

THE VIEW

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WHAT DRIVES THE ECB? AN AUGMENTED TAYLOR RULE FOR THE EUROZONE

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EXECUTIVE SUMMARY



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- **Price stability: Half of the ECB story?** The European Central Bank's primary task is the pursuit of price stability, which is defined as inflation rates below, but close to, 2% over the medium term. Our analysis shows that inflation and output gap considerations explain half of the ECB's monetary policy stance over the past decade. However, from 2016 onwards, output and inflation gap measures alone struggle to explain the ECB's increasingly accommodative monetary policy stance in a standard Taylor rule.
- **The rise of implicit targets.** To test the importance of other motives, we ran selected augmented Taylor rules, adding explanatory variables and looking at their contributions over time to explain the ECB's policy stance. Sovereign risk premia, financial stress and volatility indicators, measures of economic policy uncertainty and banks' stock market performance all appeared relevant to the ECB's decision-making over the past ten years. Their significance, especially in the case of peripheral spreads and financial stress indicators, peaked at the time of the Euro sovereign debt crisis.
- **Inflation matters (again):** From 2018 onwards, inflation has made a comeback in explaining most of the accommodative monetary policy stance. However, our results suggest that banks' stock prices continue to feature high on the ECB dashboard in recent years, especially when compared to other stress indicators.

For the past 20 years, the ECB has been responsible for setting a single monetary policy for the Eurozone. In this context, its primary objective – as laid out in the Treaty on the Functioning of the European Union, Article 127 (1) – is to maintain price stability, which has been defined as inflation rates below, but close to, 2% over the medium term. Beyond that, the ECB – "without prejudice to the objective of price stability" – is

also tasked with supporting general EU economic policies with a view to contribute to objectives such as sustainable growth and high employment. Meanwhile, financial stability is not an explicit ECB objective. Instead, the Treatise attributed only a limited, contributory role to the ECB in that regard (ECB, 2018). While the hierarchy of priorities is hence set, the weight to be given to other considerations that go beyond price stabil-

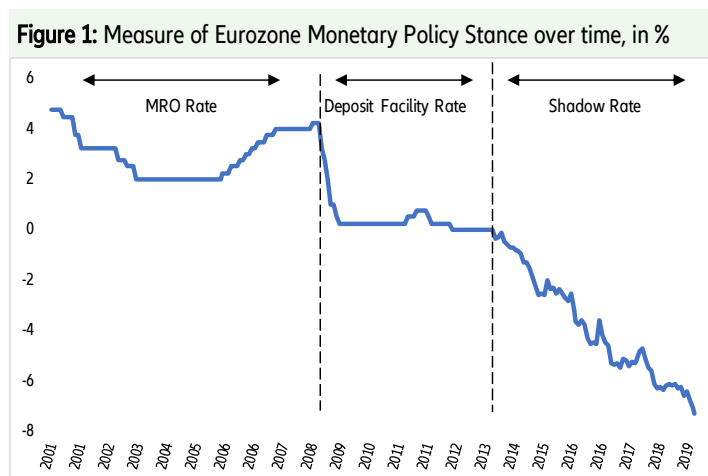
ity remains unclear. In other words: To what degree has the ECB's monetary policy stance been driven by inflation considerations on the one hand and financial stability considerations on the other hand? In this paper, we hope to shed some light on this question. In particular, we want to find out whether the focus has shifted as a result of the Eurozone debt crisis.

ESTIMATING AN AUGMENTED TAYLOR RULE FOR THE ECB

Before we can estimate a monetary policy reaction function, we first require an indicator that describes how tight or loose monetary policy has been over time. However, measuring the effective stance of monetary policy has become more complicated in recent years. After all, as the ECB ran into the zero lower bound on short-term interest rates in 2013¹ and increasingly resorted to unconventional policy measures, the main

policy rate no longer accurately reflected the overall monetary policy stance. To construct an unconstrained measure of the overall stance of ECB monetary policy, we use the ECB's main policy rate until September 2013 only¹. Thereafter, we switch to a shadow rate estimate from Wu and Xia (2016) that also reflects unconventional policy measures such as negative rates, explicit forward guidance and asset purchases. Figure 1

shows the combined time series of the ECB main policy rate and the shadow rate. As can be seen, our constructed proxy of the monetary policy stance is not constrained by a zero lower bound. In fact, ever looser monetary policy in recent years has seen the shadow rate drop below -7%.



