The Dynamic Effects of the ECB's Asset Purchases: A Survey-based Identification

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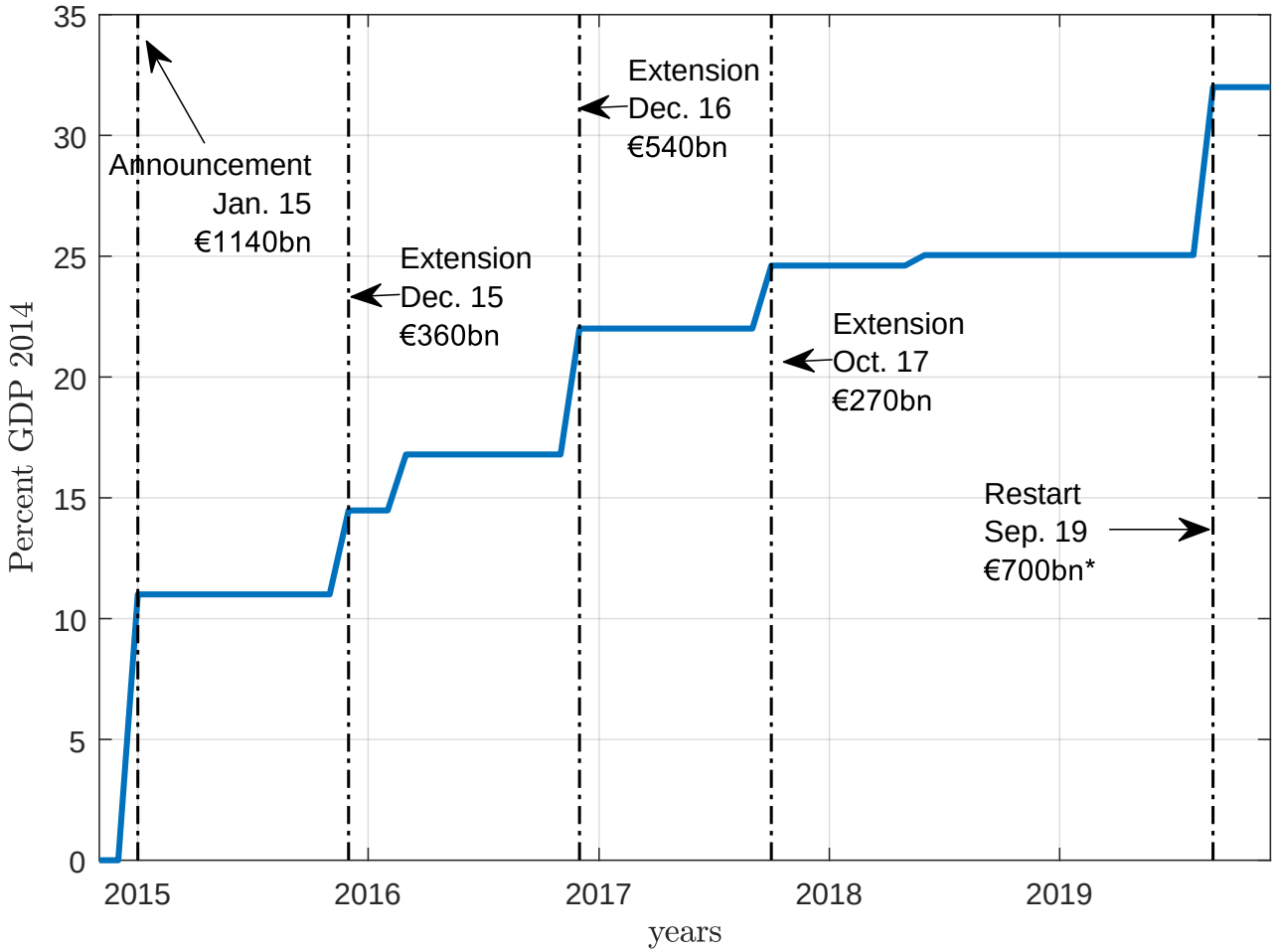
Disclaimer: The views expressed are ours and do not necessarily reflect those of the Banque de France or the Eurosystem.

