Assessment of DSTA's 2016-2019 Risk Framework and Funding Policy

seo economisch onderzoek

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Assessment of DSTA's 2016-2019 Risk Framework and Funding Policy

Input for the DSTA's 2016-2019 evaluation

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Summary

This report assesses the Dutch State Treasury Agency's (DSTA) 2016-2019 interest rate risk framework and funding policy in preparation for the DSTA's evaluation of its public debt management practices, which is to take place in 2019. In the following we present our evaluation of the interest rate risk framework (IRRF) and the funding policy in the period 2016-2019 separately, although the two should not be seen in isolation.

Interest rate risk framework

In response to historically low yields, favorable economic forecasts (including expected rising rates) and the outcomes of the evaluation of the 2012-2015 IRRF, the 2016-2019 IRRF aimed to increase the maturity of the sovereign debt portfolio through a combination of new issuances and a decreased use of swaps. Specifically, it set a target of 6.4 years for the average maturity of the portfolio, to be achieved by the end of 2019 (2015 maturity: 5.5 years). In addition, it set a maximum annual refixing amount of 18% of sovereign debt.

The DSTA has managed to achieve its stated policy targets. Every year, it has met its target maturity and stayed below the maximum refixing amount. Between 2015 and 2018 it has reduced the reliance on swaps (and no new swaps were issued), whereas sovereign debt financing costs fell by € 1 billion.

In terms of ex-post efficacy, the IRRF has contributed to this result. In practice, there is a significant compositional effect due to the legacy debt and the fact that the DSTA in practice does not issue the same instruments or volume every year. A stylized analysis that compares funding outcomes for the 7-year benchmark with deviations and the 2016-2016 IRRF policy frameworks suggests that the latter has extended the maturity of the portfolio, at an increase of the weighted average effective interest rate cost of 0.2%. If rates will rise in the future, however, the present policy may induce a cost saving due to the 'lock in' of current lower nominal rates.

At the same time, the portfolio pursued under the 2016-2019 IRRF could not have been the most cost efficient portfolio due to the fact that rates continued to fall during 2016. This does not necessarily reflect poorly on the appropriateness of the 2016-2019 IRRF, though, given the fact that (market) expectations in late 2015 suggested rising interest rates in both the short and long term. Given the knowledge and expectations at the time of introduction, the 2016-2019 IRRF has achieved the goal of low(er) funding costs at equal risk, which does not preclude that (ex-post) there were options with lower costs at equal risk.

More important, therefore, is the ex-ante assessment of risk management practices. The DSTA has underpinned its 2016-2019 IRRF with a portfolio simulation analysis to determine the optimal maturity and associated portfolio composition. Parts of the methodology of this analysis could be improved upon. At the same time, the (risk of the) portfolio suggested by the DSTA's analysis is not that different from the efficient frontier suggested by a state-of-the-art portfolio optimization model. The latter model also reveals that in ex-ante terms the IRRF 2016-2019 is cost reducing vis-à-vis the preceding IRRF at most levels of risk tolerance, suggesting that the 2016-2019 IRRF as a

policy is ex-ante effective in providing low costs of debt financing at a level of risk that is no higher than under the 7-year benchmark with deviations. In general, costs can be reduced by accepting more risk. At the same time, our analysis shows that lower costs at similar levels of risk could have been attainable through (ex-ante) relaxing e.g. the money market size constraints implied by the funding policy – though this may have side effects as well (see funding policy below). The current maximum risk appetite is based on the historical maximum risk appetite: 'risk no higher than under the preceding risk management framework' appears to have been the guiding principle. Given specific market conditions or expectations of the future, a different risk tolerance may be defined.

Funding policy

The DSTA is transparent in conducting auctions and managing the public debt. Furthermore, auctions are predictable, which contributes to lower uncertainty regarding debt issuances. These practices are in line with policy recommendations by the IMF and the World Bank. The DSTA uses various policy measures, including the issuance of several benchmark bonds and a strict quotation obligation for primary dealers, to contribute to a liquid market for Dutch government debt. The DSTA's funding policy also scores high on these guiding principles in comparison with other European debt management offices. Nevertheless, the DSTA could monitor additional liquidity measures beyond the bid-ask spread and secondary market volumes.

The DSTA opted for more flexibility in its 2016-2019 funding policy by the adoption of a target range for total capital market issuances, instead of a fixed amount. There is no evidence that this has led to an increase in the yield on 10-year bonds. Therefore, the choice for more flexibility in all likelihood has not affected the consistency of the debt management.

The major policy change regarding liquidity was the reduction in total issuance volume for new 10-year bonds from € 15 billion to € 12 billion in 2018, as the funding need had been reduced. There is evidence to suggest that this has led to some decrease in liquidity, as measured by the bid-ask spread. On the other hand, there is no evidence that the number of outstanding bonds has a significant effect on liquidity. In the case of a decreasing funding need, the DSTA faces a trade-off between reducing the volume per line and reducing the number of lines. Based on the evidence presented here, maintaining sufficient volume per line seems to be more important for liquidity than the number of lines.

Recommendations

Our recommendations follow directly from the conclusions of our empirical assessment of the IRRF and the funding policy.

When developing the new IRRF (2020-2023), we recommend that the DSTA:

- explicitly decides on and outlines a maximum risk tolerance and picks a risk indicator that measures this tolerance;
- uses stochastic methods to ex-ante assess various portfolios under interest rate and funding need scenarios;
- uses scenarios that are consistent with other scenarios used for forecasting economic and fiscal developments (e.g. CPB, DNB, FIN);
- considers the dependencies between the funding policy and the IRRF (e.g. the appropriate amount of flexibility in the composition of issuance and/or issuance policy).

With respect to the funding policy, we suggest the following:

- integrate the funding policy more explicitly in the (ex-ante) IRRF, leaving some room (ex-ante) for flexibility in the funding policy;
- when looking for ways to increase flexibility, evidence suggests that introducing (limited) target ranges for issuance volumes does not have to impede the predictability of the funding policy;
- with an expected decreasing funding need, the DSTA will have to prioritize which lines to continue and which not;
- maintain the transparency and consistency at the current high levels by continuing to inform the market and the public at the current level.

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1 Introduction

The minister of Finance is responsible for a solid and efficient funding of the State's debt. The Dutch State Treasury Agency (DSTA) is responsible for the management of the Dutch State debt. The DSTA is mandated by the minister of Finance to prepare and define the funding policy and represent the State in the closing of transactions on financial markets. This mandate, or the policy framework, is reviewed and adapted every four years. The next review of the policy framework will take place in 2019.

In order to prepare for this review, the DSTA has commissioned SEO Amsterdam Economics to assess the effectiveness and efficiency of the current Dutch policy framework, specifically with regard to the interest rate risk framework and the funding policy. This research will feed into the evaluation of the current framework and supply insights which can be used to build the framework for the next period. The overarching research questions for the evaluation align with the *Regeling Periodiek Evaluatieonderzoek*:

- How effective has the policy been? Are there positive and/or negative side effects?
- How efficient has the policy been in achieving the objectives?
- What measures can be taken to further increase effectiveness and efficiency?

This report focuses on two specific questions that will feed into the evaluation, namely:

- In what way, and how much, has the *interest rate risk framework* contributed to achieving public debt financing at the lowest possible cost, with an acceptable risk for the budget?
- In what way, and how much, have *the funding policy* and changes within this policy contributed to achieving public debt financing at the lowest possible cost, with an acceptable risk for the budget? Is there a role for more flexibility within the funding policy to increase efficiency without increasing risks?

Note that these questions are posed in isolation. Therefore, throughout most of this report we will take the funding policy largely as given when assessing the IRRF and vice versa, whilst commenting on their relation where need be.

Methodologically, this report employs a mixture of economic analysis based on the (empirical) literature, desk research, interviews and quantitative analysis. The quantitative part of this study includes (analysis of) descriptive statistics, model simulation and (portfolio) optimization, as well as panel data regressions and synthetic control method analysis.

The remainder of this report is organized as follows. Chapter 2 charts the background of the 2016-2019 IRRF and funding policy, looking at general policy objectives and guiding principles, earlier IRRFs and funding policies and their evaluations, and market conditions at the end of 2015. Chapter 3 assesses the IRRF, both from an ex-ante and ex-post perspective. Chapter 4 deals with the funding policy and discusses the principles of consistency, transparency and flexibility. Lastly, Chapter 5 provides conclusions.

2 Background

The 2016-2019 interest rate risk framework and funding policy were developed against the background of historically lower rates and a strengthening Dutch economy and sovereign debt position. In response to this, and based on 'lessons learned' through the evaluation of the 2012-2015 policy, the 2016-2019 framework and funding policy aimed to a) extend the maturity of the portfolio through new issuances and a decreased use of swaps to 'lock in' the current low rates, and b) increase (issuance) flexibility whilst maintaining funding policy transparency and consistency.

The current Interest Rate Risk Framework (IRRF) and funding policy were designed against a backdrop of the Dutch State Treasury Agency's (DSTA) policy objectives, economic and market conditions, as well as earlier IRRFs and funding policies (including evaluations). This chapter surveys this backdrop and outlines how it was translated into the present IRRF and funding policy. This leads to an overview of the IRRF and funding policy, revealing the pathways through which the current components of the IRRF and funding policy contribute to achieving the policy objectives of the DSTA. This chapter thus serves as a background for the remainder of this report on the IRRF and funding policy.

Section 2.1 describes the main policy objectives and principles guiding the IRRF and the funding policy. Section 2.2 describes the market conditions in late 2015, which served as input for the design of the new IRRF and funding policy. Section 2.3 looks back at the previous evaluation of the IRRF and funding policy for 2012-2015. Section 2.4 describes the current IRRF and funding policy in more detail, including policy responses to the previous evaluation. Section 2.4 concludes with a schematic overview of the IRRF and funding policy.

2.1 Policy objectives and principles

According to the guidelines for public debt management by the IMF and the World Bank, "the main objective of public debt management is to ensure that the government's financing needs and its payment obligations are met at the lowest possible cost over the medium to long run, consistent with a prudent degree of risk" (IMF & World Bank, 2014). The DSTA has adopted this as its main objective.

The DSTA operationalizes this objective in its IRRF and funding policy.[1] The IRRF and funding policy are based on several general guiding principles. The guiding principle for the IRRF is the trade-off between low budgetary risk and minimal funding costs. The guiding principles for the funding policy are consistency, transparency and liquidity. Of these three, consistency and transparency are leading. Nevertheless, the DSTA states that liquidity is of paramount importance as well.

[1] The DSTA has to manage risks other than e.g. interest rate risk as well, such as credit risk or foreign exchange risk for instance.

2.1.1 Interest Rate Risk Framework

The largest certainty about nominal debt-servicing payments is achieved when interest rates on public debt are fixed for as long as possible. At the same time, fixing interests for the long term typically comes at a cost as long-term rates typically are higher than short-term rates. This implies a cost-risk trade-off.

The IRRF consists of a set of policy rules that delineate the cost and risk parameters within which the DSTA has to operate. The main risk parameter of the IFFR has historically been the average maturity of the portfolio. The maturity target can be obtained through a combination of the issuance of instruments with different maturities and the use of swaps. Historically, the DSTA has used both.

Between 2008 and 2015, the DSTA employed a centered 7-year benchmark portfolio to manage its interest rate risk. Theoretically, a centered benchmark portfolio is optimal: there is no portfolio with lower costs for a given risk level, or alternatively, there is no portfolio with lower risks for a given level of costs (DSTA, 2016). The selection of a 7-year centered benchmark portfolio followed from two considerations. First, a 7-year centered portfolio sufficiently matched the composition of the actual portfolio so that it could be feasibly achieved. Second, a 7-year centered portfolio matched the contemporary budgetary policy of debt reduction. The previous risk framework featured a base risk of no more than 9% of GDP, which was derived from a benchmark based on similar European countries. At the time, this base risk combined with the contemporary budgetary policy implied a shortening of the maturity of the portfolio. The 7-year benchmark continued this trend, yet counter- instead of pro-cyclically (the 9% of GDP base risk benchmark clearly moved with GDP). It was also expected to produce better financing outcomes and less risk (DSTA, 2007).

Since 2012 it has been possible to deviate from the 7-year benchmark portfolio, subject to the rule that deviations should not increase budgetary risk. In terms of the DSTA's risk management practices, this constraint of 'should not increase budgetary risk' implied that deviations were allowed if they extended the maturity of the portfolio. In practice, this meant that issuances with a maturity longer than 10 years did not need to be swapped back to 7 years.

This suggests that operationally, the DSTA chooses an acceptable level of risk, and then attempts to find the cost minimizing portfolio conditional on their risk appetite.

2.1.2 Funding Policy

Each year the Dutch government has a projected borrowing requirement. This borrowing requirement or funding need consists of the capital market redemptions (for loans with a maturity exceeding 1 year), money market ultimo (for loans with a maturity up to 1 year), and the change in the cash balance. The DSTA splits its funding between the capital market and the money market, taking into consideration the risk management framework. The DSTA's funding policy is based on three key principles, namely consistency, transparency and liquidity.

The DSTA follows these principles because they arguably contribute to lower funding costs and a solid reputation of a credible issuer. Transparency is meant to enhance accountability and reduce uncertainty. The details of upcoming auctions are announced beforehand, so that investors have

more information and thus face less uncertainty on their investment. However, to reap the full benefits of transparency the DSTA should also be consistent. If the DSTA is transparent about upcoming auctions, but inconsistent in conducting auctions, for example by issuing a bond with a different maturity than it normally does or by changing the conditions of the auction, uncertainty will not be reduced. The main argument for reducing uncertainty is that the yield on the debt generally includes a risk premium. Hence, reducing uncertainty reduces the yield on government debt, which contributes to the main objective of meeting debt obligations at the lowest funding cost possible. Furthermore, liquidity is of importance to ensure an attractive market for investors. Additionally, in a liquid market the DSTA can quickly raise new capital if necessary, because Dutch government debt is actively traded. Furthermore, high liquidity increases the liquidity premium investors are willing to pay. In turn, this lowers sovereign bond yields and thus leads to lower funding costs (Favero, Pagano & Von Thadden, 2010; De Santis, 2014; Montfort & Renne, 2014; Schwarz, 2018).

To attract different investors with different preferences for maturity, the DSTA issues bonds with maturities ranging from 3 to 30 years. In general, DSTA issues a range of financial instruments, which mainly differ in their respective maturities:

1. capital market instruments (DSLs);
2. money market instruments (DTCs);
3. global commercial paper (GCP), in euros and foreign currencies (with exchange rate risks fully hedged);
4. money market deposits, for either borrowing or lending;
5. collateralized loans/deposits with a repurchase agreement;
6. capital market instruments in US dollars (US Dollar Dutch State bond), with the exchange rate risks fully hedged by swapping all amounts into euros. This, however, is not a regularly used instrument.

2.2 Evaluation public debt management 2012-2015

2.2.1 Interest Rate Risk Framework

Since 2008, the DSTA had employed a 7-year centered portfolio as a benchmark to assess its interest rate risk. Theoretically, a centered portfolio captures an optimal trade-off between costs and risk. Given that the DSTA does not issue new debt every day and does not only issue instruments with a 7-year maturity, the DSTA employed interest rate swaps to align the portfolio risk profile to the benchmark risk profile.

The interest rate risk framework in the period 2012-2015 allowed for deviations from the benchmark. Specifically, it allowed an extension of the average maturity of the portfolio to 'lock in' the historically low yields on Dutch sovereign debt. The aim was to reduce budgetary uncertainty at little cost or perhaps even no cost if rates were to rise again. In practice, this meant that the DSTA attempted to issue long-term securities without swapping the average maturity back to the benchmark.

Against this backdrop and given the low sovereign yield environment over the period 2012-2015, the previous evaluation concluded that the IRRF had contributed effectively to the DSTA's policy

objectives of low financing costs at acceptable (budgetary) risk. The evaluation specifically noted that differences between the benchmark and the actual portfolio were the result of purposeful deviations from the benchmark and that as a result budgetary risk had been reduced. The evaluation furthermore noted that the interest cost risk of the actual portfolio differed negligibly from the benchmark, meaning that the extension of the maturity was achieved at almost no interest rate costs. Total costs differed between the portfolio and the benchmark due to the decision to buy fewer swaps. These swaps would have netted a positive result given the steadily declining interest rates over the period 2012-2015.

The evaluation argued that the policy was effective because a) both the benchmark and deviations from it were the result of an explicit trade-off between costs and risk, and b) this trade-off contributed to lower funding costs with a reasonable risk to the budget. The 7-year benchmark was maintained because a benchmark of less than seven years was expected to increase risk, whereas an extension of the benchmark was expected to increase costs. At the same time, deviations from the benchmark were allowed due the fact that the low yield environment induced asymmetries in the likelihood of the direction of interest rate movements.

The evaluation noted that given the preference to have an interest rate horizon of seven years, the benchmark portfolio is a theoretical optimal policy in the sense that it minimizes interest rate risk. However, although the 2011 policy evaluation showed that the 7-year benchmark would be able to absorb small, temporary interest rate shocks, it was unlikely that it would be able to absorb significant interest rate shocks and/or significant increases in budget deficits. The evaluation further noted that in practice the benchmark could only be approached through a combination of issuances and the swap portfolio. This could reduce the efficiency of the risk management framework in the sense that it might fail to achieve the theoretical optimum.

The swap portfolio was of significant concern, as it has several side risks and/or effects. First, the swap portfolio induces indirect risk. Should the counterparties of the swap agreements default, it takes time for the DSTA to find new counterparties and make new swap agreements, thus re-introducing interest rate risk for the DSTA. Second, the swap portfolio interferes with the DSTA's financing needs. Specifically, in-the-money swaps result in significant incoming cash flows, reducing financing needs and thereby interfering with the funding policy. Third, the benchmark is based on sovereign rates, whereas the actual portfolio is increasingly subject to market swap rates as well. Fourth, the increased usage of swaps has increased operational risks.

The benchmark portfolio contributed to transparency and accountability. The evaluation also noted that the interest rate risk framework did not take other risks such as credit risk, liquidity risk and operational risks into account. Instead, these risks are managed separately.

2.2.2 Funding Policy

During the evaluation period, the funding policy was in principle decoupled from the interest rate risk framework. The DSTA could achieve this because of the active swap portfolio. By using interest rate swaps, each desired interest rate risk profile can be achieved in principle. Therefore, the DSTA was theoretically able to optimize its funding policy and its interest rate risk framework separately. However, because the incoming cash flows of the swap portfolio reduced the funding

need on the money and capital market, the funding policy could no longer be pursued independently.

The main principles of consistency, transparency and liquidity for the funding policy were based on the IMF and World Bank's guidelines for sovereign debt management. Compared to other countries, the DSTA scored high on these three principles, which was also confirmed by investors. However, the main focus was on consistency and therefore the DSTA had limited flexibility in its funding policy. All flexibility in the funding policy was achieved on the money market, as the DSTA stuck to the pre-announced volumes on the capital market. More flexibility on the capital market can come at the expense of consistency. The evaluation also noted that the level of flexibility may be insufficient if the decoupling of the interest rate risk framework and funding policy would be hampered (as a result of the wish to decrease the size of the swap portfolio) in the future.

Regarding the predictability of issuances, which contributes to consistency, the DSTA was found to act in line with what was announced. Between 2012 and 2014, the difference between the announced and realized amount of capital market issuances was less than € 2 billion. This difference can mainly be explained by market conditions and the non-competitive option. The non-competitive option enables certain primary dealers to increase their primary purchase by up to 15 percent at the average auction price, an offer that is valid for 3 days after the auction. Furthermore, the DSTA achieved a large degree of consistency regarding the issuance volumes, as issuance volumes were relatively stable over time. Although cost savings were not calculated, the evaluation concludes that the objective of consistency was efficiently met. There is, however, a trade-off between consistency and flexibility.

The transparency of the DSTA was positively evaluated. Specifically the communication with primary dealers, the Annual Outlooks and the quarterly reports were seen as enhancing transparency. Its level of transparency sets the DSTA apart from the Treasury agencies of other countries. The detailed information, the predictability of policies and the regular updates were valued positively by investors.

The DSTA contributes to a liquid secondary market by using the 'off-the-run facility', which makes it possible to reopen bonds that are no longer considered benchmark bonds for that maturity. This facility generates more supply and thus liquidity of a certain bond. Furthermore, the repurchase facility and a quotation obligation for primary dealers on DSLs in the secondary market also contribute to liquidity. Additionally, the evaluation focuses on the trade-off between the number of debt instruments and liquidity. A higher number of debt instruments means a lower outstanding volume per instrument, because the funding need is given. A lower volume implies a lower liquidity for that instrument ceteris paribus. Therefore, the DSTA has a minimum outstanding volume for new 10-year bonds every year. The evaluation suggests that the funding policy contributed to higher liquidity and thus lower funding costs, but it does not provide a quantitative estimate.

