DOI: 10.52950/ES.2022.11.1.007

# APPLICATION OF DSTI AND DTI MACROPRUDENTIAL POLICY LIMITS TO THE MORTGAGE MARKET IN THE CZECH REPUBLIC FOR THE YEAR 2022

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## Abstract:

This paper deals with selected instruments of macroprudential policy, the determinant of which is the amount of the monthly net income of the mortgage applicant. In November 2021, Czech National Bank reintroduced maximum DSTI as debt service indicators and DTI as income indicators with the view to the progress of real estate market in the Czech Republic. The paper discusses which of the limits will be more decisive for mortgage applicants in the conditions of rising mortgage interest rates in 2022 after the repeated increase in the base rate by the Czech National Bank. We will find out for which interest rate the DSTI or DTI is more important and which of the limits will be entirely irrelevant for almost all mortgage applicants in 2022, even with regard to age according to the legal conditions.

## Keywords:

Macroprudential policy, debt service to income, debt to income, loan to value, mortgage loans, real estate, Czech National Bank

**JEL Classification:** E58, G21

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## Citation:

ONDŘEJ VENHODA (2022). Application of DSTI and DTI macroprudential policy limits to the mortgage market in the Czech Republic for the year 2022. International Journal of Economic Sciences, Vol. XI(1), pp. 105-116., 10.52950/ES.2022.11.1.007

## Introduction

In November 2021, Czech National Bank (further CNB) included additional instruments (or tightened existing ones) within its macroprudential policy, which should mitigate the growing risks associated with credit growth and rising real estate prices. The goal of discussed instruments is to reduce excessive risks related to the mortgage market because, in September 2021, its year-on-year growth rate was well above the long-term average (CNB 2021a). It was due mainly to growth in new consumer credit secured by residential property. (CNB 2021a). The instruments aim at prudent conduct and lending to banks and other credit companies

The macroprudential policy has gained importance, especially after the financial crisis of 2008 - 2009 and central banks have been paying close attention to it since then. Instruments are focused primarily on the real estate market and mortgage financing. The text will deal with measures aimed at the debtor (or "at the level of the debtor"). This paper analyzes the role of instruments for the Czech mortgage market, focusing on the DSTI and DTI instruments (we can call them "income limits") and their impact on the mortgage market in the context of the expected change of interest rates in 2022. We will discuss which instruments (or whether DSTI and DTI as well) will be decisive in 2022 for a mortgage loan approval. We will not analyze the impact of LTV as an income-independent indicator if we do not take into account the source of the mortgage advance solely as the accumulation of past income. On the other hand, in describing the limits of macroprudential policy and its development, it is important to mention the changes in LTV as the basic and most widespread tool.

## Literature review

The beginnings of macroprudential policy instruments date back to the early 1990s (Alam 2019). The first country to introduce some macroprudential policy limits in Europe was Latvia in 2007 (CNB 2020). The use of multiple tools at once reduces the possibility of circumvention by clients and increases the effectiveness of macroprudential policy (Lim 2011). At the same time, according to this study, they complement each other because LTV addresses the wealth aspect and DTI the income aspect of the same client. Macroprudential policy is more targeted than monetary policy (ibid). Some instruments prove to be more effective than others (in relation to property price progress), including strict loan to value and debt to income ratios (Carreras 2018). The study in the French market (Dietsch 2014) recommends the need to consider domestic specifics before introducing strict credit standards. The limits are not universally transferable without examining local conditions in the real estate or mortgage market. According to this research, clients who approach 33 % DSTI and 95 % LTV are riskier; in particular, borrowers in the highest LTV or DSTI ratios are not those who generate the highest level of credit risk portfolio, as these are typologically people with high above-standard income or wealth, where the probability of default is low.

Regarding the situation in the Czech Republic, we can mention that in the last years, there was a significant change in the Czech real estate market and the possibility of owner-occupied housing, mainly due to low interest rates enabling rising real estate prices (Čermáková 2022). However, the era of low rates is already gone in 2022, as the CNB has significantly raised rates to anchor inflation expectations, cooled down aggregate demand, and reduced inflation imports due to the global negative supply shock (Hromada 2021a). At the base of study on the Korean market (Igan 2011), transaction activity in the real estate market is already declining during the first three months after the tightening of LTV or DTI limits, the dynamics of growth in real estate prices respond with a decrease with a delay of another few months. Given the high real estate prices and increased rates, support for the supply of rental housing by the state on how to address the unavailability of housing in the Czech Republic may also be an effective strategy for the future (Hromada 2021b).

