The safety trap – the financial market and macroeconomic consequences of the scarcity of safe assets*

Dániel Horváth – Róbert Szini

Despite near-zero interest rates set by large central banks and other steps towards monetary easing in recent years, the economic environment has been characterised by low inflation globally and deflationary fears in some regions, while real economic activity has remained moderate. Although symptoms of this phenomenon are similar to that of the liquidity trap, important differences may be identified, which suggests that other factors may be important as well. One of the new approaches to appear in the literature identifies the structural excess demand of safe assets as a background factor that was aggravated by cyclical effects in the crisis. The mechanism of the so-called safety trap is similar to that of the liquidity trap, but it can be observed among safe assets; therefore, it can be considered a special type of liquidity trap. Financial market tensions trigger an economic downturn and a deflationary spiral in both cases, but different types of monetary policy responses may be effective. While forward guidance may be effective in the case of a liquidity trap, certain quantitative easing policies may provide a solution in the case of a safety trap.

Journal of Economic Literature (JEL) Classification: G01, G15, E44, E52

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1 Introduction

Due to the recent economic crisis, financial market returns have stabilised at a permanently low level. This phenomenon and its possible consequences have received ample attention from decision-makers of economic policy, and several analyses published in

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The authors are staff members at the Magyar Nemzeti Bank. E-mail: horvathd@mnb.hu, szinir@mnb.hu.

the literature have used more innovative approaches than previously in order to better understand the processes. One of the proposed approaches was an in-depth study of the supply-and-demand factors related to safe assets. According to the safety trap model, increased demand for risk-free and safe financial assets ("safe assets") may result in substantial macro-economic effects in extreme cases, due to the scarcity of these assets. The phenomenon may be regarded as a special case of the well-known liquidity trap; it can be studied in a similar way, but there is a substantial difference in terms of its consequences and effective economic policy responses.

The return is so low in a liquidity trap situation that economic actors may become indifferent to holding cash versus holding other low-return investment assets.[1] Due to the ensuing low nominal interest rate, over time monetary policy will have limited options to ease monetary conditions by means of its classical toolkit, although this would be justified by the deflationary processes and the decline in real economic output. Due to the fall in risk appetite, the demand for safe assets is stronger in a safety trap scenario; therefore, their return will be close to zero. After reaching this limit, the equilibrium of the risk-free asset market can be restored by a fall in real economic activity, not the decrease in the interest rate.

Even though the consequences of the two cases are similar, there are important differences regarding their underlying cause and, hence, economic policy responses. According to theoretical results, forward guidance and commitment of the central bank may be effective in liquidity traps; however, the use of quantitative easing may prove more useful in safety traps. The situation is further complicated by the fact that the two trap situations may be simultaneously present in a crisis, and different effects may predominate during various phases of the crisis. Therefore, the effective economic policy responses may also vary over time.

We deal with the causes and consequences of the scarcity of safe assets in our article, covering both the theoretical and practical aspects and placing particular emphasis on monetary policy implications.

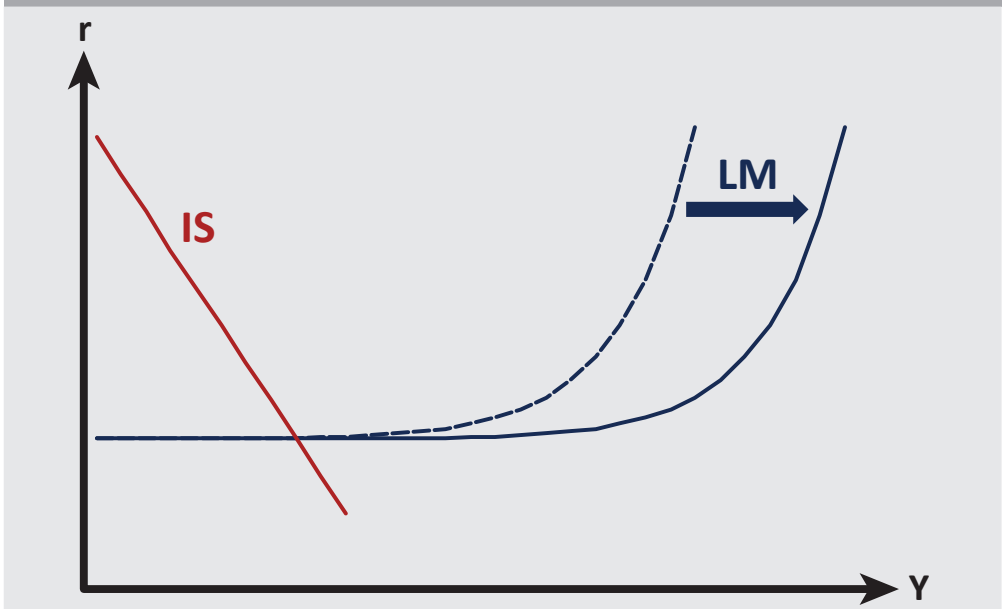
Section 2 of this article introduces the New-Keynesian Liquidity Trap as a reference. Section 3 deals with safe assets and the causes of their scarcity. Section 4 summarises the modelling attempts and conclusions to date in the literature. Section 5 presents in more detail the work of *Caballero et al. (2014)*, which may be regarded as the most developed model of the phenomenon. Section 6 summarises monetary policy and emerging market implications.

1 See Keynes (1965), p. 230.

2 Definition of liquidity trap

According to the original definition of *Keynes (1965)*, a liquidity trap is a situation in which interest rates fall to such low levels in a given economy that savers become indifferent to holding cash versus holding debt instruments. The theoretical background of the phenomenon is explained by the speculative money demand motive of Keynes's liquidity preference theory, according to which the demand for cash becomes infinitely elastic at a positive "lower limit" of cash demand (i.e. the excess liquidity injected into the economy will be fully held as cash savings, so it has no effect on the interest rate and real economic activity). In this case, the effectiveness of monetary policy drastically decreases in the sense that, through an increase in money supply, it becomes unable to substantially influence the prevailing interest rate in the economy. It is worth noting that such a situation may also arise in the case of a sudden change in the willingness of savers to hold cash, without the drop of the interest rate to zero, which may be mostly observed in times of crisis when investor confidence is seriously undermined.

Figure 1
Liquidity trap in the IS-LM model



Note: In the case of an equilibrium developing at the flat part of the LM curve, an increase in money supply will neither influence the interest rate nor the output.

Due to experiences gained in Japan and during the global crisis, the concept of a liquidity trap has been further developed over the past two decades, and it is now used in a slightly different sense than in the original definition of Keynes.[2] In current economic literature, the term is usually used in connection with the zero lower bound of the central bank's base rate. At the zero lower bound, monetary policy is no longer able to ease monetary conditions by means of conventional tools in spite of the fact that this would be justified by an environment characterised by low inflation (and/or recession). It should be stressed that, in contrast to the original approach, the cause of the problem in this case is not directly an increase in willingness to hold cash, but the zero lower bound of the short-term interest rate.

Although the definition and underlying reasons of the liquidity trap are different in the traditional and modern views, the two approaches are quite similar in terms of their consequences: the conventional instruments of monetary policy lose their effectiveness and interest rates become "stuck" at a low rate, while aggregate demand falls further and recession and deflationary processes worsen. An important difference, however, is that the two approaches of the liquidity trap call for different economic policy responses. According to the traditional approach, monetary policy loses its effectiveness in the case of a liquidity trap and only fiscal policy can stimulate the economy. In contrast, modern approaches recommend the use of unconventional central bank instruments, and most of these models focus on studying the effectiveness of the possible instruments.