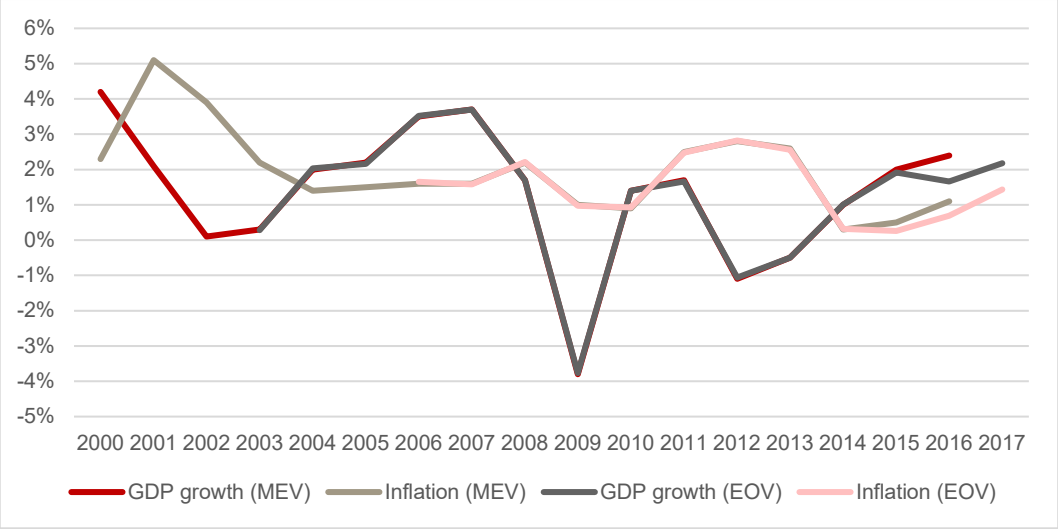
Finally, the funding policy does not lead to excessive financing risk, which can occur if a large share of the outstanding debt has short-term maturities. The refinancing risk per year, i.e. the refinancing of money market and capital market instruments divided by GDP, was about 10 percent, which is comparable to that of other European countries. Furthermore, liquidity risk is also limited, since there is a liquid money market for Dutch government debt. The desirable level of the money market is estimated to be between € 25 billion and € 30 billion. Due to the large increase in inflows of

collateral related to the swap portfolio, the DSTA had to issue fewer money market instruments. This reduced issuance on the money market put the liquidity of money market paper under pressure. However, more flexibility in the funding policy by reducing the call on the capital market and increasing it on the money market, could have contributed to higher liquidity of money market instruments. Additionally, credit risk is minimized by setting credit rating requirements for counterparties. Finally, exchange rate risks are hedged.

2.3 Market conditions in late 2015

By late 2015 the Netherlands experienced improving macroeconomic conditions. According to the CPB Netherlands Bureau for Economic Policy Analysis (CPB), growth had picked up to 2% in 2015. Concurrently, the Dutch government continued to focus on improving its structural balance. Together, this led to a reduction in EMU debt for the first time since the start of the Great Financial Crisis. Despite increased growth, inflation remained historically low, as did long-term interest rates.

Figure 2.1 Growth picking up, inflation historically low but expected to increase

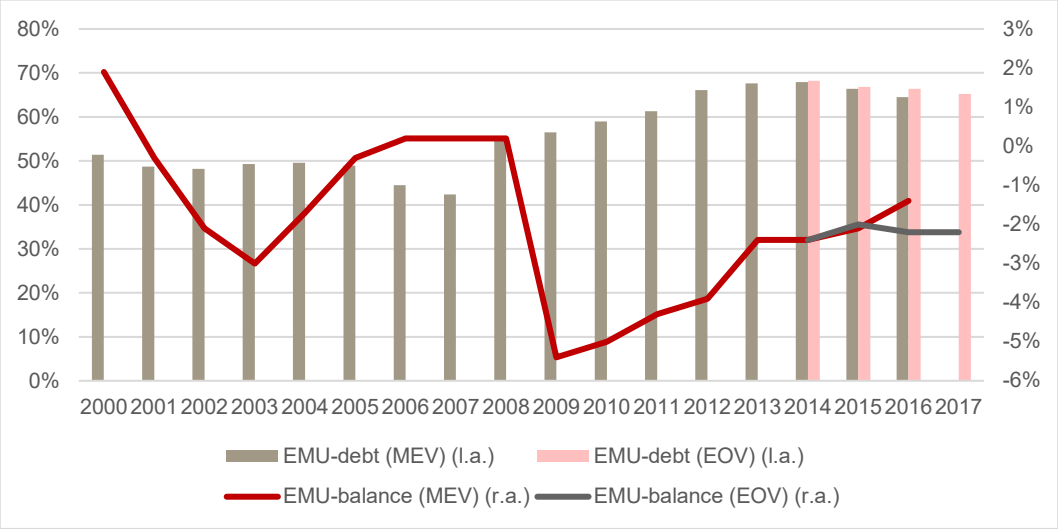


Source: CPB, *Macro-economische verkenning (MEV) 2016, Annex A2.* DNB, *Economische Ontwikkelingen en Vooruitzichten (EOV)* December 2015.

The 2016 Outlook of the DSTA noted that the latest economic forecast of the CPB continued to show robust growth for the Dutch economy into 2016. Given limited expected government expenditure growth, the CPB expected the EMU balance to improve to -1.8% of GDP. The overall debt-to-GDP ratio was expected to continue its downward path in 2016. The Central Economic Plan 2016 of the CPB expected a still lower EMU balance and debt by 2017.

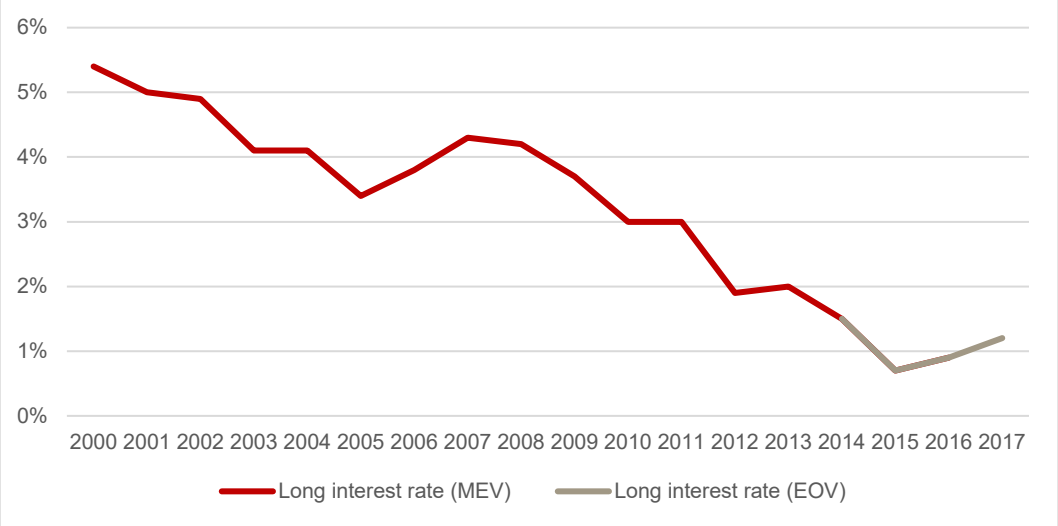
De Nederlandsche Bank (DNB) shared this optimism. In its *Economische Ontwikkelingen en Vooruitzichten* (EOV) of December 2015, DNB noted forecasted growth above potential growth. In 2015, GDP was set to grow by 1.9%, followed by 1.7% and 2.2% in 2016 and 2017, respectively. The recovery of the labor market was expected to remain sluggish, though, and inflation was expected to remain low as well. DNB expected the Dutch EMU balance to stabilize at -2% in 2015, and at -2.2% in 2016 and 2017. Combined with increasing growth, EMU debt was forecasted to fall from 68.2% in 2014 to 65.2% in 2017.

Figure 2.2 EMU balance expected to stabilize, EMU debt to decrease



Source: CPB, *Macro-economische verkenning (MEV) 2016, Annex A2.* DNB, *Economische Ontwikkelingen en Vooruitzichten (EOV)* December 2015.

Figure 2.3 Long-term rates historically low but expected to increase



Source: CPB, *Macro-economische verkenning 2016, Annex A2.* DNB, *Economische Ontwikkelingen en Vooruitzichten* December 2015.

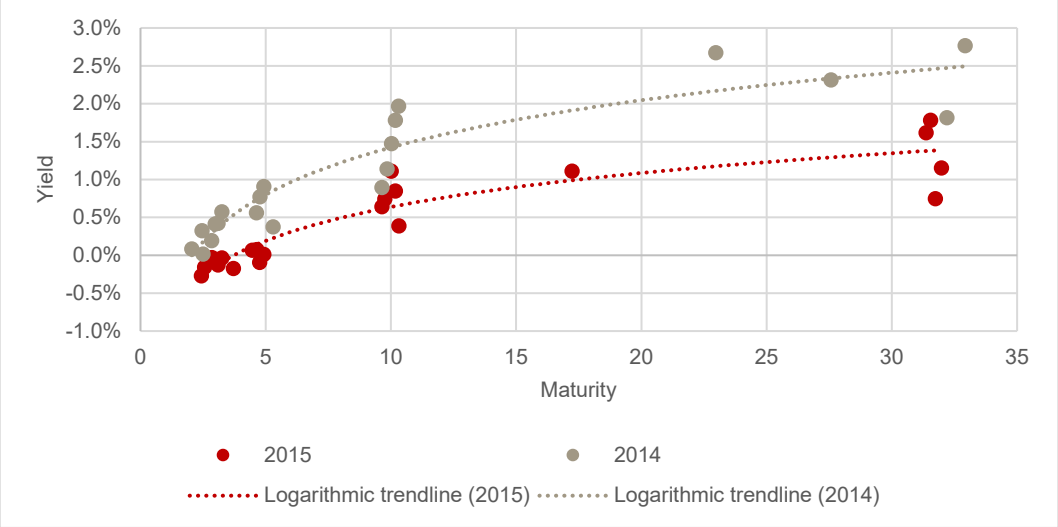
CPB and DNB analyses also noted the historically low level of Dutch long-term rates. Whereas these rates had been in excess of 4% in the pre-crisis years, by 2015 they had dropped to below 1%. In line with the pick-up in economic growth, both CPB and DNB expected these long-term rates to increase over 2016 and 2017 to 1.2% by late 2017.

Given these macroeconomic fundamentals, the DSTA expected a reduced funding need for 2016 (see Outlook 2016). According to the Outlook, this was mainly because of the lower capital market redemptions in 2016 compared to 2015. In addition, the improving economic conditions contributed to a lower money market balance. At the same time, these expectations regarding the money market and the cash position were associated with considerable uncertainty. This

uncertainty stemmed in part from the IPO of ABN AMRO, as well as cash in- and outflows related to the DSTA's swap portfolio.

The 2016 Annual Outlook noted that interest rates were at historically low levels. For all maturities, new DSLs were issued at lower yields in 2015 than in 2014. The Annual Outlook noted the effect the ECB's Public Sector Purchase Programme (PSPP) on Dutch yields. At the same time, the Annual Outlook remarked that rate volatility had increased in 2015. Furthermore, the yield curve had steepened throughout 2015. By November 2015, the yield for maturities up to 5 years was negative, whereas the yield on 30-year debt was around 1.5 percent. Although the DSTA did not explicitly communicate its forecasts of interest rate movements, expecting a greater likelihood of increasing yields seemed warranted given the forecasts of CPB and DNB.

Figure 2.4 Low yields on 2015 DSL issuances



Source: DSTA, *Issuance results DSLs*.

2.4 Response: 2016-2019 IRRF and funding policy

2.4.1 Interest Rate Risk Framework

The 2016-2019 IRRF was developed against the backdrop of market conditions in late 2015 as well as expectations of market developments over the period 2016-2019. Insights gained from the evaluation of the IRRF for the period of 2012-2015 were incorporated as well.

Compared to the previous IRRF, the new IRRF has committed to an extension of the maturity of the portfolio (including swaps). Given the low yield environment, the expectation was that the average maturity of the portfolio could be increased at relatively low cost. At the same time, low yields implied an (upward) asymmetry in the likelihood of interest rate movements, thus increasing risk. In response, the new IRRF aimed to increase the average maturity of the portfolio whilst keeping budgetary risk at least constant and with a decreased reliance on swaps. To achieve this, the DSTA targeted an average maturity of 6.4 years, to be achieved by the end of 2019.

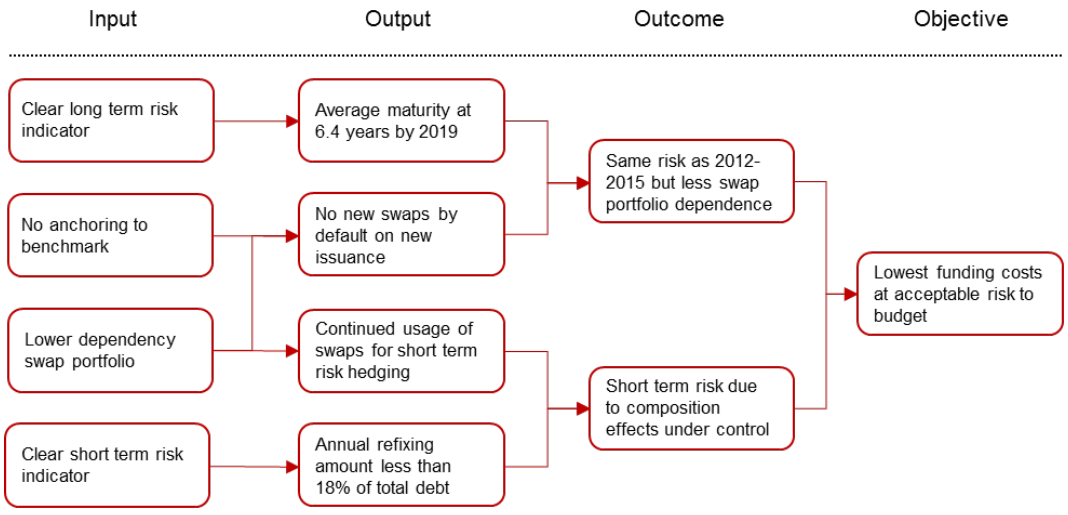
The DSTA furthermore argued that the average maturity is a measure of long-term risk, whereas the DSTA also has to manage short-term interest rate risk. The short-term risk measure that was introduced, is the refixing amount. This amount was maximized at 18% of total public debt per year.

The 2016-2019 IRRF aims to achieve the target maturity whilst staying below the maximum refixing amount. To this end, the DSTA states that it has several instruments at its disposal, namely:

- bond buybacks;
- a certain amount of flexibility of capital market issuance;
- adjustments to the swap portfolio.

Figure 2.5 presents a stylized overview of the 2016-2019 IRRF. In terms of policy inputs, the DSTA adopted a new average maturity target, a new refixing indicator, committed to a lower dependency on the swap portfolio and decided to stop anchoring the portfolio to a 7-year benchmark. The new average maturity target in combination with the detachment of the portfolio from the seven-year anchor is meant to result in a longer average maturity by 2019. In turn, this aims to achieve long-term budgetary security at low costs, thus contributing to the overall DSTA objective of minimal funding costs at an acceptable risk to the budget. Similarly, the new refixing indicator constrains short-term interest rate risk, thus contributing to budgetary stability in the short run. The unwinding of swaps as well as the more limited use of swaps on new issuances (i.e. no default swap on issuance) should contribute to several outcomes. On the one hand, the continued use of swaps could help to hedge against (short-term) risks. On the other, the decreased dependence on swaps should ameliorate the interference of the swap portfolio with the funding policy.

Figure 2.5 Overview 2016-2019 IRRF



Source: SEO Amsterdam Economics.

2.4.2 Funding Policy

The funding policy for 2016-2019 was based on the existing funding policy, which was adapted against the backdrop of market conditions in late 2015 as well as expectations of market developments over the period 2016-2019. Insights gained from the evaluation of the funding policy for the period of 2012-2015 were incorporated as well. Figure 2.7 gives a schematic overview of

the current funding policy and how it should contribute to the main objective of achieving the lowest funding costs at an acceptable risk to the budget. In Figure 2.7 the funding policy is described in terms of inputs, outputs, outcomes and objectives.

Consistency

The DSTA has several instruments to achieve consistency in its debt management and capital issuance. First of all, in the Annual Outlook the expected funding need for the following year is announced. In this Outlook, the DSTA distinguishes between the funds to be raised on the capital market and on the money market. Before 2015, the DSTA used fixed target amounts for both total annual capital market issuances and individual auction volumes. However, the evaluation noted that the DSTA has a high level of consistency in its capital market issuance, but that there may be insufficient flexibility when there are large changes in the funding need. Following the evaluation, the DSTA decided to switch from a fixed target amount on the capital market to a target range. Moving from a fixed call on the capital market to a target range reduces consistency, because investors won't know beforehand the exact amount that will be issued in a certain year. Moreover, in line with the funding plan, no exact auction volumes are mentioned when the auction is announced, only the target range is given. The latter has been common practice before 2016 as well.

In order to maintain a desirable level of liquidity in the money market, the target for this market is between € 25 billion and € 30 billion[2]. This is a soft target, though. For capital market issuances, there are three types of announcements:

1. Announcement of total capital market issuances in a year in the Annual Outlook. The DSTA uses a target range for the total capital market issuances in a year and the bandwidth of this target range has been around € 5 billion since 2016. The actual target range for capital market issuances in 2019 is € 19 billion to € 23 billion.
2. Announcement of a minimum outstanding volume per line. The DSTA uses a fixed amount for the minimum outstanding volume per line. For example, for DSLs with a maturity of 10 years the minimum outstanding volume is € 12 billion from 2018 onwards.
3. Announcement of the amount to be issued per auction. The DSTA uses a target range for the amount to be issued per auction.

The DSTA aims not to deviate from the target range announced for capital market issuances. The target range for total capital market issuances in a year provides a buffer for capital market issuances, so changes in the funding need can be absorbed by both the capital market and the money market. A target range offers more flexibility on the capital market. In the previous situation, unexpected changes in the funding need were completely absorbed by the money market. The DSTA notes that the money market will remain the primary source of flexibility[3].

The target range for the first auction of new DSLs is announced by press release no later than one week before the auction. Target ranges for individual auctions of reopened bonds are announced in the quarterly issuance calendar. The target range for the money market is merely an indication, the actual issuances are determined by developments in the funding need[4]. Additionally, the money market can also be used to bridge mismatches between redemptions and new auctions.

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2 Letter to parliament "Further specification of the risk framework national debt 2016-2019" (p. 3-4). http://www.dsta.nl/english/Subjects/Risk_management/For_more_information

3 DSTA (2015). Outlook 2016 (p.20)

4 DSTA (2017). Outlook 2018 (p.17)

The DSTA each year issues benchmark bonds of 10 years, and when feasible also bonds with a shorter maturity (3, 5 or 7 years). The minimum outstanding volume of new 10-year bonds at the end of the year was € 15 billion until 2017, but this was reduced to € 12 billion in 2018, due to a lower borrowing requirement. The DSTA still has the option to increase the minimum outstanding volume to € 15 billion if desirable. For bonds with a maturity above 10 years, the benchmark volume was € 10 billion, but the DSTA slightly reduced this in 2018 in order to increase issuances in other segments. The minimum outstanding volume of a bond can also be achieved by re-opening it, and does not necessarily have to be raised within one year. The use of minimum outstanding amounts contributes to consistency because investors can expect that at least a certain amount of debt will be issued in certain segments.

The DSTA further contributes to consistency by announcing auction dates, volumes and the name of the bond for capital market issuance in each Quarterly Outlook. Further details are announced 6 days before the auction takes place. For auctions on the money market, however, the DSTA announces the auction dates and type of program in the Quarterly Outlooks, but it does not provide information about the auction volumes. This information is given 5 days before the auction takes place. The DSTA does not deviate from the announced auction dates and volumes. It thus acts consistently with its announcements.

Transparency

Transparency is closely linked to consistency. Several aspects of the funding policy contribute to both consistency and transparency. The publications by the DSTA, such as the Annual and Quarterly Outlooks, issuance calendars, auction announcements, and the auction results provide investors with information about what they can expect from the DSTA. As mentioned in the previous section, there is a difference between the announcements of capital market auctions and money market auctions. This difference can be explained by the fact that the money market is the primary source of flexibility and acts as a buffer to absorb changes in the funding need. If the DSTA would announce the target auction volumes before the quarter in which the auction will take place, it would reduce the flexibility. Nevertheless, the details of money market auctions are published around a week before they take place and the DSTA then acts accordingly. Therefore, the announcement of the details of the auctions enables primary dealers to take the appropriate preparatory actions. Shortly after the auctions (generally on the same day), the DSTA publishes the results, including the volume raised, the issue price and the yield.

Communication with the primary dealers is another aspect of the funding policy that is related to transparency. The DSTA actively communicates with the public about each upcoming auction. Furthermore, it consults primary dealers about market developments. Increasing transparency reduces uncertainty. However, a prerequisite is that the DSTA then acts consistently with the information it releases. Not doing so would seriously damage the reputation of a debt management office. Therefore the policy instruments regarding consistency and transparency are closely related to each other. Additionally, the DSTA holds several roadshows for investors to provide information about the borrowing outlook and the DSTA.

Using the inputs described above, more consistency and more transparency (outputs) are meant to reduce uncertainty for investors. Uncertainty is usually measured as the risk premium on bonds

versus German bonds[5]. Less uncertainty can decrease the risk premium, although the general economic and fiscal outlook are more important determinants of the yield. A lower difference between the yield on Dutch bonds and the yield on German bonds (risk-free rate) indicates a lower risk premium, which enables the DSTA to finance the debt at the lowest funding costs (objective).

Box 2.1 Determinants of the risk premium

The goal of consistency and transparency in the DSTA's funding policy is to reduce the risk premium on Dutch government debt. However, the funding policy can only affect the risk premium to a limited extent.