## Evidence of DSTI and DTI in the Czech Republic and European countries

As mentioned above, macroprudential instruments are being introduced as the standard part of nowadays macroprudential policy in Europe. However, regulations, methodologies, and instruments differ across countries. For example, if we look at the Euro area countries of the instruments we have selected, the most frequently used instrument is LTV, followed by DSTI and DTI is the least used (CNB 2020, ECB 2021). Somewhere instead of DTI is used LTI (loan to value), which monitors only the ratio of a given loan to income, not all loans including those that the loan applicant already has. LTV ranks other sources as the most used tool (Alam 2019). Another possible tool is regulating the longest possible loan repayment period, which also implies other indicators such as DSTI. The last change in the macroprudential policy limits was made in the Czech Republic at the end of November 2021. The currently valid legal setting of the CNB is as follows: (CNB 2021a):

LTV (loan to value; loan amount against collateral value - estimated value of real estate): decreasing of upper limit to 80 % (90 % for applicants under 36 years);

DSTI (debt service to income; what can be the total monthly loan repayment): newly 45 % (50 % for applicants under 36 years) of monthly net income;

DTI (debt to income; what is the maximum loan amount in multiples of net annual income): newly 8,5 x (9,5 x for applicants under 36 years).

A 5% volume exemption may be applied to the above rules according to the volume of the previous quarter. Changes are valid from 1 April 2022, but it was recommended to use it as soon as possible (CNB 2021a).

We can show the difference of the instruments in comparison with other countries, e.g. Slovakia has an LTV limit of 90 % (but max 20 % of volume over 80 % LTV), DSTI limit higher (60 %) and DTI limit lower – 8 x (NBOS 2022). Although the parameters seem to be similar at first glance, each country responds to changes in the real estate or mortgage markets independently, and its macroprudential policy is influenced by the central bank's interest rate settings. In reality, setting limits is most likely a combination of modeling and expertise, which is very similar to the bank board's decision to change or keep existing interest rates.

## Progress of DSTI and DTI in the Czech Republic

The following table shows implementation or changes of limits from 2015 when the first instrument (LTV) as the CNB recommendation was introduced (it is important not only how low or high the individual limits are but also their form, i.e. whether they are enforced law).

**Figure 1: Major changes by effective day**

| date | changes |
|---|---|
| *16.06.2015* | LTV max. 100 % (max. 10 % volume of loans with LTV > 90 %) |
| *01.10.2016* | LTV max. 95 % (max. 10 % LTV 85 - 95 %) |
| *01.04.2017* | LTV max. 90 % (max. 15 % LTV 80 - 90 %) |
| *01.10.2018* | **DSTI** 45 % (max. 5 % DSTI > 45 %), **DTI** 9 (max. 5 % DTI > 9) |
| *01.04.2020* | LTV max 90 % (max. 5 % LTV > 90 %), **DSTI** 50 % (max. 5 % DSTI > 50 %), **DTI** cancelled |
| *08.07.2020* | **DSTI** cancelled |
| *01.04.2022* | LTV, **DSTI, DTI** new limits *(page 3)* |