Sources: Datastream, Allianz Research

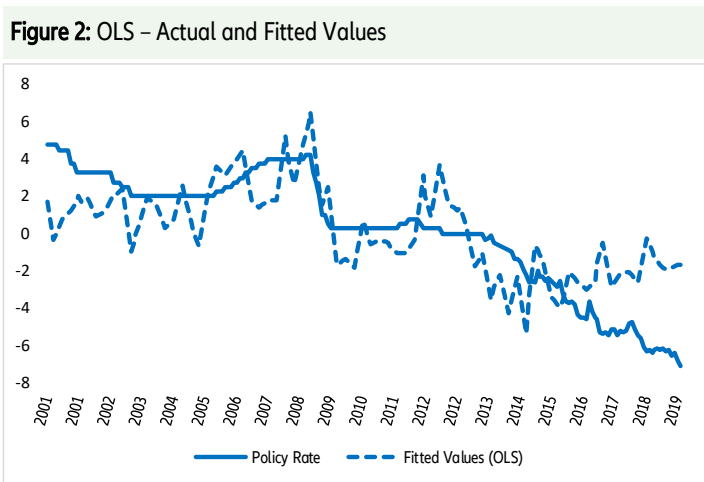
¹Until October 2008, the main policy rate is the rate on main refinancing operations (MROs). Following the Lehman collapse, the ECB decided to support interbank lending through a series of interventions which resulted in excess liquidity in the banking system. Consequently, the EONIA dropped to the level of the deposit facility rate, which became the new main policy rate from October 2008 onwards. For more details, see Hartmann and Smets (2018). See Appendix for more information on shadow rates.

Equipped with our measure for the overall monetary policy stance in the Eurozone, we can now estimate our baseline monetary policy reaction function. We use a version of the Taylor rule, which suggests the monetary policy stance can be explained by a constant plus a weighted sum of the deviation of inflation from target (inflation gap) and output from potential (output gap)². Figure 2 plots fitted values and residuals from an OLS regression of our monetary policy measure on the constant, the inflation

and the output gap. The standard Taylor rule largely provides an accurate description of the ECB’s monetary policy stance.

However, from 2016 onwards it fails to capture the ongoing sharp decline in the shadow rate. Whereas the actual shadow rate falls much lower, the Taylor rule suggests only slightly negative rates. While inflation and output gap considerations are overall useful at explaining the ECB monetary policy stance over the

past 20 years, output and inflation gap measures struggle to explain the ECB’s increasingly more accommodative monetary policy stance from 2016 onwards. These findings provide us with an incentive to shed more light on what other factors have been driving monetary policy over the past four years.



Sources: Datastream, Allianz Research

²See Appendix for further information on the variable definitions.

ECB MONETARY POLICY OBJECTIVES: SHIFTING PRIORITIES

In order to test for ulterior considerations beyond price stability, we supplement our baseline model with different explanatory variables. We choose the variables specifically to test to what extent the ECB's monetary policy stance can be explained by financial stability concerns.

- First, we include the VSTOXX as a measure of stock market volatility. Equivalent to the famous VIX for the S&P 500, the VSTOXX extracts option-implied volatility from the EURO STOXX 50.
- To account for systemic risks arising from movements across financial markets, we also consider the Country-Level Index of Financial Stress (CLIFS)³.
- To test to what extent the ECB takes into consideration "Italian risk" when setting its monetary policy, we add the difference in the yield on Italian vs German 10-year government bonds.

- We include a bank equity index (DJ EURO STOXX Banks) to measure to which extent the ECB has responded to concerns about the state of the European banking sector.
- Lastly, the ECB may have felt the need to support the economy through an accommodative monetary policy stance during times of high policy uncertainty. Therefore, we also consider an EU Policy Uncertainty index to account for changes in political risk.

We use a time-varying parameter model in the style of Strohsal et al. (2016) to estimate the augmented Taylor rules. We suggest that the weights attributed to the respective variables may have changed over time, particularly due to impactful events such as the Great Financial Crisis and the Eurozone sovereign debt crisis. Therefore, allowing for time-varying coefficients can provide more insightful results than standard

OLS, which implies that the ECB assigned the same weight to the measure from 2001 until 2019.