The S&P Sovereign Rating Methodology (2017) summarizes other factors that influence the credit rating, and thus the risk premium. These factors can be divided into five categories: institutional assessment, economic assessment, external assessment, fiscal assessment and monetary assessment. The institutional assessment focuses on the sovereign's transparency, but also the debt payment culture. The economic assessment includes the level of income and size of the tax base. The external assessment rates the position of the local currency and the country's external position. The fiscal assessment includes the debt-to-GDP ratio, sustainability of fiscal deficits, interest costs, debt structure and funding access. The monetary assessment focuses on monetary policy and the exchange rate regime.

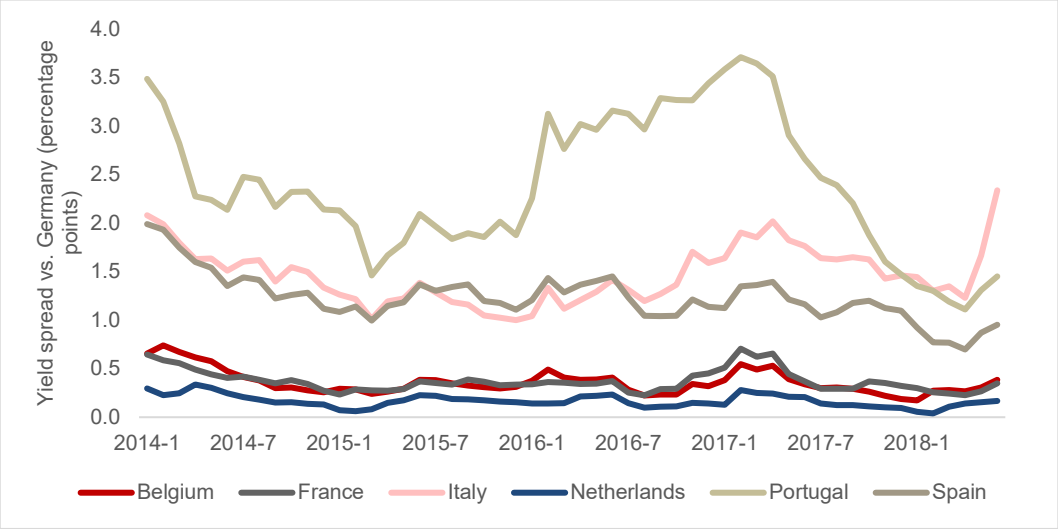
A consistent and transparent funding policy can contribute to lower interest rate costs, a solid debt structure and stable funding access. However, the funding policy plays only a small part in the overall assessment of the credit rating.

Source: SEO Amsterdam Economics.

Consistency and transparency are meant to reduce uncertainty, which lowers the risk premium. The risk premium can be approximated by the difference between the yield on Dutch 10-year bonds and the yield on German 10-year bonds, or the yield spread. However, the yield spread captures liquidity differences as well as the fiscal and economic outlook of a country (see Box 2.1). Figure 2.6 shows that Dutch government bonds are considered to be not much riskier than German bonds. Generally, the yield spread is below 0.5 percentage points and lower than for other countries. In addition to the relatively strong Dutch fiscal position and the other factors listed in Box 2.1, the DSTA's funding policy in all likelihood also contributes to the low yield spread, albeit only to a small extent. Since investors know what they can expect and they know it in advance, uncertainty regarding the funding policy is low. This also contributes to the low yield spread, enabling the DSTA to finance the government debt at the lowest cost possible against acceptable risk to the budget.

5 The yield spread includes liquidity differences as well.

Figure 2.6 Dutch 10-year yield spread vs. Germany lowest in sample of European countries



Source: SEO Amsterdam Economics, based on Bloomberg data.

Liquidity

The DSTA states that liquidity is of paramount importance for the funding policy. A debt management office benefits from a liquid market for government debt because marketability attracts investors. The DSTA has several instruments (inputs) to ensure a liquid market for Dutch government bonds. Higher liquidity (output) increases the liquidity premium investors are willing to pay for bonds (outcome), which in turn lowers the yield on debt. Therefore, maintaining a liquid market for government debt can assist the DSTA in achieving the lowest possible funding cost at acceptable risk to the budget (objective). Furthermore, if the government is in urgent need of capital it will be better able to raise capital in a liquid market than in an illiquid market where government debt is scarcely traded.

To ensure an active trade in Dutch government debt, the DSTA aims to maintain a sufficient outstanding volume of individual government bonds. This can be achieved by issuing new benchmark bonds or reopening old ones. After initial issuances, bonds can be reopened to achieve the target volume. The DSTA issues bonds with maturities ranging from 3 to 30 years, to attract a broad investor base and establish a liquid yield curve. Annual issuances are expected to contribute to liquidity. One contributing factor is the yearly issuance of 10-year bonds, which is one of the cornerstones of the DSTA's issuance schedule. Furthermore, the yearly issuance of 10-year bonds allows for a liquid yield curve, enabling trade in all maturities up to 10 year. This is an important driver of liquidity. However, there is a trade-off between the number of outstanding lines and the outstanding volume for each of these lines. Since the funding need is given, one can either issue a higher volume for fewer instruments or a lower volume for more instruments.

The DSTA aims to have both a liquid capital market and a liquid money market. To maintain a balance between liquidity in both markets, the DSTA generally sets target ranges of approximately similar sizes. For example, the target ranges for capital market issuances and for money market issuances in 2019 are both € 19 billion to € 23 billion. Nevertheless, in years with a larger expected money market ultimo, the majority of the funding need will be raised on the money market. The sample applies to the capital market in years where capital market redemptions are higher.

However, as noted above, the target for the money market is a 'softer' target, as it is also the primary source to absorb unforeseen changes in the funding need. This buffer function of the money market stresses the importance of maintaining a sufficient issuance volume and high liquidity in the money market. The DSTA can less easily raise additional capital in the money market if it is less liquid, and thereby the illiquidity puts a strain on the buffer function. The DSTA uses, amongst others, regular DTC auctions, benchmark programs, re-openings and a variety of maturities to maintain liquidity in the money market.

Furthermore, primary dealers have a quotation obligation, which means that they have to quote a price for government debt (DSLs and DTCs) on the secondary market. This ensures that there is always a market price for Dutch government debt, which enhances marketability and liquidity. Finally, the repo facility for primary dealers also contributes to liquidity. The majority of the repo facility is in DTCs (83 % of € 6.5 billion in 2018).

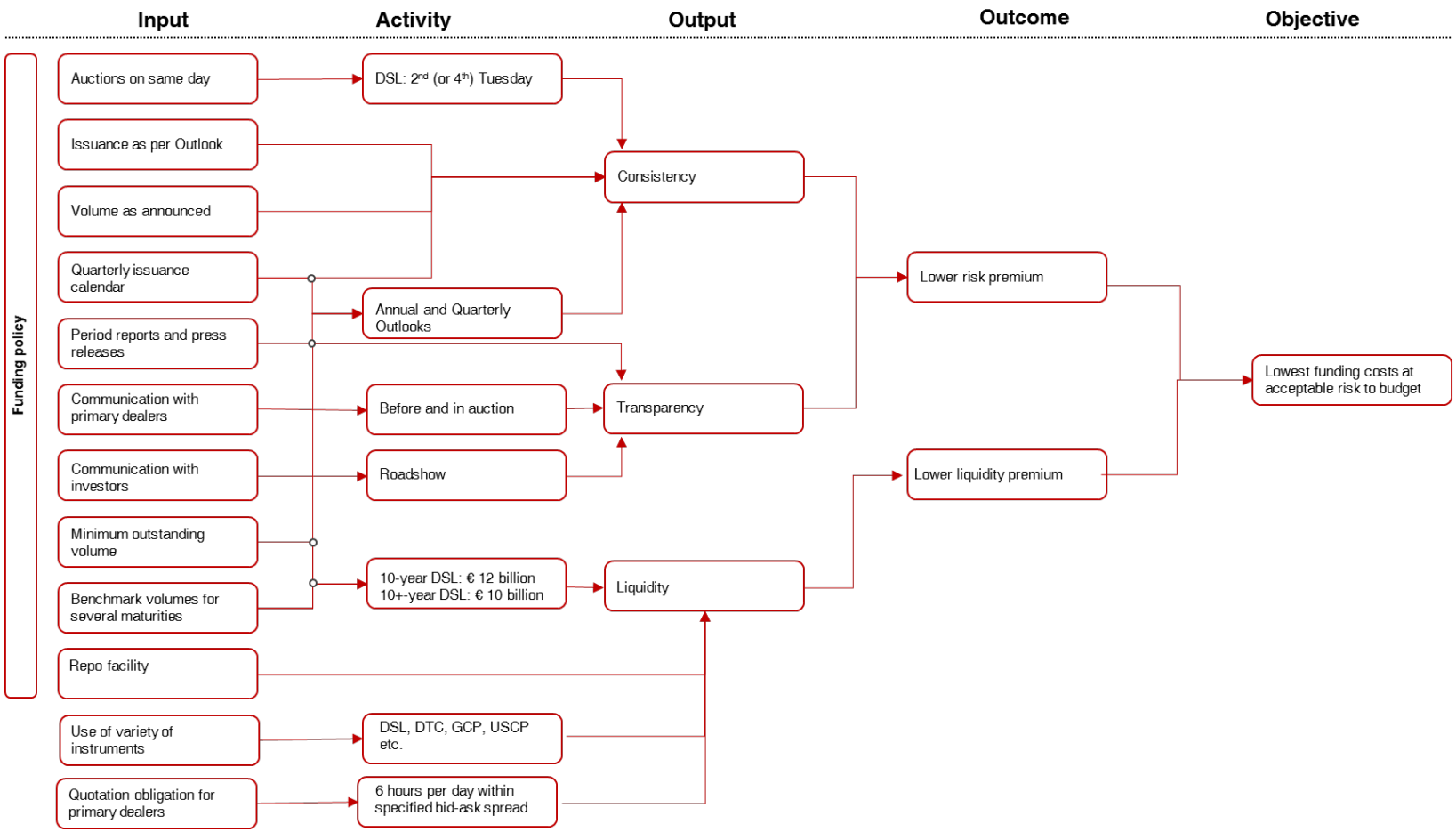
2.5 Background summary

The current IRRF and funding policy are designed against a backdrop of the DSTA's policy objectives, economic and market conditions and developments, as well as earlier IRRFs and funding policies (including their evaluations).

The IRRF strikes a balance between budgetary risk and funding costs. Historically, it appears that operationally the DSTA has chosen a maximum risk appetite and then attempted to stay below this maximum risk whilst minimizing funding costs. Specifically for the 2016-2019 IRRF, the conjunction of late 2015 market conditions and the evaluation of the 2012-2015 IRRF has resulted in a risk framework that stressed the achievement of reduced long-term risk at relatively low costs. This framework has relied on the extension of the average maturity of the portfolio through new issuances and changes to the swap portfolio. This appeared feasible at low costs given the low yield environment for Dutch sovereign debt. In addition, short-term risks were limited by the introduction of a maximum refixing amount.

The DSTA's funding policy focuses on consistency and transparency in its auctions, while maintaining a liquid market for Dutch government bonds. The 2012-2015 evaluation noted that the DSTA had a solid reputation when it comes to consistency and transparency, but that flexibility is limited. In response to this, the DSTA adopted a target range for capital market issuance in 2016-2019. If executed correctly, the funding policy contributes to achieving the main objective of the lowest funding costs possible by reducing the risk premium on the yield and increasing the liquidity premium investors are willing to pay for Dutch government debt.

Figure 2.7 Overview funding policy 2016-2019



Source: SEO Amsterdam Economics.

3 Interest Rate Risk Framework

The IRRF 2016-2019 achieved its maturity and refixing amount targets. Interest costs fell over the period of 2015-2018. Ex-post analysis suggests that the IRRF contributed to the achievement of these outcomes. The ex-post analysis by DSTA that supported the new maturity target leaves room for improvement, though its policy implications are not that different from those of a more sophisticated model developed by Zenios et al. (2018).

The DSTA's IRRF attempts to contribute to the achievement of the DSTA's policy objective: minimizing funding costs subject to an acceptable risk to the budget. To assess the extent to which the 2016-2019 IRRF contributed to the achievement of this objective, this chapter follows two approaches.

The first, 'ex-ante' approach looks at the appropriateness of the DSTA's original analysis underpinning the 2016-2019 IRRF. Qualitatively, we outline and assess the analysis performed by the DSTA. Quantitatively, we assess the appropriateness of the ex-ante risk assessment by holding it against the yardstick of a state-of-the-art sovereign debt portfolio optimization model.

The second, 'ex-post' approach looks at to what extent the DSTA has (likely) achieved its objectives. Directly observable are the 2016-2019 IRRF policy parameters such as the size of the swap portfolio, the average maturity of the portfolio and the annual refixing rate. The question whether minimized funding costs given an acceptable level of risk were achieved is trickier to answer, due to the absence of the counterfactual, or of the funding costs paid had the DSTA opted for a different IRRF. Qualitatively, we assess the ex-post effectiveness of the IRRF by comparing its assumptions to actual economic and market developments and judging whether these developments have likely contributed to higher or lower funding costs and/or risk. Quantitatively, in a stylized setting we calculate the costs associated with the portfolio under the 2016-2019 IRRF as well as the portfolio under the old 7-year benchmark with deviations.

3.1 Ex-ante risk assessment

3.1.1 DSTA analysis underpinning 2016-2019 IRRF

Description

The DSTA has sought to underpin the 2016-2019 IRRF using a quantitative analysis. This analysis focused on the optimal maturity of the portfolio from a risk management perspective.

The outcomes of the evaluation of the 2012-2015 IRRF were taken as first principles, namely:

- Reduce the dependency on interest rate swaps by letting go of the 7-year (at auction) benchmark (hereafter referred to as the '7-year benchmark with deviations');
- Increase the average maturity of the portfolio to between 5.5 and 6.5 years by 2019. This implied that under the 2016-2019 IRRF the risk to the budget should not increase (and ideally decrease) compared to the 7-year benchmark with deviations.

To determine the optimal portfolio satisfying these two criteria, the DSTA calculated the costs and risks of some 50 'equilibrium portfolios' subject to 9 interest rate scenarios and the DSTA's funding policy. The DSTA then compared these portfolios to a benchmark portfolio based on the 2012-2015 policy and picked the portfolio that was cost-minimizing and no riskier than the benchmark under all interest rate scenarios. The continuation of the 2012-2015 policy was taken to be the benchmark.

This quantitative analysis relied on specific operationalization of risk and costs measures, as well as several equilibrium assumptions, funding policy constraints and interest rate development scenarios. These are summarized in Table 3.1.

Table 3.1 DSTA analysis of optimal maturity

	Operationalization
Metrics	
Cost	Interest payments over a 12-year period given current yields
Risk	Increase in interest payments over a 12-year period due to increases in interest rates
Equilibrium assumptions	
Level of debt	No increase
Funding need	Balanced budget + stress test with € 15 billion shock.
Funding policy	
Money market (1d)	Between € 25 bln and € 30 bln excluding collateral
3 to 5 yrs	Every year a new issuance of € 15 bln within 12 months
10 yrs	Every year € 15 bln
30 yrs	Every 4 to 5 years a new issuance with an eventual size of at least € 10 bln, and up to between € 14 bln and € 15 bln
Other maturities or instruments	3-yr, 4-yr, 5-yr or 20-yr instruments to cover funding need
Swaps	No swaps
Interest rate	
Current benchmark rate	Average yield curve Q3 2015
Scenarios	200bps, 300bps and 400bps upward level shifts [linear increase over 4 years to new steady state level] + steepening or flattening of the yield curve

Source: SEO Amsterdam Economics, based on internal DSTA memos.

3.1.2 Qualitative assessment: DSTA analysis

The DSTA's analysis necessarily uses some assumptions and simplifications in order to reduce the complexity of reality into a model. As a consequence, several of these metrics, assumptions and

scenarios are limiting in some respects, thus suggesting possible improvements for the methodology.

The DSTA's model operationalized cost as the interest payments due on new issuances over a 12-year period given the current yield curve. The 'current yield curve' was taken to be the average yield curve over Q3 2015. Risk was defined as the interest payments above those associated with the current yield curve due to interest rate increases. This labels all deviations from the current interest rates as risk. This measure of risk means that the model underestimates (overestimates) costs but overestimates (underestimates) risk, given that costs above (below) those at current yields are attributed to risk even for anticipated increases (decreases) in interest rates. Given that at the end of 2015 most forecasts of future interest rates suggested steadily rising interest rates (e.g. CPB, 2015), higher costs due to higher interest rates could have been anticipated and this part of the increase in costs should not be considered risk. Instead, only unexpected deviations from these anticipated higher costs should be defined as risk. Note that this does not mean that taking the current yield curve as a cost benchmark is necessarily unwarranted: in a steady state/highly efficient financial markets the anticipated (future) interest rates are equal to the current ones.

A second problem is presented by the model time horizon of 12 years, which in some cases can result in an underestimation (overestimation) of the risk associated with higher (lower) rates (given maturity choices). This affects optimal policies. In the DSTA's analysis a longer (shorter) modeling time horizon maps almost directly into a longer (shorter) maturity portfolio, because with a longer horizon the DSTA would want to lock in the current low level of interest rates by issuing for a longer period of time, in order to benefit from low interest rates over the entire horizon. The 12-year time horizon was pragmatically chosen to parsimoniously balance the long and short term. It furthermore coincides with three 4-year cabinets and associated government budget policies. To the DSTA, this seemed to be the relevant policy horizon.

The investigated portfolios have been ex-ante designed and constrained by funding policy principles. This means that the DSTA analysis has shown which of these ex-ante portfolios is the best, and not whether that portfolio is optimal out of all other options, including those dynamic funding policy strategies. Furthermore, the funding policy assumptions are constraining (e.g. € 15 bln of 10 yr every year – no more, no less). Hence, it is possible that a better portfolio could have been achieved under a different funding policy.

The DSTA argues that, based on their analysis, the selected portfolio satisfies the criterion of 'lower cost, but no higher risk' under all interest rate scenarios. This does not mean that this portfolio is necessarily optimal in other scenarios that were not considered, including scenarios with declining interest rates, for example. It may be argued that falling rates do not constitute risk. On the other hand, with falling rates a similar risk profile can be obtained at lower costs. Not considering the possibility of falling rates (if warranted) may result in an analysis that leads to policies that 'overpay' for budgetary certainty. A related issue is that no probabilities have been assigned to the interest rate scenarios. This leaves open the question how likely the considered scenarios are and what the optimal portfolio is. In the context of the preceding example: if falling rates are possible but very unlikely, they should have relatively little weight in the design of the risk managing portfolio. Conversely, scenarios that account for rising rates should be given more weight. This is not without limits, though: it may be or become very expensive to reduce the risk associated with events that

have a low probability but high impact. It may be rational in a cost-risk trade-off sense to give less weight to these scenarios again when designing the risk-minimizing portfolio. This, however, requires an explicit probabilistic model of the future.

Interest rate shocks could interact with the legacy portfolio and affect costs and risk (especially through the swap portfolio). The analysis only partially reflects this. The optimal portfolio in the analysis of the DSTA only consists of issuances and no swaps. Hence, swaps were not part of the analysis of the optimal portfolio. The analysis of the difference between this optimal portfolio and the current (legacy) portfolio naturally has taken the legacy debt and swap portfolio into account.

A related issue is that the maximum refixing rate has not been included in the analysis. In the actual 2016-2019 IRRF, an 18% per annum cap was implemented. It is not clear whether this is consistent with the maturity schedule of legacy debt and the increase of the average maturity implied by the analysis above.

Finally, possible portfolios were compared to a benchmark de facto consisting of the (hypothetical) continuation of the 2012-2015 IRRF. As a result, the DSTA analysis only pointed out improvements in portfolio composition over the one for the 2012-2015 period, where the maximum risk tolerance of the 2016-2019 IRRF portfolios was defined by the 2012-2015 benchmark. This does not address the question to what extent this maximum risk tolerance is appropriate and what guiding principles it is based on. Above all, the current maximum risk tolerance is based on historical changes to the IRRF. Specifically, the 7-year benchmark could be no riskier than the 9% of GDP basis risk; the deviations from the 7-year benchmark were not allowed to be riskier than the 7-year benchmark; and the current de-anchoring of the portfolio from the benchmark including deviations could also not be riskier than the 7-year benchmark with deviations. In effect then, in the limit the current maximum risk tolerance of the 2016-2019 IRRF is (still) based on an international comparison of annual refinancing needs and the maturities of the sovereign debt portfolios of several European countries that are 'somewhat similar' to the Netherlands (cf. DSTA, 2007).

