through the following steps. First, a random vector of quarterly shocks is drawn over 2012-16. These shocks are jointly-normally distributed with means zero and a variance/covariance matrix identical to those of historical shocks. Second, these shocks are added to get annual innovation to the respective variable: growth, interest rates in the two currencies (HUF and EUR) and exchange rate (Annex 1 gives the distribution of simulated variables). The annual shocks on the different variables are written in the following way:

- Growth shock of year t: the annual shock is the sum of quarterly shocks, hence:

$$\varepsilon_t^g = \sum_{q=1}^{4} \varepsilon_{q,t}^g$$

- Exchange rate shocks are similarly the sum of quarterly shocks:

$$\varepsilon_t^e = \sum_{q=1}^{4} \varepsilon_{q,t}^e$$

- Shocks to interest rates of the different currencies are getting bigger overtime as debt is progressively rolled over. It is assumed that all debt has been issued at fixed interest rates, so a shock on interest rates in a given year is carried over to the following years proportionally to the part of the debt that has been rolled over. Shocks to the interest rate are applied assuming an average maturity of debt in domestic currency and foreign currency (euro) of, respectively, 5 and 10 years. Hence, the value of the shocks from years 2012 to 2016 are the following:

$$\varepsilon_t^r = \frac{1}{T} \sum_{y=2012}^{t} \sum_{q=1}^{4} \varepsilon_{q,y}^r \text{ with T=5 for HUF and T=10 for euros}$$

These shocks are applied to the debt accumulation equation in two different ways. The first is to assume temporary shocks: new shocks only impact the baseline variable each year; the implicit assumption being that the impact of past shocks on the different variables is not persistent. The second way to apply shocks is to assume that past shocks are persistent, *i.e.* that new shocks impact the last value of the variable, not the baseline assumption. This assumption of a permanent impact of shocks (*i.e.* a persistence of past shocks) is applied only to interest and exchange rates. Permanent shocks on exchange rates are expressed in percentage and not in level so as to keep the relative size of shocks identical when the exchange rate deviates from the baseline level. Shocks to GDP are assumed to remain temporary. Obviously, these two scenarios are extreme cases, and the most likely debt paths are probably in between these two scenarios. The way shocks are simulated is:

- Temporary shocks:

$$g_t = \overline{g_t} + \varepsilon_t^g \text{, with } \overline{g_t} \text{ being the baseline value}$$

$$r_t = \overline{r_t} + \varepsilon_t^r \text{, with } \overline{r_t} \text{ being the baseline value}$$

$$e_t = \overline{e_t} + \varepsilon_t^e \text{, with } \overline{e_t} \text{ being the baseline value}$$

- Permanent shocks:

$$r_t = r_{t-1} + \varepsilon_t^r \text{ if } t \geq 2013$$

$$e_t = e_{t-1} \times (1 + \varepsilon_t'^e) \text{ if } t \geq 2013 \text{, with } \varepsilon_t'^e = \frac{e_t - e_{t-1}}{e_{t-1}}$$

More sophisticated models of stochastic debt simulation usually assume a fiscal policy reaction function to increase the likelihood of the simulated debt path. In this simple stochastic debt sustainability exercise, no fiscal policy reaction function has been estimated. However, two different simple fiscal policy reactions are tested: the first allows the automatic stabilizers to operate; the second offsets them. Assuming that average tax elasticity to GDP is equal to one, letting the automatic stabilisers operate is equivalent to assuming that changes in the fiscal balance (in percent of GDP) are approximately equal to changes in the output gap (in percent of GDP) times the tax burden (in percent of GDP).

$$\Delta(\mathit{fiscalbalance}) \approx \frac{\mathit{Taxes}}{\mathit{GDP}} \Delta(\mathit{outputgap})$$

Or: $\varepsilon_t^p = 0.36 \times \varepsilon_t^g$

Letting the automatic stabilizers operate has a feedback on activity through fiscal multipliers. The fiscal multipliers are derived from S. Benk and Z. Jakab (2012), taking into account their estimates of tax multipliers since it is assumed that automatic stabilizers mainly operate on the revenue side. Using a weighted average of the elasticity of three main taxes (labour income taxes, social contribution and valued-added) based on their respective share in total revenues collected, we obtain:

$$\Delta(\mathit{outputgap}) \approx -0.2 \times \Delta(\mathit{fiscalbalance})$$

Starting from the debt ratio in 2011, we apply the different shocks to the debt accumulation equation to obtain debt paths over 2012-21. We repeat the above steps 100 times and extract the 5th, 25th, 75th and 95th percentile to construct a fan chart of the debt path. The debt accumulation equation is obtained by summing up the debt accumulation equation for the debt in each currency, assuming that primary deficits are financed in each of the two currencies (HUF and USD) proportionally to the ratio of the debt in each currency in 2011. The debt accumulation equation is obtained in the following way:

Debt level in HUF:

$$D_t^{HUF} = (1 + r^{HUF}) \times D_{t-1}^{HUF} - \frac{D_{2011}^{HUF}}{D_{2011}^{Total}} \times P_t \qquad (1)$$

Debt level in EUR:

$$D_t^{EUR} = (1 + r^{EUR}) \times D_{t-1}^{EUR} - \frac{e_{2011}^{HUF/EUR} \times D_{2011}^{EUR}}{D_{2011}^{Total}} \times \frac{P_t}{e_t^{HUF/EUR}} \quad (2)$$

