Early exit from ECB bond purchase program could reduce GDP growth and inflation

By Marius Clemens, Stefan Gebauer, and Malte Rieth

The European Central Bank is planning a gradual reduction of government bond purchases under the asset purchase program it initiated in 2015. The present study by the German Institute for Economic Research analyzes the potential macroeconomic implications of different exit strategies. The authors examined the potential effects of a reduction in net purchase volume, an early exit, and a faster exit from the program on output and inflation in the euro area. Model simulations showed that economic growth and inflation rates would decrease in all three scenarios. However, the effects of the scenario with reduced asset purchases are less severe than those of an exit from the program that is earlier or faster than expected. In particular, an early exit from the program should significantly affect inflation rates, an effect that the European Central Bank should factor into its decision-making process.

On October 26, 2017, the European Central Bank (ECB) announced it was planning to cut its current asset purchases of 60 billion euros per month to only 30 billion euros as of January 2018. Economic recovery in the euro area is set to continue, and given some positive signals from forward-looking economic indicators such as purchasing manager and consumer confidence indexes, the ECB is facing pressure to taper its "Asset Purchase Programme" (APP) as a means of countering the potential threat of overheating and risks to financial stability. However, it is opting to stay the course with its expansionary policy until inflation picks up. By mandate, the ECB is committed to guaranteeing price stability in both directions and considers its policy to be successful when the inflation rate is just below two percent. Given this strategy, the present study evaluates the macroeconomic consequences of different tapering scenarios, i.e., different strategies for gradually exiting the APP, particularly with respect to GDP growth and inflation rates in the euro area.

There is a wealth of literature on the effects of central bank asset purchases on financial markets and the macro economy.[1] However, these studies evaluate the overall impact of APPs instead of separately evaluating entry into and exit from such programs. More precisely, they evaluate the aggregated effects of net asset purchases, reinvestments due to expiration of bonds, and reductions in the volume held by the central bank. In most cases, purchase programs by the U.S. Federal Reserve, which has started to decrease its bond holdings, have been analyzed. The ECB, on the other hand, remains a net purchaser of bonds although it reduced its pur-

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1   See Han Chen, Vasco Cúrdia, and Andrea Ferrero, "The macroeconomic effects of large-scale asset purchase programmes," *Economic Journal* 122 (2012); P. Andrade et al., "The ECB's asset purchase programme: an early assessment," *ECB working paper* no. 1956 (2016); Michael Hachula, Michele Piffer, and Malte Rieth, "Unconventional Monetary Policy, Fiscal Side Effects and Euro Area (Im)balances," *DIW Berlin Discussion Paper* 1596 (2016) (available online); and Stefan Hohberger, Romanos Proftis, and Lukas Vogel, "The macroeconomic effects of quantitative easing in the Euro Area: Evidence from an Estimated DSGE Model," *EUI Working Papers ECO* 2017/04 (2017).

Box 1

A DSGE model for the euro area

The present study relied on a dynamic stochastic equilibrium (DSGE) model with price and real wage rigidity,[1] financial friction, and different types of households.[2]

Assumptions

When analyzing asset purchase programs, the assumption of segregated bond markets (short- and long-term bonds) is a crucial means of incorporating the monetary policy channel through which these purchases affect the macro economy. And households are assumed to differ with respect to their access to financial markets. Whereas unrestricted households are allowed to trade in both short- and long-term bond markets, restricted households only have access to long-term bonds. Although in reality it is not possible to separate households into these categories literally, the assumptions of market segmentation and separation of the two household types capture the observation that a fraction of the private sector saves through pension funds and other intermediaries that are specialized in the market of long-term securities. On the other hand, unrestricted agents can be thought of as standing in for agents that save through highly liquid assets such as commercial bank deposits. Central banks engage in both unconventional asset purchases and conventional interest rate policy to conduct monetary policy, and governments finance fiscal policy expenses by issuing short- and long-term bonds.

1 See Lawrence Christiano, Martin Eichenbaum, and Charles L. Evans, "Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy," *Journal of Political Economy* vol. 113(1) (2005):1–45; and Frank Smets and Rafael Wouters, "Shocks and Frictions in US Business Cycles: A Bayesian DSGE Approach," *American Economic Review* vol. 97(3) (2007): 586–606.