3.1.3 Qualitative assessment: DSTA assumptions

Level of debt and funding need

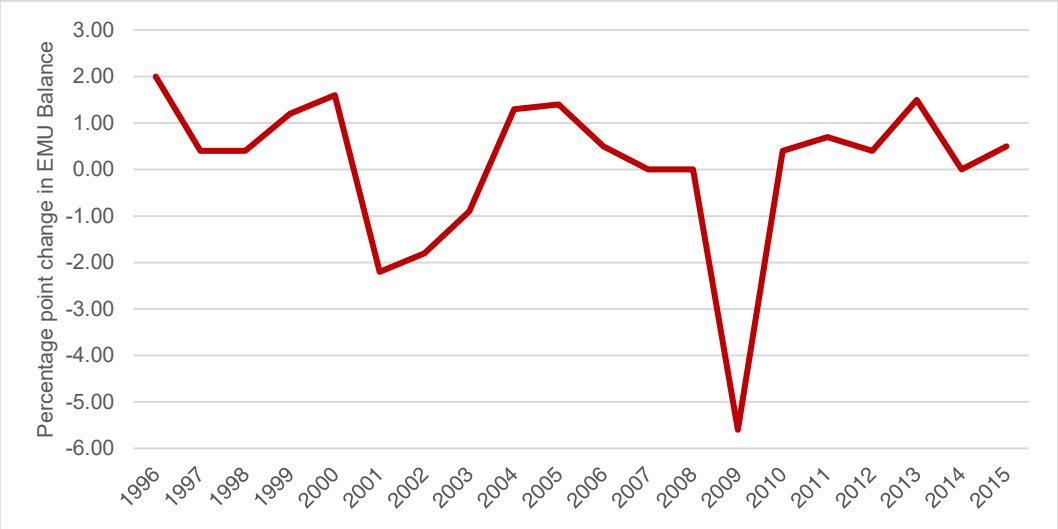
The DSTA's baseline analysis assumed a balanced budget and thus no increases in debt. CPB (2016) forecasted a reduction of the debt-to-GDP ratio due to a combination of economic growth and an improving primary balance. At the same time, CPB's short-term forecasts included a negative primary balance – questioning the validity of the assumption of a balanced budget and no increase in the (nominal level) of public debt.

In a secondary scenario, the DSTA assumed a € 15 billion funding need shock. To proxy for the appropriateness of the € 15 billion shock scenario, we proxy for shocks by looking at historical changes in the EMU balance.[6] Figure 3.1 shows the annual change in the EMU balance between 1995 and 2015. For the years in which the slope of the graph is negative, the average change

[6] Note that the DSTA only funds central government debt. Fluctuations in the EMU balance, however, are mainly driven by fluctuations in the central government balance. We therefore deem the EMU balance an adequate proxy of the volatility of the funding need.

amounted to a (negative) 'shock' of 2 percentage points. The steepest decrease occurred in 2009, with a 5.6 percentage point drop. Given a forecasted nominal GDP of € 698 billion for 2016, the monetary value of these (historical) drops is around € 14 billion on average, or € 39 billion in the worst case. The '15 billion scenario' thus covers an average drop in the EMU balance, but not an extreme event such as the Great Financial Crisis/Recession.

Figure 3.1 Annual change in EMU balance



Source: SEO Amsterdam Economics, based on CEP (2016).

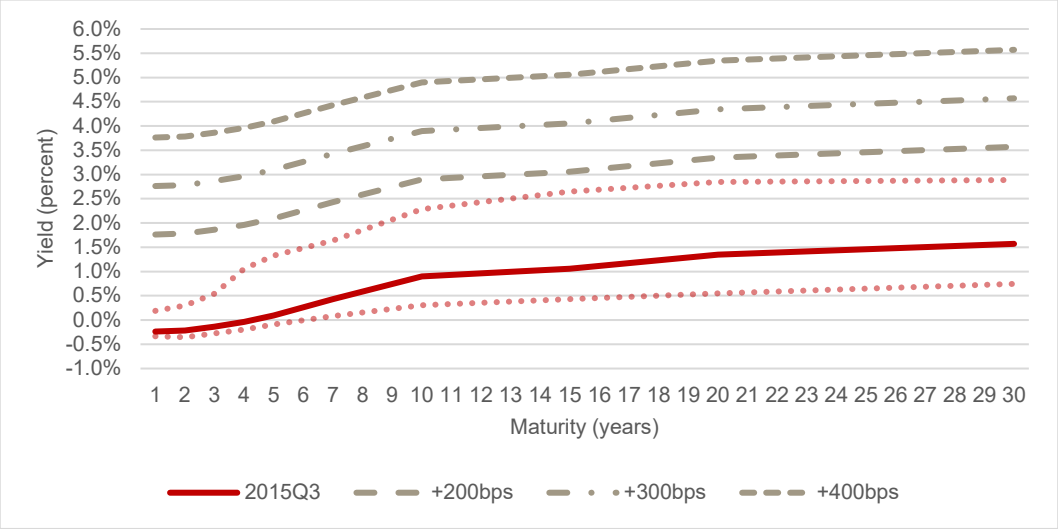
Interest rates

The DSTA's analysis has taken the 'current yield curve' to be the average yield curve over Q3 2015. Against this benchmark, it assessed scenarios with 200, 300 and 400 bps level shifts of the yield curve, as well as steepening or flattening of the yield curve (primarily for maturities less than 10 years).

Figure 3.2 reveals that these level shifts are significant compared to the benchmark and out of the 95% percentile bounds based on the preceding 3 years. This suggests that the interest rate scenarios considered by the DSTA might be 'pessimistic', at least over the short to medium run. This is further supported by the forecasts of the DNB (cf. Chapter 0 above), which suggested a long-term interest rate (10 years) of slightly over 1% by 2017 – well within the 95% bounds over the preceding 3 years.

Such 'pessimism' by the DSTA can be considered prudent from a risk management perspective. On the other hand, it induces the possibility that the expected costs of future financing (i.e. risk in the DSTA's analysis) will become overstated. Figure 3.2 further reveals that this is especially the case at the short end of the yield curve (maturities less than 10 years, and especially maturities less than 5 years) where the distance between the top 95% percentile and the DSTA level shift scenario's is larger than at the long end. This means that the short end is likely to remain relatively cheaper than the long end even in adverse interest rate risk scenarios. Although extension of the maturity of the portfolio might still be optimal, the trade-off between costs and risks becomes different. This could imply a lower average maturity target.

Figure 3.2 DSTA scenarios vis-à-vis historical 95% percentile bounds



Source: SEO Amsterdam Economics, based on internal DSTA memo and historical bond yield data courtesy of Bloomberg.

3.1.4 Quantitative assessment: portfolio optimization

We employ the model of Zenios et al. (2018) and perform a portfolio optimization exercise to hold the DSTA's analysis against the yardstick of a state-of-the-art sovereign debt portfolio optimization model.

Model setup

The model minimizes interest payments subject to a risk tolerance by picking an optimal issuance profile of instruments of different maturities (possibly constrained by the funding policy). The model takes legacy debt as given. The risk metric in the model is Conditional Flow at Risk (CFaR), which is the expected change in gross funding need as a share of GDP in the worst x% cases. Risk and interest costs are calculated over a scenario tree ('discretized probability distribution') consisting of a baseline (expected) path for economic development and stochastic deviations from this baseline.

The model does not include swaps. As a result, the model does not reflect the cost and risk effects associated with the legacy swap portfolio. New swap issuances were deemed out of scope given the fact that the 2016-2019 IRRF aimed to reduce the dependency on swaps.

For a detailed exposition of the model, we refer to Zenios et al. (2018).[7]

The model requires several inputs, which will be specified here.

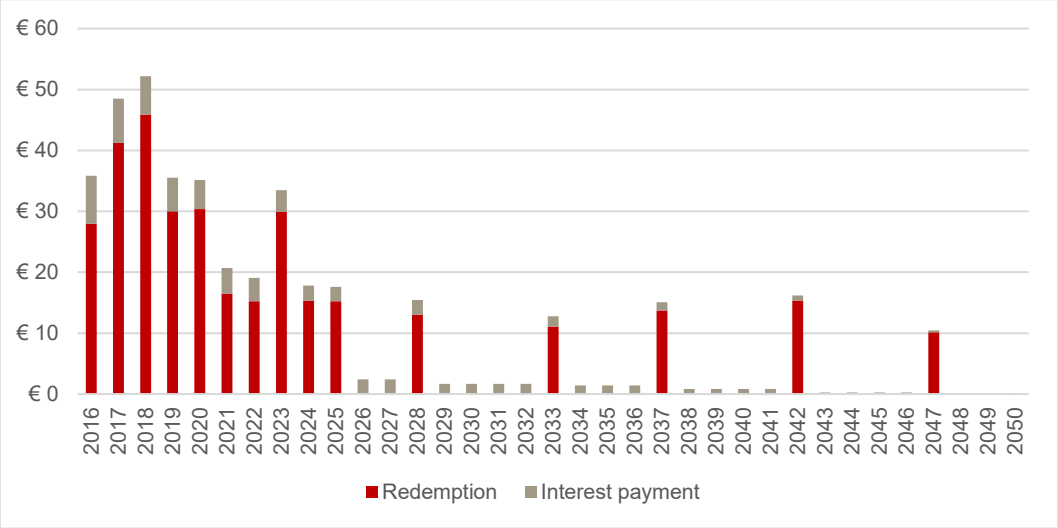
Legacy debt

The model includes the late 2015 legacy debt redemption profile. This legacy profile (incl. interest payments) follows from the DSTA's monthly reports (see Figure 3.3). The model does not allow

[7] We kindly thank Stavros Zenios and Andrea Consiglio for their help with the model analyses performed below.

for the inclusion of the legacy swap portfolio and is therefore omitted (cf. DSTA's own analysis above).

Figure 3.3 End of 2015 legacy debt



Source: SEO Amsterdam Economics, based on DSTA monthly report December 2015.

Scenarios

To model the scenario tree we employ forecasts for the 2016-2017 period, while statistics on the development of the GDP growth rate, primary balance and risk-free rate are based on CPB (2015). We combine these forecasts and statistics with long-term scenarios for the growth rate and primary balance for the Dutch economy as laid out in CPB (2014a) and CPB (2014b). Together, this yields a baseline trajectory for the growth rate, primary balance and risk-free interest rate.

For the nominal GDP, we follow CEP until 2017 and then assume 0.2 percentage points of additional growth per year up to a growth rate of 3.8 percent per year in 2021 and later years. This is consistent with long-term CPB scenarios of potential (real) growth and inflation, as well as with the ECB's inflation target. For the primary balance we follow CEP until 2017, and then follow the CPB's assumption of a primary balance surplus of 1.6 percent until 2023. We assume convergence to a primary balance (of zero percent) by 2027. For the risk free rate, we follow CEP until 2017, after which we assume an annual growth of 0.5 percentage points to 3.4 percent by 2023. This is roughly consistent with the CPB's long-term scenarios, as well as with observed historical data.

Deviations from these trajectories are simulated by introducing stochastic dynamics around the baseline trajectories based on the historical (long-term) variances and correlations of these series. Long-term means, variances and correlations are presented below in Table 3.2. Long-term scenarios and their variances are displayed in Figure 3.4.

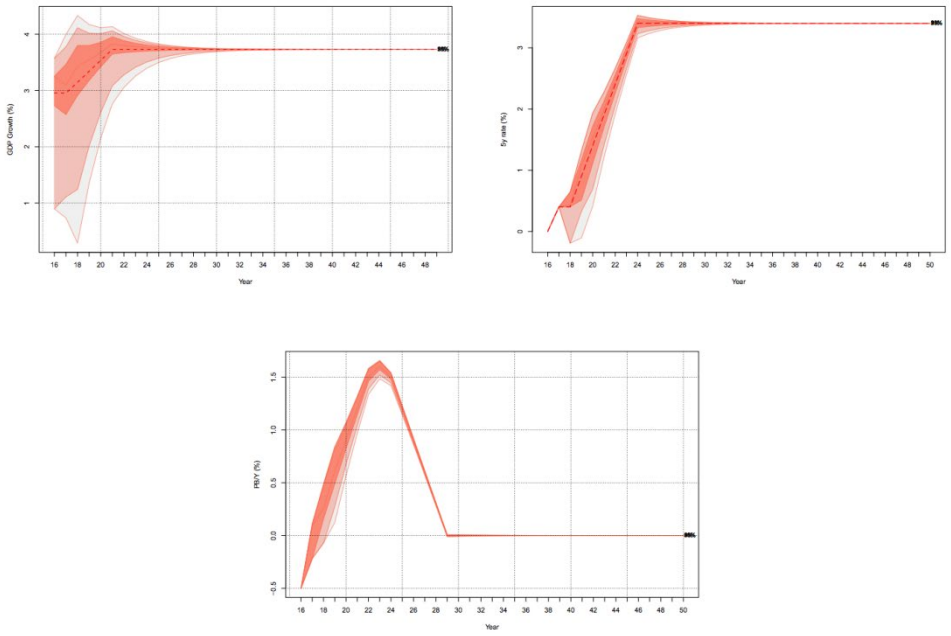
Table 3.2 Long-term statistics growth rate, primary balance and risk free rate

	1997-2015			1997-2017 forecast		
	Growth	Balance	Rate	Growth	Balance	Rate
Mean	3.79	0.73	3.52	3.68	0.64	3.22

Standard Deviation	2.47	2.54	1.45	2.38	2.43	1.67
Correlation						
Growth rate	1.00			1.00		
Primary balance	0.84	1.00		0.85	1.00	
Risk free rate	0.64	0.69	1.00	0.61	0.63	1.00

Source: SEO Amsterdam Economics, based on long time series in CEP 2016, CPB (2015).

Figure 3.4 Stochastic fluctuations around long-term scenario



Source: SEO Amsterdam Economics. We kindly thank Stavros Zenios and Andrea Consiglio for their help with the model analyses performed below. Lighter shaded regions show decreasing probability. The top-left, top-right and bottom panels show scenarios for economic growth, the interest rate and the primary balance, respectively.

Yield curve

Lastly, the model contains an endogenous yield curve that shifts and rotates as a result of changes to the debt-to-GDP ratio. These shifts and rotations of the yield curve are relative to a 'baseline yield curve'. This baseline yield curve is based on historical data for periods where the debt-to-GDP ratio was below 60%. The changes to this baseline yield curve for periods and states in the model where the debt-to-GDP ratio is above 60% are calibrated to European data of bond yields and debt-to-GDP ratios.

Instruments and policy parameters

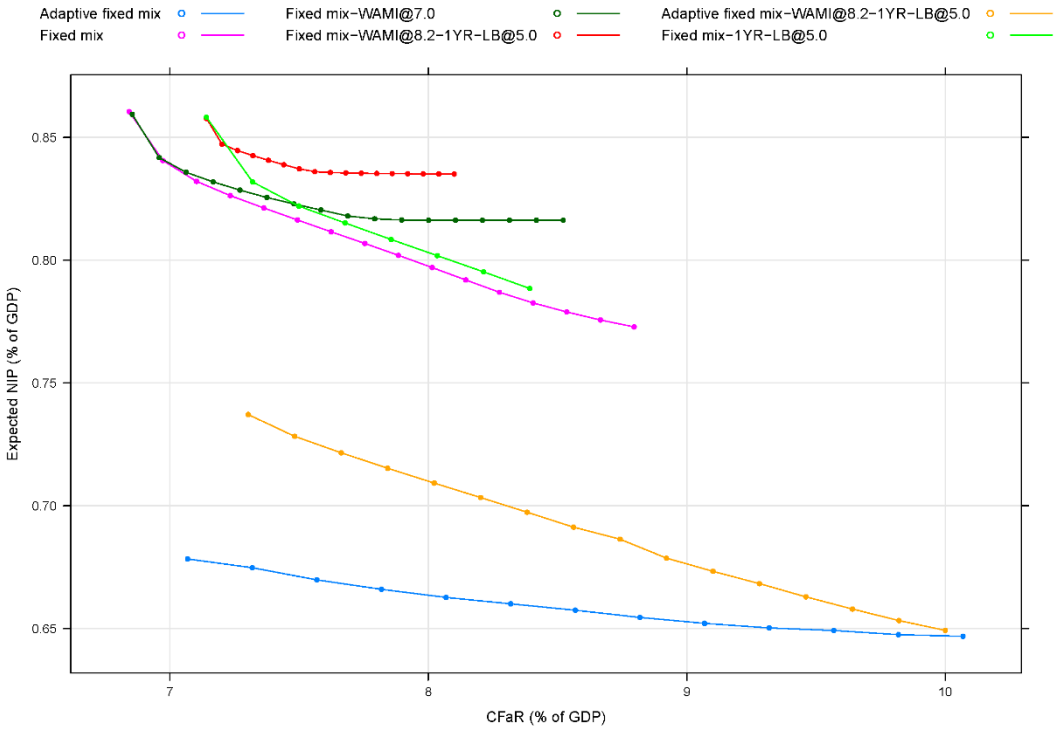
Several model solutions to assess the efficacy of the IFFR policy choices were calculated. In all cases the model minimizes the expected Net Interest Payments (NIP) subject to a Conditional Flow at Risk (CFaR) measure. In all cases, the model aims to perform this minimization by issuing

instruments of different maturities. The maturities available in the model are: 1 year to proxy for the money market, 3 years, 5 years, 10 years, 20 years and 30 years. Policy constraints considered in our simulations are maturity constraints, portfolio composition (fixed versus dynamic) and a minimal size for the money market.

Results

Figure 3.5 shows the model solutions. Each charted line displays a 'solution set' consisting of several portfolios with different cost and risk profiles, but obtainable at the same policy parameters (for instance: a maturity constraint/target).

Figure 3.5 Cost-risk trade-off



Source: SEO Amsterdam Economics. We kindly thank Stavros Zenios and Andrea Consiglio for their help with the model analyses performed below.

Benchmark

We first calculate a stylized 'benchmark' portfolio that is in the spirit of the DSTA's equilibrium portfolio (displayed in bright red, labeled Fixed mix-WAMI@8.2-1YR-LB@5.0). This model consists of a fixed issuance profile (an issuance profile with identical shares per instrument for all years, e.g. x% of issuance in year y is of maturity m) and is subject to two constraints, namely a Weighted Average Maturity at Issuance (WAMI) of 8.2 years and a money market of at least 5 percent of GDP every year. We omit further constraints on the issuance of other instruments because this would pin down a single solution instead of a solution set that allows us to investigate the cost-risk trade-off. The WAMI of 8.2 years corresponds (parsimoniously) to the '7-year benchmark with deviations' that was the policy target until 2016, the deviations amounting to a 1.2 years longer maturity in the limit based on the DSTA's chosen portfolio composition.[8]

[8] At constant issuance shares per instrument as per the DSTA's analysis (cf. section 3.1.1), with only the 20- and 30-year instruments having a maturity at issuance of more than 7 years.

This benchmark portfolio has a low NIP of between 0.83 and 0.86 percent of GDP.[9] Risk is low as well, with a CFaR(5%) of between 7.1 and 8.1 percent of GDP. Interestingly, the right part of the solution set is flat – implying that risk can be reduced at no increase in costs at least on that part of the curve.

Departure from the benchmark + deviations

Secondly, we calculate the solution set that no longer imposes a WAMI of 8.2 years, i.e. no longer anchors the maturity to a benchmark (displayed in bright light green, labeled Fixed mix-1YR-LB@5.0). Note that, because we no longer fix the WAMI, portfolios along this line vary in terms of composition and, hence, in terms of average maturity at issuance. Crucially, however, at each point along the line the composition of the corresponding portfolio is kept constant over time. The WAMI is decreasing in risk, i.e. portfolios at the bottom right have lower WAMIs than portfolios at the top left. Relative to the 'benchmark' this policy achieves lower costs at similar levels of risk, except for the most risk averse (i.e. left) part of the solution set. The level of cost reduction is increasing with risk tolerance. The left most part of this solution intersects with the benchmark solution. This yields the conclusion that the DSTA's policy of departing from the benchmark maturity anchor is ex-ante cost reducing at a given level of risk as long as the DSTA has a sufficiently high risk tolerance.

Departure from money market assumptions

Relaxing the assumption of a money market of a minimal size yields the solution set labeled Fixed mix, displayed in bright purple. Relative to the previous solution sets, this solution set is cheaper at a given level of risk (or, equivalently, less risky for a given level of costs). The optimal portfolios in this solution set typically employ the money market to a lesser extent than the constrained level. This may be rationalized by the fact that the forced large share of money market needs to be compensated with relatively costly long-term issuances to get to a given risk level. Without the money market constraint the same risk could be achieved with a portfolio that is more focused on medium-length maturities.

In the presence of a significant money market, this then suggests that the DSTA's policy of extending the maturity has been an ex-ante successful risk management practice. Yet it also suggests that from a cost-risk trade-off perspective the DSTA's policy should rely less on the money market. The counterargument to this conclusion is that the DSTA perhaps needs to maintain a money market of a certain size to ensure that they can call on this market as need be. The comparatively high costs associated with the minimal money market size then are an 'insurance premium' that guarantees that the DSTA has a money market of a certain size at its disposal. Such 'kinked' dynamics have not been modeled here.

Risk minimizing portfolio

The top-left most portfolio in this solution set is the globally risk minimizing portfolio. The risk minimizing portfolio has a WAMI of 8.6 years at a CFaR of 6.84 percent of GDP (95% confidence) with expected NIP of around 0.86 percent of GDP. The cost-risk trade-off in this unconstrained

[9] The fact that this portfolio is among the most expensive of the model solutions (cf. other lines, see below) does not necessarily mean that the portfolio is costly in the absolute sense of the word: average NIP of 0.8 percent of GDP are fairly limited cost, especially in comparison to the historical costs of sovereign debt financing.

case is bounded at low levels. The model solutions considered vary in costs between around 0.76 and 0.86 percent of GDP at between roughly 8.7 and 6.7 percent of GDP base risk, respectively. In addition, note the low slope of the risk-return trade-off that this implies. Note that the model does not address what an optimal level of risk is. The model only suggests a trade-off: costs (in the limit) could be reduced by around 0.1 percent of GDP at the cost of a 2 percent of GDP increase in risk (equivalently: 2 percent 'certainty' can be bought at 0.1 percent of GDP).