Total debt level in HUF:

$$D_t^{Total} = D_t^{HUF} + e_t^{HUF/EUR} \times D_t^{EUR} \qquad (3)$$

Or, by inserting (1) and (2) into (3):

$$D_t^{Total} = (1 + r_t^{HUF}) \times D_{t-1}^{HUF} + e_t^{HUF/EUR} \times (1 + r_t^{EUR}) \times D_{t-1}^{EUR} - P_t$$

Finally, by dividing all variable by GDP and using lower cases for ratio to GDP:

$$d_t^{Total} = \frac{1 + r_t^{HUF}}{1 + g_t} \times d_{t-1}^{HUF} + \frac{e_t^{HUF/EUR}}{e_{t-1}^{HUF/EUR}} \times \frac{1 + r_t^{EUR}}{1 + g_t} \times d_{t-1}^{EUR} - p_t$$

Simulation results

Fan charts of temporary or permanent shocks, depending on fiscal policy reaction

The stochastic simulations of debt result in different fan charts depending on whether shocks are considered temporary or permanent (Figure 2). Permanent shocks illustrate a more risky scenario. Potential debt paths diverge more substantially depending on whether the automatic stabilizers are allowed to operate. With the automatic stabilizers, the debt path becomes potentially explosive in the worst case (Figure 2, Panel A). Offsetting the impact of automatic stabilizers narrows potential debt trajectories, underscoring the benefits of not deviating excessively from fiscal targets. It should be noted, though, that there is still a probability of 25% that the debt ratio could be above 90% of GDP by 2016 (Figure 2, Panel B), a level that is deemed to hurt growth and that may trigger adverse financial market reactions.

Figure 2. **Stochastic general government debt simulations**[1]

Per cent of GDP
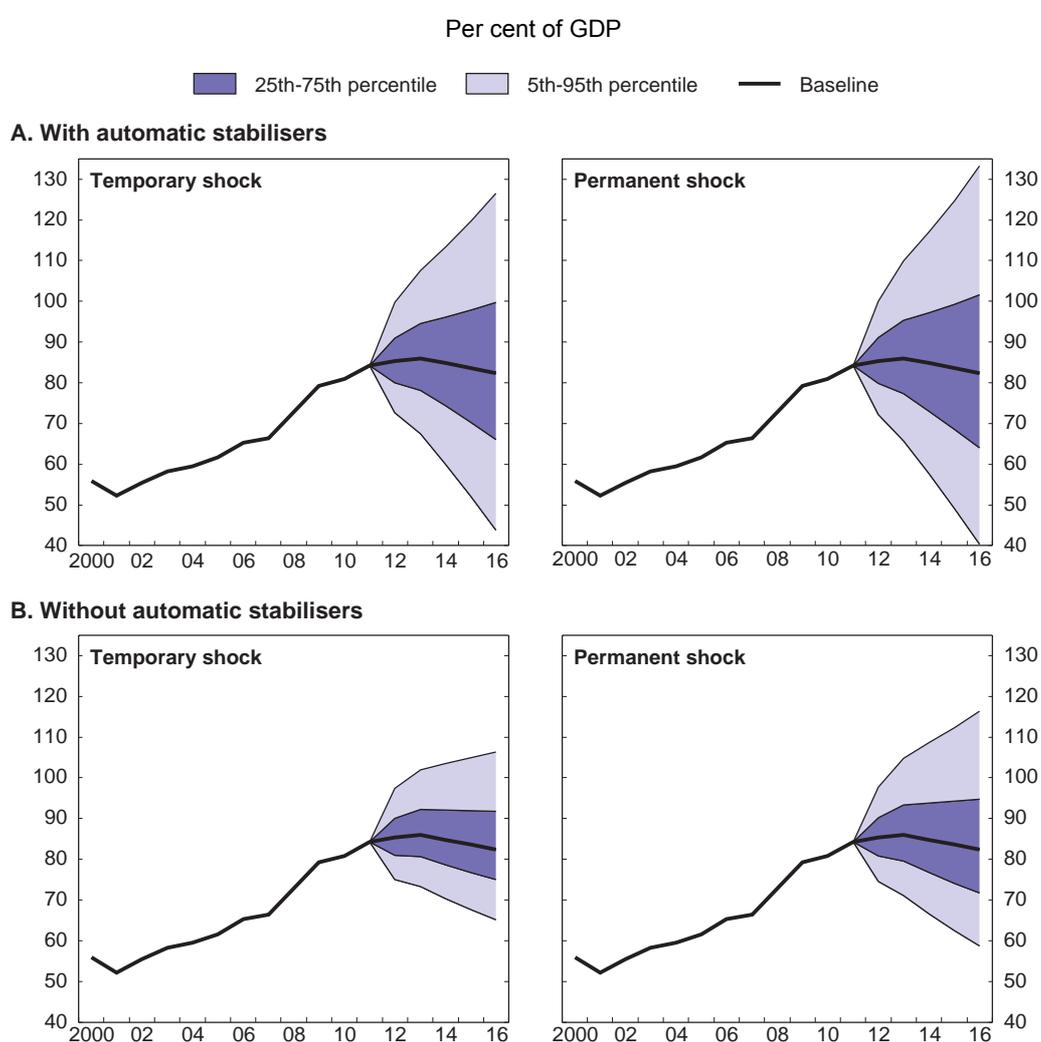
1. The debt path in the baseline scenario follows the debt rule adopted in the fiscal responsibility law of 2009 (*i.e.* a debt-to-GDP ratio constant in real terms). Temporary and permanent stochastic macroeconomic shocks are applied to the baseline scenario and the likelihood of potential debt paths are shown with their attached probability.