2 See Han Chen, Vasco Cúrdia, and Andrea Ferrero, "The Macroeconomic Effects of Large-Scale Asset Purchase Programs," *Economic Journal* 122, no. 564 (2012): 289–315.

Effects

Market segmentation and household heterogeneity in the model imply that only a fraction of the agents in the economy can arbitrage away differences in risk-adjusted returns between long- and short-term bonds. This introduces friction that provides a rationale for asset purchase programs having an effect on macroeconomic developments: the yield curve matters for aggregate demand, such that monetary policy affects the real economy not only via the short-term policy rate but also via interventions in long-term bond markets that affect long-term interest rates.

The macroeconomic relevance of both short- and long-term rates evokes monetary policy interventions that can affect the economy even when the nominal short-term policy rate is at the zero lower bound (ZLB) and cannot be reduced further. In the model, we allow for a ZLB constraint on policy rates and assume it to be binding for an extended period of time (five quarters). In the long-term government bonds market, central bank tapering leads to an increasing bond price and a reduction of long-term yields.

In the case of a segmented bond market, restricted households react by changing their saving and consumption patterns. They tend to consume more today, which increases output growth. On the other hand, households adjust their portfolios upward to some transaction costs when markets are not segmented. They would sell long-term bonds and buy short-term bonds immediately, resulting in a decline in the yield to maturity of the long-term bonds. However, the expected returns for long- and short-term assets stay constant over time, which does not have real effects.

chases from 80 to 60 billion euros per month in 2017. Currently, its cumulative bond holdings amount to two trillion euros, or 15 percent of the euro area GDP. The ECB has announced that it is set to reduce asset purchases further to 30 billion euros per month. Under the circumstances, the macroeconomic effects of tapering asset purchases and a subsequent reduction in the volume held by the central bank are of particular interest.

Macroeconomic effects of asset purchase programs

To evaluate the macroeconomic effects of different tapering scenarios, a dynamic stochastic general equilibrium (DSGE) model is constructed and calibrated to match euro area conditions. The model features the expectation formation of agents and therefore permits quantitative evaluation of the impact of ECB monetary policy announcements. It is also set up to enable analysis of the fundamental mechanisms through which bond purchases affect the real economy (Box 1).

Given that the goal was to evaluate the effects of different tapering paths and not the overall APP, the following assumptions for the quantitative analysis of the model are made. Only the period since the latest announcement of reducing asset purchases from January 2018 onward is included in the analysis. Therefore, past announcements

regarding the size and duration of the programme were ignored. And it is abstracted from the trend in short-term interest rates from past announcements.

First, the effects of a baseline scenario consisting of three phases are calculated: accumulation of bond holdings by the ECB, constant asset holdings, and reduction of bond holdings (Figure 1). The baseline scenario trend until September 2018 therefore parallels the latest ECB announcement in October 2017. The ECB was subsequently expected to continue its asset purchases until it reached the legal limit of holding no more than one-third of the bonds traded in the market.[2] Thereafter, the ECB keeps its portfolio of bonds constant for four years by assumption before reducing its holdings, allowing bonds to expire without replacement (Box 2).

To quantify the effects of different tapering scenarios, three alternative scenarios were considered and the resulting deviations from the baseline scenario were evaluated. The focus was not on the effects derived from the baseline scenario in the analysis, since they include the overall effects of quantitative easing (QE)—and the effects from entering the APP in particular. The alter-

2 Given that the legal maximum is particularly relevant for country-specific government bonds and the ECB already holds more than 30 percent of the existing bonds of some countries, the reinvestment phase could potentially start earlier. In this case, a uniform increase in overall holdings would only be feasible assuming changes in country quotas and by allowing for consistent distribution effects.