Constant coefficients do not allow for potential changes in the relative importance of different factors over time⁴. We may expect that while the ECB had to pay relatively little attention to financial stability considerations before the financial crisis, its focus on stability measures increased considerably in the more recent past.

The results are presented below. For each variable included as an alternative determinant of the monetary policy stance, we report the contribution of that variable to the fitted value in each month from the respective estimation with time-varying parameters.

³ The CLIFS is a measure of systemic financial stress. It takes into consideration market developments in equity, bond and foreign-exchange markets and additionally considers co-movements across sector-specific indicators to capture systemic risk. For more details, see Duprey et al. (2015). Our measure for the CLIFS consists of the sum of country-level values for Greece, Italy, Ireland, Portugal and Spain.

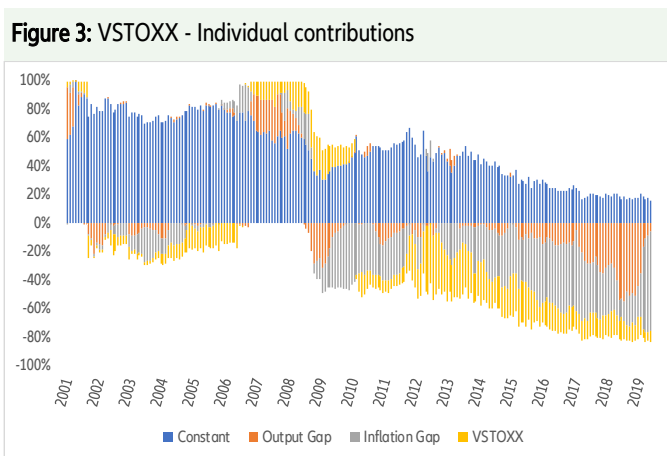
⁴ Nevertheless, we report the results from the standard OLS estimations in the Appendix.

VSTOXX: To what degree can ECB policy be explained by efforts to suppress equity market volatility?

When including the VSTOXX as an additional variable, much of the variation in the policy/shadow rate throughout the entire sample is explained by the constant. This effect is particularly strong for the pre-crisis subsample. Since we have not defined underlying economic dynamics for the constant, the interpretation of this term is difficult. However, as we have not included the equilibrium real interest rate, which is a standard component of the Taylor rule, we may conjecture that the constant at least partly picks up the effect of the omitted real rate⁵. The further loosening of the monetary

policy stance in the period between the financial crisis and the European sovereign debt crisis was mostly driven by the inflation gap. In 2010, the effects of the VSTOXX on the monetary policy stance changed sign from positive to negative. This is due to a steep fall of the coefficient attached to the VSTOXX from positive to negative territory from February to May 2010. The contribution of the VSTOXX was particularly strong during the European sovereign debt crisis, when the coefficient fell sharply again and the uncertainty index rose strongly: Up to 50% of the level of the shadow rate was determined by considerations related to

stock market volatility. Following the Euro crisis, the effects of the VSTOXX decrease in importance but still make up an economically significant share of 15-20% of the shadow rate. Over the past two years, it appears that the inflation gap has had an increasing effect, explaining up to 50% of the level of the shadow rate during some months in 2018. This “comeback” of the inflation target is apparent in all of our regressions and largely explained by a sharp rise in the associated coefficient. In 2018 and 2019, we find the VSTOXX to explain less than 5% of the level of the shadow rate.



Sources: Datastream, Allianz Research

CLIFS: To what degree can ECB policy be explained by efforts to keep a lid on financial stress?

We also test the Country-Level Index of Financial Stress (CLIFS). This index provides a more holistic market-based measure of financial market stability than the VSTOXX as it considers equity, bond and foreign-exchange markets as well as co-movements between these markets to capture systemic risk. While the concept of the CLIFS was introduced as recently as 2015, we use it as a proxy

for cross-market financial stability considerations of the ECB in general for the entire sample period.