Source: OECD (2011), *OECD Economic Outlook: Statistics and Projections* (database), December and OECD calculations.

Impact of isolated shocks

To analyze the impact of specific shocks on debt, Figure 3 shows the debt path when shocks are applied to each variable independently. Shocks on GDP have the biggest impact, owing to their high volatility and their direct impact on the debt ratio. Shocks on interest rates have the lowest impact, with only one fifth of debt in forint and one tenth of debt in euro being rolled over each year. The impact of exchange rate shocks is in-between. While the volatility of exchange rate is lower than that of other shocks, its impact on debt remains significant since half of the debt has been issued in foreign currency.

Figure 3. **Impact of shocks on each variable separately on general government debt shock simulations**[1]
Per cent of GDP
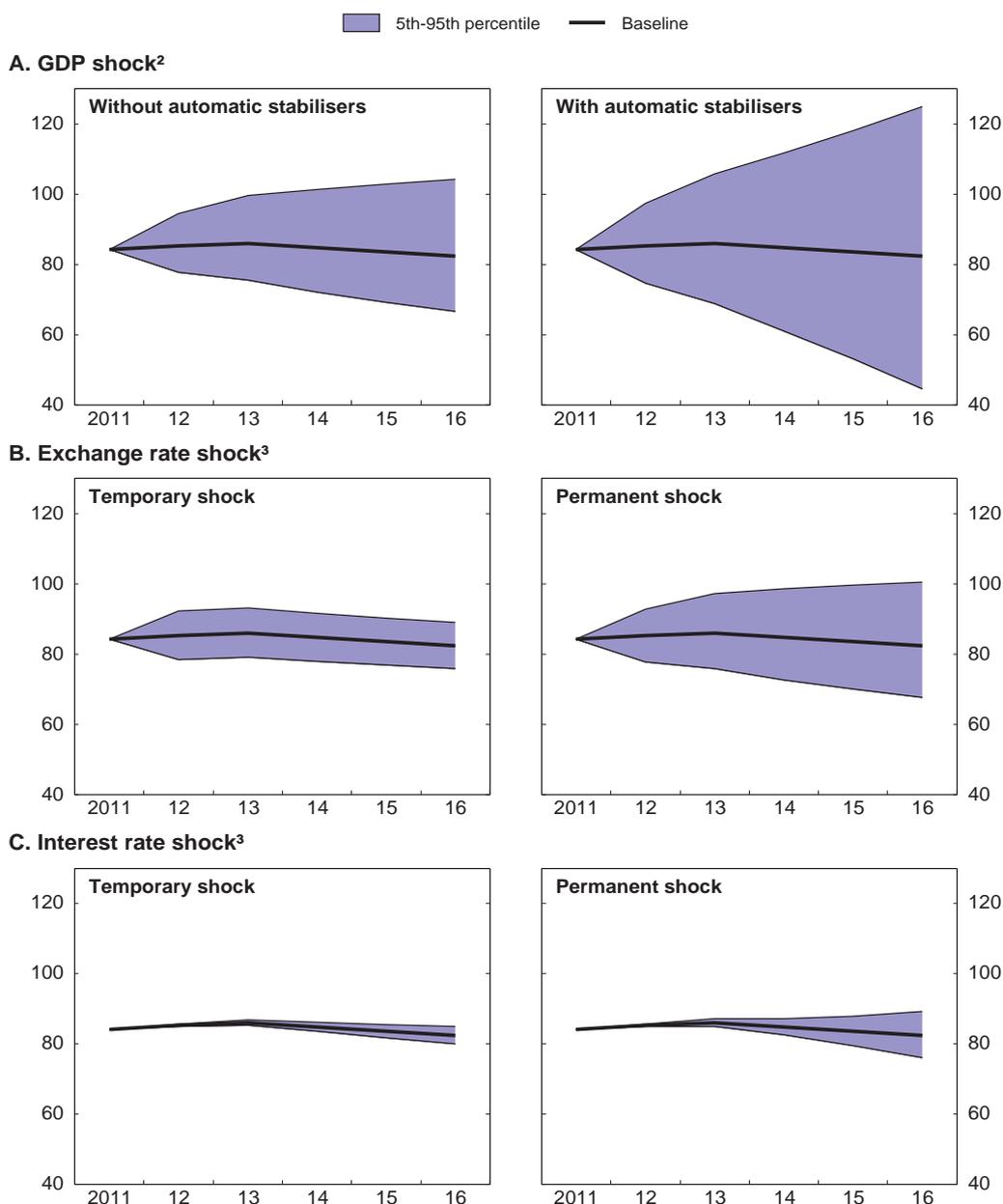
1. Temporary and permanent stochastic macroeconomic shocks are applied to the baseline scenario.
2. No change for temporary or permanent shocks.
3. No change with and without automatic stabilisers.
Source: OECD (2011), *OECD Economic Outlook: Statistics and Projections* (database), December and OECD calculations.