Figure 1

Market value of long-term bonds held by the ECB in the baseline and alternative scenarios

In Million Euro (stylized)
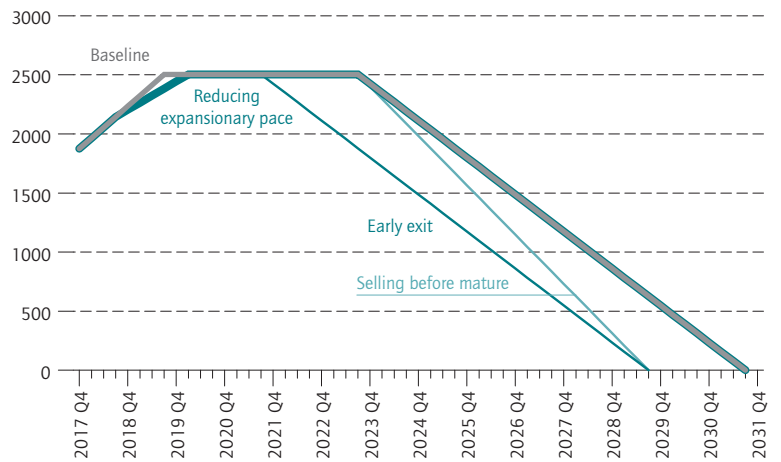
Source: Authors' own calculations.

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Until the third quarter of 2018, the ECB will keep buying bonds, afterwards there are alternative ways to taper.

Table

The scenarios

Scenario	1st expansionary stage, quarterly	2nd reinvestment stage	3rd exit stage, quarterly
"Baseline"	90 billion euros until 3rd quarter 2019	until 3rd quarter 2023	−80 billion euros until 3rd quarter 2031
"Reducing expansionary pace"	90 billion euros until 3rd quarter 2019 and 60 billion euros until 3rd quarter 2020	until 3rd quarter 2023	−80 billion euros until 3rd quarter 2031
"Early exit"	90 billion euros until 3rd quarter 2019	until 3rd quarter 2021	−80 billion euros until 3rd quarter 2029
"Selling before mature"	90 billion euros until 3rd quarter 2019	until 3rd quarter 2023	−104 billion euros until 3rd quarter

Source: Authors' own calculations.

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natives vary with respect to the pace of asset purchase, the duration for which the quantity of bonds held was expected to be constant, and the pace at which the amount was ultimately reduced (Table). For all scenarios, the assumption has been that private households and firms expected the short-term policy rate to remain at zero for five quarters and the central bank would return to its standard interest rate policy afterwards.

In the first scenario, the ECB was expected to announce a sharper reduction in the pace of bond purchases compared to the baseline scenario in Q4 2017, with lower purchases from Q4 2018 onwards. In the second scenario, the ECB announced it would reduce bond holdings by not replacing expiring bonds in Q3 2019, two years earlier than in the baseline scenario. Finally, the third scenario featured an announcement by the ECB in Q3 2023 that it would also sell bonds during the phase of reducing bond holdings, such that holdings would be reduced at a faster pace than in the baseline scenario.

Reducing the expansionary pace of monetary policy has moderate effect on output growth and inflation

In the first scenario, the ECB reduced the expansionary pace by decreasing net purchases from 30 to 20 billion euros per month or 90 to 60 billion per quarter, respectively. Based on this behavior, the long-term bond portfolio held by the central bank reached its legal maximum of 33 percent of the total volume of government bonds issued six months later than in the baseline scenario. Afterward, it followed the baseline scenario trend.

The results of the model simulation indicated lower GDP growth and inflation rates for several quarters compared to the baseline scenario (Figure 2). In the first year, the cumulative differences in GDP growth and inflation rates would be 0.01 percentage points each.