The DSTA's policy space

The average maturity that corresponds to the maturity of the portfolio chosen by the DSTA is not that different from this risk minimizing portfolio. On the (unconstrained) 'Fixed-mix' solution set, the DSTA's chosen portfolio is around the third bullet from the top left. In general, the DSTA's policy space is the top-left part of the cost-risk plane – i.e. the DSTA picks risk averse policies. The top-left part of the chart then shows that at high levels of risk aversion it is difficult to generate substantial further cost reductions averaged over scenarios and time at a given level of risk if the policy also specifies a fixed portfolio composition and a significant money market (conditional on late 2015 expectations of the future).

Dynamic portfolio optimization

Higher cost reductions at a given (low) level of risk are possible by pursuing a more active (funding) policy that sets portfolio weights dynamically. Figure 3.5 labels these dynamic portfolios as 'Adaptive fixed mix'. In these portfolios the composition is allowed to change every year to take advantage of changing rates and expectations, resulting in (average) cost reductions of at most 0.15 percent of GDP depending on maturity constraints, the role of the money market and risk appetite. It should be noted that the annual fluctuations under the 'Adaptive fixed mixed' strategies are significant. This may be at odds with a stable and predictable funding policy (see next chapter). It should furthermore be noted that through its periodic evaluation and recalibration of the IRRF, the DSTA already pursues some (slightly more limited) form of dynamic portfolio optimization. In a stylized setting, the model then shows that this is a good practice for cost minimization.

Summary

The model simulations suggest that the DSTA's policy decisions have been ex-ante appropriate from a risk management perspective, given the late 2015 expectations and restrictions on portfolio composition as a result of the funding policy. Under the assumption of a fixed portfolio composition at given risk, only very limited reductions in cost could have been achieved. A departure from the '7-year benchmark with deviations' paradigm ex-ante results in lower costs at a given level of risk for most levels of risk tolerance. More generally, model simulations suggest that extending the maturity of the portfolio ex-ante (conditional on late 2015 information) results in lower costs at a given level of risk.

Given the fact that the DSTA's chosen policy is in the 'low risk' quadrant of the cost-risk plane, it is difficult to obtain ex-ante (significant) further cost reductions without relaxing money market requirements and/or employing a more dynamic issuing strategy. With respect to the former, we at the same time note the 'insurance motive' of having a money market of minimal size. With respect to the latter, it should be noted that the DSTA already employs a 'limited dynamic' issuing strategy through the evaluation of its IRRF and funding policy every four years. We argue that this contributes to the appropriateness of the DSTA's risk management practices.

Clearly, costs can be reduced in all cases by taking on more risk. The model employed here has only assessed the cost-risk trade-off and in interpreting the model results we have taken the DSTA's risk appetite ('non-increasing') as given. We have not assessed the appropriateness of this risk appetite.

3.2 Ex-post assessment

3.2.1 Funding outcomes

Sovereign debt dropped by € 27 billion between 2015 and 2018 to € 343 billion (expected based on government budget). Interest payments fell from € 7.1 billion in 2015 to € 6.1 billion (expected) in 2018. This implies an absolute and relative (as a percentage of sovereign debt) decrease in interest payments over the period 2015-2018.

Consistent with the stated objective of reducing the dependency on the swap portfolio for risk management, the swap portfolio shrunk from € 595 billion in 2015 to € 299 billion in 2018 (expected) – close to a 50 percent reduction. The decrease in the swap portfolio is the result of both early natural terminations and expirations of contracts.

Table 3.3 DSTA has achieved smaller debt and swap portfolios

	2015	2016	2017	2018
Debt portfolio (€ bln)				
Sovereign debt	370	363	346	343
Interest payments*	7.1	7.4	6.6	6.1
Swap portfolio (€ bln)				
Pay	320	267	216	164
Receive	275	237	197	135
Net	46	30	19	29

Source: SEO Amsterdam Economics, based on *Rijksjaarverslag XI Financien en Nationale Schuld* 2015-2017, *Rijksbegroting* 2018, DSTA monthly reports December 2015-2018. * The interest payments listed in the annual report (*Rijksjaarverslag*) contain interest payments that are not related to sovereign debt. These other payments, however, are small.

Similarly, the DSTA has achieved its other stated policy targets with respect to the IRRF. The realized maturity of the portfolio has been in line with the target maturity. Effectively, the 2019 maturity target was already achieved in 2018. Furthermore, the annual refixing rate has consistently remained below its maximum.

Table 3.4 DSTA has met its risk management targets

	2016	2017	2018	2019

Target maturity (years)	5.5	6.0	6.3	6.4
Realized maturity (years)	5.6	6.0	6.4	
Target annual refixing rate (% of debt)	<18%	<18%	<18%	<18%
Realized annual refixing rate (% of debt)	15.4%	16.3%	13.2%	

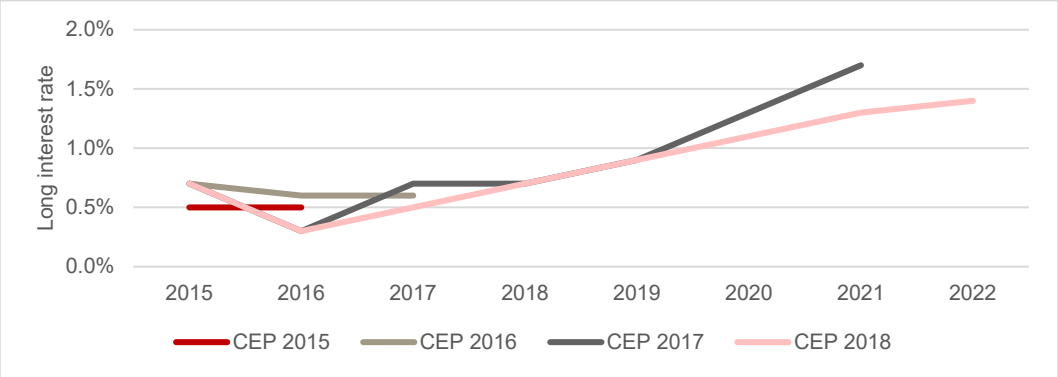
Source: SEO Amsterdam Economics, based on DSTA Outlook 2019, DSTA monthly report December 2018. Here, target maturity is the average maturity of the portfolio (including swaps).

3.2.2 Economic developments 2016-2019

The 2016-2019 IRRF was developed based on expectations about future developments at the end of 2015. We take CEP 2015 as a proxy for these expected developments. By comparing these expected developments to CEP 2016, CEP 2017 and CEP 2018, we gain insight into the extent to which these expectations materialized.

Interest rates have remained lower than expected over the period 2015-2018. CEP2018 shows that interest rates were lower in 2016 than CEP 2015 and CEP 2016 had forecasted. The same holds for 2017, based on CEP 2016 and CEP 2017. CEP 2018 suggests that long-term rates in 2019 will be below 1%, which is significantly below DSTA's original interest rate scenarios as well as below the CBP's long-term scenarios for the Dutch economy.

Figure 3.6 Long-term interest rates typically lower than forecasted between 2015-2018



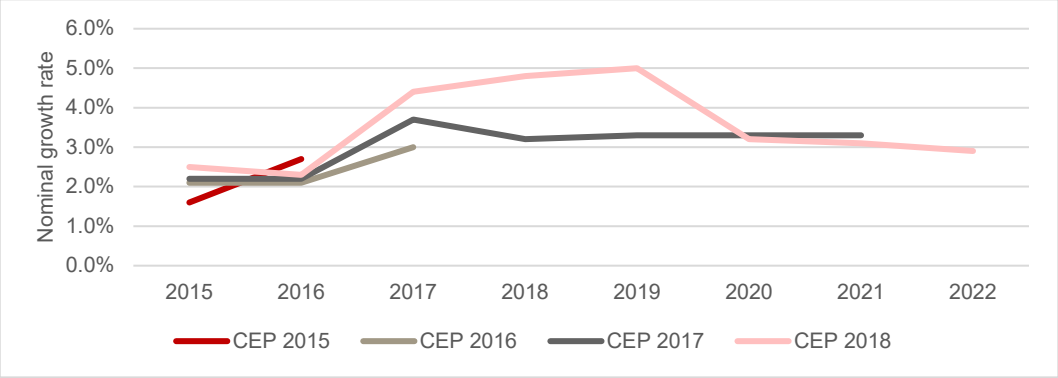
Source: SEO Amsterdam Economics, based on CPB *Centraal Economisch Plan* 2015-2018.

Growth in 2016 turned out to be lower than was foreseen in 2015. In later years, growth typically was higher than expected (Figure 3.7). This – in part – has been driving an accelerating decrease in the level of public debt relative to GDP (see Figure 3.9). The other contributing factor to this accelerating decrease has been the larger than expected improvement of the EMU balance (Figure 3.8).

The fact that rates have been lower than expected (trivially) implies that the DSTA's strategy has not been ex-post cost minimizing. This can be illustrated based on Figure 3.1. The cost minimizing strategy in late 2015 would have been to shorten the maturity of the portfolio in 2015 and 2016 to take advantage of low and decreasing rates (assuming no significant twisting of the yield curve), only to start extending the maturity of the portfolio from 2016 and 2017 onwards to lock in the lower rates (thus reducing risk). In the limit case, decreasing rates imply that the ex-post cost

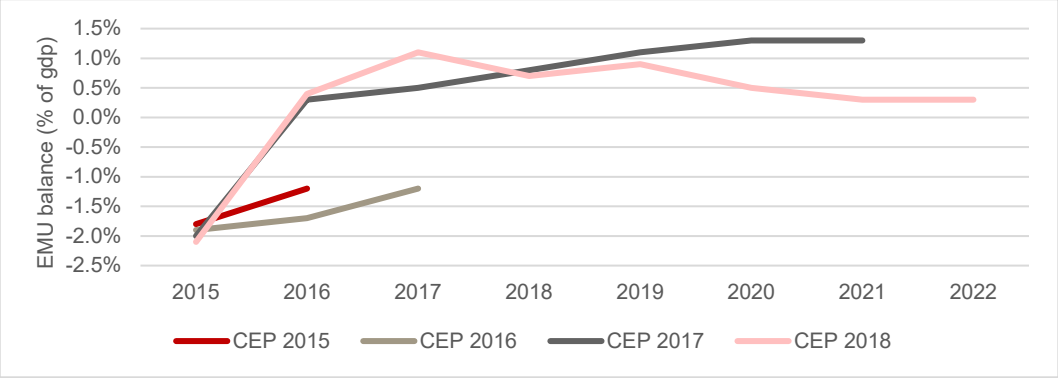
minimizing strategy would have been to issue as much short-term debt as possible until rates would start to rise again. At the same time the lower and decreasing rates imply that by the DSTA's methodology, which defined risk as the excess interest costs over the 2015 (Q3) yield curve, the realized risk was 'negative' in 2016. This is not to say that from a risk management perspective the DSTA's IRRF and risk management practices have been inadequate. Ex-post cost minimization would have required that the DSTA had perfectly forecasted interest rate developments (in the limit case on a daily basis) for several years – an untenable task.

Figure 3.7 Growth initially slower, then faster than expected



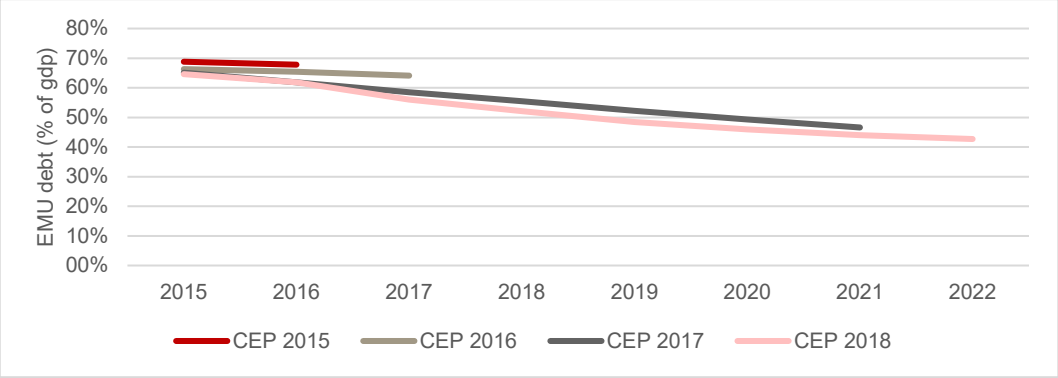
Source: SEO Amsterdam Economics, based on CPB *Centraal Economisch Plan* 2015-2018.

Figure 3.8 Strongly improving EMU balance



Source: SEO Amsterdam Economics, based on CPB *Centraal Economisch Plan* 2015-2018.

Figure 3.9 Accelerating decrease in public debt



Source: SEO Amsterdam Economics, based on CPB *Centraal Economisch Plan* 2015-2018.

3.2.3 Stylized policy performance

Above we noted that between 2016 and 2018 the financing costs of the DSTA were reduced. This may be due in part to the persistently low (or even falling) interest rates, but also to a maturity effect that stems directly from maturity choices under the 2016-2019 IRRF. We perform a highly stylized exercise in an attempt to parsimoniously disentangle these effects.

We take the legacy portfolio and yearly issuances as given. The DSTA does not issue the same amount (or instruments of the same maturity for that matter) every year. As a result, there is a compositional effect in the realized interest rate costs and maturity. In practice, the maturity profile of legacy debt and swaps matters for realized interest rate costs as well as for the average maturity of the portfolio. Under the '7-year benchmark with deviations' policy, instruments with a maturity longer than 10 years were not swapped to achieve the 7-year benchmark. The 2016-2019 IRRF departed from the '7-year benchmark with deviations' policy. In our (stylized) counterfactual simulation, several legacy (pre-2016) instruments would have been refixed under the '7-year benchmark with deviations' policy. In addition, several newly-issued instruments and reopenings would have been swapped as well. We perform a (stylized) counterfactual simulation based on the legacy portfolio at the end of 2015 and new issuances since 2016 to assess the cost and maturity effect of this departure.

Our (stylized) counterfactual simulation suggests that the departure from the '7-year benchmark with deviations' policy has increased the weighted average maturity of the portfolio by 0.2 years per year on average. In the context of our counterfactual simulation, this implies an increase of the weighted average effective interest rate of 0.2% on average.

This effect may be partially offset by the fact that rates have been mostly rising over the period of 2016-2018. Given the fact that the DSTA has a net payer position, this would have increased the NPV of the swaps. The exact effect has not been quantified. It should furthermore be noted that the lengthening of the maturity could have a cost reducing effect in the future if interest rates continue to rise (sufficiently) due to the fact that the current low rates are 'locked in'.

3.3 Synthesis

Looking back

In response to historically low yields, favorable economic forecasts (including expected rising rates) and the outcomes of the evaluation of the 2012-2015 IRRF, the 2016-2019 IRRF aimed to increase the maturity of the sovereign debt portfolio through a combination of new issuances and a decreased use of swaps. Specifically, it set a target for the average maturity of the portfolio of 6.4 years, to be achieved by the end of 2019 (2015 maturity: 5.5 years). In addition, it set a maximum annual refixing amount of 18% of sovereign debt.

The DSTA has managed to achieve its stated policy targets. Every year it has met its target maturity and stayed below the maximum refixing amount. Between 2015 and 2018 it has reduced the reliance on swaps (and no new swaps were issued), and sovereign debt financing costs fell by €1 billion.

In terms of ex-post efficacy, the IRRF has contributed to this result. In practice, there is a significant compositional effect due to the legacy debt and the fact that in practice the DSTA does not issue the same instruments or volume every year. A stylized analysis that compares funding outcomes for the '7-year benchmark with deviations' and the 2016-2016 IRRF policy frameworks suggests that the latter has extended the maturity of the portfolio, at an increase of the weighted average effective interest rate cost of 0.2%. If rates rise in the future, however, the present policy may induce a cost saving due to the 'lock in' of current lower nominal rates.

At the same time, the portfolio pursued under the 2016-2019 IRRF could not have been the most cost efficient portfolio due to the fact that rates continued to fall during 2016. This does not necessarily reflect poorly on the appropriateness of the 2016-2019 IRRF, though, given the fact that (market) expectations in late 2015 suggested rising interest rates in both the short and long term. Given the knowledge and expectations at the time of introduction, the 2016-2019 IRRF has achieved the goal of low(er) funding costs at equal risk, which does not preclude that (ex-post) there were options with lower costs at equal risk.

More important, then, is the ex-ante assessment of risk management practices. The DSTA has underpinned its 2016-2019 IRRF with a portfolio simulation analysis to determine the optimal maturity and associated portfolio composition. Parts of the methodology of this analysis could be improved upon. At the same time, the (risk of the) portfolio suggested by the DSTA's analysis is not that different from the efficient frontier suggested by a state-of-the-art portfolio optimization model. This latter model also reveals that in ex-ante terms the IRRF 2016-2019 is cost reducing vis-à-vis the preceding IRRF at most levels of risk tolerance, suggesting that the 2016-2019 IRRF as a policy is ex-ante effective in providing low costs of debt financing at a level of risk that is no higher than under the 7-year benchmark with deviations. In general, costs can be reduced by accepting more risk. At the same time, our analysis shows that lower costs at similar levels of risk could have been attainable through (ex-ante) relaxing e.g. the money market size constraints implied by the funding policy – although this may have side effects as well (see funding policy below). The current maximum risk appetite is based on the historical maximum risk appetite: 'risk no higher than under the preceding risk management framework' appears to have been the guiding principle. Given specific market conditions or expectations of the future, a different risk tolerance may be defined.

Looking ahead

The DSTA is set to develop its 2020-2023 IRRF during 2019. The preceding suggests several points or facts that could be taken into account in this process.

First, the current maximum risk tolerance is defined in terms of the maximum risk tolerance supported by the preceding IRRFs. In the limit, this suggests that the current risk appetite is (still) bounded above by the 2002 9% base risk target. The next IRRF should do well to more explicitly define and consider its upper bound on risk, given the current market conditions, expectations of the future and policy parameters.

Second, the ex-ante methodology employed in the previous development phase of the IRRF can be improved upon. We highlight the option of including fully specified probabilistic scenarios for

interest rate developments, the means of which correspond to e.g. the CEP forecasts by CPB. This would a) correctly move the costs associated with foreseen interest rate increases to 'costs' instead of 'risk', and b) allow for the definition of a risk measure that weighs the impact of possible future states of the world by their likelihoods. An added benefit of conforming to CPB forecasts is an increased overall consistency of underlying economic and financial scenarios for the Dutch government. Beyond the development of fully specified probabilistic scenarios for interest rate developments, the text above further notes the inclusion of scenarios for growth and the government's fiscal and sovereign debt positions, and an extension of the modeling horizon amongst other options.

Third, the ex-ante analyses considered in the development of the 2016-2019 IRRF by and large took the funding policy as given. The analysis performed in this chapter showed that the relaxation of (some of) the constraints implied by the funding policy could result in better outcomes in terms of interest costs and interest rate risk (a softening of the cost-risk trade-off). At the same time these gains could potentially come at costs associated with reduced effectiveness of the funding policy, for instance. This implies a trade-off. If the DSTA seeks to continue its decreased reliance on swaps, it seems prudent to develop a more integrated analytical framework that considers the IRRF and funding policy jointly, explicitly modeling costs and benefits associated with more flexibility in the funding policy in the portfolio optimization.

4 Funding Policy

The DSTA's funding policy is in line with the international standards regarding consistency, transparency, and liquidity. In the international comparison, the DSTA scores high on these guiding principles. This has likely contributed to lower uncertainty and lower funding costs.

The funding policy materializes objectives and goals to practical policy measures in order to obtain funding at the lowest cost possible against acceptable risk to the budget. The DSTA's guiding principles are consistency, transparency and liquidity. Consistency and transparency ensure that auctions are predictable, which reduces uncertainty and the risk premium on Dutch government debt. Furthermore, liquid bonds have a higher liquidity premium investors are willing to pay, which translates into lower funding costs.

The first step to evaluate the DSTA's funding policy is to review the academic and policy literature on sovereign debt management. This literature review gives an overview of the international standard in funding policy, which is a benchmark for the DSTA's policy. Additionally, the DSTA's funding policy is contrasted with the policies of other European DMOs in an international benchmark comparison. This enables a relative performance evaluation of the DSTA. Finally, we empirically analyze whether the adoption of more flexibility in the funding policy has led to a higher risk premium on government debt. Furthermore, we analyze the effect of issuance volume and number of outstanding lines on liquidity. This allows us to comment on the policy question of how to sustain liquidity in the context of a decreasing funding need.

Section 4.1 discusses the consistency and transparency of the funding policy. Section 4.2 focuses on liquidity. Finally, section 4.3 provides a synthesis of this chapter as well as an evaluation of the operational targets for the funding policy, as described in the theory of change in section 2.4.2.