The model for risk-free assets presented below is compared with one of the most popular, the New-Keynesian approach to the liquidity trap.[3] Based on the results of this school, any monetary policy instruments that increase the expected future wealth of savers stimulate the economy in a liquidity trap situation. This also includes forward guidance, which means higher future asset prices and higher inflation by "fixing" the low interest rate. Due to an increase in expected wealth, forward guidance shifts upward and through the lower real interest rate, flattening the intertemporal budget constraint and thus increasing present aggregate demand.

The New-Keynesian liquidity trap models generally come to opposite conclusions with regard to quantitative easing programmes. A major reason for this is that the asset purchases in themselves only result in a present increase in the monetary base, which, by definition, does not affect prices and the real economy in a liquidity trap situation. *Krugman (1998)* points out that, in the case of a "simple" quantitative easing, the market expects that monetary policy – according to its mandate – will endeavour to keep inflation low after escaping the liquidity trap, and therefore the future demand-increasing effect will not be present through expected inflation and asset prices, as in the case of forward guidance. Consequently, quantitative easing can only be effective in conjunction with

2 The work of Paul Krugman advanced the reinterpretation of the concept, based on the experiences gained in Japan (see Krugman, 1998). For further definition issues regarding the liquidity trap, see the articles by Rhodes (2011) or Koppány (2007).

3 See e.g. Eggertson et al. (2003); Werning (2012); or Cochrane (2013).

some commitment to an increased monetary base and maintenance of the low interest rate.[4] Overall, quantitative easing programmes in themselves do not influence aggregate demand, according to the New-Keynesian approach to the liquidity trap.[5]

The results related to forward guidance and quantitative easing are interesting for the purposes of this article because their effectiveness on liquidity traps and so-called safety traps will be compared later.

3 The scarcity of safe assets

The mainstream economic reasoning on liquidity traps makes the simplification that the economic actors may either be holding their savings in cash or in a given government bond investment. Concerning the possible investment forms, this is a limitation in regard to both maturity and risk.[6] However, many investments with different maturity and risks are available in reality, which may affect the practical relevance of the theoretical results related to liquidity traps. Experience has shown that it may be important to first and foremost take into account the risk dimension,[7] since the scarcity of safe assets and their macroeconomic importance has been identified by several authors in recent years.

3.1 What is a safe asset?

Before studying the scarcity of safe assets, it is worth briefly referring to issues of terminology and definition. In the literature dealing with this topic, these instruments are referred to as "safe assets", but this is an unusual name in Hungarian financial terminology. Even though the term "risk-free asset" may be used, this is problematic for different reasons. On one hand, the recent global crisis pointed out that, in contrast to models, "there are no real risk-free assets" in reality *(IMF, 2012)*; therefore, the term may be misleading. On the other hand, investors also face inflation risk in the case of US government bonds traditionally considered as risk-free,[8] and *Beckworth (2013)* demonstrates that the stock

4 According to Krugman, the monetary policy has to "credibly promise to be irresponsible".

5 For the purposes of our article, we can be satisfied with this statement referring to the general case; however, it is worth mentioning a recent result (see e.g. Woodford (2012). According to theoretical and empirical results, some targeted quantitative easing programmes focusing on submarkets may have an economic stimulus effect in liquidity traps as well.

6 For further problems of the typical approach to investment decisions in the mainstream economic thinking, see e.g. Hossein-zadeh, Ismael (2014).

7 For a broader overview of the risk factors prevailing in government bond returns, see Horváth et al. (2014).

8 The stock of Paperss indexed to inflation is very limited in the world, so it would not be practical to limit the term "safe asset" to only these Papers.

of government bonds held by foreign investors typically decreased in high inflationary periods (i.e. high inflation was actually regarded as a risk). In addition, it can also be noted that *Papers* considered to be risk-free signify a secure cash flow only if they are held until maturity; the investor runs an interest-rate risk in the case of a sale before the maturity date. On the basis of these considerations, the term "low-risk" will be used for the examined asset class in the Hungarian version of the article. In the English version, to remain in line with the literature, we refer to this asset class as "safe assets".

What is understood by safe assets is naturally a more important question than the name; however, there is no clear position on this set of assets in the literature:

- according to the strictest definition, only liquid and credit risk-free government bonds may be included in this group (see e.g. *M.C.K., 2012*);
- with regard to the potential use of *Papers*, those assets may be considered safe that function as a wealth accumulation asset, collateral and pricing benchmark, in addition to being regarded as safe assets by prudential regulation;
- from a modelling point of view, the practical definition is the one that regards those assets as safe assets whose value is independent from the state of the world (i.e. "information insensitive") (*Steffen, 2012*; *Gourinchas et al., 2012*);[9]
- based on a definition that focuses on subjectivity, safe assets are those that "investors would feel comfortable using as a store of value" *(Beckworth, 2011).*

Although the above definitions make possible both a narrow and broad interpretation of safe assets, the models and related results are based on information insensitivity and an absence of risks. This is not likely to represent a serious problem with regard to the practical relevance of conclusions presented later, but the differences in definitions is worth keeping in mind.

3.2 Demand and supply factors

Some studies examining the background of high current account deficit in the United States before the crisis have already dealt with the supply-and-demand imbalances of the safe asset market.[10] The emerging market crash in the 90s and the "dot-com bubble" that shocked the developed markets have generally been identified as background factors that, on one hand, contributed to increasing the appetite of investors for safe assets

9 From a modeling point of view, this approach may be useful because the present and future values of safe assets are the same in every state of the world. Therefore, in the case of a future shock, it is easier to establish a relationship between the present and future values of risky assets as well (see section 5 of this article for more detail).

10 See e.g. Caballero (2006); Caballero et al. (2006); Bernanke (2005; 2007).

and, on the other hand, resulted in a decrease in the number of assets considered to be safe. With regard to the crises, it can also be highlighted that, based on lessons learned, more and more emerging market central banks started to build higher foreign exchange reserves, which previously had almost exclusively been held in high-quality government bonds. In addition, certain commodity-exporting emerging countries had had significant current account surpluses due to booming exports and growing global market prices; through their sovereign[11] funds, these were partially invested in assets considered to be safe. The development of financial markets has also increased the demand for safe assets: some high-quality collateral was necessary for the implementation of increasingly complex financial transactions. In addition, the ageing societies of developed countries are requiring more and more forms of safe saving.