Similar to the VSTOXX, the attached coefficient falls sharply in early 2010 and 2012. Interestingly, the coefficient also fell strongly during the early 2000s, which was not the case for the VSTOXX. As can be seen in Figure 4, the CLIFS contributed significantly to movements in

the policy/shadow rate during the Great Financial Crisis and the European debt crisis, two periods which were characterized by severe systematic financial stress. While the attached coefficient becomes increasingly negative, thus signaling a stronger consideration of systemic financial risk over time, the overall effect on the monetary policy stance gets weaker after the sovereign debt crisis.

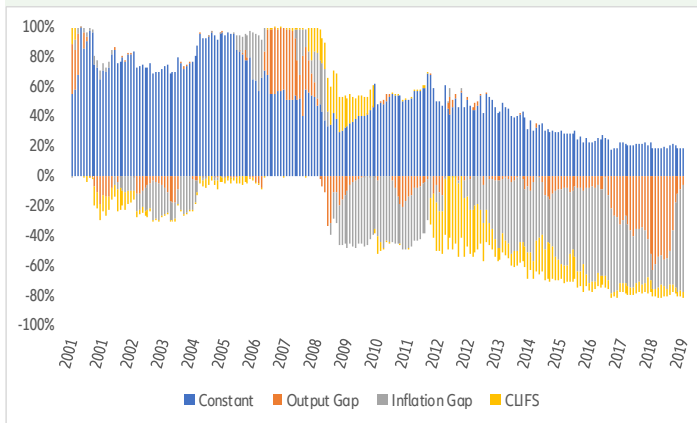
⁵ We provide more detail on this intuition below, when we include the real rate instead of a constant in our regressions.

Since 2016, explained shares range largely below 5%. In contrast, the inflation gap accounts for almost 75% of the shadow rate after 2018, which implies the largest role for inflation over the entire sample.

We see that the inflation gap seems to pick up the entire difference in the explained share between CLIFS and VSTOXX, while the output gap and the constant explain virtually the same proportion of the policy stance as before.

We conclude that the ECB seems to set its monetary policy with systemic risk in financial markets in mind during financial crisis periods but that the recent period of monetary stimulus is mostly driven by alternative factors.

Figure 4: CLIFS - Individual contributions



Sources: Datastream, Allianz Research

Italian 10yr sovereign bond spreads: To what degree can ECB policy be explained by efforts to stave off an Italian debt crisis?

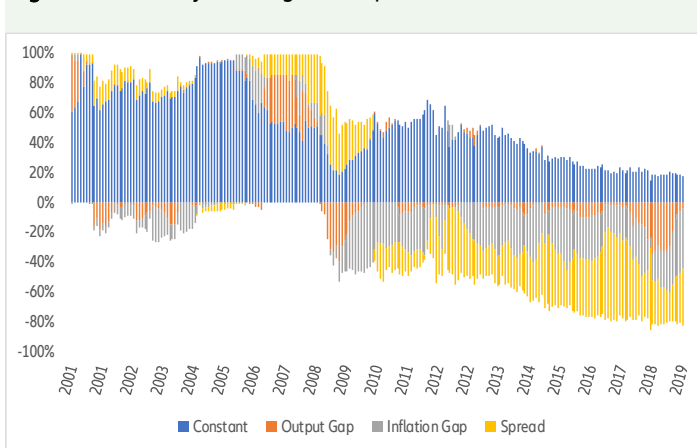
We find that bond spreads account for a both statistically and economically significant share of the level of the policy/shadow rate. This is particularly true for the time after the Great Financial Crisis. The importance of the spread increases over the post-crisis subsample. The spread accounts for close to 60% of

the monetary policy stance in 2017 and its relative contribution remains clearly elevated in 2019. This contrasts this measure from the VSTOXX and CLIFS.

In comparison to the base scenario, including the sovereign spread leaves explained proportions from the constant

and the output gap virtually unchanged but reduces the size of the relative contribution from the inflation gap significantly. We may interpret this result as the ECB attaching less weight to its inflation target to address Italian sovereign debt concerns instead.

Figure 5: Italian 10yr sovereign bond spreads – Individual contributions



Sources: Datastream, Allianz Research

Euro Bank Equity index: To what degree can ECB policy be explained by efforts to calm concerns about the state of the Eurozone banking sector?