4.1 Consistency and transparency

4.1.1 Literature review

Rationale for consistency and transparency

Consistency and transparency are important for public debt management, because they can reduce uncertainty. Greater predictability increases the demand and lowers the uncertainty premium on government debt (Jonasson & Papaioannou, 2018). This enables the DMO to obtain funding at a lower cost, because of the reduced uncertainty (or risk) premium. Transparency about auction rules improves the demand for debt instruments. In addition, the announcements prior to the auction about the bond to be auctioned, volume and coupon should be consistent and transparent as well (Jonasson & Papaioannou, 2018). Furthermore, since the demand is higher with greater predictability, the same is true for the liquidity. The IMF and World Bank (2014) guidelines state that transparency is a key factor in debt management, since policy effectiveness can be strengthened if the goals and instruments are known to the public. Furthermore, transparency supports accountability. The DMO's objectives should be made public in order to reduce uncertainty

regarding future funding plans. If the DMO is consistent and executes its funding plan according to previous announcements, it will build up a good reputation, which will increase the demand for government bonds.

However, there is a trade-off between consistency and flexibility. In volatile markets or in times of uncertainty about the government's funding need, flexibility can help adapting to unforeseen changes. If, for example, a DMO announces all auction details at the beginning of the year and the funding need turns about to be higher than expected, acting according to the announced schedule will result in a shortage of capital raised. On the other hand, the flexibility should not be so large as to damage the reputation of the DMO. Therefore, many DMOs use the money market as a buffer for flexibility, while issuing according to the borrowing plan on the capital market. Nevertheless, DMOs can also choose to abandon the fixed target volume on the capital market and adopt a target range instead. This gives them more flexibility in raising capital, at the same time providing a certain degree of consistency if the bandwidth of the target range is not too wide. Additionally, there is evidence that foreign auction cycles have spillover effects on domestic auctions (Beetsma, Giuliodori, Hanson & De Jong, 2018). Furthermore, Beetsma et al. (2018) show that issuing costs are higher if the market volatility is higher. If that is the case, the DMO could take into account the dates of foreign auctions in order to set its own auction dates in such a way that spillovers from foreign auctions are minimized. Additionally, it could take into account market volatility when deciding on auction dates. Moving an auction date shortly before the auction is set to take place will decrease predictability. In turn, this could decrease liquidity and increase the risk premium, but on the other hand it can also lead to lower funding costs if volatility is lower at the new auction date. If the latter effect dominates the former, moving the auction date would contribute to the objective of obtaining funding at the lowest cost possible against acceptable risk to the budget.

Policy tools

A DMO has several policy tools at its disposal to improve consistency and transparency. A few policy tools to increase consistency are (IMF & World Bank, 2014; Jonasson & Papaioannou, 2018):

1. Issuing bonds at regular times in a year.
2. Issuing new benchmark bonds every year.
3. Announcing a target volume for the total amount to be issued in a year, but also for each line or for each auction separately.
4. Ensuring that this target volume is reached.
5. Executing funding policy in accordance with the risk management framework, not deviating from it to capture short-term gains at the cost of an increase in risk.

Policy tools to improve transparency include (IMF & World Bank, 2014; Jonasson & Papaioannou, 2018):

1. Making debt management objectives public.
2. Timely publication of the borrowing plan for the following year, with a high level of informational content.
3. Announcing auction dates and details as early as possible.
4. Publishing periodic updates about the borrowing requirement.
5. Publishing post-auction results.
6. Clearly describing the auction process.

7. Frequently communicating with primary dealers and investors about the funding plan and auction details.
8. Disclosing the rationale for and statistics about the derivative portfolio.

All of these policy tools provide more information about the debt management, which reduces uncertainty for primary dealers and investors. However, it goes without saying that consistency and transparency cannot be used independently. Without transparency, investors cannot check the DMO's consistency. Without consistency, transparency is of limited value, since it does not provide any information about the actual debt management and funding policy. In other words, the benefits of transparency are larger when consistency is larger, and vice versa.

Measuring consistency and transparency

Although there is no obvious measure for consistency or transparency, one can make qualitative comparisons between different DMOs. For example, comparing the publication date of the issuance calendar, whether the DMO uses a target volume or a target range, the size of this target range, whether the DMO reaches this target and the informational content of annual outlooks and issuance calendars allow to compare the consistency and transparency of the Dutch DMO with those of other countries. Furthermore, the DMO's policy can be evaluated against the benchmark provided by the IMF and World Bank (2014). Since consistency and transparency are meant to make auctions more successful, one can also measure the success of an auction. This is typically measured by the bid-to-cover ratio (Beetsma et al., 2018a). A higher bid-to-cover ratio is an indicator for a successful auction, as the demand for government bonds exceeded the supply. Nevertheless, in some cases auctions are oversubscribed, because investors know that they will only be allocated a part of their bid. Furthermore, the bid-to-cover ratio does not distinguish between different types of auctions. Dutch tap auctions have a bid-to-cover ratio of 1 by definition, making it an imperfect measure of the success rate. However, DDAs do have a bid-to-cover ratio, enabling a comparison of the success rate over time.

Confrontation with 2016-2019 funding policy

The DSTA states that consistency and transparency are guiding objectives of its funding policy. The policy tools the DSTA uses to achieve consistency and transparency are in line with the literature and IMF and World Bank principles. The DSTA holds auctions regularly, announces information about the auctions in a timely manner, conducts the auction accordingly, and provides relevant information in its Quarterly and Annual Outlooks. Additionally, the DSTA aims not to deviate from the risk management framework. In the current low interest rate environment, some DMOs issue very long bonds to lock in low interest rates. However, the DSTA sticks to its policy of issuing a 30-year bond every 4 or 5 years. Additionally, DMOs could also shorten the portfolio to benefit more from the lower interest rates, albeit against a higher risk. The DSTA thus shows consistency in its issuance policy for very long bonds in a changing environment.

The DSTA opted for more flexibility in its 2016-2019 funding policy, by switching from a target volume to a target range on the capital market, and by announcing in 2018 that it would issue a very long bond without specifying more details. The DSTA uses more flexibility, but retains consistency by meeting the target range. However, the announcement that it would issue a long bond in 2018 without clarifying whether this would be a new bond or a reopening of an off-the-run bond, may have introduced uncertainty in the market. Several primary dealers also mentioned

this as an increase in uncertainty in the long segment. It gave the DSTA more flexibility, but since the 30-year maturity segment is not the most liquid segment in the Dutch government bond market, more uncertainty can have a relatively larger upwards effect on the yields. This may counteract the leading objective.

Regarding money market issuances, the DSTA uses flexibility to a larger degree than for capital market issuances. The money market has been the primary source for flexibility for several years and was the main buffer to absorb changes in the funding need. The announced target for total money market issuances in the Annual Outlook is only indicative when the expected and realized funding need are equal to each other. In the recent years the funding need has been lower than expected, due to larger-than-expected government surpluses. Therefore, the realized money market issuances were near the lower bound of the target range or even below that range. Generally, DTCs are issued on the first and third Monday of the month. However, the DSTA cancelled the December program and re-opened the January program instead, citing lower cash demand and stronger demand for the January DTC as the main reasons. Additionally, in 2018 the DSTA shortened the maturity of one DTC program by a few days. This shows that the DSTA exercises great flexibility in its money market issuances, although it also shows consistency by having regular issuance dates for DTCs with a shorter and longer maturity, among others.

4.1.2 International benchmark

Compared to other European DMOs, the DSTA generally scores high on predictability and transparency. The DSTA's publications are informative, which contributes to communication with investors and primary dealers, but also with the general public. Finally, the Netherlands has the lowest yield spread over German bonds in the sample of European countries, indicating that the consistent and transparent funding policy likely has reduced uncertainty (see Figure 2.6). However, one should note that the funding policy can only contribute to a lower yield spread to a small extent, as mentioned in Box 2.1.

The DSTA scores high on the predictability of auctions in the international benchmark comparison. All countries in the sample for the international benchmark, consisting of Belgium, Germany, France, Italy, Portugal and Spain, use an issuance calendar to announce auction dates and auction characteristics. However, the countries differ with regard to the informational content of those issuance calendars. Germany puts great focus on predictability and transparency, and therefore publishes a complete issuance calendar, including auction dates, bonds to be auctioned, maturities and target volume at the beginning of the year (AFME, 2017). Although it maintains the possibility to deviate from the planning if market conditions demand it, as a rule the German debt office sticks to the schedule as much as possible. On the other hand, Italy states the announcement date, auction date and settlement date in its annual issuance calendar, but details regarding the maturity, line and volume are only announced three working days before the auction takes place (AFME, 2017). The Belgian DMO publishes the auction dates for bonds at the beginning of the year, but auctions may be cancelled and replaced by a syndication, and the size and maturity of instruments can be adapted to market demand. Belgium thus puts greater focus on flexibility than Germany, but provides details on the auctions at least 5 working days before they take place. The Portuguese DMO publishes an indicative quarterly issuance calendar, but it may adjust the funding plan to changes in the borrowing requirement and funding policy. The DSTA also retains the

option to cancel an auction if necessary, but in principle aims to issue according to the schedule that is announced in the funding plan. Each quarter, the DSTA announces the bond to be reopened and the target volume for new auctions. For new lines, the DSTA announces each quarter whether it will issue a new line, but it retains flexibility regarding the actual auction date. For example, the Annual Outlook 2019 stated that the DSTA would issue a new benchmark 10-year bond in February/March 2019, and on the 21st of January, 2019 it announced the specific auction date (12th of February, 2019), maturity date, reference bond and target volume. In conclusion, although German auctions are more predictable than Dutch auctions, the Netherlands scores higher on predictability and consistency than most other countries, as it timely announces auctions and the specific details of the auction, and in general does not deviate from the funding plan.

The DSTA performs well on transparency and communication in the international benchmark comparison. The Annual and Quarterly Outlooks of the DSTA are not only informative about the funding policy, but also contain information about the interest rate risk framework, economic outlook, budgetary outlook, recent market developments and relevant statistics. The French DMO also publishes information on the issuance plans. In addition, it discusses recent market developments, provides information on the redemption schedule and shows various other data charts that are informative about the DMO's policies and the French sovereign debt position. Although investors can easily access this information using other sources, it does matter for the general public. Additionally, it places the funding policy in the context in which the DMO operates. The Belgian and German DMOs, on the other hand, mainly focus on the funding plans and issuance calendars in their annual outlooks and do not discuss the economic and budgetary outlook. Their outlooks are mainly written for investors and not for the general public, whereas Dutch and French publications are more accessible. The DSTA communicates about its policy decisions and the rationale behind the debt management framework. Based on this comparison, the DSTA is one of the most transparent DMOs internationally.

4.1.3 Regression analysis

The adoption of a target range for total capital market issuances by the DSTA in 2016 did not increase the risk premium on Dutch government bonds. Building on the empirical baseline model by Afonso, Arghyrou and Kontonikas (2015), we do not find a significant effect of the target range on the spread between the yield on Dutch 10-year bonds and 10-year German government bonds (Table 4.1). A priori one could think that the introduction of a target range for total capital market issuances introduces more uncertainty for investors. This heightened uncertainty would then translate into a higher risk premium. However, none of our empirical models show evidence that the adoption of the target range affected the yield spread in any way. One explanation is that the variation in the sample is likely too small to get clear results on the effect of the target range, as only the Netherlands has adopted a target range. Furthermore, the yield spread is mainly determined by its lagged value, and in some specifications the government balance-to-GDP ratio and the government debt-to-GDP ratio. Furthermore, during the euro crisis between 2010 and 2012, Italy, Spain and Portugal experienced significantly higher yield spreads than other countries. The VIX measures volatility in US financial markets, but this does not affect yield spreads after controlling for time-specific effects. Furthermore, the real effective exchange rate, measuring productivity differences and macroeconomic imbalances, does not have a significant effect on the yield spread. The growth rate of industrial production or the ratio of long-term government debt

to total government debt does not affect the yield spread significantly. A government surplus does reduce the yield spread, but this is only significant at the 10 percent level in one specification. The same applies to the government debt-to-GDP ratio. These results are broadly in line with those of Afonso et al. (2015), who also show a strong persistence of the yield spread. However, Afonso et al. (2015) find that apart from the lagged value of the yield spread and government debt variables, volatility on US financial markets (VIX) and the growth rate of industrial production have a significant effect on the yield spread. The difference between the results found by Afonso et al. (2015) and the ones described in this report lies in the econometric specification of the model. Afonso et al. (2015) do not control for monthly time effects. Since the VIX does not vary between countries, but only over time, it is fully absorbed in the time dummies in our model.

Table 4.1 Adoption target range by DSTA did not increase the yield spread on 10-year bonds

	(1)	(2)	(3)	(4)
	Dependent variable: yield spread 10-year bonds vs. DE			
Yield spread (-1)	0.959***	0.958***	0.952***	0.951***
	(0.0086)	(0.0087)	(0.022)	(0.022)
ln(VIX)			-36.630	-36.690
			(35.070)	(35.050)
ln(VIX) (-1)	-17.070	-17.110		
	(24.490)	(24.570)		
ln(Real effective exchange rate)			-0.527*	-0.493
			(0.316)	(0.323)
ln(Real effective exchange rate) (-1)	-0.428	-0.389		
	(0.334)	(0.345)		
Growth industrial production			-0.069	-0.088
			(0.188)	(0.191)
Growth industrial production (-1)	-0.0046	-0.016		
	(0.044)	(0.043)		
Government balance / GDP			-0.0028	-0.0028
			(0.0017)	(0.0017)
Government balance / GDP (-1)	-0.0014*	-0.0013		
	(0.00063)	(0.00070)		
Debt / GDP			0.00092	0.00096*
			(0.00056)	(0.00057)
Debt / GDP (-1)	0.00067	0.00071		
	(0.00070)	(0.00068)		
Long-term debt / debt			-0.00070	-0.00064

			(0.0016)	(0.0016)
Long-term debt / debt (-1)	-0.0012	-0.0011		
	(0.0012)	(0.0012)		
Euro crisis for ES, IT, PT	0.257*	0.258*	0.267***	0.268***
	(0.106)	(0.106)	(0.056)	(0.056)
Target range		0.026		0.027
		(0.017)		(0.022)
Observations	1227	1227	1205	1205
Adj. R-squared	0.986	0.986	0.989	0.989
Specification	Fixed effects	Fixed effects	Pooled 2SLS	Pooled 2SLS

Source: SEO Amsterdam Economics. The sample consists of Belgium, France, Italy, the Netherlands, Portugal and Spain for the period 2000-2018. All models include a constant, country fixed effects and year-month dummies. Robust standard errors are given between parentheses. Instruments for the pooled 2SLS model are the second and third lag of the yield spread, the first, second and third lag for other explanatory variables, a dummy for the euro crisis, a dummy for the target range, country fixed effects and year-month dummies.

Synthetic control method

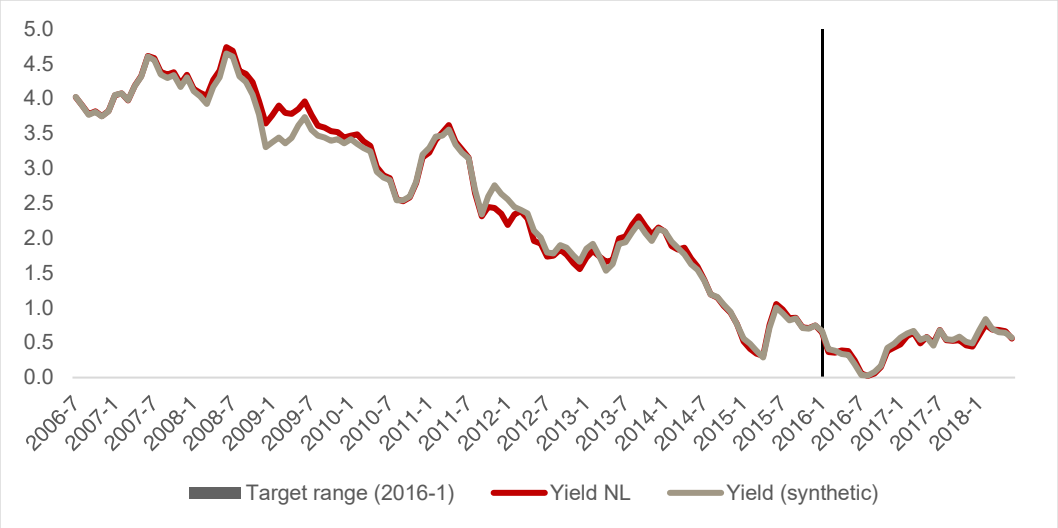
Using a different methodology, we also do not find evidence that the adoption of a target range in 2016 led to a higher yield on Dutch government debt. We apply the "synthetic control method", which essentially assigns weights to other countries to replicate the data for the Netherlands in order to construct a counterfactual (Abadie, Diamond & Hainmueller, 2010). The synthetic control method can give more insightful results when the variation in the treatment is small, as is the case with the target range. This "synthetic" control group for the Netherlands consists for 53% of Germany, for 37% of France, and for 9% of Belgium. Due to missing data in the sample, we calculate the weights over the period July 2006 until December 2015. The synthetic control group should be constructed in such a manner that it replicates the Netherlands closely. As shown in Table 4.2, the synthetic control matches the Netherlands very well for the yield on 10-year bonds, whereas the values for the S&P rating, industrial production, the long-term government debt-to-total debt ratio and the government balance-to-GDP ratio are similar for the synthetic control group and the Netherlands. Figure 4.1 shows that up until 2016 the yield for the Netherlands is almost perfectly replicated by the synthetic control group. If the adoption of a target range would have had a positive (negative) effect on the Dutch yield, we would expect the two lines to diverge after 2016. Assuming that no other systematic policy changes were introduced around that date, the difference between the Dutch yield (treatment group) and the synthetic control group would be the effect of the adoption of the target range. However, the two lines remain almost exactly equal to each other. This suggests that the adoption of a target range did not have a significant effect on the Dutch yield. Therefore, the adoption of the target range did not lead to higher uncertainty in the market for Dutch government bonds.

Table 4.2 Synthetic control group closely matches the Netherlands

Predictor	Netherlands	Synthetic Netherlands
Yield on 10-year bonds	3.44	3.41
S&P rating (10: AA+; 11: AAA)	10.83	10.69
Industrial production	101.76	95.69
Long-term debt / debt	17.25	21.27
Government balance / GDP	-2.04	-2.56

Source: SEO Amsterdam Economics

Figure 4.1 Introduction of target range did not affect yield on Dutch government bonds



Source: SEO Amsterdam Economics

Confrontation with 2016-2019 funding policy

The DSTA introduced a target range for total capital market issuances in 2016, to provide more flexibility in the funding policy. So far the DSTA is the only DMO in our sample of European countries to use a target range instead of a fixed target. Until 2016, the DSTA solely relied on money market issuances to absorb changes in the funding need. However, a target range increases uncertainty for investors, because they cannot know for sure how much the DSTA will issue in a year. Nevertheless, the above results suggest that the introduction of the target range in 2016 has not led to a higher yield spread nor to a higher yield. Note that this does not imply that consistency and transparency have no effect at all on the yield spread. However, the evidence suggests that the effect is at best small. Therefore, we can conclude that the flexibility of a target range does not have to impede the consistency of a DMO's funding policy.

4.1.4 Synthesis

In this section we have evaluated the DSTA's funding policy on the basis of two of its guiding principles, namely consistency and transparency. The literature review listed several policy tools DMOs have at their disposal to manage the sovereign debt in a consistent and transparent way. Comparing this to the DSTA's current policy tools, we conclude that the DSTA follows the

international standards closely. Most recommended policy tools are already used by the DSTA. However, the DSTA has opted for more flexibility in its funding policy, which could counteract consistency and transparency. Indeed, it is also likely that due to the focus on consistency and the high demand for Dutch government debt, the DSTA can allow itself some degree of flexibility without harming its reputation of a consistent and transparent issuer. The money market has been the main source of flexibility for several years and is also characterized by a strong demand for DTCs. The international benchmark comparison shows that the DSTA's funding policy scores high on consistency and transparency compared to other European countries. The German DMO scores better on predictability, for example, as it announces the auction details at the beginning of the year. On the other hand, the German DMO's annual publications do not contain information about the context in which the DMO operates. In its periodic publications, the DSTA does not only focus on the technical aspects of its policy but also discusses the economic and budgetary outlook and explains its policy decisions. Finally, although the adoption of a target range for capital market issuances may have reduced predictability, there are no indications that this has led to a quantifiable increase in the yield spread. In conclusion, the 2016-2019 funding policy of the DSTA is very consistent and transparent in international comparison, and can be said to have contributed in all likelihood to the main objective of obtaining funding at the lowest cost possible against acceptable risk to the budget. The increase in flexibility has in all likelihood not increased yields and does not seriously impede the DSTA's reputation of a consistent and transparent issuer.