Motivation

- On January 2015, the ECB decided to launch an asset purchase programme (APP) to address the risks of a too prolonged period of low HICP inflation
  - → Initial announcement of €1.14 trillion (11% of GDP)
  - → APP was extended and re-calibrated on various occasions
- Measuring macroeconomic effects is challenging
  - → Likelihood of endogenous movements in policy variables
  - → ECB announcements have been partly anticipated by the public
  - → APP and other monetary policies are often announced during the same time-frame

Total asset purchase announcements in the euro area



Note : Sample period : 2014.M11 — 2019.M12.

Existing studies

- The task of identifying asset purchase shocks has been largely conducted using conventional, but criticized, approaches in VAR
  - → "Recursive approach" : Weale and Wieladek (2016), Garcia Pascual and Wieladek (2016)
  - → "Sign restrictions approach" : Baumeister and Benati (2013), Gambacorta et al. (2014), Gambetti and Musso (2020)
- Recently, a "high-frequency" approach is used to address the shortcoming of both approaches
  - → Movements of asset prices around monetary policy announcements à la Gertler and Karadi (2015)
  - → Compute decompositions to isolate asset purchase shocks : Rogers et al. (2018), Kim et al. (2020), Swansson (2021)
  - → However, decompositions require questionable exclusion and narrative restrictions, and variable selection.

What we do

- Introducing a "survey-based approach" to identify asset purchase shocks
  - → Surprises are **unexpected changes in the size of additional purchases announced**
  - → Inference on the basis of public expectations released in quantitative surveys just before APP announcements
  - → Contrary to high-frequency approach, allow to directly infer the unexpected component of asset purchase announcements
- Using our surprise measure within a Proxy-SVAR framework **to trace out the dynamic effects of APP shocks**
  - → Stock and Watson (2012) and Mertens and Ravn (2013)
  - → Bayesian methods
- Running (modest) historical counterfactual simulations **to assess the impact of successive APP recalibrations**

Methodology

- Bayesian SVAR framework
- Monthly euro area data from Nov. 2014 to Dec. 2019 ▸ Figure
  - → cumulative amount of asset purchases announced (scaled by the annualized 2014 euro area GDP) ;
  - → logarithm of industrial production ;
  - → logarithm of HICP index ;
  - → spread between the 10-year euro area government bond yields of the four largest euro area countries and the 10-year OIS ;
  - → De Santis (2018)'s excess bond premium.
- VAR is estimated in (log) levels with 2 lags
- Identification strategy : External instrument (i.e., Proxy-SVAR)
  - → Algorithm by Arias, Rubio-Ramírez, and Waggoner (2018)

Methodology

Proxy ≡ Unexpected changes in the size of additional purchases announced

- Make extensive use of surveys conducted by Reuters and Bloomberg ahead of each Governing council (GovC)
  - → About 60 respondents in each survey
  - → Questions were often asked in different ways (eg. a pace + a length of purchases, or a total additional amount) ▸ Examples
  - → Substantial dispersion in the expectations across market participants ▸ Figure
- Check the consistency of the expectations with three other sources
  - → ECB Survey of Monetary Analysts (SMA)
  - → Banque de France survey among fixed income desks
  - → Narrative in financial press

Methodology

Proxy ≡ Unexpected changes in the size of additional purchases announced

- Derive our surprise as follows

$$proxy_t = X_t^{announced} - X_t^{expected}, \qquad t \in \{\text{GovC date}\}$$

→ $X_t^{announced}$: additional amount effectively announced by ECB

→ $X_t^{expected}$: median additional amount expected by market

- Computing these surprises is often straightforward as the ECB announced a fixed and predetermined additional amount ▸ Table