Early exit has negative short-term macroeconomic implications

Assuming that the decrease in bond holdings starts not four, but two years after the end of net purchases, growth effects would phase out earlier (Figure 3). In the first year, this resulted in a cumulative reduction in GDP growth and the inflation rate of 0.1 and 0.3 percentage points, respectively. In view of the constant refinancing needs of governments and firms, lower ECB demand would result in lower bond prices and consequently, in rising long-term yields compared to the baseline scenario. This

Box 2

The implications of the zero lower bound in the baseline scenario

In line with the DSGE literature, the parameters are calibrated to match the economic structure of the euro area. The trend of the net purchase program is simulated over time in our baseline scenario to compare our model results with those in the literature. Initially, the level of long-term bonds in the hands of the public was reduced by 25 percent of its steady state value, while the central bank asset purchase balance increased by the same amount.
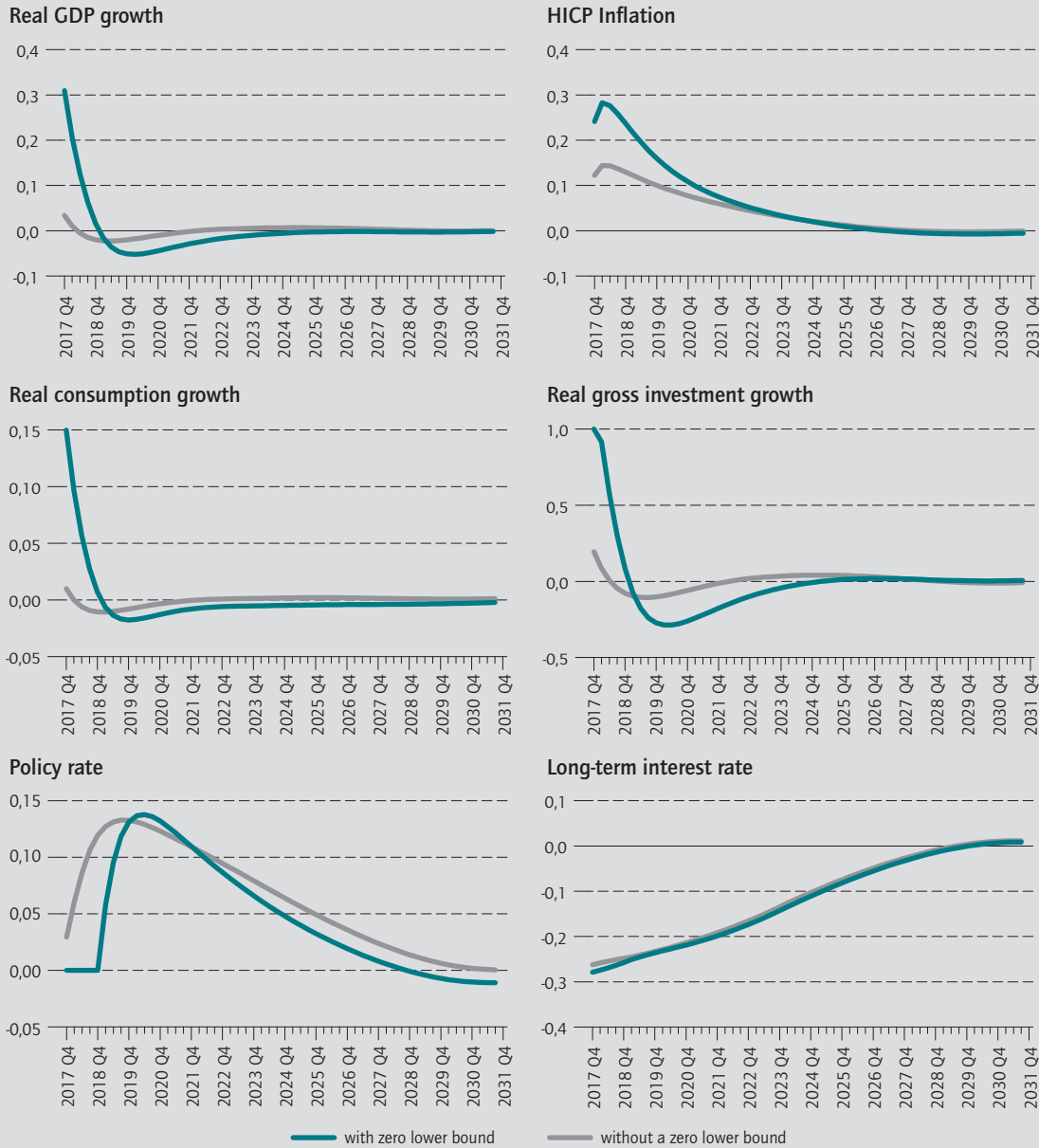
The effects of bond purchases are amplified if the central bank announces the short-term interest rate to be fixed at the lower bound for an extended period (forward guidance). The reason is that QE-induced higher output growth leads to higher inflation. Without a fixed interest rate, monetary policy would typically react to higher output growth and inflation by increasing the policy rate. This would have a contractive effect on output growth and inflation. However, a commitment to leaving the policy rate at the zero lower bound would eliminate the contractive impulse and amplify the effects of the APP. More precisely, the policy rate is not limited from below because of non-negativity. Instead, it is limited from above by the central bank announcement. By simulating the APP scenario with and without a ZLB, we can see that the effects on GDP growth and inflation are roughly doubled (Figure).