We analyze this question by including the DJ EURO STOXX Banks index as an additional explanatory variable. We find the bank equity price index to contribute in a both statistically and economically significant manner to the monetary policy stance over almost the entire sample. Interestingly, however, bank equity considerations seem to have had a negligible influence on the policy rate during the 2008/2009 financial crisis. This may be the case since bank stocks retreated on a global scale, implying that concerns

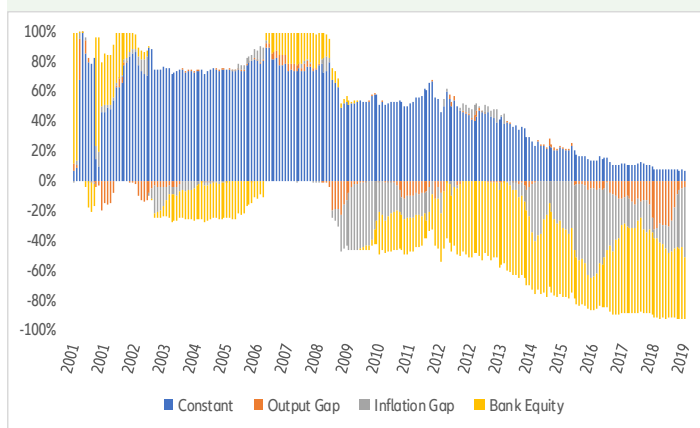
were driven by a general loss in confidence in the financial system and not idiosyncratic European banking sector weakness.

Following the Great Financial Crisis, the decreases in the policy and shadow rate are strongly accounted for by the movements in the equity index, with shares varying between 20% and 60%. Notably, the explained share remains at around 50% during the 2018/2019 period.

In contrast to the case of the VSTOXX and CLIFS – and similar to the estimation

with the bond spread – the role of the inflation gap in determining the monetary policy stance seems to be smaller than that of bank equity considerations over the last two years. Hence, the ECB's unconventional monetary policy decisions seem to have been particularly driven by such alternative objectives. This may provide support for theories that saw the ECB pursue a monetary policy aimed at propping up the banking sector under former ECB president Mario Draghi.

Figure 6: DJ EURO STOXX Banks index – Individual contributions



Sources: Datastream, Allianz Research

EU Policy Uncertainty: To what degree can ECB policy be explained by efforts to make up for elevated policy uncertainty?

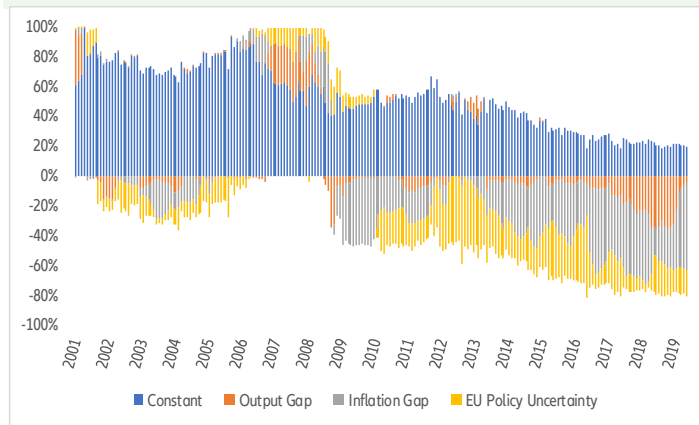
Lastly⁶, we also include the EU Economic Policy Uncertainty Index. This index measures uncertainty about economic policy based on newspaper articles from France, Germany, Italy, Spain and the United Kingdom. We find a similar pattern as in the case of the VSTOXX. Especially during the Euro crisis, the contribu-

tion to the monetary policy stance reaches almost 60%. It is also worth noting that the period of the Eurocrisis stands out as a time during which the inflation and output gap seemed to have had very little influence on the setting of the ECB's monetary policy measures. Nevertheless, the inflation gap accounts for

around 50% of the expansionary monetary policy stance during 2016 and the 2018/2019 period. While the constant and the output gap have a negligible effect, policy uncertainty is strongly associated with the policy stance over the entire post-Euro crisis period, also the post-2016 years.