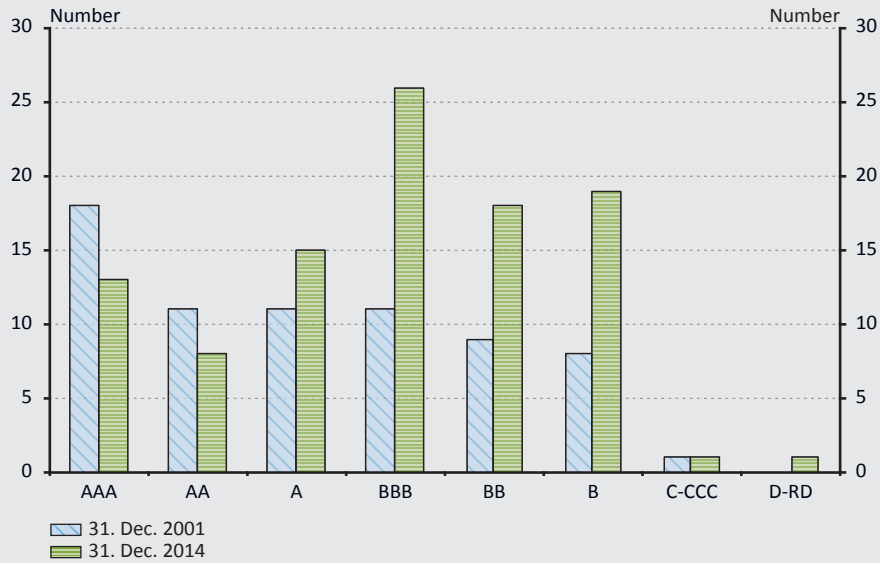
While there has been pressure on the demand side, the supply side has not been able to keep up with the need. Since there are a very limited number of assets in the emerging countries that may be considered risk-free, this increasing demand was mostly directed to the developed markets. This had two important consequences. On one hand, the yields on government bonds of certain developed countries – primarily the United States – have fallen to a very low level, which might have contributed to the development of risk-appetite and stock-exchange booms prior to the crisis. On the other hand, excess demand for safe assets created incentives for the private sector to generate such assets, which facilitated the development of instruments that create assets with higher ratings from risky ones (e.g. CDOs, MBSs). On this basis, it can be said that the excess demand for safe assets contributed to the development of global imbalances prior to the crisis and the subsequent spread of assets that were later proven to be toxic.

The consequences of the scarcity of safe assets were felt much more pronouncedly in the crisis (both in the phases of the subprime crisis and the sovereign crisis) and the subsequent period, so more and more research was published in the literature on this topic.[12] On the demand side, the effect of the deterioration of investor confidence has been of particular importance in the crisis. Supply has fallen on one hand due to sovereign downgrades and on the other hand by the market collapses of instruments created by the private sector. Due to these processes, the value of safe assets has significantly increased, while their returns have fallen close to zero.

11 Based on the aggregation of the SWF Institute, the assets held in sovereign funds exceeded USD 7,000 billion by the end of 2014.

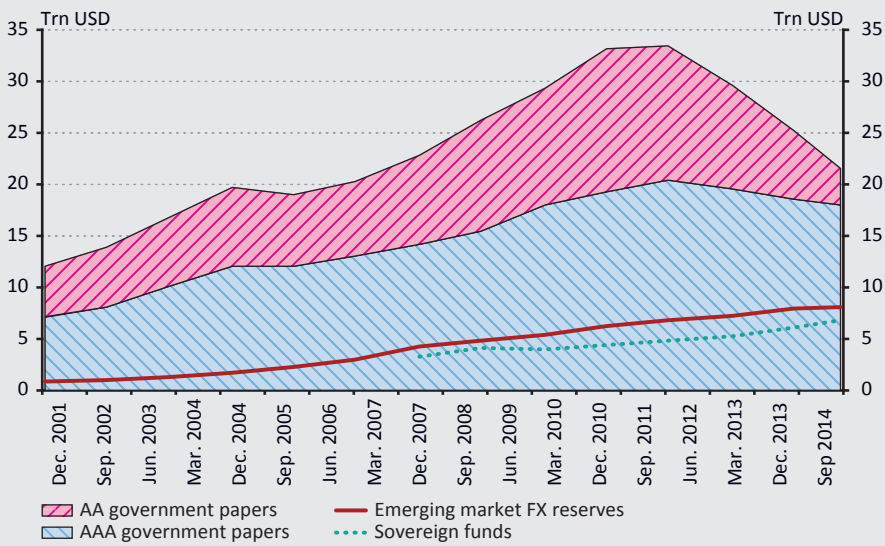
12 See e.g. Caballero (2010); Bernanke et al. (2011); IMF (2012); Gourinchas et al. (2012); Gorton et al. (2013); Aoki (2014).

Figure 2
The distribution of sovereign credit ratings



Note: Local currency credit ratings
Source: Fitch Ratings

Figure 3
The development of the global amount of highly rated sovereign *Papers* and the assets held in the foreign exchange reserves and sovereign funds of emerging countries



Note: Adjusted with purchases by Fed, BoE and BoJ
Source: Fitch Ratings, BIS, IMF COFER, SWF Institute

Figures 2 and *3* show how the quantity of highly rated sovereign debt decreased in absolute and relative terms and how demand through emerging market foreign exchange reserves and sovereign funds increased. Similar processes could also be observed in the case of safe assets of the private sector (e.g. MBS market*) (Bernanke et al., 2011*; *Gorton, 2010)*.

Although the tensions have somewhat eased after the most intense phase of the crisis (2008–2009), looking ahead factors can be identified on both the demand and supply sides that may act as incentives for the persistence of the problem.

Following the experience of the crisis, safe assets will likely continue to play a decisive role in portfolio and liquidity management with regard to demand, and their benchmark role may also remain strong, which is a factor that supports demand as well.[13] In addition, due to the tightening of the prudential regulatory environment (Basel III, Solvency II), increased demand may also be expected from banks and insurance companies. Similar to the period prior to the crisis, the development of financial markets may also bring an increase in demand due to margin requirements. It may also be highlighted that the OTC market structure had begun to be transformed into a central counterparty clearing (CCP) system, which also increased systemic margin requirements. The role of the asset purchase programmes of central banks introduced in the crisis and afterwards may also be mentioned here: the Fed and the Bank of England strive to maintain the quantity purchased, while the asset purchase programme of the Bank of Japan is currently still active, and the ECB announced an asset purchase programme of EUR 60 billion per month lasting until September 2016. All of these central bank purchases decrease the quantity of safe assets available on the market. It may also be highlighted in the case of the ECB programme that the German *Papers*, which are considered to be the safest, are purchased in the largest quantity due to the use of ECB capital keys.

With regard to the expected supply-side processes, it can first be said that, due to the already high debt levels of the developed countries, a substantial increase in the highly rated debt stock is not likely in the medium term, while there seems to be no serious chance that trust will be quickly restored in the sovereigns previously considered safe but subsequently downgraded in the crisis. As a response to the economic crisis, trust in instruments offered by the private sector has also vanished. The emerging countries continue to be able to contribute to the supply of safe assets only to a limited extent. However, on the supply side, the activities of central banks may support the markets; based on experience of the crisis, they contribute to maintaining market stability through their instruments, if necessary. The most important factors related to the supply and demand of safe assets are summarised in *Tables 1* and *2* (based on *IMF, 2012*).

13 A further interesting issue is the possible effect of excess demand for safe assets on the benchmark role of these assets. If the returns on assets considered safe in asset pricing models are low due to structural excess demand and not because of fundamental reasons, this fact might invalidate the conditions of the traditional asset pricing models (see e.g. Berlinger et al., 1999) and might theoretically contribute to the development of asset price bubbles (which presumably happened prior to the crisis).