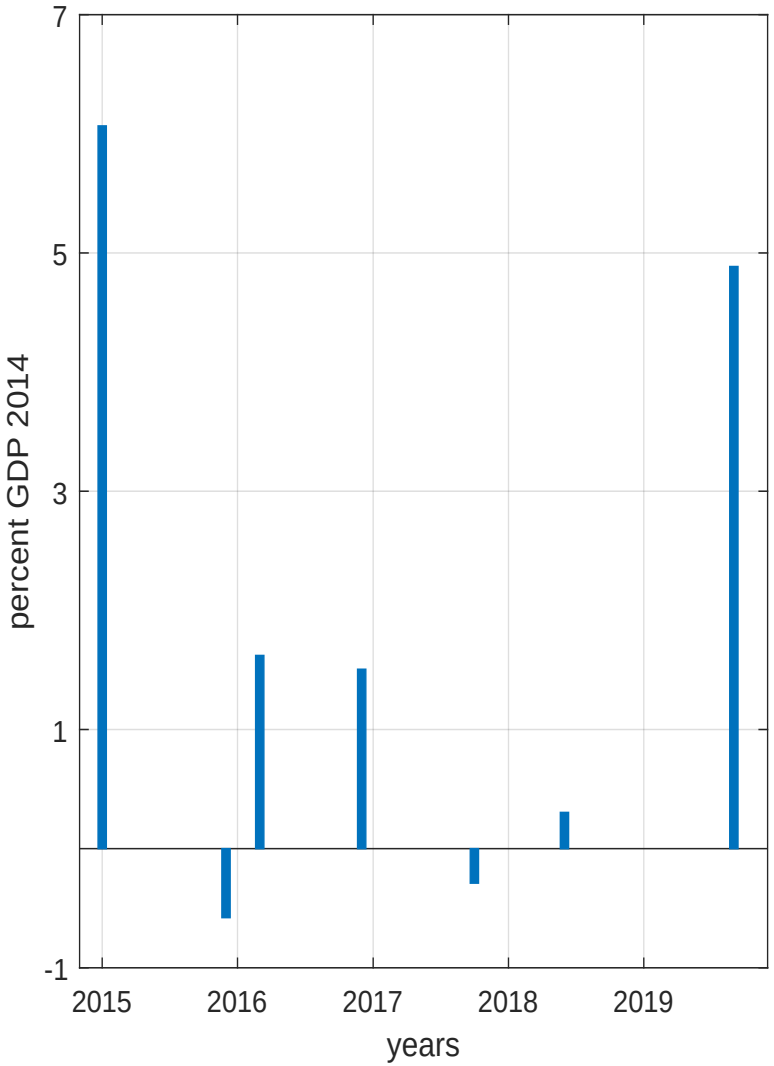
- However, in September 2019, ECB announced an open-ended APP