In the baseline scenario with a binding ZLB, the APP increases output growth by roughly 0.7 percentage points and inflation by around 1 percentage point annualized and in the first year.

Macroeconomic effects of quantiative easing with and without a zero lower bound announcement
Deviation from the baseline in percentage points, quarterly

Real GDP growth

HICP Inflation

Real consumption growth

Real gross investment growth

Policy rate

Long-term interest rate

with zero lower bound   without a zero lower bound

Source: Authors' own calculations.

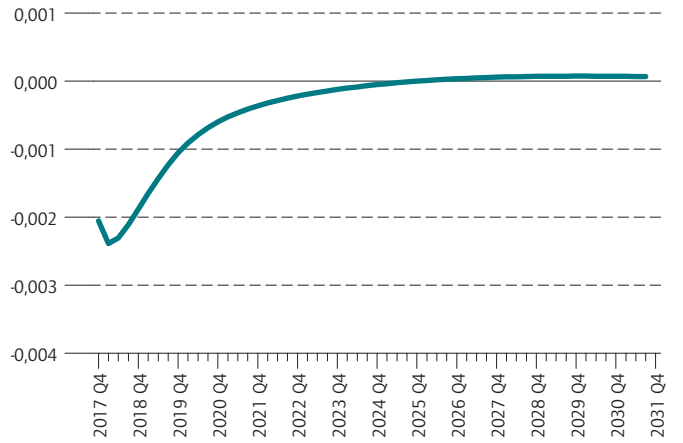The macroeconomic effects of quantitative easing are amplified by forward guidance and the ZLB.

Figure 2

Macroeconomic effects of reducing the expansionary pace
Deviation from the baseline in percentage points, quarterly
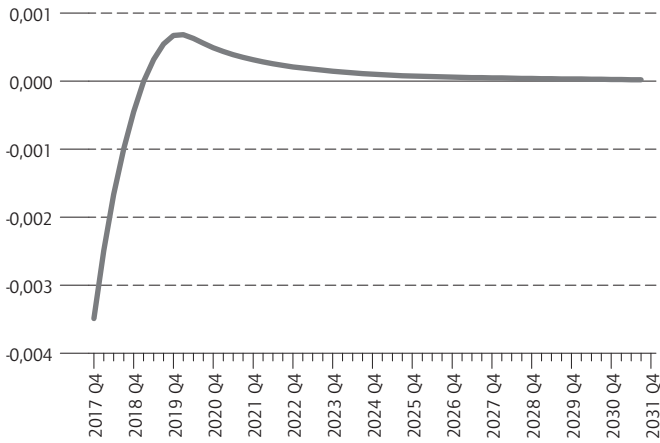
Real GDP growth
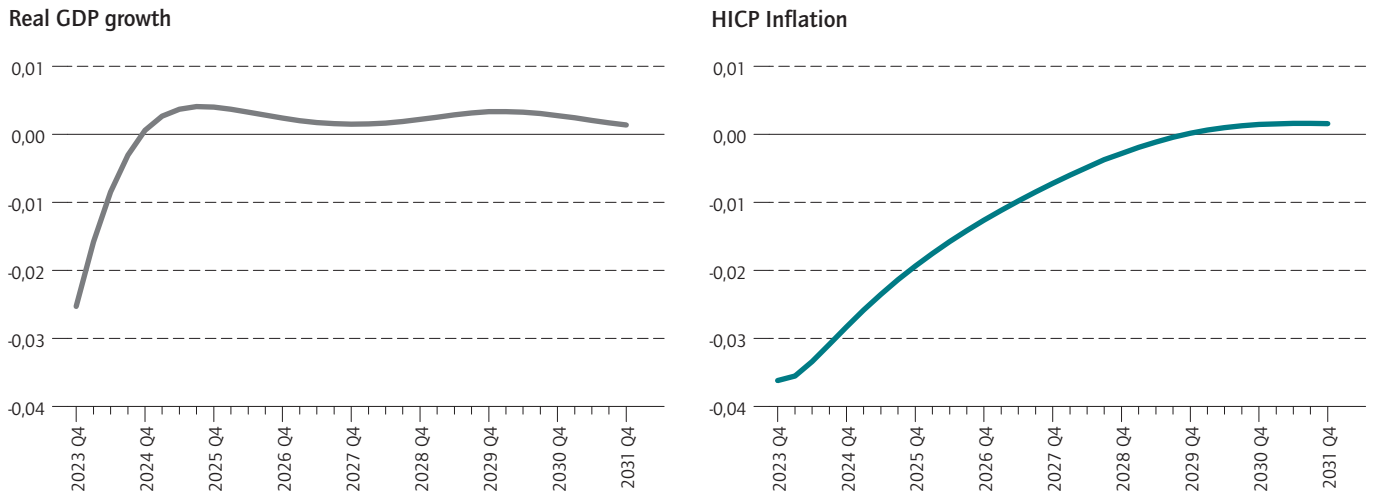