Overall, shocks to GDP explain most of the variance: the fan chart resulting from combining all shocks simultaneously is not very different from the one based on GDP shocks only. A back-of-the envelop calculation extracting the standard deviation from the fan charts (assuming that the difference between the 95 percentile and the baseline scenario is roughly equal to the standard deviation) confirms this: the variance of the scenario combining all shocks is close to the sum the variance of each shocks, as it should be the case for normal probability distributions that are roughly additive. This result highlights the crucial role of growth for debt sustainability in Hungary.

Conclusion

Despite being a simplified version of more sophisticated stochastic debt sustainability analysis, these simulations allow to draw some conclusions on where the risks lie for Hungarian debt sustainability. If the volatility of future shocks remain close to what has been observed in the past 10 years, the probability of a debt ratio going beyond 90% of GDP in the next five years – a level which is likely to hurt growth – is non-negligible in case of both temporary and permanent shocks (at least 25% in the most favourable scenario). The main risks to debt sustainability over the 5-year horizon are driven by nominal growth shocks whose volatility is particularly high in Hungary. This highlights the importance of boosting real GDP growth. The impact of exchange rate depreciation on debt sustainability can also be important, especially if shocks are permanent, while the rise in interest spreads would have a much more limited impact over the 5-year horizon. Finally, the fiscal policy reaction matters. Offsetting the impact of automatic stabilizers significantly reduces the width of potential debt path over the five-year horizon compared to a scenario where automatic stabilizers are allowed to operate.

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ANNEX 1

Distribution of simulated data

Figures below present histograms of the simulated data to which shocks have been applied (growth, interest and exchange rate) for the 5 years of the projection period.

Distribution of simulated growth

As expected, the distribution of growth (incl. shocks) is similar over-time. While the distribution is quite wide, it is in line with observed past volatility.

Histogram of g.2012

Histogram of g.2013

Histogram of g.2014

Histogram of g.2015

Histogram of g.2016
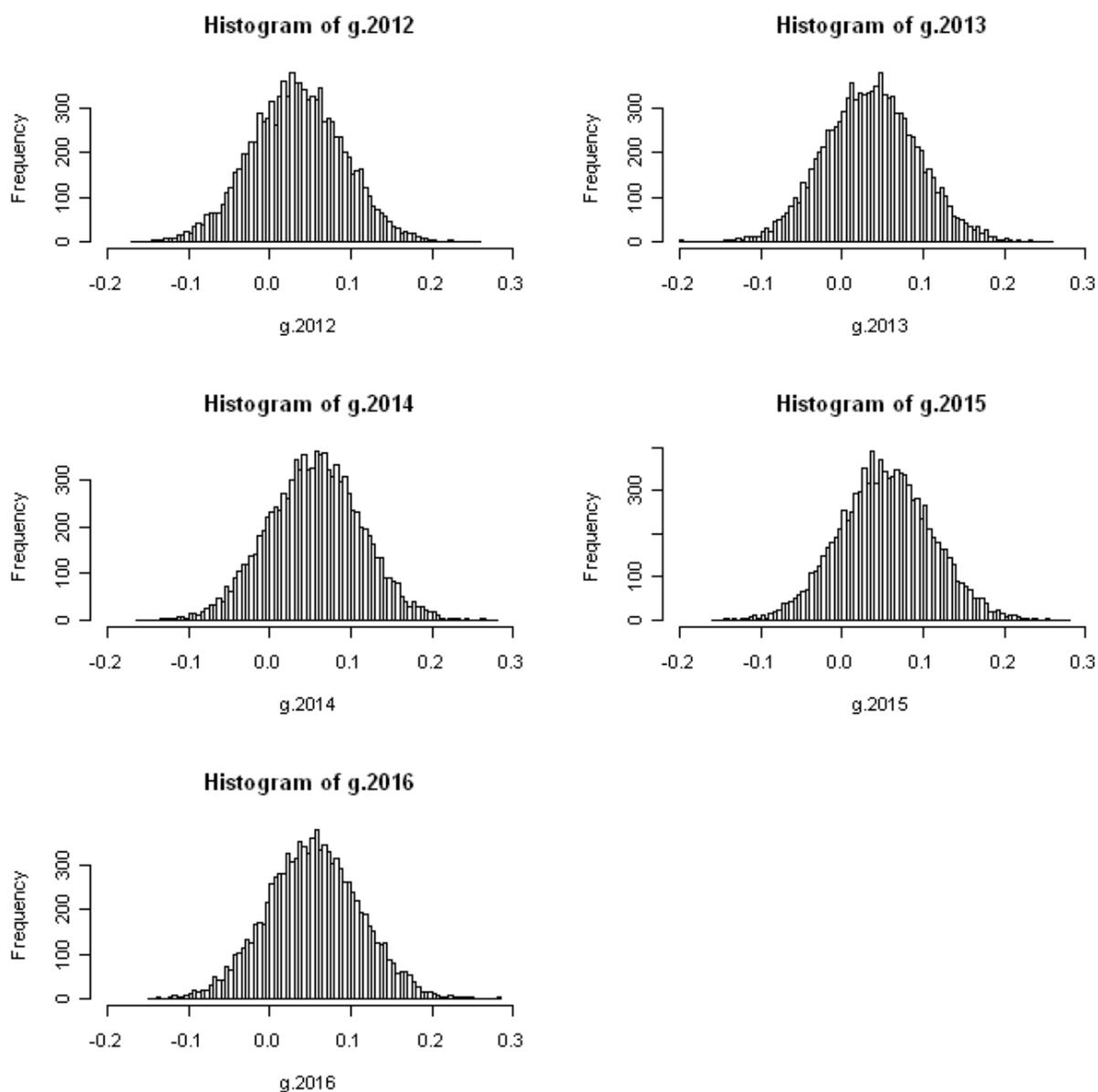
Distribution of simulated exchange rate