→ APP is linked to the horizon of the first interest rate hike

→ We infer the implicit announced total size with October polls ▸ details here

Methodology

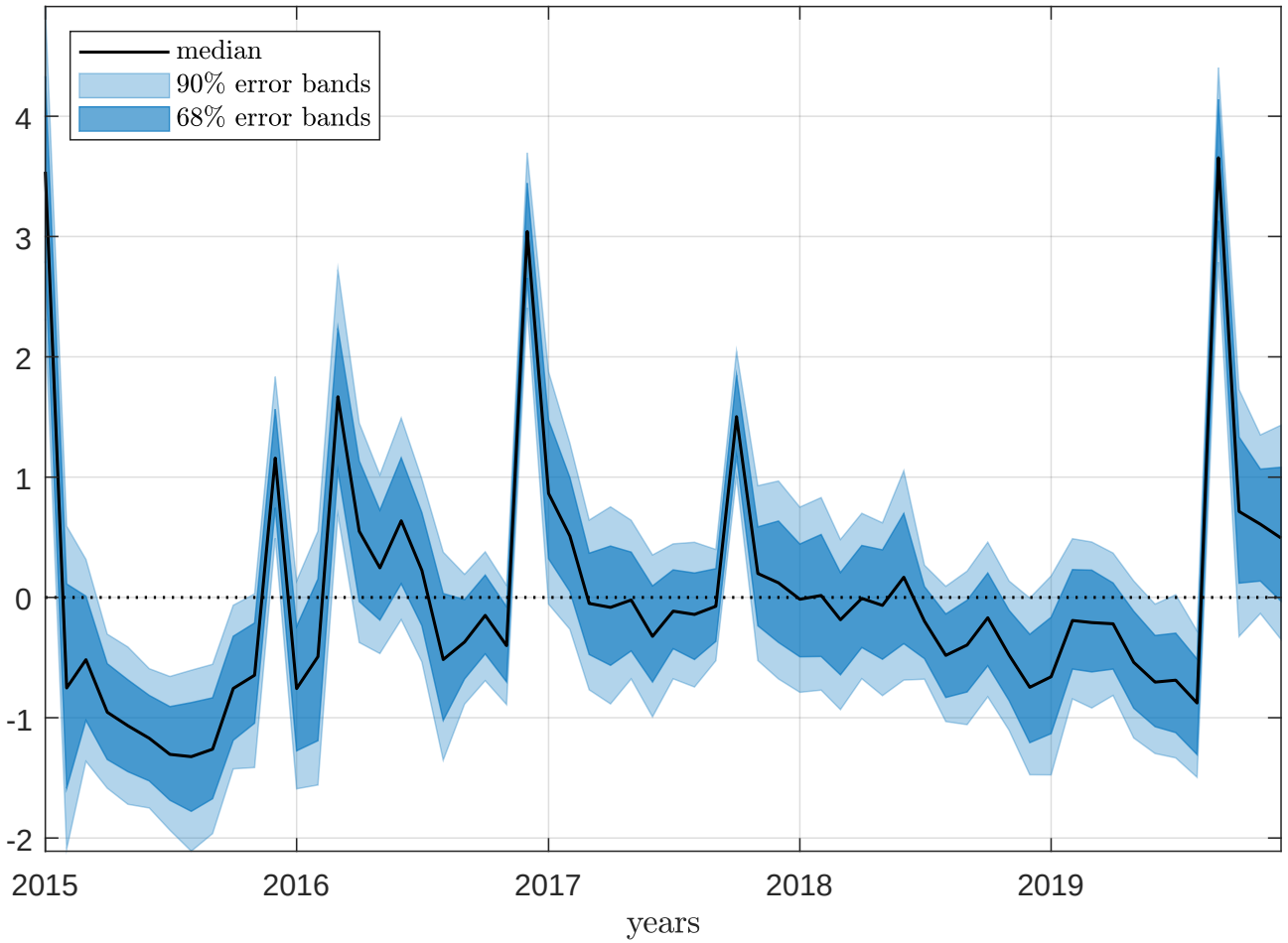
Proxy ≡ Unexpected changes in the size of additional purchases announced



- Non-zero surprises only during major APP announcements
- No significant proportion of respondents expecting an APP decision at a GovC which turned out to be a non-event
- Market participants have inferred correctly the timing of APP announcements most likely through communication means
- Sign of surprises is corroborated by the press ▸ examples