HICP Inflation

Source: Authors' own calculations.

Reducing the expansionary pace may have only moderate effects.

Figure 3

Macroeconomic effects of an early exit
Deviation from the baseline in percentage points, quarterly

Real GDP growth
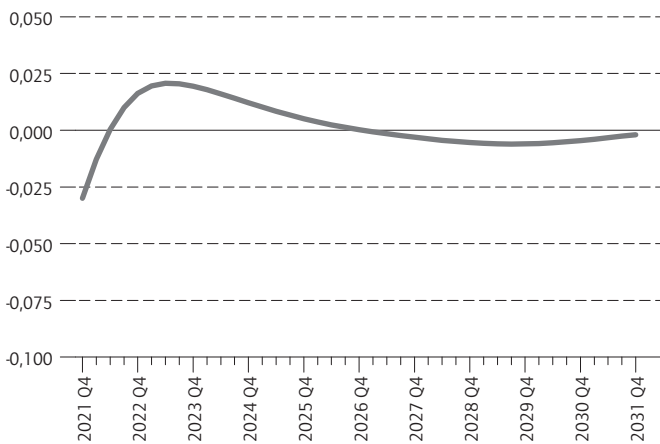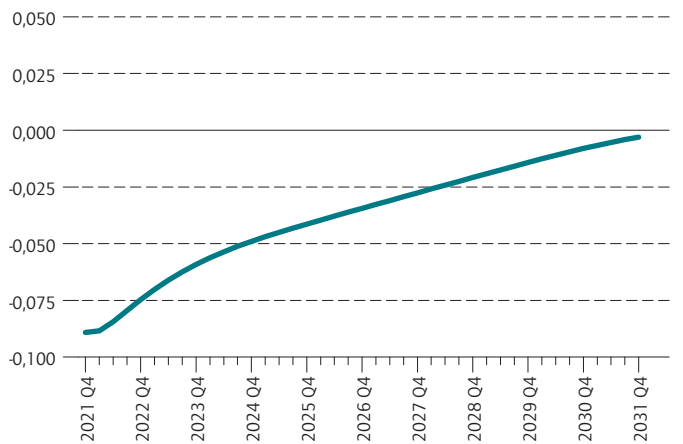
HICP Inflation

Source: Authors' own calculations.

An early exit may dampen especially inflation.

Figure 4

Macroeconomic effects of selling before mature

Deviation from the baseline in percentage points, quarterly

Real GDP growth

HICP Inflation

Source: Authors' own calculations.