Temporary shocks

The distribution of exchange rate based on temporary shocks is very similar over-time. The values taken by exchange rate within the 95% probability are not significantly different from past values.
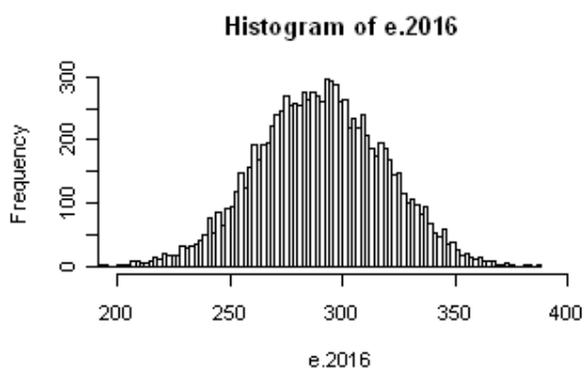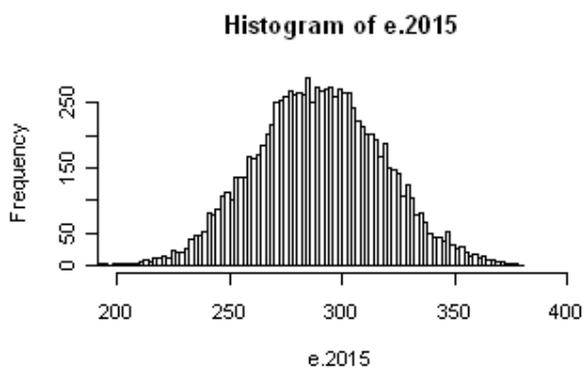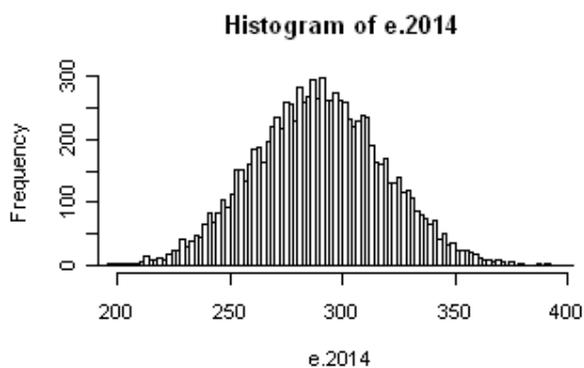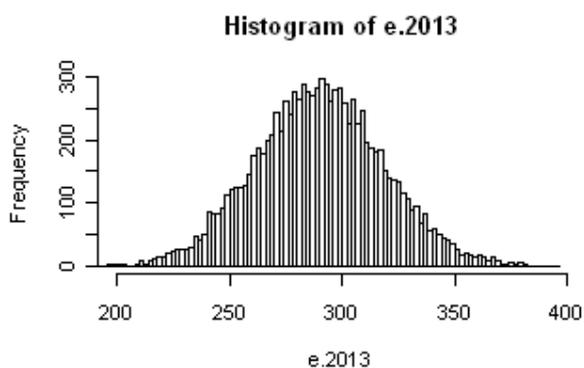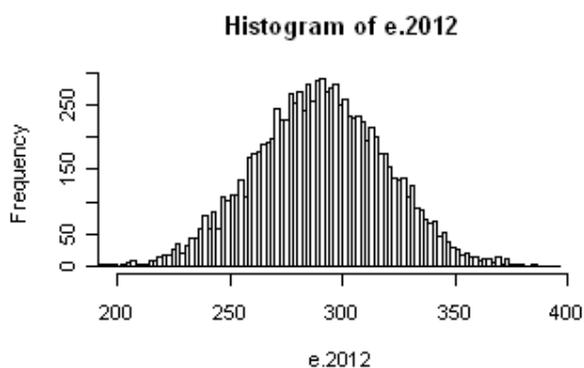
Permanent shocks