Results

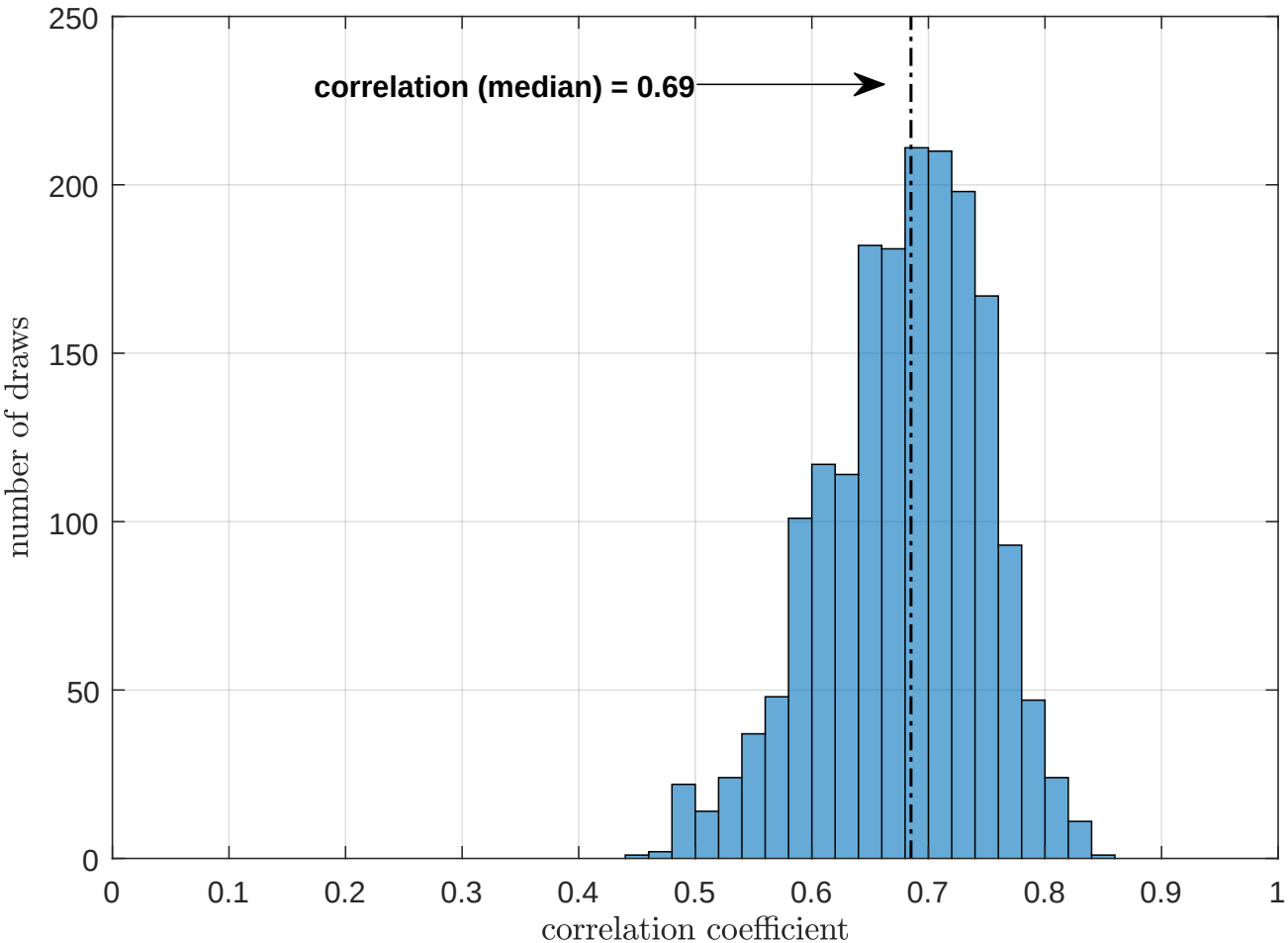
Historical Path of Structural APP Shocks



Note : Sample period : 2015.M01 — 2019.M12.

Results

Correlation between Proxy and APP Shock



Note : Histogram based on 1805 independent draws generated from MCMC.

Results

A test of "structuralness" of APP shocks

- APP identification relies on a relatively small amount of information drawn from a 5-variables VAR –> are shocks non-fundamental ?

- Check VAR contains sufficient information to identify the structural APP shocks.