Table 1
Summary table of demand factors related to safe assets

Source of demand	Investor type	Factor	Trend of factor
Portfolio management	Mutual funds	Role of safe assets in portfolio allocation and liquidity management	↑
	Insurance companies, Pension plans	Conservative investment policy	→
	Nonbank financial institutions	Low level of investor confidence	↑
Collateral for transactions	Banks and other financial intermediaries	Margin need of derivative transactions	↑
		Stricter rules for collateral management	↑
		Collateral need of repos	→
Regulation	Banks	Basel III	↑
		Higher risk-weight for downgraded sovereign papers	→
	Insurance companies	Solvency II	↑
Crisis management	Central banks	Asset purchase programs	↑
Benchmark role	Banks and other financial intermediaries	General demand for safe investments	→

Source: IMF (2012)

Overall, it can be said that the global scarcity of safe assets could also result from cyclical and structural factors. Although cyclical effects may have receded since the crisis, due to structural reasons, factors may dominate in the medium term to strengthen this phenomenon.

Table 2
Summary table of supply factors related to safe assets

Source of supply	Factor	Trend of factor
Developed sovereigns	Debt problems, downgrades	↓
Private sector	Low level of investor confidence after the crisis	↓
Central banks	Risk management tools in the crisis	↑
Emerging sovereigns	Limited ability to issue safe assets	→

Source: IMF (2012)

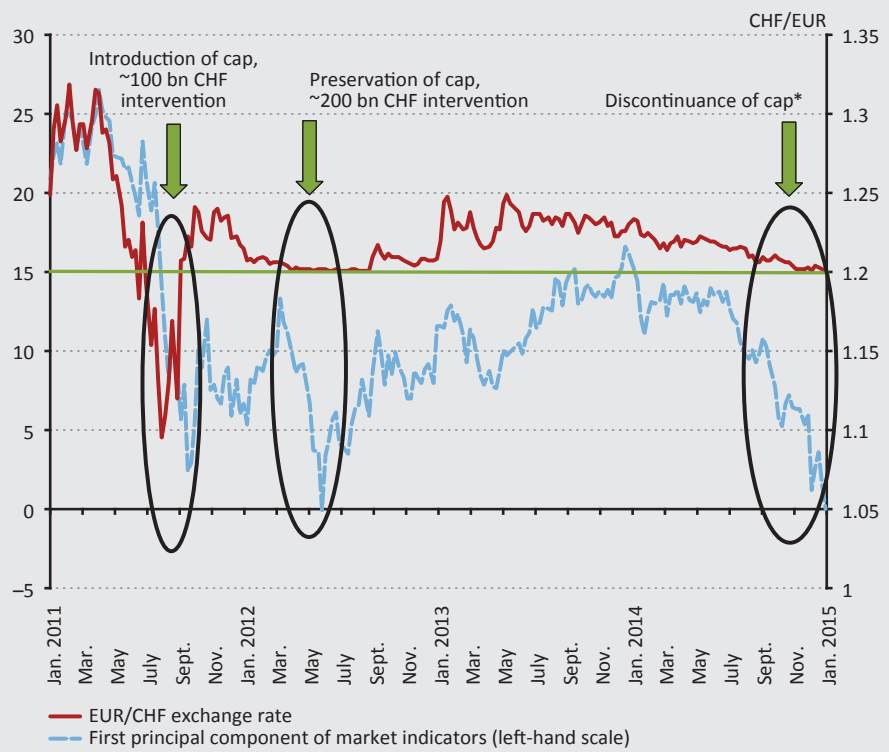
Box 1
Practical examples of the consequences of a scarcity of safe assets

In the box, two brief examples demonstrate the practical consequences of a scarcity of safe assets.

I. Pressure on the exchange-rate ceiling of the Swiss central bank

The Swiss franc is widely considered to be a safe-haven asset (i.e. a safe asset whose value generally appreciates in turbulent periods). In response to the fast appreciation of the franc, the Swiss central bank decided to establish an exchange-rate ceiling of 1.2 CHF/EUR in autumn 2011, which was necessitated by the substantial decrease in the global risk appetite. Subsequently, the exchange rate of the franc remained in the range of 1.2–1.25, and periodically "stuck" to the 1.2 rate. Even though the exchange rate of the Swiss franc as a risk indicator has thus essentially lost its previous information content, from the price

Figure 4
The euro/Swiss franc exchange rate and development of the principle component made up of market indicators



*Note: *No intervention data were available at the writing of this article.*
Source: Bloomberg, www.snb.ch, own calculation

dynamics of other safe-haven assets we may still be able to draw conclusions about the demand for safe assets. In this way, we can determine the possible pressure on the Swiss exchange rate ceiling at certain periods. Figure 4 shows the development of the principle component, calculated on the basis of the values of other safe-haven assets and certain market indicators,[14] which signals this pressure. Based on the development of the principle component highlighting the dynamics of the demand for safe assets, the demand on the Swiss franc market might have also been increasing since autumn 2014. The central bank lifted the exchange rate ceiling in January 2015. Based on the first opinions of market analysts, the ensuing appreciation of the franc decreased the growth outlook of the Swiss economy and increased deflationary risks.

This case may be interpreted as a consequence of structural and cyclical global excess demand for safe assets, and it highlights the possible negative macro-economic effects of the phenomenon.

II. The role of US government bonds

We can summarise the consequences of a scarcity of safe assets and risk-free market perception related to US government bonds based on the thoughts of *Robert Jenkins,* one of the managers of the Bank of England:[15]

1. Due to the present environment of extremely low returns, the government of the United States can secure very cheap financing, which may temporarily obscure the problems related to the long-term sustainability of the budget and delay necessary structural reforms. A 1 percentage-point rise in the interest rate would mean an annual expenditure growth of USD 160 billion. The normalisation of returns, compared to the average of pre-crisis returns, would mean an annual additional expenditure of USD 500 billion in the United States (which is equivalent to 3 percent of GDP).

2. There is a significant foreign demand for US Papers because of the role of the dollar as a reserve currency, the perception that US government bonds are risk-free, and global excess demand for safe assets. Therefore, almost half of the outstanding stock is held by foreign actors, which is an excessively high value among the developed countries and might limit the financial independence of the United States.

3. As a result of the quantitative easing programmes focusing on the long-term government bond segment, as well as so-called "operation twist" operations aimed at increasing the balance sheet of the central bank, the stock held by foreigners has substantially decreased in recent years. Due to this, the interest-rate exposure of foreign market participants has decreased, perhaps making them more willing to sell their US Papers at the start of yield normalisation, which might make returns and the exchange rate of the dollar more volatile.

14 The first principle component is calculated on the basis of the 10-year euro and dollar returns, the euro/dollar exchange rate, the value of gold, the VIX index and the weekly changes of the EMBI Global spread, which may be interpreted as a composite global risk indicator (the lower levels indicate a decrease in the risk appetite).

15 Jenkins (2013)

4. The global pricing of pension assets of around USD 20 thousand billion, assets held in investments funds in the value of USD 60 thousand billion and derivative assets of USD 600 thousand billion is directly or indirectly connected to the yields developing in the US government debt market. Therefore, any bias has multiple effects on global processes, and any wavering of faith in risk-free US Papers would have unforeseeable consequences.
5. In recent years, following the 2011 downgrading of the United States, as well as the risks arising from the aforementioned factors, more and more investors have revised their investment strategies. This has resulted in a higher reliance on internal or external rating-weighted indices, instead of market capitalisation-based indices as benchmarks. Beyond the government bond market of the United States, this may negatively influence other large borrowers as well (see, for instance, Italy, which has a large government bond market but "only" a BBB credit rating).