With permanent shocks, the distribution of exchange rate is progressively widening. As shocks are applied in percent and not in level (conversely to temporary shocks), the distribution of simulated exchange rate does not follow a normal law any more. Extreme values taken in the outer years become quite different from historical range of value: they clearly belong to extreme case scenarios.
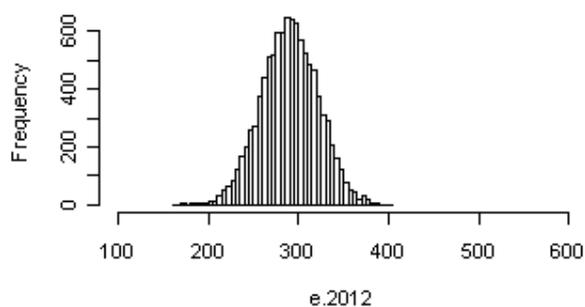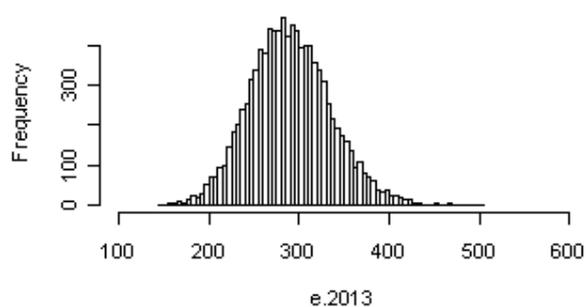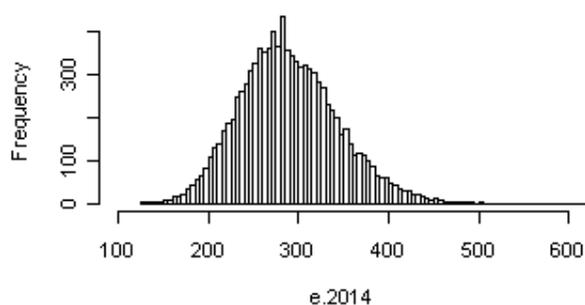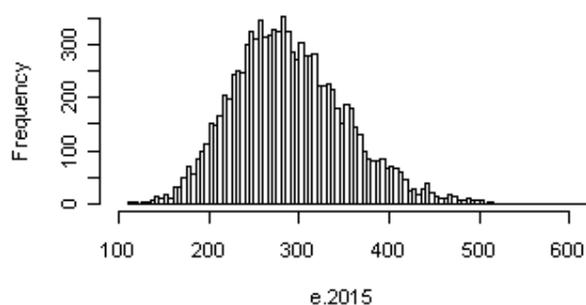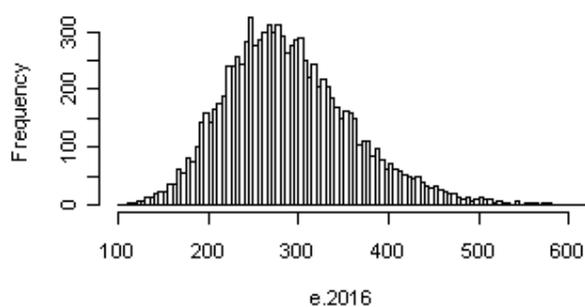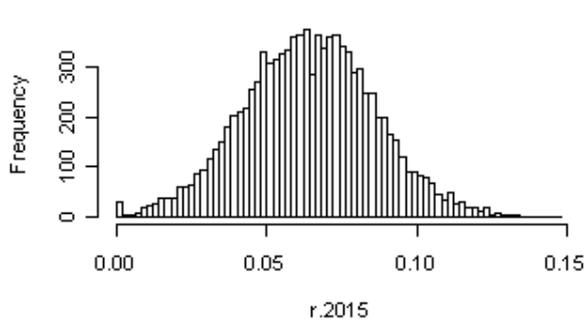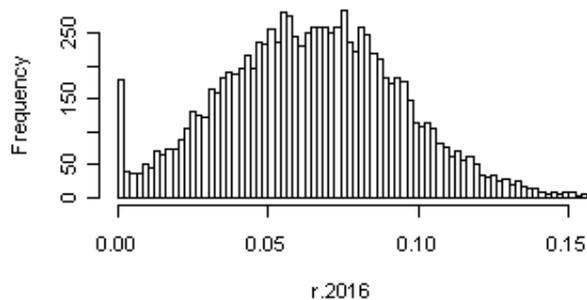
Distribution of interest rates in HUF

Temporary shocks

The distribution of interest rates in forint is widening slowly because of debt being progressively rolled over: shocks on interest rate fully impact the total amount of debt issues in forint by 2016. Extreme values of the distribution are consistent with past observations.