*Source: Author's own figure based on CNB 2021b*

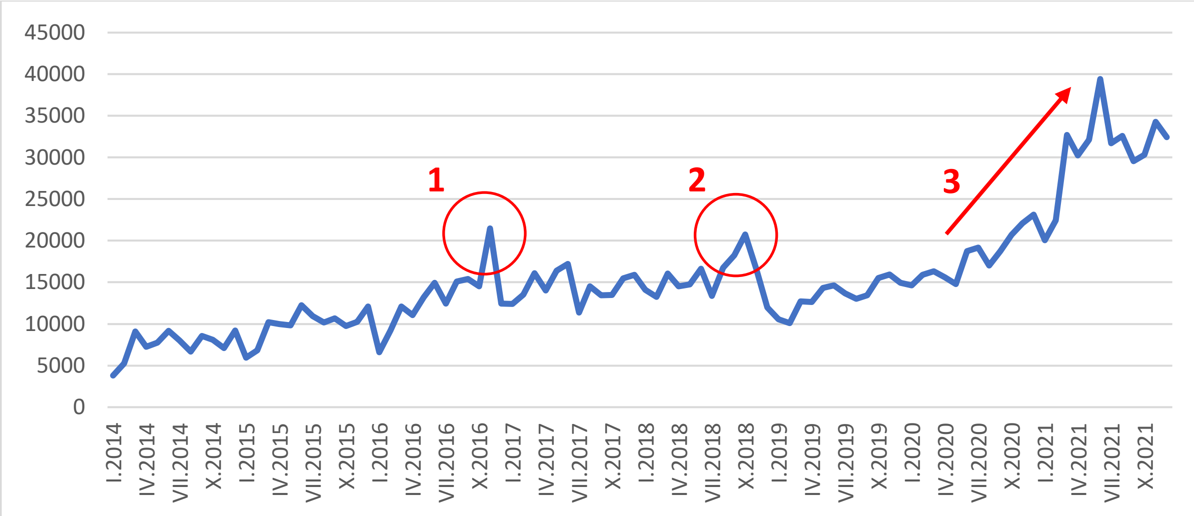
The first recommendation was to set the LTV limit. Its purpose was to prevent a situation in which, given falling real estate prices, the previous ratio of the bank's collateral to the loan would fall after the previous growth on the Czech market. Rising real estate prices and the prospect of further growth increased the demand for mortgage loans, which at that time became more accessible to a broader group of clients due to relatively low interest rates and rising household incomes. However, these additional clients, often with volatile income, also included potential repayment problems at a time of worse economic progress and higher rates. Therefore, recommendations started with regulation only LTV limits (generally most used instrument). After that, DSTI and DTI limits were introduced in 2018 and subsequently phased out in 2020 in response to the covid-19 situation and from the CNB's point of view need to release conditions in the mortgage market. In April 2022, we will return to similar levels of DSTI, DTI, and LTV as in the period before the covid; a complete novelty is the milder limits for younger mortgage applicants. The LTV and DTI limits are the strictest in history, while the DSTI limit is lower than before the reduction in April 2020 (keep this simple comparison in mind for analysis in the following chapters).

## The volume of mortgages provided

The interest rate is a vital determinant of the volume of mortgages provided. The role of macroprudential policy limits was indicated above. Now, let's look at whether changes in interest rates or macroprudential policy limits do not significantly affect the mortgage market. Following figure shows the monthly volume of new mortgage loans excluding refinancing in 8 years from January 2014 to December 2021. We set the beginning of the period as the last year without LTV type recommendations. A fundamental change is the form change from a guidance to a legal measure.

**Figure 2: Volume of new mortgage loans including extencion (in millions CZK)**




*Source: Author's own figure based on data from CNB ARAD Database*

At first glance, there are three trend fluctuations, which are shown in red on the graph:

1. On 14 June 2016, CNB announced that from 1 October 2016 will be recommendation for LTV only 95 % instead of 100 %, and from 1 April 2017 even 90 % (see Figure 1). You can see the peak of the volume of new mortgages provided at the moment of tightening the CNB's recommendations.[1] The monthly volume increased by 62 % from May 2016 to November 2016 and in January 2017 was lower by 6 % compared to May 2016, which was the last month before CNB's announcement. The frontloading of mortgages had a short-term effect on the volume of mortgages provided and the expected tightening of the CNB's monetary policy and preparations for raising interest rates after the end of the EUR/CZK exchange rate commitment. As a result, mortgage interest rates had the bottom in December 2016 (see the Figure 3).