⁶For simplicity, we have so far left out the equilibrium real interest rate as an important component of the Taylor rule and instead included a generic constant term. To test the robustness of our results, we include an estimate of the equilibrium real interest rate based on the methodology of Holsten et al. (2017) instead of the constant. Estimates are available from the NY Fed's website. We let this real rate enter either without a coefficient or with a time-varying coefficient. The latter case allows for a time-varying weighting of the equilibrium real rate in the ECB's reaction function. We find our results to be robust to the inclusion of the real interest rate for every variable. Interestingly, we find no differences between the case of constant and time-varying weighting of the real rate. This is because we find the coefficient attached to the real rate to be very persistent over the sample period. Further, we find the real rate to contribute little to the variation in the shadow rate after 2015, when the contribution is very close to zero in several months. This is explained by the level of the equilibrium real interest rate in these periods, which is close to zero according to the estimates from Holsten et al. (2017).

Figure 7: EU Policy Uncertainty – Individual contributions



Sources: Datastream, Allianz Research

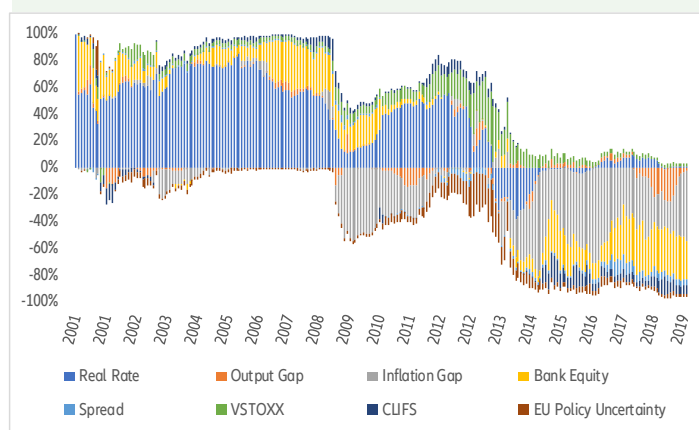
Focus on Eurozone banks

Finally, augmenting our Taylor rule with all variables simultaneously confirms the initial results. Next to the inflation

gap, movements in the Euro Bank Equity index best explain the ever more expansive ECB policy stance in the after-

math of the Eurozone sovereign debt crisis.

Figure 8: All variables – individual contributions



Sources: Datastream, Allianz Research

APPENDIX

Box: A Quick Guide on Shadow Rates

The nominal short-term policy rate cannot fall below a certain lower bound since depositors have the outside option of holding cash instead of bank deposits. If the short rate falls below zero, agents face a trade-off between negative rates on their deposits and the cost of storage, transportation and insurance required for cash holdings. If the short rate falls even further below its “physical lower bound” (Coeuré, 2016), cash holdings are preferred, resulting in deposit withdrawals.

This is one of the reasons why the European Central Bank – among other central banks – introduced unconventional measures to provide additional monetary stimulus despite short-term policy rates at or close the lower bound. This complicates econometric analyses of the monetary policy stance since the short-term policy rate no longer is the only determinant of the degree of monetary accommodation. Black (1995) introduces a so-called “shadow rate”, which is the short-term interest rate that would accurately reflect the monetary policy stance in absence of the outside option of holding currency. The shadow rate can be positive or negative. If the short-term policy rate is positive, the shadow rate and the short-term policy rate coincide by definition. If the short-term policy rate reaches its lower bound, the shadow rate can convey additional information about the monetary policy stance as it captures effects from conventional and unconventional monetary policy alike. As we see for the Euro-zone (Figure 1), the shadow rate falls sharply below zero after the introduction of unconventional measures.

Variable Definitions

All data is from Datastream, unless stated otherwise. The frequency is monthly. The sample period is 01/2001-06/2019. The **Inflation gap** is the difference between ECB macroeconomic staff projections for one-year ahead Euro area inflation and set the inflation target of 2%. The ECB macroeconomic staff projection for inflation is y/y (expected) growth in HICP inflation for the euro area (central projection). Following Orphanides and Wieland (2013), one-year-ahead forecasts for inflation are interpreted as three-quarter-ahead forecasts. This is because macroeconomic data takes time to be published and, say, data for Q3 2018 might not be available in Q3 2018 to predict Q3 2019 data. Instead, in this example we would use the Q4 2018 ECB Staff projection to estimate growth from Q3 2018 to Q3 2019 such that Q3 2018 data is considered in the estimation process. Due to data availability issues, ECB projections for Q3 2017 and before are not based on quarter-on-quarter growth. Instead, projections of each

quarter are assigned to the respective year (i.e. Q1-Q4 2017 projections for 2017 growth are used for 2017), thus approximating three-quarter-ahead forecasts. Projections of Q1 2013 and before are only published in ranges instead of point estimates. Estimates presented here are the midpoints of these ranges. We linearly interpolate the quarterly published ECB staff macroeconomic projections to obtain a monthly frequency.