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Selling before mature may reduce growth and inflation to the same extent.

effect basically drives output growth.[3] While the effects of an early exit were consistently negative for inflation, such a policy could have slightly positive effects on GDP growth in later periods, particularly when the period of zero interest rates ends. Agents expected the central bank to raise the interest rate by less, since an early exit would dampen the inflation rate and GDP growth in the short term. The growth impulse would fade out earlier but the contractive effect in subsequent periods would also be less pronounced. Therefore, whether an early exit turns out to be generally beneficial depends on the gap between the inflation rate and the ECB's target in the particular period.

Additional selling in secondary markets has contractive effects

In the final scenario, a faster pace of bond holding reduction compared to the baseline scenario was simulated. The term structure of the portfolio and the average remaining maturity of bonds held were the sole determinants of the trend over time. The alternative scenario

assumed that the ECB would increase the speed of tapering by selling additional bonds before maturity.[4] Thus, the pace of tapering would increase. More precisely, the assumption was that the ECB reduction rate would be 1.5 times higher than in the baseline scenario in order to arrive at exactly the same date as in the early exit scenario. This made it easier to compare the two scenarios independently of the baseline. The simulation showed that a steeper path is associated with dampened GDP growth and lower inflation rates compared to the baseline scenario (Figure 4). In the first year, cumulatively, both GDP growth and the inflation rate should be 0.1 percentage point lower than in the baseline scenario. Compared to the early exit scenario, the effects on inflation were therefore lower (Figure 5).

Summary

To evaluate the potential macroeconomic effects of different exit scenarios on the ECB's asset purchase program (APP) for the euro area in a general equilibrium model, a baseline scenario was constructed. The scenario con-

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3   Due to market segmentation, not all agents can react to changes in yield spreads by shifting portfolios towards long-term assets. To compensate for this, they will increase savings and reduce consumption and investment.

4   Alternatively, one could imagine that the ECB reduced its purchases more slowly by continuing asset purchases, but at a lower level than that at which bonds expire.

Figure 5

The macroeconomic effects of different tapering strategies

Deviation from the baseline in percentage points, annual cumulated
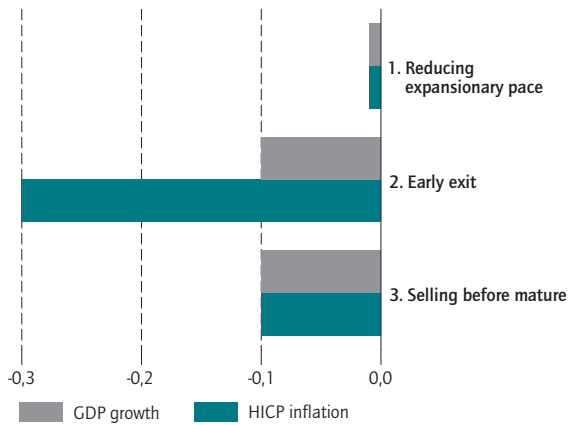
Source: Authors' own calculations.

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The early exit has a higher contractive effect than alternative tapering paths.

sisted of the previously observed increase in asset holdings by the central bank and a hypothetical future trend.

The analysis of three alternative scenarios shed light on the effects of announced changes in program setup. The simulated scenarios were characterized by 1) a reduction in net purchases, 2) an earlier-than-expected reduction in asset holdings, and 3) a faster exit pace, achieved by selling assets in addition to forgoing the replacement of expiring bonds. All three tapering strategies reduced the growth and inflation impulses of the baseline scenario. The comparison showed that reducing net purchases further only has moderate effects, whereas the earlier reduction of holdings and a higher exit pace have more pronounced effects. While the GDP growth rate was 0.1 percentage points lower compared to the baseline scenario in both cases, the impact on inflation was particularly pronounced in the case of an early exit. Cumulatively, the inflation rate was 0.3 percentage points lower than in the baseline scenario, whereas ultimately the difference was only 0.1 percentage points in the scenario with a higher exit pace. Policy decisions should therefore be based on the prevailing inflation rate.

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