2. We can observe another apparent trend deviation at the end of 2018. On 12 June 2018, CNB issued recommendations on indicators DSTI and DTI not applied so far (see Figure 1). The frontloading effect is visible again in monthly volume increase by 41 % from May 2018 to October 2018 and even more visible in the decline of almost half in just two months. The monthly volume of new mortgages provided in October 2018 was again exceeded in more than two years. The main difference compared to 2016 was that this time we were not close to the local bottom of mortgage interest rates (see Figure 3), but on the contrary, in the growing trend, which peaked at the beginning of 2019. From this point of view, we can state that the effect of the CNB's new recommendations was fully reflected here and mortgages frontloading was not as strongly correlated with the expected interest rate movements as in 2016. The following chapters will discuss and estimate whether the frontloading could have been more DSTI-based or DTI-based (or similar).[2]

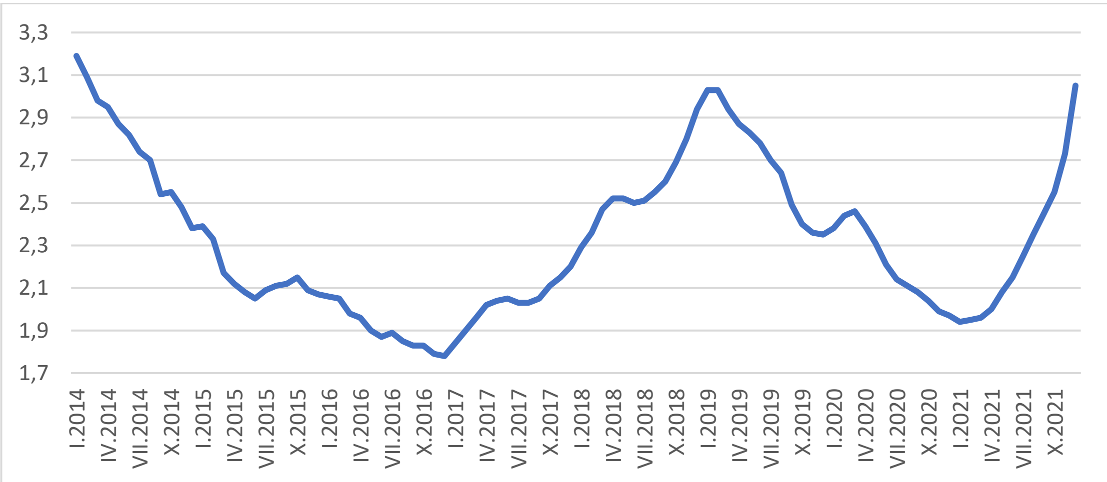
[1] We have take into account some delay from fixing the interest rate, approving the mortgage to finalizing the entire loan process, which is not a matter of days.
[2] There was no change of LTV limit.

3. In 2020, regarding the situation around covid-19 CNB relaxed the recommendation on limits for assessing new mortgages, first by cancelling the DTI limit, increasing the LTV and DSTI limits and then canceling the DSTI recommendations (see Figure 1). Interest rates continued their downward trend (see Figure 3). The expansive monetary policy was already reflected in the year-on-year growth in the volume of new mortgages by 34 % in 2020; in 2021, the growth rate accelerated significantly with the growth of 128 % compared to 2019. The driving force was the expected tightening of monetary policy, which responded to rising inflationary pressures after the acute problems associated with the covid-19. The reintroduction of the DSTI and DTI limits and the increase of the LTV limit (this time no longer as a recommendation but as a binding rule according to the amendment to the CNB act) did not affect the record volumes of mortgages provided.

As we can see in the aforementioned Figure 3, the correlation between the interest rate and the volume of new mortgages provided is not clear in the monitored period[3], despite the assumption that interest rate is a key determinant of the volume of mortgages provided. Although we see two local interest rate bottoms, the volume of mortgages provided is clearly growing despite the temporary stagnation in the period under review.

**Figure 3:** Average interest rate (% p.a.) of new mortgage loans, including extensions of loans (excluding building societies)




*Source: Author's own figure based on data from CNB ARAD Database*

In December 2021, the interest rate on mortgages jumped above 3 % p.a. After a short episode from the turn of 2018-19, average rates will remain there for a more extended period. Let us not forget that the CNB's 100 bps rate increase in December and 75 bps in February is not yet fully included in December rates. In addition, some December mortgages could still be negotiated at the rates agreed before the November increase of 125 bps. In the first half of 2022, we will see an upward trend in interest rates that will reach above 4 % p.a. Whoever ends the mortgage fixation in 2022, especially after the rate increase, must prepare for the increased interest costs of the mortgage, but does not have to deal with the implementation of DSTI or DTI indicators. But what will this mean for applicants for a new mortgage or refinancing? Will this be another major hurdle to approving a mortgage loan?