4 Modelling opportunities

The literature examines and presents several approaches and modelling opportunities, among which we would like to highlight the results of *Gourinchas et al. (2012)*. In their article, these authors look for an answer to the question of how a possible future scarcity of safe financial assets (i.e. a shortage of assets) would affect the financial stability of the world. The authors underline the timeliness of the topic and question, since they argue that in the case of an economic shock, only these assets would be able to provide sufficient security for economic actors. Since in addition to being stable in value these assets also cover financial transactions, they fulfil the prudential requirements of the financial intermediary system, as well as fill the pricing benchmark function of financial instruments. Hence, their possible absence would significantly increase the instability of the financial system. The authors find the answer to the question asked in their article in a new type of modelling framework: they study financial bubbles, with the help of which the supply level of safe financial instruments can be temporarily increased. Nevertheless, the financial bubble studied by the authors cannot be a perfect substitute, since, during its evaluation, it must be assumed that its future value is stable. Namely, if some uncertainty later arose with regard to its value, this would further worsen the problem of supply shortage. Therefore, the scarcity of safe assets entails a risk that financial bubbles might appear, since this can temporarily mitigate the phenomenon. Based on the results obtained, the authors draw attention to the fact that safe financial assets should be definitively defined by competent and consistent authorities in prudential regulation, since the private sector has a high moral hazard.

In this article, *Agarwal (2012)* studied the role of the central bank in the case of excess demand of safe assets. The study was also conducted within a modelling framework,

due to which it was concluded that the role of the central bank in avoiding the supply shortage in question is outstanding if the amount of safe financial instruments that can be issued by the government is limited (i.e. it cannot be increased above a certain level since the central bank can directly influence the amount of risk-free assets held by the market participants through the use of its instruments). The other key finding of the study is that the amount of safe financial instruments serving a long-term preservation of value significantly determines the willingness of market participants to buy risky assets as well. This means that the risk premium expected for holding risky assets will be lower if safe financial instruments are present in greater proportion in the portfolios of market participants.

The article of *Aoki et al. (2014)* offers a specific suggestion for solving the phenomenon of supply shortage discussed in our article. In the modelling framework that serves as the basis for the study, the economy is hit by a negative shock, due to which the supply of safe assets is increased. The supply shortage can be avoided in two ways: by decreasing the real interest rate and thereby the demand for safe assets, or by providing adequate supply to meet excess demand. The "safe asset bubble"[16] approach suggested by *Aoki et al. (2014)* provides a solution to the latter; the approach would create excess supply, fulfilling demand and thereby ensuring a consistent level of consumption of market participants over several periods, in spite of the negative economic shock. Based on the model described by the authors, the bubbles clearly lower economic growth, since market participants will invest capital in the bubbles in place of risky assets (i.e. the overall price for slower economic growth is to ensure a consistent level of consumption over several periods). The authors also studied the use of bubbles from the aspect of social welfare, and they came to the conclusion that the level of overall social welfare[17] was in every case higher with bubbles than without them. Nevertheless, the authors of the article draw attention to the fact that, in addition to the welfare-enhancing effect of bubbles, the value of bubbles depends on the subjective assessment of investors. Therefore, they can never be safe or risk-free. Consequently, a pressing problem can only be handled in the short term through the use of bubbles, and hence it is an absolute necessity to take further measures that can ensure the supply of safe assets at an adequate level, so that market participants can effectively protect themselves against economic shocks.

16 Risk-free assets or assets regarded/identified as low-risk assets.

17 Social welfare decreases with the fall of economic growth, but increases with an increase in consumption and the smoothing out of the consumption level over several periods. Based on the model of the authors, the positive effect caused by the latter two changes to welfare exceeds the negative welfare effect caused by the slowdown in economic growth.

5 The model

In the following, we review the model of *Caballero et al. (2014)*, which describes the equilibrium of the safe financial asset market, with particular regard to a scenario in which a scarcity of safe financial assets, together with a sudden increase in demand, may cause significant macro-economic effects.

5.1 Equilibrium

Let us assume that the actual level of output of a given economy (further denoted by X) may be influenced by two different types of economic shock:[18] a positive shock, which increases the output μ^+-times (i.e. above the original level ($\mu^+X > X$)) and a negative shock, which decreases the output μ^--times (i.e. below the original level ($\mu^-X < X$)). Let us further assume that, out of the two shocks, only one shock can take place (i.e. after each shock, the new output level is constant in the long run).

Assuming an overlapping generation (OLG) structure, the birth and death rates of the agents are further denoted by ϑ; furthermore, we assume that the agents only consume at the moment of their death.[19] Based on the previous conditions and denotations, the aggregate consumption function can be written for time t as $C_t = \vartheta W_t$, where W_t is the aggregate wealth pertaining to time t, which is owned by the individual agents. In the case of market equilibrium, we consume as much as we produce ($X = C$) so that, on the basis of the aggregate consumption function, the following relationship is obtained for wealth in equilibrium at every time t:

$$W = \frac{X}{\theta}.$$

The model of *Caballero et al. (2014)* distinguishes between two types of market actors. The risk-neutral agents hold both risk-free[20] and risky assets in their portfolio, while the risk-averse agents[21] only like to hold the former type of assets. Let us further assume

18 For the purposes of modelling the economic shocks, the authors use Poisson processes with different intensity parameters (λ^+, λ^-), but they assume that these parameters belong to 0 in order to be able to study the model within a simpler framework ($\lambda^+ \to 0$, $\lambda^- \to 0$). The simplifying assumption can be used for managing the potential macro-economic effects of the increased demand for risk-free assets; the assumption is only lifted in the study of forward guidance belonging to the unconventional instruments of the central bank, the result of which will be addressed later.

19 In addition to the overlapping generation structure, theoretical simplification takes place so that the simple aggregate consumption function can be defined later.

20 Since the model is based on the information insensitivity of safe assets, we are dealing with risk-free assets in the description of the model.

21 The risk-averse market participants are infinitely risk-averse (i.e. they develop their portfolios at time interval t and $t + dt$ as if the economic shock would take place with probability 1 in the next infinitely small time interval).

that the fraction of risk-neutral agents is $1 - \alpha$ in the total population, while the fraction of risk-averse agents is α, and the total wealth is distributed among these two types of agents in every time t (i.e. $W_t^k + W_t^s = W_t$, where index k denotes risk-averse agents and index s denotes risk-neutral ones).

From the supply side, let us further assume that δX part of the total output is accumulated in the form of wealth at every time t (in the form of dividends), while its $(1 - \delta)X$ part will be allocated between new agents and agents remaining in the market. Prior to the economic shock, the total accumulated wealth and total market value of assets must be equal in the equilibrium, as follows:

$$V = W = \frac{X}{\theta} .$$

Furthermore, we assume that only a fraction ρ of the total assets is risk-free, and we note that the total value of the assets is the same as the sum of the values of the risky and risk-free components (i.e. $V = V^m + V^r$, where index m denotes risk-free assets and index r denotes risky assets). From the above, we can write down the supply of risk-free financial assets after a potential negative economic shock:

$$V^m = \rho\mu^- \frac{X}{\theta} .$$

Since by definition the value of risk-free assets does not change in the case of a negative shock, the present supply of risky assets can be defined by the use of the relationship $V - V^m$

$$V^r = \left(1 - \rho\mu^-\right)\frac{X}{\theta} .$$

Since we have already indicated when introducing the agents that the risk-averse agents only hold risk-free assets in their portfolios, their total wealth cannot be higher than the total market value of risk-free assets (i.e. $W_t^k \le V^m$).