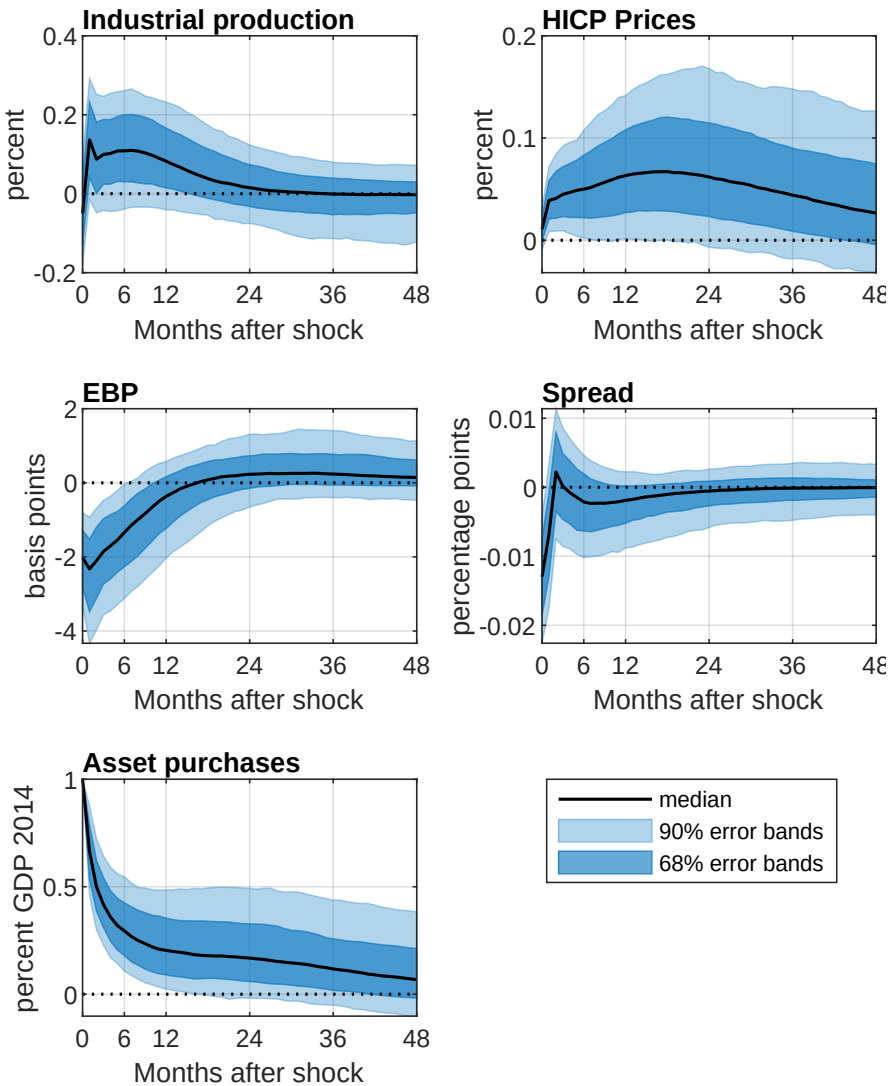
- Projecting the structural APP shocks onto the factors summarizing the information content of a large set of information available ahead of each Governing Council.

  → 38 macroeconomic, survey and financial time series

- Shocks are not predictable based on past information available, and thus the structuralness is accepted.

Results

Impulse responses to an APP shock



- APP size : +1% of GDP
  ≡ around Eur bn 100
- Median effects at the peak
  +0.15% in output
  +0.06% in prices
  -2.0bps in EBP
  -1.5bps in spread
- Large uncertainty
- Our results are at the lower bound of available literature