[3] I realize that a period of 8 years may not be enough to find a closer correlation

## Application of DSTI a DTI limits in 2021 - 2022

Now let's look at the limits of DSTI and DTI from the practical point of view. For which clients will cut off be the criterion for granting a mortgage? From this point of view, will DSTI or DTI be the prevailing limit? And what is the dependence on the nominal interest rate? We will now consider the maximum DSTI and DTI limits at different income levels at the December 2021 and January 2022[4] average rate. First, based on various net incomes (determined arbitrarily, it is not essential for analysis), we look at the maximum limits of the sum of all loan product repayments (DSTI) and the full amount of mortgage that can be achieved (DTI).

**Figure 4:** Maximum DSTI and DTI on the different level of monthly net income

| net income | max. DSTI | max. DTI |
|---|---|---|
| 25000 | 11250 | 2550000 |
| 50000 | 22500 | 5100000 |
| 75000 | 33750 | 7650000 |

*Source: Author's own calculations, in CZK*

The intuitive conclusion we can confirm is that as the income of the morgant applicant (or applicants) increases, the maximum debt service indicator and the income indicator and the probability of approving the mortgage application increase. We will extend the analysis to include the nominal interest rate effect and use the average new mortgage rate of December 2021 in Figure 3 for a client over 36 years of age. The last assumption is the standard maximum provided mortgage maturity which is 30 years for banks in the Czech Republic. Longer maturities are exceptional.

**Figure 5:** DSTI and DTI at maximum limits at the average new mortgage rate of December 2021 (3,05 % p.a.)[5]

| net income | max. DSTI | DTI | max. DTI | DSTI |
|---|---|---|---|---|
| 25000 | 11250 | 2651000 | 2550000 | 10820 |
| 50000 | 22500 | 5303000 | 5100000 | 21640 |
| 75000 | 33750 | 7954000 | 7650000 | 32459 |

*Source: Author's own calculations, in CZK*

Let's look at two different situations. First, when the maximum possible DSTI limit - for all considered income levels - the DTI limit has always exceeded the statutory maximum (see Figure 4). An applicant with a net income of CZK 25000 per month at a mortgage loan rate of 3,05 % p.a. in the absence of other loan installments, it may have a monthly installment of CZK 11250, but at this installment, it already exceeds the income indicator, which would reach the value of 8,84; thus 0,34 more than the allowable limit. For the remaining modeled incomes, the result is the same - DTI limit exceeded. In the second variant - the maximum DTI limit - the debt service indicator does not disqualify the applicant in all cases. For example, for a client with an income of 50000 CZK, the DSTI is 860 CZK lower than the upper limit of the installment. With increasing income, the "repayment cushion "increases and does not entirely disappear at any income level. In general, we can say that the applicant did not have to follow the DSTI

[4] Two last months; in January 3,47 % p.a. for new morgages loans including extensions of loans according to CNB ARAD Database

[5] All calculations are rounded to thousands of CZK.

indicator at the average interest rate in December 2021. The cut-off criterion for the application was only the DTI indicator.[6] We will perform precisely the same calculation on the average January rates.

**Figure 6:** DSTI and DTI at maximum limits at the average new mortgage rate of January 2022 (3,47 % p.a.)

| net income | max. DSTI | DTI | max. DTI | DSTI |
|---|---|---|---|---|
| 25000 | 11250 | 2515000 | 2550000 | 11860 |
| 50000 | 22500 | 5029000 | 5100000 | 22816 |
| 75000 | 33750 | 7544000 | 7650000 | 34224 |

*Source: Author's own calculations, in CZK*

We consider the same two situations as in the previous case, but we come to different results. In the first case, with a monthly income of CZK 75000, the maximum possible installment is CZK 33750 and the income indicator is CZK 7544000, which is following the max. DTI limit (8,38 vs. 8,5). This applies equally to the remaining income under consideration. In the second variant with maximum DTI limits, we encounter a problem with the DSTI limit. A client with an income of CZK 50000 could borrow up to CZK 5100000, but with this mortgage, the monthly installment is CZK 22816, which exceeds the specified debt service ratio by 316 CZK and the mortgage will not be able to be provided under standard conditions. As the income at the DSTI limit increases, the distance from the DTI limit also increases proportionally.