We need to introduce three more variables in order to be able to write down the equation determining the market equilibrium. Hereafter, let r denote the rate on risky assets, r^m denote the rate on risk-free assets and δ^m denote the dividends paid by produced and issued risk-free assets. The equation system describing the market equilibrium is the following, according to *Caballero et al. (2014)*:

$$\begin{aligned}
&r^m V^m = \delta^m X \\
&rV^r = \left(\delta - \delta^m\right)X \\
&W_t^k = -\theta W_t^k + \alpha\left(1-\delta\right)X + r^m W_t^k \\
&W_t^s = -\theta W_t^s + \left(1-\alpha\right)\left(1-\delta\right)X + rW_t^s \\
&W_t^k + W_t^s = V^m + V^r
\end{aligned}$$

In terms of this model, *Caballero et al. (2014)* distinguish between two different cases, based on whether condition $W_t^k \leq V^m$ is met in the form of an inequality (i.e. it is not binding) or in the form of an equality (i.e. a binding condition). If the condition is not binding, then the risk-neutral agents will also possess a certain share of the risk-free assets, which can be fulfilled only if the rates on both types of assets are the same:

$$r = r^m = \delta\theta .$$

Therefore, the relevant case to be analysed is the one in which the inequality is fulfilled as a binding condition $\left(W^k = V^m\right)$. The safety trap scenario, which is the main topic of our article, may appear in such a market environment. Based on the previously described relationships, we are able to calculate the scarcity condition of the risk-free financial assets by means of appropriate algebraic transformations:[22]

$$\alpha > \rho\mu^- .$$

For the sake of analysing the safety trap scenario, we henceforth assume that the above condition is not met and therefore the supply of risk-free financial assets is determined by the severity of the negative shock $\left(\mu^-\right)$ and the ability of the economy to create risk-free assets $\left(\rho\right)$. Their demand is determined by the level of α which, based on the condition in question, is higher than the supply. If $r^m < \delta\theta < r$ there is a positive risk premium $\left(r - r^m > 0\right)$ in the model.

5.2 The safety trap scenario

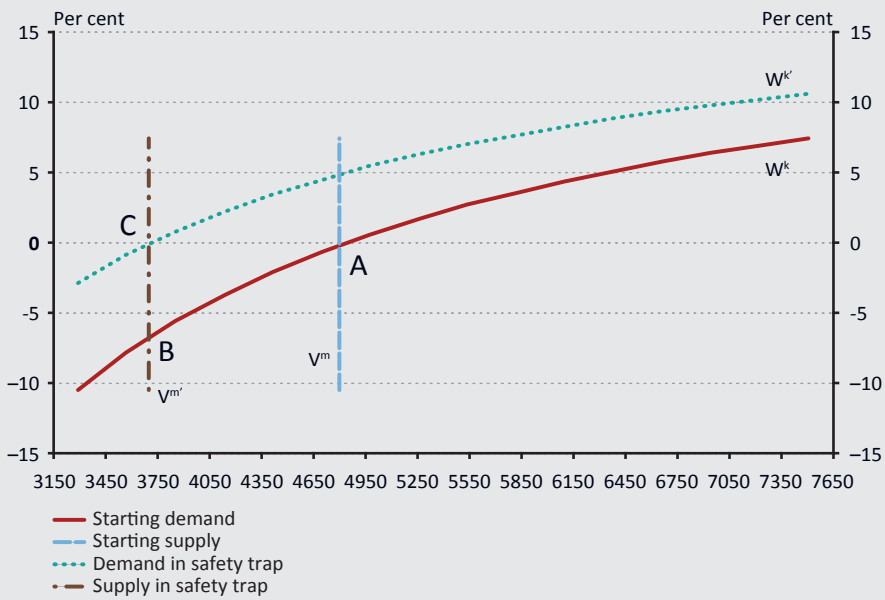
Based on the scarcity condition described above, if the severity of the negative economic shock increases (μ^- decreases) or the ability of the economy to create risk-free assets decreases (ρ decreases), the supply of these assets falls and simultaneously the demand for these assets grows (ρ increases). The demand will decrease to enable the risk-free financial asset market to reach equilibrium again, which may take place through a reduction in the risk-free interest rate $\left(r^m\right)$. But what happens if the risk-free interest rate cannot be negative (i.e., the $r^m \geq 0$ bound prevails)?

For the purposes of studying the above case, we introduce parameter ξ, which shows us how the actual level of output is related to the potential level of output. That is, if $\xi < 1$, then the actual level of output ξX is under the potential level of output. The aforementioned $\left(1-\delta\right)X$ (i.e. the output divided between the new market participants and the participants remaining on the market), as well as ξX, (i.e. the dividends paid) are reinterpreted in the following way: the former is the amount of produced goods,

22 The interested reader can find the specific deduction in the article of Caballero et al. (2014).

while the latter is the amount required for the "re-production" of labour used in the next period. Then, if $\xi < 1$, less input will be used in production. With regard to the market participants and the initial condition according to which the market participants only consume when they die, we can state that those leaving market demand have produced goods (for consumption purposes) and supply assets required for the "re-production" of labour, while the new entrants and participants remaining in the market supply produce goods and demand assets. The development of the safety trap scenario in the environment presented above can be illustrated by the following graph:

Figure 5
The supply and demand of safe assets in a safety trap



Source: Own calculation

In the above graph, curve V^m indicates r^m, (i.e. the rate on risk-free financial assets at a given supply level), while W^k indicates rate r^m at a given supply level. The intersection of the two curves indicates the rate of risk-free returns developing in equilibrium.[23] Assuming that the negative shock described in the previous chapter takes place so that the supply for risk-free financial assets decreases (i.e. the vertical line V^m shifts left in the above graph, which is denoted by $V^{m'}$). Then, in a situation characterised by interest rate r^m and decreasing supply, excess demand for risk-free assets develops and the wealth of risk-

23 This is indicated by point A in the graph.

averse agents relatively increases, since the new interest rate[24] corresponding to the new supply level would be lower in equilibrium than the current value. This means that in order to reach equilibrium again, the actual interest rate should be appropriately reduced, by means of which demand and the total wealth of risk-averse agents fall. Nevertheless, the pre-condition for the development of a safety trap scenario is the existence of a lower bound for interest rates, the percent of which is 0, as described above. The above graph shows the conditions for developing a safety trap scenario. The interest rate of risk-free assets was 0 in equilibrium prior to the shock, which, due to the bound applied, cannot fulfil the negative interest rate condition required for reaching a new equilibrium corresponding to decreasing supply after the shock. Therefore, the question arises, how can a new equilibrium be reached in the market by keeping the interest rate at the original 0 percent?

Since the interest rate cannot be reduced in order to reach a new equilibrium after the shock, the demand and the wealth of the risk-averse agents may only be decreased by a recession. The effect of the recession is indicated by the previously described parameter ξ in the model, which also reduces the actual level of output. Based on lower supply and lower demand after the shock, the new equilibrium[25] is determined by the following equation:

$$\frac{\alpha\left(1-\delta\right)\xi X}{\theta - r^{m}} = \rho\mu^{-}\frac{X}{\theta}\,.$$

As we can observe in *Figure 5*, the new equilibrium is reached at a lower level of demand and supply by such a recession effect (parameter ξ) that the equilibrium interest rate still remains at 0. That is, the recession reduces excess demand for risk-free assets in such a way that supply is not modified, thereby ensuring the development of a new equilibrium.