4.2 Liquidity

4.2.1 Literature review

Rationale for liquidity

The IMF and World Bank Revised guidelines for public debt management state that "debt managers should pay attention to maintaining liquidity and transparency to the extent possible in the secondary market" (2014, p.41). Additionally, the importance of maintaining a liquid primary market is articulated as well. Funding liquidity is important because it relates to the DMO's ability to finance its borrowing needs (Jonasson & Pappaioannou, 2018). In a liquid bond market, the DMO can more easily raise new capital if necessary than in an illiquid market. Liquidity is also desirable from the investors' perspective. If an investor is in need of liquidity, he can more easily sell a liquid bond on the market to match his needs. Additionally, high liquidity may also change the investment horizon of investors, as investors with a shorter horizon are more comfortable holding longer bonds if they are liquid (Jonasson & Pappaioannou, 2018). More liquidity also improves primary market access (OECD, 2018). Liquidity is intertwined with demand: a higher demand for a bond increases liquidity, but a higher liquidity increases demand as well. DMOs can attract more demand by issuing bonds at various maturities, to serve different clienteles with different preferences (Errunza & Losq, 1985; De Jong & De Roon, 2005). Another option is to infrequently issue new bonds, but to have frequent re-openings. Frequently auctioning bonds at different maturities contributes to establishing a liquid yield curve. Since liquid bonds are more attractive to investors, they are willing to pay a liquidity premium for them. A higher liquidity premium translates into a lower yield (Favero, Pagano & Von Thadden, 2010; Montfort & Renne, 2014). De Santis (2014) provides evidence that between 2006 and 2012 the yield spread between Dutch and German public debt could be entirely explained by the higher liquidity of German

government bonds compared to Dutch government bonds. This is referred to as the 'flight-to-liquidity'. Schwarz (2018) shows that liquidity accounted for 36 percent of sovereign spread widening during the global financial crisis and 21 percent during the European debt crisis. Furthermore, liquidity can also determine interbank spreads. Therefore, establishing and maintaining a liquid market for Dutch government debt contributes to lower funding costs.

Even though several DMOs, including the DSTA, stated in 2017 that the liquidity position was relatively good in normal times, an adverse shock could easily turn market conditions and liquidity around (OECD, 2018). Furthermore, central bank bond purchasing programs have adverse effects on sovereign bond liquidity, especially since central banks generally hold the bonds to maturity and do not trade them actively. If secondary market instruments are seen as highly substitutable to primary market instruments, the effects of quantitative easing on the secondary market can spill over to the primary market. This is the case in particular with re-openings of off-the-run bonds. Furthermore, worsening liquidity can lead to decreased demand, since less-liquid bonds are not as attractive to investors as liquid bonds. This decreased demand will further reduce liquidity, which in turn will lower demand even further etc. (OECD, 2018). On the other hand, an improvement in liquidity has positive feedback effects. Therefore, it is important that DMOs continuously seek to ensure that their instruments are liquid.

Policy tools

The literature proposes several ways to improve liquidity in government bond markets. Jonasson and Papaioannou (2018) suggest:

1. Issuing a sufficient size per auction, so that no party holds the majority of that instrument.
2. Selecting primary dealers based on secondary market trading activity.
3. Establishing quantity limits per primary dealer at auctions, to ensure that no primary dealer gets a hold of a too high proportion.

The OECD (2018) also lists several policy tools for DMOs to enhance liquidity:

1. The other general debt management principles, consistency and transparency, can contribute to liquidity by ensuring that the demanded instruments will be available to investors. Providing more information about debt management and the borrowing outlook improves the price discovery process, which in turn allows investors to make better informed choices.
2. The use of benchmark bonds promotes liquidity because a certain amount is traded every year. If necessary, bonds can be easily bought or sold in the future.
3. A quotation obligation for primary dealers further improves liquidity by ensuring that the bond has a market price on each day. This improves price transparency and makes the bond more attractive to investors.
4. A security lending facility, such as a repo facility, reduces the risk of shortages and helps primary dealers continuously quoting prices.
5. The German DMO withholds part of the pre-announced issuance volume at each auction, and later uses this for secondary market activities. The German DMO claims that this helps to spread the timing of financing activities, stimulates smooth trading and provides daily insight in demand and supply.
6. Reopening old bonds at different prices than the initial auction also creates liquidity in that segment. This approach is frequently used to increase supply in existing lines and limit market fragmentation.

7. Tap sales enable DMOs to sell bonds and increase the volume without the need to organize an auction.
8. DMOs can increase liquidity of off-the-run bonds by means of a buyback program, which (temporarily) increases demand in the secondary market. However, in the long run this will decrease liquidity, so it only moves liquidity from one period to another.
9. DMOs can broaden the investor base and thus enhance liquidity by executing Separate Trading of Registered Interest and Principal of Securities (STRIP) Programs. STRIP programs refer to splitting the principal payments from the interest payments of a bond. Effectively turning the bond into a zero-coupon security can attract investors who prefer a single payment instead of coupon payments.

Measuring liquidity

Since it is important to ensure a liquid government bond market, it is also paramount to monitor developments in liquidity. The literature again proposes several measures of liquidity, which are generally used by DMOs (OECD, 2018). Bid-ask spreads are frequently used to measure liquidity, since they measure price tightness. A smaller bid-ask spread indicates lower transaction costs, which increases liquidity. Trading volumes give an indication of the depth of the market and the number of active traders. Turnover ratios, trading volume over the outstanding amount, indicate the frequency of trading. A higher turnover ratio relates to higher liquidity. Furthermore, the spread between government bond yields and government-backed agency bond yields is an important measure of liquidity (Schwarz, 2018). One example of this is the KfW-Bund spread for Germany. Since KfW is an agency that is backed by the government, it has the same creditworthiness as the government. Therefore, the KfW-Bund yield spread should not reflect credit risk differentials. However, since government bonds are generally more liquid than government-backed agency bonds, liquidity differentials should explain the (entire) yield spread. If two bonds have the same creditworthiness, are comparable in terms of maturity, and are both non-inflation linked, but one (government-backed agency bond) has a 50 basis points higher yield than the other (government bond), the liquidity premium is 50 basis points. A similar measure for the Netherlands is the BNG (Bank Nederlandse Gemeenten) Bank – government bond spread. Furthermore, the volatility of volumes and costs are also measures of liquidity (Jonasson & Papaioannou, 2018). Generally, different liquidity measures capture different aspects of liquidity, so it is recommended to monitor several liquidity measures to obtain a broad view of liquidity (OECD, 2018).

Confrontation with 2016-2019 funding policy

Consistent with the IMF and World Bank guidelines, the DSTA stresses the importance of liquidity. The DSTA uses several of the listed policy tools to enhance liquidity, namely the quotation obligation for primary dealers, the use of benchmark bonds, providing information about upcoming auctions in quarterly issuance calendars, a repo facility, bond re-openings, allowing primary dealers to strip bonds, maintaining minimum outstanding volumes, and issuing various instruments to attract a broad investor base. Furthermore, the yearly issuance of new 10-year bonds contributes to maintaining a liquid yield curve for maturities up until at least 10 years. Additionally, the strict quotation obligation is an important driver of liquidity, as mentioned by primary dealers in interviews. Therefore, the DSTA conducts its policy according to the standards mentioned in the literature. The DSTA has a minimum quantity per primary dealer per auction, but it does not use a maximum quantity limit. However, it has the possibility to cut the allocation at DTC auctions if a party would be allotted more than 40 percent of the total amount. At DDAs, the DSTA uses a

quantity limit per counterparty and there is also a quantity limit per spread point above the reference bond.

The policy tools used to sustain liquidity in the capital market are also the main instruments to sustain liquidity in the money market. Regular issuances, benchmark DTC programs, a quotation obligation and extensive use of the repo facility contribute to liquidity in the money market, ensuring that the money market can function as a buffer to absorb unforeseen shocks to the funding need.

Table 4.3 DSTA uses most policy tools recommended by the literature

Policy tool for liquidity	Used by DSTA
Issuing sufficient size so no party holds majority of instrument.	Yes
Selecting primary dealers based on secondary market trading activity	Yes
Establishing maximum quantity limits at auctions	Mixed
Consistency and transparency	Yes
Issuing benchmark bonds	Yes
Quotation obligation for primary dealers	Yes
Security lending facility	Yes
Withholding part of issuance volume for secondary market trading	No
Reopening off-the-run bonds	Yes
Tap sales	Yes
Bond buyback program	Yes
Separate Trading of Registered Interest and Principal of Securities programs.	Yes

However, there is some room for improvement regarding the monitoring of liquidity. The DSTA mainly monitors bid-ask spreads and secondary market volumes (OECD, 2018). This analysis could be extended to measuring the spread between Dutch government bond yields and a government-backed agency bond yield, such as that of the BNG Bank. Furthermore, turnover ratios and volume volatility could be included in the monitoring process.

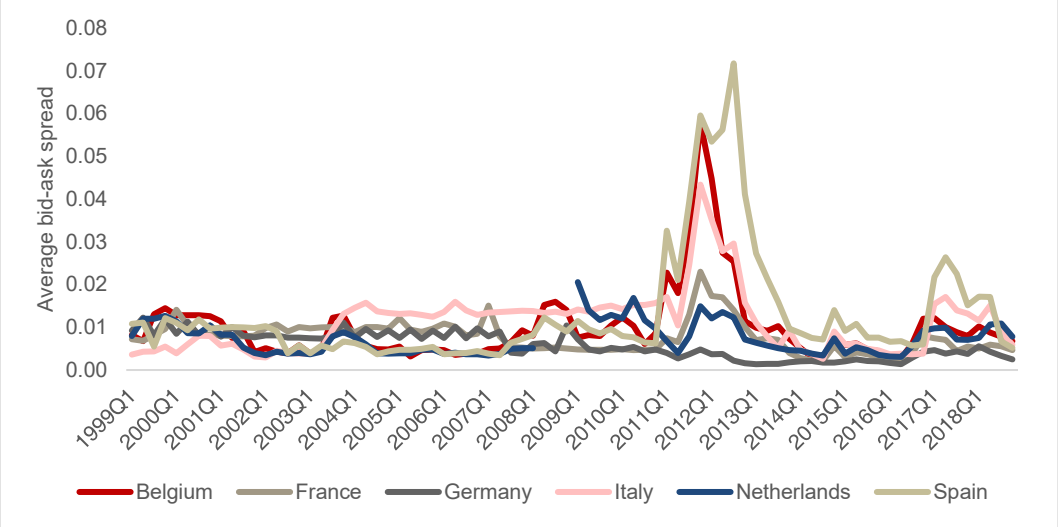
4.2.2 International benchmark

A frequently used measure of liquidity is the bid-ask spread[10]. A higher bid-ask spread indicates a lower liquidity and a lower bid-ask spread indicates a higher liquidity. Figure 4.2 shows the quarterly average bid-ask spreads for several countries. This international comparison suggests that Dutch 10-year bonds are among the most liquid. German bonds are the most liquid, given their international role as a safe haven in the government bond market. After 2012, Dutch 10-year bonds are very liquid compared to other countries. There is a drop in liquidity in 2017, but this affects all of the countries in the sample, so that the relative liquidity of Dutch bonds remains high. The timing of the increase in the average bid-ask spread from 0.007 in 2018Q1 to 0.011 in 2018Q2 corresponds with the DSTA's decision to reduce the benchmark volume for 10-year DSLs from €

[10] The bid-ask spread is the difference between the bid price (selling price) and the ask price (buying price) in the market. Often a market maker quotes the bid-ask spread and other market participants follow.

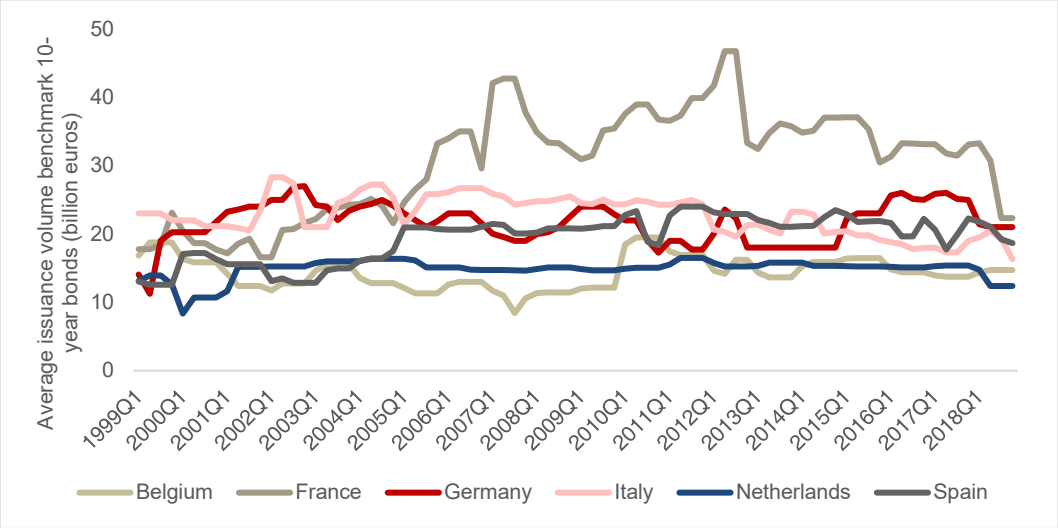
15 billion to € 12 billion, as a new 10-year DLS was issued in March 2018. This increase suggests that the reduction in volume reduced liquidity in the 10-year segment, although there may be other factors at play. The next section analyzes the relationship between volume and liquidity more formally using regression analysis.

Figure 4.2 Dutch government bonds are very liquid



Source: SEO Amsterdam Economics, based on Bloomberg data.

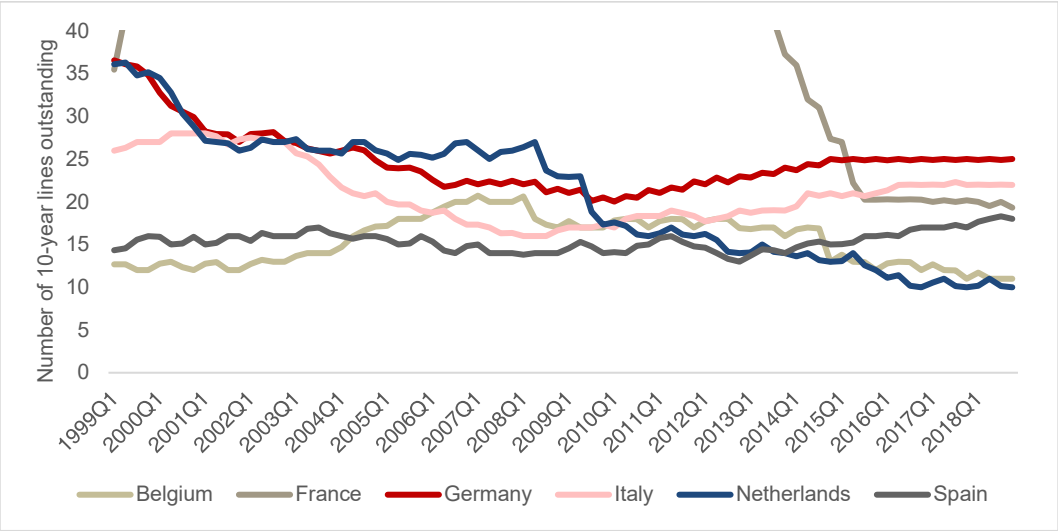
Figure 4.3 Issuance volume (in billions of euros) for 10-year bonds lower in the Netherlands



Source: SEO Amsterdam Economics, based on data of DMOs.

Finally, comparing the issuance sizes of benchmark 10-year bonds, the Netherlands has a relatively low issuance volume with € 15 billion on average (Figure 4.3). However, average issuance volumes should be seen in relation to the funding need, which depends on size of the economy (primary balance and debt) and the redemption schedule. The DSTA generally issues only one new 10-year bond per year. Figure 4.4 shows that the number of outstanding 10-year bonds is also decreasing.

Figure 4.4 Netherlands has smallest number of not-matured 10-year bonds



Source: SEO Amsterdam Economics, based on data of DMOs.

Confrontation with 2016-2019 funding policy

Based on this international benchmark comparison, we can conclude that the current funding policy contributes to sustained high liquidity in the Dutch government bond market. Dutch bonds are generally more liquid than the bonds of most other European countries (with the exception of Germany and, in recent years, France), despite the fact that these countries in general have a much larger issuance volume and more lines. One reason for this can be that Dutch bonds are considered to be quite safe, as is evident from the relatively low yield spread versus German bonds (see Figure 2.6). Since investors have an appetite for safe bonds, in times of market volatility a strong demand for Dutch bonds and high liquidity are positively related to each other. Nevertheless, issuance of a new benchmark 10-year DSL with a lower volume corresponds to a small decrease in liquidity as measured by the bid-ask spread, although the evidence is only suggestive.

4.2.3 Regression analysis

As the DSTA has experienced a decreasing borrowing requirement over the past few years, it has had to issue fewer bonds and DTCs. However, lower issuance can hinder liquidity, as the total issuance volume decreases. In the context of a decreasing funding need, the DMO has two policy options. One is to maintain the number of lines, but to decrease the issuance volume per line. The other is to maintain the issuance volume per line, but to decrease the number of lines. The following empirical analysis discusses the trade-off between volume and number of lines, and their effects on liquidity.

The regression analysis in Table 4.4 does not find a significant effect of the volume or number of lines on the bid-ask spread as a measure of liquidity. There is only one issuance volume per bond, but there are many (daily) observations of the bid-ask spread per bond. Since the variation of volumes is low, the regression does not yield a robust effect on the bid-ask spread. The same applies for the number of lines. Generally, the number of 10-year bonds outstanding changes only infrequently. Therefore, the coefficients on both the volume and the number of lines are insignificant (Table 4.4). For the post-2014 period, the results counterintuitively suggest that issuing

more lines lowers the bid-ask spread, and thus increases liquidity. Nevertheless, the results are not robust (column 3). The lack of robustness of the results may reflect the limited variation in outstanding volumes and number of lines. Alternatively, it may be the result of substantially heterogeneity in the effects for the different countries included in the analysis.

The main determinants of the bid-ask spread are the lagged value of the bid-ask spread, the yield on government bonds and the VSTOXX, which measures the volatility in European financial markets. The lagged value of the bid-ask spread measures persistence, and this persistence is larger in the pre-2014 period than in the post-2014 period. The bid-ask-spread does not fluctuate heavily from day to day, but is mainly determined by yesterday's value. Furthermore, a higher yield relates to a higher bid-ask spread in the post-2014 period. The yield also measures country-specific financial stress, and a higher level of financial stress also decreases liquidity. Additionally, the general level of financial stress in Europe, measured by the VSTOXX, also has a positive effect on the bid-ask spread, and thus a negative effect on liquidity. Again, this is only significant in the post-2014 period.

Table 4.4 No robust effect of volume and number of lines on liquidity

	(1)	(2)	(3)
	Bid-ask spread	**Bid-ask spread**	**Bid-ask spread**
Bid-ask spread (-1) pre-2014	0.967***	0.968***	0.967***
	(0.015)	(0.015)	(0.015)
Bid-ask spread (-1) post-2014	0.754***	0.763***	0.748***
	(0.032)	(0.030)	(0.031)
ln(total issuance volume in bln) pre-2014	0.00088		0.00083
	(0.00073)		(0.00074)
ln(total issuance volume in bln) post-2014	-0.0010		-0.0010
	(0.00058)		(0.00085)
ln(number of lines) pre-2014		-0.000065	-0.00035
		(0.00020)	(0.00041)
ln(number of lines) post-2014		-0.0018**	-0.00065
		(0.00060)	(0.00048)
Yield (-1) pre-2014	0.0018	0.0018	0.0018
	(0.0013)	(0.0013)	(0.0013)
Yield (-1) post-2014	0.0020**	0.0021**	0.0021**
	(0.00075)	(0.00082)	(0.00075)
ln(VSTOXX) (-1) pre-2014	-0.00044	-0.00044	-0.00044
	(0.00050)	(0.00050)	(0.00050)
ln(VSTOXX) (-1) post-2014	0.00068**	0.00066**	0.00068**

	(0.00026)	(0.00024)	(0.00026)
Post-2014 dummy	0.0059*	0.0054*	0.0065*
	(0.0029)	(0.0028)	(0.0031)
Observations	34308	34308	34308
Adjusted R^2	0.978	0.978	0.978

Source: SEO Amsterdam Economics. All models include a constant, country fixed effects and year-month dummies. Robust standard errors are given between parentheses. Total issuance volume refers to the total issuance volume of the bond for which the bid-ask spread is recorded in Bloomberg. Number of lines measures the number of outstanding 10-year bonds that have not yet matured at a given date.

A next step in the analysis is to estimate the above model using data for the Netherlands only. It is possible that due to cross-sectional heterogeneity across the countries, the country-specific results become insignificant. The models in Table 4.5 suggest that the baseline results differ if only the Netherlands is considered. First, the persistence in the bid-ask spread is smaller than in the baseline model. Furthermore, the results suggest that the total issuance volume possibly has a negative effect on the bid-ask spread. Although the coefficients for the issuance volume in the pre-2014 period are insignificant, there is a significant negative effect on the bid-ask spread in the post-2014 period (column 1), in which the standard line volume of individual 10-year new bonds was changed from € 15 billion to € 12 billion. A simple calculation shows that this decrease in total volume translates into a 0.003 increase in the bid-ask spread. This suggests that the decrease in the total issuance volume of 10-year bonds is associated with a decrease in liquidity. On the other hand, there seems to be a positive relationship between the number of lines outstanding and the bid-ask spread in the post-2014 period (column 2). However, this effect becomes insignificant when the total issuance volume is also controlled for (column 3). Although the results need to be interpreted carefully, they seem to suggest that (a lower) volume has a significant (negative) effect on liquidity, whereas the total number of 10-year lines outstanding does not.