When we compared the model situations in December 2021 and January 2022, we come to the opposite conclusions - the DTI limit was important in the first month, the DSTI limit in the following month (and the DTI limit was no longer a cut off criterion as DSTI was not in December 2021). Within a single month, the attention of mortgage applicants shifted from DTI to DSTI, although we have not to forget that the month-on-month growth in the average interest rate on new mortgages was the highest in our period between December 2021 and January 2022. The newly set CNB terms from the end of November 2021 necessarily had to take this change into account in the very short term, given their macroeconomic forecast, the next bank board meeting in December 2021 and the completion of older mortgage applications at lower rates.

## Breakthrough mortgage interest rate indicators

We know that the break-even interest rate from the DTI to the DSTI indicator is somewhere between the interest rate measured in December 2021 and January of the following year. We calculate at what rate both indicators are equivalent, i.e. it is not true that one is relevant for the approval of a mortgage loan and the other irrelevant under otherwise the same conditions. The calculation is shown in Figure 7, which shows the rate for the maximum limits of both indicators simultaneously.

[6] In reality such an explicit decision did not have to be done, the limits were in the recommended regime and a volume exception was possible.

**Figure 7:** Equivalent influence of DSTI and DTI on mortgage approval

| net income | int. rate (% p.a.) |
|---|---|
| 25000 | 3,36 |
| 50000 | 3,36 |
| 75000 | 3,36 |

*Source: Author's own calculations, in CZK*

For all modeled incomes, the calculated rate is rounded to two decimal places 3,36 %, which corresponds to our premise that it will be somewhere between the above-mentioned average monthly rates. We will call it "the equilibrium rate of the DSTI and DTI limits. "The general conclusion is that any rate below 3,36 % means that the applicant (or bank) only monitors the DTI indicator under the given conditions (the DSTI limit is irrelevant), above the 3,36 % rate it only monitors the DSTI limit. It cannot happen that at a rate higher than the above-mentioned equilibrium, the cut-off criterion is the DTI mortgage limit. The higher the nominal interest rate, the more important the DSTI and the more important the DTI decreases (we consider positive rates). In the simplified formula, we can present:

*The determining income limit is DTI → 3,36 % p.a. → The determining income limit is DSTI*

When the CNB relaxed the conditions for obtaining a mortgage in April 2020 (see Figure 1), the first possible step was to abolish the DTI, as the interest rate on new mortgages was below 2,5 % (see Figure 3). It did not make sense to cancel the DSTI limit first while keeping the DTI limit unchanged. At the time, "the equilibrium rate of the DSTI and DTI limits "was 2,91 % because of the higher standard limit of DTI.

For applicants under the age of 36, the situation regarding the cut-off criteria is slightly more favorable, as the maximum limits are higher. Nevertheless, we perform calculations according to the same procedure as for clients older than 36 years.

**Figure 8:** Maximum DSTI and DTI on the different levels of monthly net income for a client under age 36

| net income | max. DSTI | max. DTI |
|---|---|---|
| 25000 | 12500 | 2850000 |
| 50000 | 25000 | 5700000 |
| 75000 | 37500 | 8550000 |