Histogram of r.2012

Histogram of r.2013

Histogram of r.2014

Histogram of r.2015

**Histogram of r.2016**
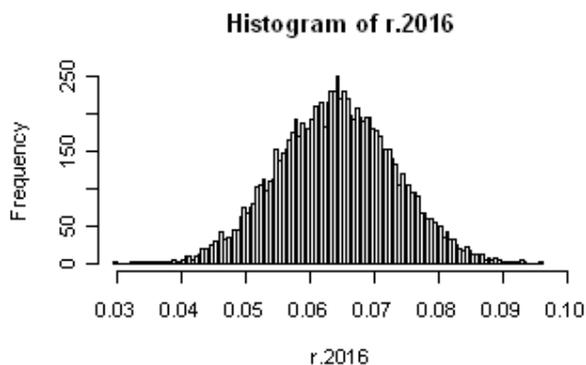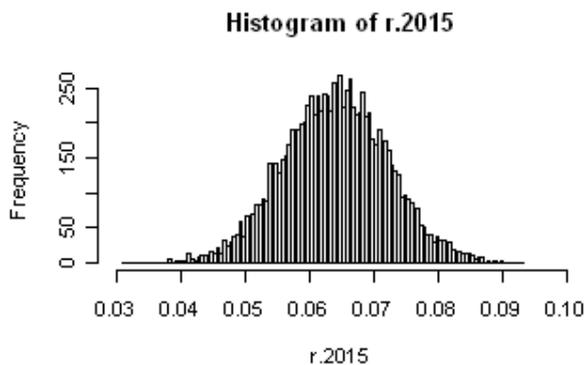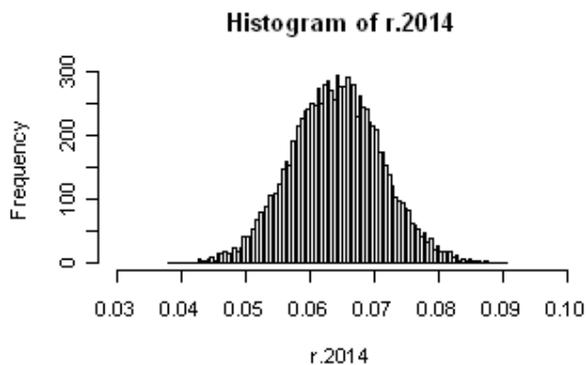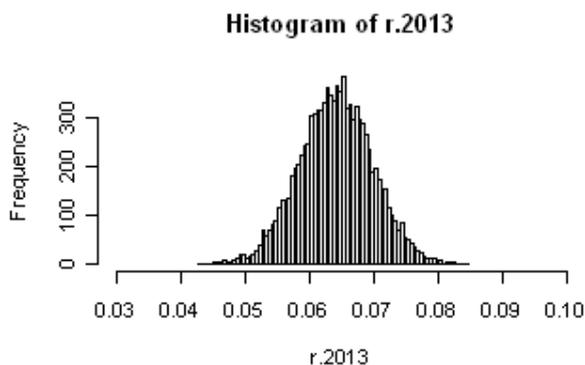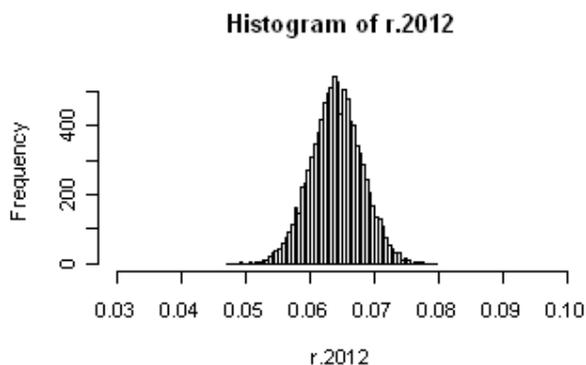
Permanent shocks

With permanent shocks, interest rates take more extreme value not experienced in the past. Notably, interest rates hit increasingly the zero bound while highest values go beyond 15%. However, values with the 50% probability seem plausible and those within the 95% interval could belong to some extreme, although less likely scenarios.

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Distribution of interest rates in euro

Temporary shocks

The distribution of interest rate in euro is widening more slowly than in forint as the debt is fully rolled over only after 10 years. Extreme values of the distribution are consistent with past observations and highly plausible.

Histogram of r.eu.2012

Histogram of r.eu.2013

Histogram of r.eu.2014
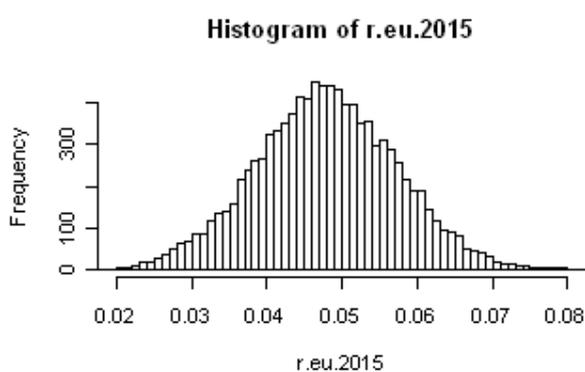
Histogram of r.eu.2015