However, a recession not only affects risk-averse agents, but risk-neutral ones as well. They also hold risky assets, in addition to risk-free financial assets, through which their accumulated wealth is reduced (as outlined above). Following a potential recession, the dividends from risky assets will definitely decrease (i.e. the value of r parameter decreases), thereby reducing the value of risky assets, which further decreases the wealth accumulated by risk-neutral market participants. This further reduces market demand for assets, further deepening the recession. It should be noted that the accumulated wealth of risk-averse market participants is the same in both potential outcomes (i.e. it is not dependent on whether the new equilibrium is reached by an open decrease in r^{m} or through a recession). At the same time, due to the decrease in the value of risky assets, the wealth situation of risk-neutral market participants will be worse during a recession than if r^{m} were free to reduce.

24 The lower rate required for establishing equilibrium is indicated by point B in the graph.

25 This is indicated by point C in the graph.

6 Monetary policy and emerging market implications

In the following, based on the model *Caballero et al. (2014)*, we present two instruments belonging to the collection of possible methods of the central bank that may be suitable for solving the safety trap scenario; we also address aspects of the emerging market.

6.1 Effectiveness of forward guidance

Forward guidance means the public commitment of the central bank to the long-term maintenance of loose monetary conditions (i.e. according to the communication of the central bank, monetary conditions will not be immediately tightened even if the inflation target remains above the level considered desirable for a while).[26] Based on the results, if the cause of the current low interest rate is a scarcity of safe assets, forward guidance will not be effective.

In order to study the effectiveness of forward guidance, let us assume that every condition of the safety trap scenario – the main topic of our article and what was described in the previous section – is fulfilled (i.e. the economy was hit by a negative shock, condition r^m=0 is fulfilled and a new equilibrium was reached by recession, which is represented by condition $\xi < 1$ in the model). We assume that as part of forward guidance, the central bank communicates to market participants that, after the recovery of the economy,[27] the interest rate r^m will be kept at a low level for a while. The economic recovery will be taken into account by the Poisson shock mentioned at the introduction of this model, which has a positive intensity[28] in this case, where $\mu^+ X > X$. Let us first consider the case where the safety trap situation is followed by a recession and the central bank uses forward guidance, but a positive shock does not take place. Then the supply of risk-free assets still remains at a lower level[29] and, due to the recession, the supply of risky assets will also be at a lower level than the original one:

$$V^m = \rho\mu^- \frac{X}{\theta}$$
$$V^r = \left(\xi - \rho\mu^-\right)\frac{X}{\theta} .$$

26 Bihari (2013); Ábel et al. (2014).

27 As described by mathematical tools, we assume that the economy recovers at time *t,* then the central bank fixes the interest rate of risk-free financial assets at level it for period $t + T$, where $it < \delta\vartheta$ and where $\delta\vartheta$ is the natural interest rate used in the introduction of the model. Following period $t + T$, the relevant interest rate is fixed again at level $\delta\vartheta$.

28 $\lambda^+ > 0$

29 The level corresponding to the curve shifted to the left in the graph used in the introduction of the model.

Since the central bank has already used forward guidance, its effect is integrated into the return achievable on risky assets, which consists of lower dividends on one hand and, on the other, the amount of wealth accumulated in a given period. This is expressed by the following formula:

$$rV^r = \xi\delta X + \lambda^+\left(\mu^+ - \xi\right)\frac{X}{\theta}\,.$$

These three equations determine the r return on risky assets. If our result obtained for the supply of risky assets is used in the latter context, we obtain the following relationship for the return on risky assets:

$$r = \frac{\xi\delta\theta + \lambda^+\left(\mu^+ - \xi\right)}{\xi - \rho\mu^-}\,.$$

Note that the parameters of positive shock are only present in the equation of the risky interest rates level, so the use of forward guidance has only one effect before the economic recovery: the return on risky assets will be higher. Therefore, the supply for the risk-free assets and the risky assets will not change, compared to the situation in a recession; furthermore, the wealth (demand) of risk-averse agents will also not change and, due to equilibrium, the returns on risky assets will rise to such an extent that the wealth (demand) of risk-neutral participants will also remain the same. In light of this, it is clear that if economic recovery (i.e. the positive Poisson shock takes place), the supply (value) of risky assets will permanently grow, which will enhance the wealth of the risk-neutral market participants.

Overall, the forward guidance instrument proves to be ineffective in managing the safety trap phenomenon in this model because it keeps the supply for risk-free financial assets at the same level (i.e. it does not increase their output). This is also true for the risky assets if the promise of the central bank has already been made but economic growth has not yet begun. On the whole, the only effect of forward guidance is an increase in the risky interest rate *r.*

6.2 Effectiveness of quantitative easing

Quantitative easing belonging to the unconventional central bank instruments should be treated together with the introduction of government instruments. It must be noted that the quantitative and qualitative easing distinguished in the literature have different effects on the central bank balance sheet (i.e. quantitative easing leaves the proportion of asset categories unchanged, while the balance sheet total as a whole rises); meanwhile, qualitative easing leaves the balance sheet total unchanged and there will be more risky assets in the portfolio. The instrument described below is a quantitative and qualitative

easing.[30] First, the public debt and the tax rate imposed by the government must be defined. Let τ^+ denote the tax rate after a positive economic shock, τ^- denote the tax rate after a negative shock and τ denote the tax rate before a negative shock. Based on the fiscal capacity of the state,[31] $\tau^+<\tau^-$, since, due to the economic shock, a lower level of tax revenue is expected, which is also sufficient to finance public debt. Based on our previous denotations, the public debt level after a negative shock is defined as:

$$D=\tau^-\mu^-\frac{X}{\theta}.$$

Since by definition we can assume that the fiscal constraints are stricter after a negative economic shock than after a positive shock, parameter τ^- can be used as a measure of the fiscal capacity of the government, which characterises its ability to raise tax rates. Let us further assume that there is a safety trap situation (i.e. the economy was hit by a negative shock), the demand for risk-free financial assets has increased, the rate of risk-free return is 0 (i.e. it cannot be further decreased), and the money market equilibrium is restored by the recession ($\xi<1$) described in the previous sections.

In the above situation, the government may raise the supply for risk-free financial assets at the expense of short-term public debt, the level of which is the function of the previously mentioned fiscal capacity, which is measured in the level of tax rate τ^-. Consequently, the higher the fiscal capacity, the more capable the government is to raise the supply for risk-free financial assets at the expense of short-term public debt, thereby reducing the risk premium.[32] Based on our previous calculations, if the level of public debt increases from level *D* to level *D'*, then the lower output level of the recession also increases, namely from level ξX to level $\xi' X$, where

$$\xi'=\frac{D'}{D}\xi>\xi.$$

So that the state can also finance the public debt level *D'*, it must have suitable fiscal capacity (i.e. it must set a suitable tax rate level):

$$\tau'^-=\frac{D'}{D}\tau^->\tau^-.$$

On the basis of the above, we can conclude that the government has a comparative advantage over the private sector in the issuance of risk-free assets and, therefore, if its fiscal capacity allows, it can efficiently manage the safety trap phenomenon.