We define the **Output gap** as the difference between ECB macroeconomic staff projections for one-year ahead Euro area GDP and the growth rate of potential output. The ECB macroeconomic staff projection for GDP is the y/y expected growth rate of real GDP for the euro area, calculated from q/q projections (central projection). Following a similar logic as with inflation forecasts, we use 2-quarter ahead forecasts. Projections of Q1 2013 and before are only published in ranges instead of point estimates. Estimates presented here are the midpoints

of these ranges. Potential output growth is defined as the quarterly growth rate of potential output. Potential output data is for the euro area in Euro, at 2010 reference levels, from AMECO. Growth rates are based on annual growth rates, and assumed to be constant over a calendar year. We linearly interpolate quarterly published ECB staff macroeconomic projections to obtain a monthly frequency. We also compute monthly growth rates from the quarterly growth rate of potential output, assuming constant monthly growth rates within quarters. Note that we use predicted values instead of unobservable values such as actual GDP, about which reliable information only becomes available with some delay. In this sense, our Taylor rule incorporates a conceptual element of the Orphanides Rule, namely that it describes real-time monetary policy decisions by only considering information actually available to the policymakers at a given point in time.

OLS Estimation Results

Table 1 presents the OLS estimation results for our baseline Taylor rule (1) and the augmented versions (2) – (6). We find that including the alternative

measures leads to an improved in-sample fit as measured by R-squared. However, as mentioned above, the associated coefficient estimates may not pro

vide useful interpretations since OLS assumes the Taylor rule coefficients to be fixed over the sample period.

Table 1: OLS Results (Dependent Variable: Monetary Policy Stance; Sample: 01/2001-06/2019)

	(1) Baseline	(2) VSTOXX	(3) CLIFS	(4) Spread	(5) Bank Equity	(6) EU Policy Uncertainty
Constant	2.58 (0.22)	1.09 (0.50)	2.56 (0.34)	3.50 (0.22)	-1.99 (0.47)	5.18 (0.32)
Output Gap	-1.75 0.24	-1.32 (0.27)	-1.74 (0.26)	-1.50 (0.21)	-1.55 (0.20)	-1.35 (0.20)
Inflation Gap	5.87 (0.41)	5.81 (0.40)	5.87 (0.42)	5.11 (0.37)	2.78 (0.45)	4.45 (0.37)
Additional Variable*		5.92 (1.81)	0.02 (0.33)	-0.97 (0.12)	0.02 (0.00)	-2.05 (0.21)
Observations	222	222	222	222	222	222
R ²	0.51	0.54	0.51	0.63	0.68	0.68

*The additional variable refers to either the VSTOXX, CLIFS, Spread, Bank Equity index, or the EU Policy Uncertainty index. Standard errors are in parentheses.

For example, the OLS coefficient associated with the VSTOXX is positive: Heightened stock market uncertainty seems to

be correlated with rate hikes. This stands in contrast to the argument of recent years that the ECB's ultra-expansive

monetary policy still aims at calming financial markets.

Limitations

To some extent, the measures we have included in our augmented Taylor rules reflect the same information about the soundness of the economy and the financial system. Further, these variables may be correlated with a variety of other indicators that may be of interest to the ECB. Therefore, we do not claim to have found a specific index or measure the ECB is bluntly using as part of its reaction function. Rather, we find our results to

support the conjecture that the ECB's reaction function is not only explained by output and inflation gap measures but likely also includes financial stability considerations to an economically significant extent.

Reverse causality may play a non-negligible role in our results. For example, the coefficient attached to the bank equity index in the period following the European sovereign debt crisis is nega-

tive, suggesting that the ECB cut rates in response to rising bank equity valuations. We view this critically and acknowledge that more sophisticated methods such as structural vector autoregression would provide more insights in this causal relationship.

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