Histogram of r.eu.2016
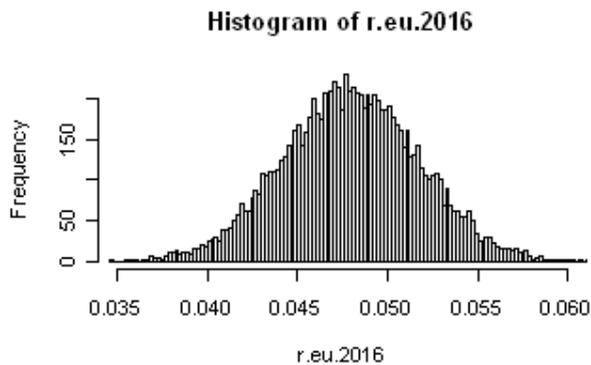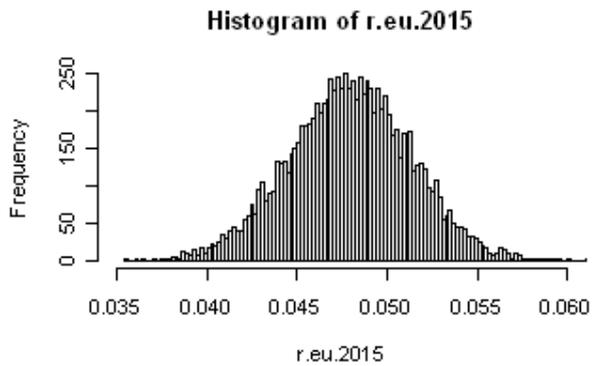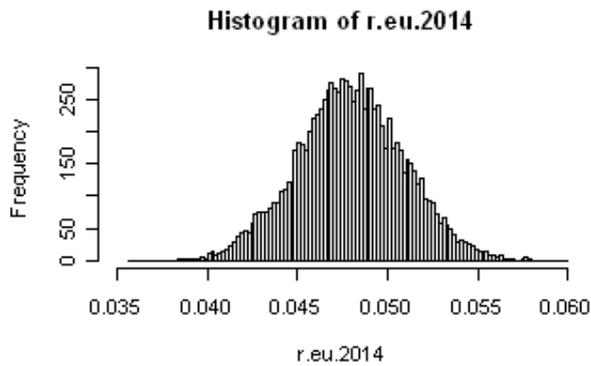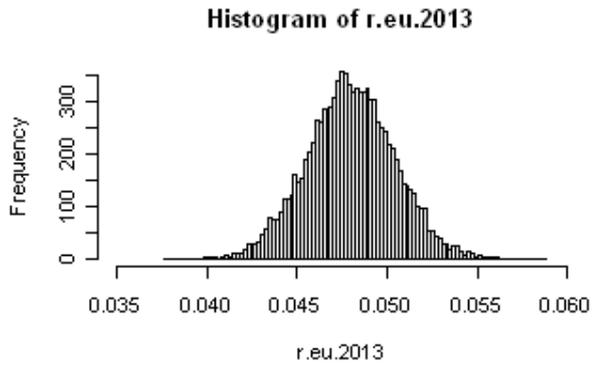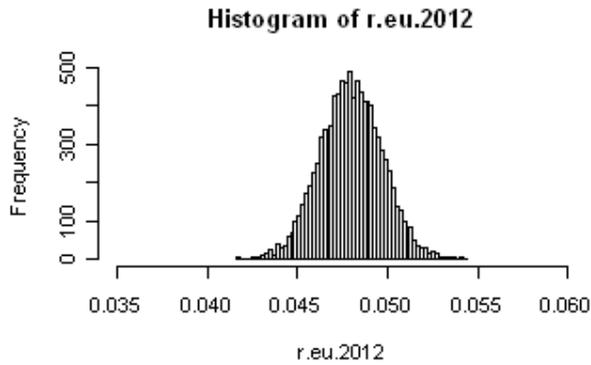
Permanent shocks

As for the forint, interest rates take more extreme value not experienced in the past in the permanent scenario. However, the zero bound is not hit as debt is rolled over more progressively and overall values within the 95% interval remain plausible.
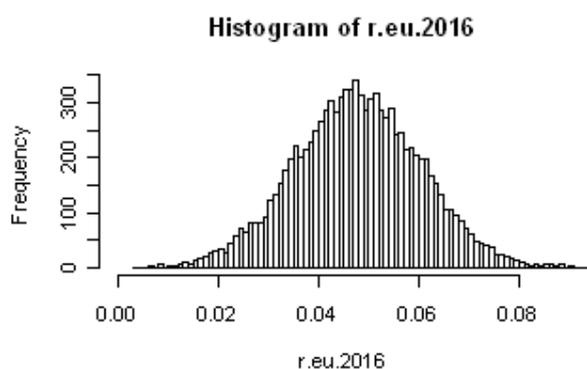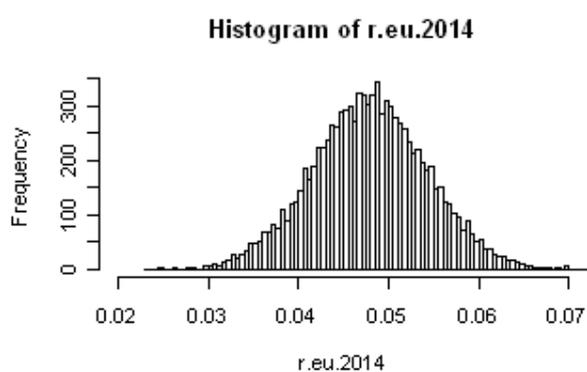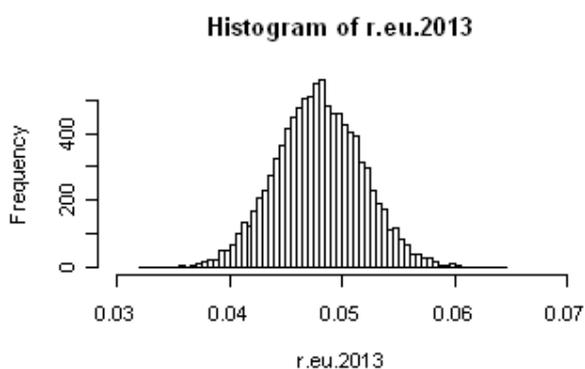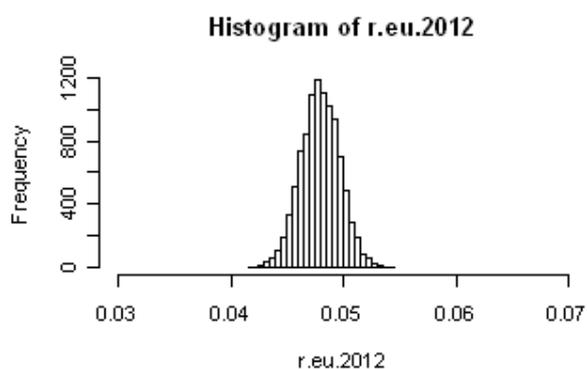
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