But what happens if the government has no possibility of raising tax revenues and thus increasing the supply of risk-free assets at the expense of public debt? In this case, quantitative easing may also prove an effective solution to the safety trap phenomenon.

30 Central banks such as the Japanese central bank often use the two presented methods together in a combined way (Shirai, 2014).

31 In the sense of how long it is able to finance public debt in a negative economic environment.

32 In accordance with our previous denotations: $r–r^k\geq 0$. The specific deduction can be found in Caballero et al. (2014).

In this framework, the state purchases risky assets (through the central bank), while by higher public debt issuance it releases risk-free assets into the system (i.e. it increases demand for them). It is important to underline that this does not apply to the government bond purchase programmes of the central bank, but to the purchase programmes for risky assets (e.g. the QE1 programme of the Fed or the central bank operations related to the "lender of last resort" function). The state does not spend the resources originating from an excess government bond issuance, but invests them in riskier assets through the central bank; hence, this solution does not strain its fiscal capacity. This mechanism works well in this model but naturally the situation is a lot more complicated in practice: the closer link between public finances and the central bank's outturn, the alignment of strategies and credibility are pre-requisites.

Based on our previous denotations, level D of public debt and level τ of the tax rate are considered to be constant; namely, we assume that the government does not have enough fiscal capacity, such that, on the whole, the return r^k of risk-free assets increases due to the quantitative easing of the central bank, and the return r of risky assets decreases so the risk premium decreases as well.

On the basis of the above, we can conclude that government instruments may be effective in managing the safety trap phenomenon if fiscal capacity allows it, but if this is not the case, the objective pursued may be achieved with the help of quantitative easing.

6.3 Comparison of liquidity trap and safety trap

We have already mentioned that only those central bank instruments that increase the expected future wealth of savers are effective in the New-Keynesian liquidity trap. In contrast, only those assets that increase the amount of safe assets (or what is equivalent to it in the model: the wealth of risk-averse participants) may be effective in a safety trap.

Forward guidance increased present aggregate demand by moving the intertemporal budget constraint in a liquidity trap. Since based on our model this only affects the return on risky assets and not the supply of safe assets, forward guidance may prove ineffective in managing the situation in a safety trap.

According to the New-Keynesian approach, quantitative easing is ineffective in a liquidity trap because it increases money supply in the present (which does not lead to stimulus in a liquidity trap), while it does not represent any commitment for the future. In contrast, the special type of quantitative easing studied in relation to the model (government bond issuance in addition to the purchase of risky assets) may be effective in a safety trap since it increases the supply of safe assets.

6.4 The situation of emerging markets

Emerging-market financial instruments are traditionally not considered as safe assets; therefore, models mostly developed for developed markets and related conclusions in the literature are not necessarily directly applicable to a study focusing on emerging markets. The following is a brief summary of the most important effects of the scarcity of safe assets on the emerging markets.

The safety trap model can also be used in the case of a small and open emerging economy. It may be assumed that there is some bias among the market participants towards the domestic assets ("home bias"), because of which emerging-market domestic government bonds – the domestic assets with the lowest risk – are treated like quasi-risk-free assets. However, in this case, the lower bound of the interest rate is not 0, but the global risk-free interest rate plus a positive risk premium. This means that a safety trap may be more easily established by the increase in the risk premium since the lower bound of the interest rate is higher. On the other hand, it should also be pointed out that the asset market equilibrium is not necessarily restored by a recession. If the domestic economic actors may freely purchase safe assets (with a positive return that is lower than the domestic one) abroad, then they can satisfy their demand in such a way. This means that a safety trap does not necessarily mean a recession in emerging markets, but it may cause developing financial market imbalances.

Let us assume that first we use the model for describing only developed market processes, and then we also take into account the emerging markets. Let us consider the three parameters of the scarcity condition ($\alpha > \rho\mu^{-}$) gained from the model. From the point of view of the model, emerging market assets are risky assets (i.e. ρ is low). Experience has shown that this country group is more sensitive to global crises, so the recession parameter μ^{-} may be also lower. Thus, taking account of the emerging markets results in a lower value on the right side of the scarcity condition. It is difficult to make strong statements regarding the proportion of risk-averse market participants (α). Due to foreign exchange reserves being higher than before, as well as large sovereign funds and the increasing demand of the population, there is a high demand for safe assets in these countries as well; on the other hand, due to the lower level of financial integration, demand for these assets may be lower than in the case of the developed markets. Overall, it can be said that emerging-market demand may worsen the scarcity of safe assets at a global level and, due to the low proportion of domestic risk-free assets, the model predicts capital outflow from the emerging markets, which may cause imbalances.

The model may assist us in studying the effects of unconventional central bank policies of developed countries on emerging markets. As we have seen, the special case of quantitative easing results in an increase of risk-free returns, a decrease of returns on risky assets, and higher output. In the case of emerging-market government bonds that are mostly considered risky, this means a reduction in returns, as well as a higher export

due to increasing demand in the emerging markets. In the case of forward guidance, we concluded that it does not help in recovery from a safety trap; it only increases the return on risky assets. Therefore, this central bank instrument has no effect on developed markets but results in an increase in returns in emerging markets. This may help in reducing emerging market imbalances; however, it presumably worsens the recession since it results in the tightening of monetary conditions.

Caballero (2006) draws attention to another important emerging-market phenomenon: the low global interest rate level caused by a scarcity of safe assets is in contrast with the return on certain emerging-market investments. In this respect, investments in real estate may be highlighted. This provides incentives for the development of emerging-market asset price bubbles, which increases macroeconomic volatility and worsens the effects of crises. This effect was reflected in the spread of foreign currency lending in Hungary. *Caballero et al. (2005)* make an interesting monetary policy assumption in this respect. They conclude that due to this effect, a re-definition of the inflation target could be considered in certain circumstances. Specifically, they recommend decreasing the weight of inflation of tradeable assets in the inflation target, because this mitigates the expectations of economic actors that the central bank will react to changes in the exchange rate, thereby reducing speculative motives and the likelihood of creating asset price bubbles.

7 Conclusion

The low inflationary environment and restrained economic activity visible at a global level during the crisis and in recent years may only be partially explained by the liquidity trap phenomenon. However, there are indications that the structural and cyclical scarcity of safe assets may have also contributed to the problem. The mechanism of the so-called safety trap is similar to that of the liquidity trap, but it can be observed among safe assets, and therefore it can be considered as a special case of the liquidity trap. From the demand side, changes in prudential regulation, financial innovations, the spread of collateralised financial transactions and increasing emerging-market demands may have all contributed to the phenomenon. Parallel to this on the supply side, neither developed nor emerging countries nor the private sector can sufficiently increase the issuance of safe assets. Based on the model presented here, a safety trap may cause an economic downturn and deflationary spiral in the same way as a liquidity trap. However, various monetary policy responses may be practical in the two cases. While forward guidance may be effective in the case of a liquidity trap, certain quantitative easing policies may provide a solution in the case of a safety trap. The study of the phenomenon is also relevant from an emerging-market point of view: on one hand, it may contribute to the development of imbalances and bubbles; on the other hand, it sheds new light on the emerging-market effects of the steps of developed central banks.

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