Table 4.5 Decrease in total issuance volume is negatively related to liquidity for the Netherlands

	(1)	**(2)**	**(3)**
	Bid-ask spread	**Bid-ask spread**	**Bid-ask spread**
Bid-ask spread (-1) pre-2014	0.350***	0.349***	0.350***
	(0.075)	(0. 075)	(0. 075)
Bid-ask spread (-1) post-2014	0.112**	0.118**	0.110*
	(0.057)	(0. 057)	(0. 057)
ln(total issuance volume in bln) pre-2014	-0.00014		-0.00014
	(0.00050)		(0. 00050)
ln(total issuance volume in bln) post-2014	-0.016***		-0.014***
	(0.0021)		(0.0026)
ln(number of lines) pre-2014		0.00026	0.00027
		(0.0032)	(0.0032)

ln(number of lines) post-2014		0.0082**	0.0047
		(0.0040)	(0.0040)
Yield (-1) pre-2014	0.0014**	0.0014***	0.0014**
	(0.00060)	(0.00059)	(0.00060)
Yield (-1) post-2014	-0.0019	-0.0023	-0.0021
	(0.0016)	(0.0017)	(0.0017)
ln(VSTOXX) (-1) pre-2014	0.0010**	0.0010**	0.00099**
	(0.00046)	(0.00047)	(0.00047)
ln(VSTOXX) (-1) post-2014	0.00013	-0.00013	0.0000078
	(0.00069)	(0.00069)	(0.00069)
Post-2014 dummy	0.048***	-0.0084	0.034**
	(0.0064)	(0.012)	(0.017)
Observations	4707	4707	4707
Adjusted R^2	0.726	0.726	0.726

Source: SEO Amsterdam Economics. Data for the Netherlands only, All models include a constant and year-month dummies. Newey-West robust standard errors (using 5 lags) are given between parentheses. Total issuance volume refers to the total issuance volume of the bond for which the bid-ask spread is recorded in Bloomberg. Number of lines measures the number of outstanding 10-year bonds that have not yet matured at a given date.

In conclusion, on the basis of the baseline, regression analysis does not provide hard evidence about the trade-off between volume and number of lines with respect to liquidity. However, the regression using data for the Netherlands seems to suggest that the decrease in total issuance volume in 10-year Dutch government bonds may be related to a decrease in liquidity in that segment, while there is no effect of the number of 10-year lines outstanding.

Synthetic control method

As in the previous section, we can test whether the decrease in issuance volume has led to an increase in the bid-ask spread using the synthetic control method. The new 10-year DLS with an issuance volume of € 12 billion was issued in week 11 of 2018. This identifies the timing of the treatment[11]. Using weekly data from 2015 onwards, the synthetic control group for the Netherlands consists of Belgium (2.7%), France (86.9%), Germany (3.2%), Portugal (3.9%) and Spain (3.3%). The synthetic control group was selected to match the average bid-ask spread from 2015 until week 11 2018. Additionally, more weight was given to the average bid-ask spread in each week in 2018 prior to week 11, in order to closely match the Dutch bid-ask spread before the 'treatment'. Table 4.6 shows that the synthetic control group generally matches the Netherlands well. Only in week 10 is the bid-ask spread for the Netherlands 0.002 higher than for the synthetic control group. Figure 4.5 shows that from 2015 onwards the bid-ask spread for the synthetic control group is approximately equal to the Dutch bid-ask spread. The synthetic control group replicates the Netherlands well. However, after week 11 in 2018, the bid-ask spread for the Netherlands is

[11] Note that the new 10-year DSL was issued on a Tuesday, and that the data uses weekly average bid-ask spreads. The bid-ask spread for week 11 in 2018 is thus a combination of the pre-treatment and post-treatment period. The results do not change if the treatment is assigned to week 10.

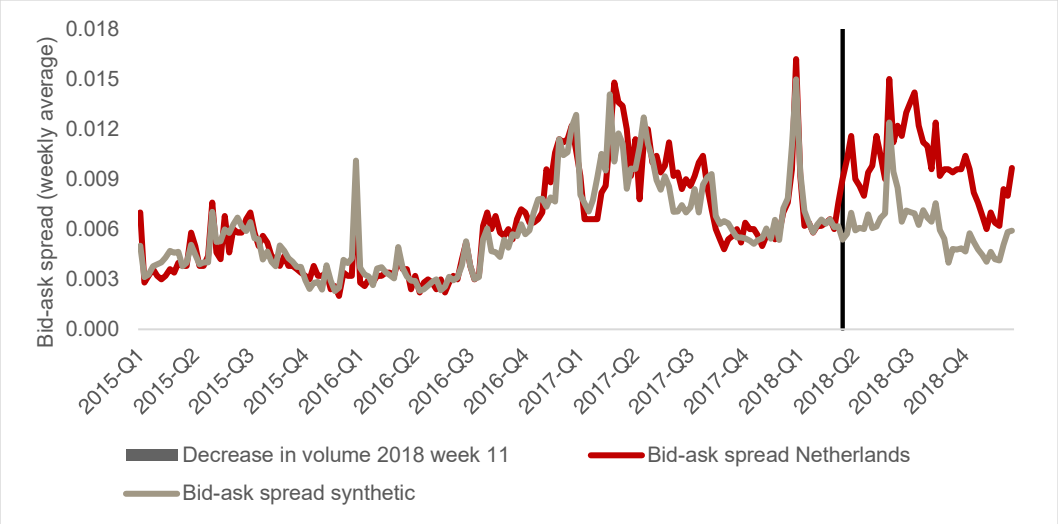
substantially higher than for Synthetic Netherlands. This difference broadly persists until the end of 2018, when the sample ends. The average bid-ask spread for the Netherlands since 2015 until the policy change was 0.006, after the decrease in issuance volume the bid-ask spread is 0.010 on average, an increase of 0.004. However, for the synthetic control group, the average bid-ask spread is 0.006 in both periods. The difference between the Netherlands and the synthetic control group is between 0.002 and 0.006 after the decrease in issuance volume, with an average of 0.004. Before the reduction in issuance volume, the difference was between -0.002 and 0.002, with an average of 0. This suggests that the decrease in issuance volume from € 15 billion to € 12 billion has reduced the liquidity.

Table 4.6 Synthetic control group closely matches the Netherlands

Predictor balance	Netherlands	Synthetic Netherlands
Bid-ask spread	0.006	0.006
Bid-ask spread 2018 week 1	0.009	0.009
Bid-ask spread 2018 week 2	0.006	0.007
Bid-ask spread 2018 week 3	0.006	0.006
Bid-ask spread 2018 week 4	0.006	0.006
Bid-ask spread 2018 week 5	0.006	0.006
Bid-ask spread 2018 week 6	0.006	0.007
Bid-ask spread 2018 week 7	0.006	0.006
Bid-ask spread 2018 week 8	0.007	0.007
Bid-ask spread 2018 week 9	0.006	0.006
Bid-ask spread 2018 week 10	0.008	0.006

Source: SEO Amsterdam Economics

Figure 4.5 Decrease in issuance volume reduced liquidity of Dutch 10-year bonds



Source: SEO Amsterdam Economics

Another explanation would be that it is not the decrease in volume that matters, but the fact that a new benchmark 10-year DSL is issued, which increases the number of lines outstanding. To test this hypothesis, the same method is applied to the issuance dates of the benchmark 10-year DSLs in 2016 week 12 and 2017 week 6. This analysis does not show a significant increase in the bid-ask spread after the issuance of the new benchmark bond. This supports the hypothesis that the issuance volume is of greater importance for liquidity than the number of lines.

Confrontation with 2016-2019 funding policy

The main policy change in the 2016-2019 funding policy was the reduction in the minimum outstanding volume of 10-year DSLs from at least € 15 billion to at least € 12 billion. The number of outstanding 10-year bonds has been stable at 10, indicating one new 10-year bond per year. The results in Table 4.5 suggest, but not prove, that the issuance volume likely has a larger effect on liquidity than the number of lines. The synthetic control method in Figure 4.5 confirms this suggestion, as it shows that the liquidity is structurally lower in 2018, after the decrease in issuance volume. The bid-ask spread for Dutch 10-year government bonds increased from an average of 0.006 between 2015 and the beginning of 2018, to 0.010 after the reduction in issuance volume. This cannot be explained by the issuance of a new benchmark 10-year DSL, as the analyses for the new benchmark bonds in 2016 and 2017 do not show a significant increase in the bid-ask spread. These results suggest that the issuance volume is of greater importance to liquidity than the number of lines outstanding.

4.2.4 Synthesis

This section has evaluated the DSTA's funding policy regarding liquidity. In conclusion, the DSTA's funding policy likely has contributed to sustaining high liquidity in the government bond market. Based on the literature review, we can conclude that the DSTA's funding policy closely follows the international standard. Most policy instruments suggested by the literature have already been adopted by the DSTA. However, the literature stresses that liquidity cannot be captured in one statistic and that DMOs should use several measures to capture different aspects of liquidity. The DSTA may be advised to pay attention to other liquidity measures beyond the bid-ask spread and secondary market volumes.

The international benchmark comparison shows that the Netherland has a very liquid government bond market. The bid-to-cover ratios are generally high, and the bid-ask spreads are generally low. Liquidity is higher in Germany and in recent years also in France, but lower in Spain, Portugal, Italy and Belgium. Even though some other countries have a larger market for government bonds and can thus issue more debt, the DSTA maintains a high level of liquidity. This is also related to the low level of riskiness, as bid-ask spreads are related to the yield level. Especially in times of volatility, investors have an appetite for a low-risk instrument, which increases the demand and liquidity for that instrument. Dutch 10-year government bonds are such an instrument.

The regression analysis attempted to estimate the effect of issuance volume and number of lines on liquidity, to be able to assess liquidity in the context of a decreasing funding need. However, due to the limitations of the data this is not possible for the baseline panel model. When only the Netherlands is considered, the analysis suggests that a larger issuance volume is related to higher liquidity, but that the number of lines outstanding has no significant effect on liquidity. The

synthetic control method finds similar results: the bid-ask spread on Dutch 10-year bonds is around 0.004 higher after the reduction in issuance volume. This cannot be explained by just the issuance of a new bond, as there was not a similar effect for issuances in 2016 and 2017. This suggests that the reduction in issuance volume in 2018 has likely led to a decrease in liquidity.

4.3 Synthesis

Looking back

The DSTA has several operational targets regarding the interest rate risk framework and the funding policy, as formulated in the theory of change in sections 2.4.1 and 2.4.2. The DSTA has consistently met all of its targets regarding the funding policy over the period 2016-2018 (Table 4.7). Given that these policy actions contribute to consistency, transparency and liquidity, and that these guiding principles contribute, albeit only to a small extent, to a lower yield, the DSTA's funding policy in all likelihood has contributed to the main objective of obtaining funding at the lowest cost possible at acceptable risk to the budget.

Table 4.7 DSTA achieved operational targets for its funding policy

Policy action	Target achieved
Auctions on same day	Yes, the DSTA has not deviated from the schedule.
Issuance as per Outlook	Capital market: yes. Money market: no, due to lower-than-expected funding need money market issuances were below the specified target range. However, the target range for the money market is only indicative when there is a constant funding need, as changes in the funding need are primarily absorbed on the money market.
Auctioned volume as announced range	Yes, the volume announced in the quarterly issuance calendar or auction announcement has been met consistently.
Quarterly issuance calendar	Yes
Periodic reports and press releases	Yes, in the form of Annual and Quarterly Outlooks, press releases, announcement and results of auctions.
Communication with primary dealers	Yes, primary dealers are positive about communication, especially during auctions and the primary dealer meeting.
Communication with investors	Yes, several road shows per year for investors, but also other parties.
Minimum outstanding volume reached	Yes, the announced minimum outstanding volume for new DSLs has been consistently reached within the specified time frame.
Benchmark volumes for several maturities issued	Yes, for example a new benchmark 10-year DSL was issued every year, and 5-year, 7-year and longer bonds were also consistently issued.
Use of a variety of instruments	Yes, DSLs and DTCs with various maturities were issued, as well as CP, Depo's and the Repo facility.
Quotation obligation for Primary Dealers	Yes, primary dealers have fulfilled their quotation obligation.
Use of repo facility	Yes, the repo facility was used frequently.

Source: SEO Amsterdam Economics, DSTA Annual Outlooks, DSTA press releases, interviews with primary dealers.

Furthermore, in this chapter we analyzed the academic and policy literature to describe the international standard in public debt management. Comparing the DSTA's funding policy to this international standard, it can be concluded that most policy recommendations are adopted by the

DSTA. Nevertheless, given the importance of liquidity, the DSTA could monitor more indicators of liquidity. This will especially be relevant in the coming years as the projected decreasing funding need will likely lead to a decrease in issuance and thus possibly to a lower level of liquidity.

Compared to other European DMOs, the DSTA performs well on consistency, transparency and liquidity. The yield spread on Dutch government debt vs. German debt is the lowest in the sample of European countries (except for Germany). It should be noted that the funding policy can only contribute to a low yield spread to a small extent as it is mainly determined by the economic and fiscal outlook. Furthermore, liquidity is also high, although evidence suggests that recently there has been a decrease.

The empirical analysis suggests that there is no evidence that the introduction of more flexibility in the funding policy through the adoption of a target range for the total capital market issuance, has led to a higher yield spread on Dutch 10-year bonds. Regarding the liquidity, there seems to be evidence to suggest that a higher issuance volume is correlated with higher liquidity, and that a higher number of 10-year outstanding bonds is not significantly related to liquidity. Specifically, the synthetic control method suggests that bid-ask spreads for Dutch 10-year government bonds are 0.004 higher after the reduction in issuance volume from € 15 billion to € 12 billion in 2018, and that the reduction in issuance volume in all likelihood has led to a decrease in liquidity.

Looking ahead

The Netherlands has experienced a decreasing funding need in the past few years. Given the projected budget surpluses and decreasing government debt, a further decrease in the funding need is to be expected. The decreasing funding need will likely put pressure on the liquidity of Dutch government debt. The analyses in this section suggest that in order to maintain liquidity, the outstanding volume should be sufficiently high. As the results suggest that the decrease in issuance volume for 10-year bonds from € 15 billion to € 12 billion likely has reduced liquidity, a further reduction in the issuance volume may reduce liquidity even further. There is, however, a trade-off between the volume and number of lines. If the volume is to be maintained at € 12 billion and the total funding need decreases, this can be achieved by decreasing the volume or the number of lines. The evidence presented in this report indicates that the number of 10-year lines is less important for liquidity than the total issuance volume. This should be taken into account when deciding on the funding policy for the coming years. However, one should note that e.g. moving from an annual issuance of a new 10-year bond to a biannual issuance of a new 10-year bond also has implications for the consistency, which are not reflected in this analysis. Additionally, we have analyzed the number of 10-year bonds outstanding, and not the number of bonds with other maturities. The trade-off between the liquidity and number of lines can be seen over time (how often should a certain bond be issued?) and within a year (which bonds should be issued in a year?). Nevertheless, this report suggests that it is important to maintain liquidity in the 10-year government bond market, as it is the pillar of the DSTA's funding policy.

5 Conclusions

The minister of Finance is responsible for a solid and efficient funding of the State's debt. The Dutch State Treasury Agency (DSTA) is responsible for the management of the Dutch State debt. The DSTA is mandated by the minister of Finance to prepare and define the funding policy and represent the State in the closing of transactions on financial markets, given this mandate. This mandate, or the policy framework, is reviewed and adapted every four years. The next review of the policy framework will take place in 2019.

In order to prepare for this review, the DSTA has commissioned SEO Amsterdam Economics to assess the effectiveness and efficiency of the current Dutch policy framework, specifically with regard to the interest rate risk framework and the funding policy. This research will feed into the evaluation of the current framework and supply insights that can be used to build the framework for the next period. The overarching research questions for the evaluation align with the *Regeling Periodiek Evaluatieonderzoek*:

- How effective has the policy been? Are there positive and/or negative side effects?
- How efficient has the policy been in achieving the objectives?
- What measures can be taken to further increase effectiveness and efficiency?

This report focuses on two specific questions that will feed into the evaluation, namely:

- In what way, and how much, has the *interest rate risk framework* contributed to achieving public debt financing at the lowest possible cost, with an acceptable risk for the budget?
- In what way, and how much, have *the funding policy* and changes within this policy contributed to achieving public debt financing at the lowest possible cost, with an acceptable risk for the budget? Is there a role for more flexibility within the funding policy to increase efficiency without increasing risks?

Interest Rate Risk Framework

In response to historically low yields, favorable economic forecasts (including expected rising rates) and the outcomes of the evaluation of the 2012-2015 IRRF, the 2016-2019 IRRF aimed to increase the maturity of the sovereign debt portfolio through a combination of new issuances and a decreased use of swaps. Specifically, it set a target of 6.4 years for the average maturity of the portfolio, to be achieved by the end of 2019 (2015 maturity: 5.5 years). In addition, it set a maximum annual refixing amount of 18% of sovereign debt.

The DSTA has managed to achieve its stated policy targets. Every year, it has met its target maturity and stayed below the maximum refixing amount. Between 2015 and 2018 it has reduced the reliance on swaps (and no new swaps were issued), whereas the sovereign debt financing costs fell by €1 billion.

In terms of ex-post efficacy, the IRRF has contributed to this result. In practice, there is a significant compositional effect due to the legacy debt and the fact that in practice the DSTA does not issue the same instruments or volume every year. A stylized analysis that compares funding outcomes for the '7-year benchmark with deviations' and the 2016-2016 IRRF policy frameworks

suggests that the latter has extended the maturity of the portfolio, at an increase of the weighted average effective interest rate cost of 0.2%. If rates rise in the future, however, the present policy may induce a cost saving due to the 'lock in' of current lower nominal rates.

At the same time, the portfolio pursued under the 2016-2019 IRRF could not have been the most cost efficient portfolio due to the fact that rates continued to fall during 2016. This does not necessarily reflect poorly on the appropriateness of the 2016-2019 IRRF, however, given the fact that (market) expectations in late 2015 suggested rising interest rates in both the short and long term. Given the knowledge and expectations at the time of introduction, the 2016-2019 IRRF has achieved the goal of low(er) funding costs at equal risk, which does not preclude that (ex-post) there were options with lower costs at equal risk.

More important, then, is the ex-ante assessment of risk management practices. The DSTA has underpinned its 2016-2019 IRRF with a portfolio simulation analysis to determine the optimal maturity and associated portfolio composition. Parts of the methodology of this analysis could be improved upon. At the same time, the (risk of the) portfolio suggested by the DSTA's analysis is not that different from the efficient frontier suggested by a state-of-the-art portfolio optimization model. The latter model also reveals that in ex-ante terms the IRRF 2016-2019 is cost reducing vis-à-vis the preceding IRRF at most levels of risk tolerance, suggesting that the 2016-2019 IRRF as a policy is ex-ante effective in providing low costs of debt financing at a level of risk that is no higher than under the 7-year benchmark with deviations. In general, costs can be reduced by accepting more risk. At the same time, our analysis shows that lower costs at similar levels of risk could have been attainable through (ex-ante) relaxing e.g. the money market size constraints implied by the funding policy – although this may have side effects as well (see funding policy below). The current maximum risk appetite is based on the historical maximum risk appetite: 'risk no higher than under the preceding risk management framework' appears to have been the guiding principle. Given specific market conditions or expectations of the future, a different risk tolerance may be defined.

Funding policy

The DSTA is transparent in conducting auctions and managing the public debt. Furthermore, auctions are predictable, which contributes to lower uncertainty regarding debt issuances. These practices are in line with policy recommendations by the IMF and the World Bank. The DSTA uses various policy measures, including the issuance of several benchmark bonds and a strict quotation obligation for primary dealers, to contribute to a liquid market for Dutch government debt. The DSTA's funding policy also scores high on these guiding principles in comparison with other European debt management offices. Nevertheless, the DSTA could monitor additional liquidity measures beyond the bid-ask spread and secondary market volumes.

The DSTA opted for more flexibility in its 2016-2019 funding policy by adopting a target range for total capital market issuances, instead of a fixed amount. There is no evidence that this has led to an increase in the yield on 10-year bonds. Therefore, the choice for more flexibility in all likelihood has not affected the consistency of the debt management.

The major policy change regarding liquidity was the reduction in total issuance volume for new 10-year bonds from € 15 billion to € 12 billion in 2018, as the funding need was lower. There is evidence to suggest that this has led to some decrease in liquidity, as measured by the bid-ask spread. On the other hand, there is no evidence that the number of outstanding 10-year bonds has

a significant effect on liquidity. When the funding need decreases, the DSTA faces a trade-off between reducing the volume per line and reducing the number of lines. Based on the evidence presented here, maintaining sufficient volume per line seems to be more important for liquidity than the number of lines.

Recommendations

Our recommendations follow directly from the conclusions of our empirical assessment of the IRRF and the funding policy.

When developing the new IRRF (2020-2023), we recommend that the DSTA:

- explicitly decides on and outlines a maximum risk tolerance and picks a risk indicator that measures this tolerance;
- uses stochastic methods to ex-ante assess various portfolios under interest rate and funding need scenarios in order to assess the weighted average impact of shocks;
- uses scenarios that are consistent with other scenarios used for forecasting economic and fiscal developments (e.g. CPB, DNB, FIN);
- considers the dependencies between the funding policy and the IRRF (e.g. the appropriate amount of flexibility in the composition of issuance and/or issuance policy).

With respect to the funding policy, we suggest the following:

- integrate the funding policy more explicitly in the (ex-ante) IRRF, leaving some room (ex-ante) for flexibility in the funding policy;
- when looking for ways to increase flexibility, evidence suggests that introducing (limited) target ranges for issuance volumes does not have to impede the predictability of the funding policy;
- with an expected decreasing funding need, the DSTA will have to prioritize which lines to continue and which not;
- maintain the transparency and consistency at the current high levels by continuing to inform the market and the public at the current level.

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