*Source: Author's own calculations, in CZK*

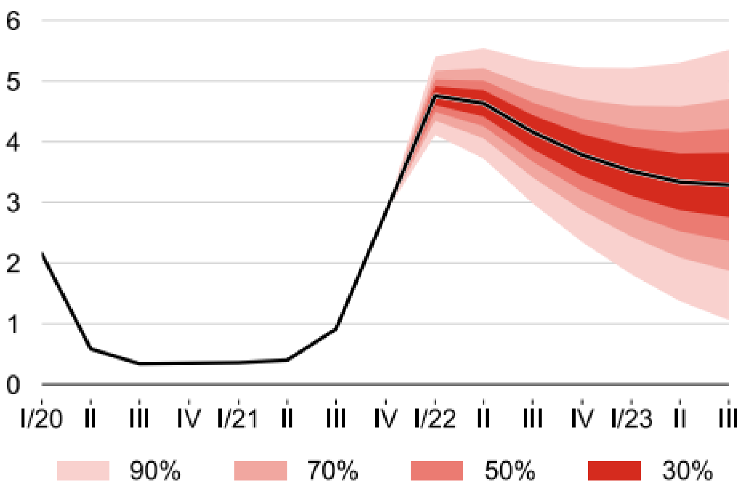
A client under the age of 36 with a net monthly income of CZK 25000 has a higher upper limit for the monthly mortgage payment by 1250 CZK and the possible credit limit is CZK 300000 higher than a client over the age of 36 (compare with Figure 4). Under our assumption of income independence from the limits - there is no income limit below which one or the other cut-off indicator would be a criterion such as the interest rate - we conclude that "the equilibrium rate of the DSTI and DTI limits "is lower - based on calculations rounded there is the rate 3,31 % p.a. The difference is not significant because both limits are increased in roughly the same ratio and its inequality is obviously due to the fact that the limits are rounded. It would probably be challenging to explain why the DSTI limit is not set at 50 %, but perhaps at 48,5 %.

## Progress of mortgage rates in terms of DSTI and DTI in the Czech Rep. in 2022

The development of short-term interest rates according to the CNB forecast in 2022 can be seen in Figure 9. Although the movement in mortgage interest rates is far from proportional to the change in short-term interest rates directly influenced by the central bank, short-term monetary policy expectations provide a good indication market. The chart shows that in 1Q 2022 it's expected to move around the peak of rates and their subsequent reduction in the following quarters of the year.

**Figure 9:** 3M PRIBOR in %, confidence interval on the monetary policy horizon




*Source: CNB 2022*

The model above does not fully include the geopolitical influence in Ukraine for 2022, which results in a weakening of the CZK against both the EUR and the USD in particular, which under otherwise identical conditions puts pressure on further monetary tightening (or continuing tightening) and delays reduction of the CNB base interest rate. Let's not forget again that the average interest rate on new mortgages from January 2022 still does not fully include the rate increases from December 2021 and February 2022 (a total of 175 bps at the 2W repo rate), a possible further increase already at the March meeting of the bank board, delays between reservations, rate approval and the provision of a mortgage loan itself. Under this assumption, it prolongs the determining effect of the DSTI before the DTI on mortgage approvals and delays the repayment (this time from above) to "the equilibrium rate of the DSTI and DTI limits. "

## Conclusion

DSTI, DTI and LTV instruments are now commonly used in macroprudential policy in many (not only) european countries. They regulate the entry of applicants into the mortgage market and the possible volume of provided mortgages according to the set criteria. The DSTI indicator depends on the nominal interest rate (or more precisely mortgage interest rate), by contrast DTI indicator is not dependent on interest rate. As the nominal interest rate rises, the importance of the DSTI above the DTI indicator grows. For mortgage applicants over the age of 36 with the current setting of DSTI and DTI from 1.4.2022, the cut off criterion will be the DTI indicator at the interest rate below 3,36 % p.a.; above the 3,36 % interest rate the DTI indicator is irrelevant in the current calibration; only the DSTI debt service indicator is relevant. The second option is a scenario for most mortgage applicants as early as January 2022, as the average rate for new mortgages is higher. For applicants under the age of 36, "the equilibrium rate of the DSTI and DTI limits "is 3,31 % p.a., above this rate, the effect of DTI is fully eliminated. According to the expected progress of rates, in 2022, the DSTI will continue to be more dominant than the DTI. However, the CNB can change the criteria operationally, as it has done several times in recent years. The tightening of monetary policy in terms of raising rates under otherwise identical conditions reinforces the importance of the DSTI and lags behind the DTI. The reintroduction (and this time in a legal form) of the currently dominant DSTI generally reduces the probability of mortgage approval and will indirectly affect the volume of mortgages provided in the Czech Republic, which will be lower than in the same situation without DSTI implementation.

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