▸ see results

Results

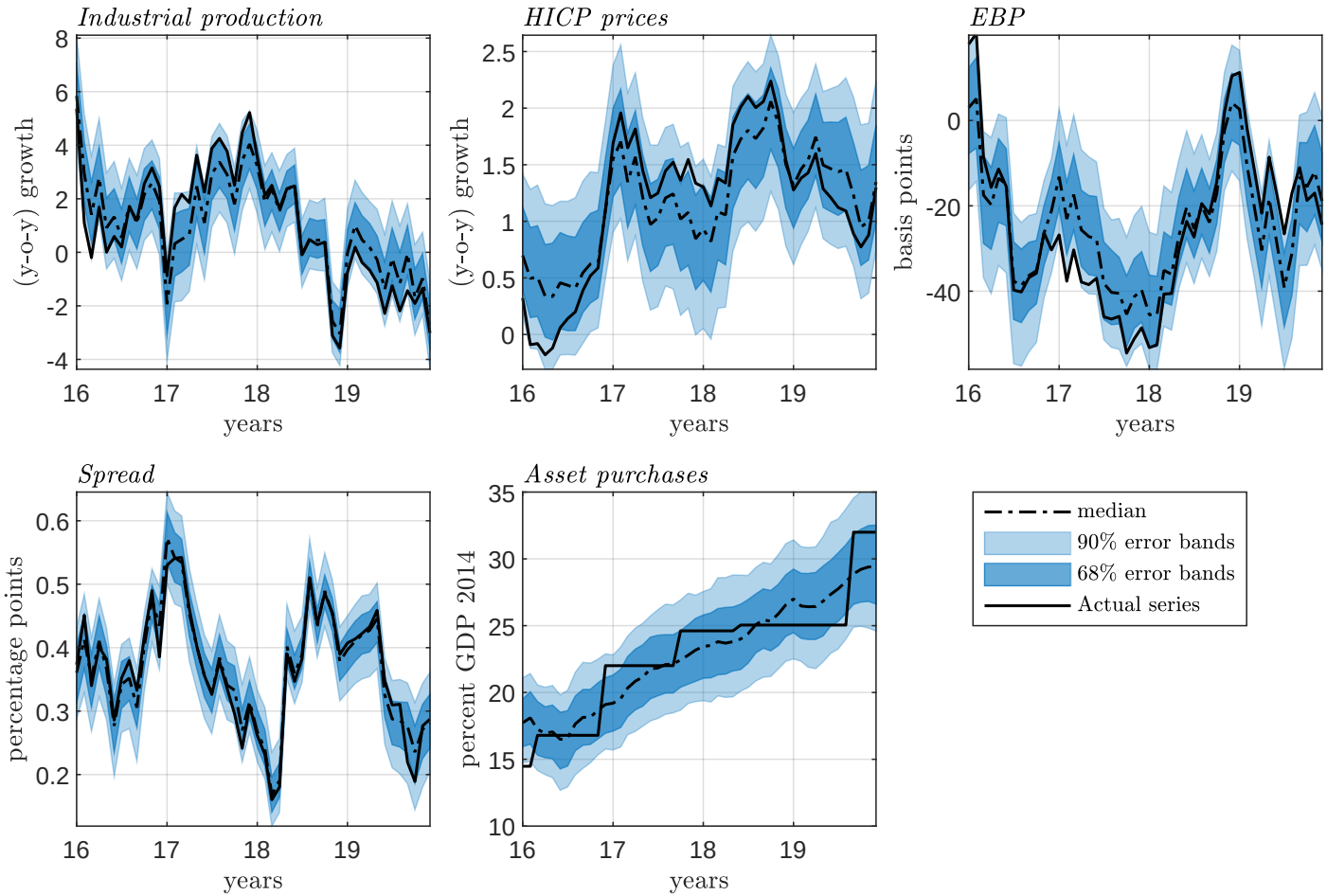
Forecast Error Variance Decomposition

Horizon	IP	Prices	EBP	Spread	APP
1M	5.88 [2.69;11.81]	9.02 [2.71;18.69]	16.89 [7.37;29.21]	9.44 [3.39;19.01]	91.19 [85.16;95.21]
6M	8.46 [2.83;19.90]	14.14 [4.07;29.35]	21.21 [9.75;35.29]	9.24 [4.51;16.27]	77.02 [65.33;86.03]
12M	11.32 [3.39;25.59]	16.29 [4.41;34.74]	20.85 [9.54;34.04]	10.33 [5.42;17.53]	63.63 [46.33;76.60]
24M	12.24 [3.50;27.55]	18.53 [4.61;40.38]	19.59 [8.76;33.50]	11.03 [5.84;18.57]	49.22 [30.02;66.88]
36M	12.22 [3.83;27.94]	19.53 [4.68;41.87]	19.33 [8.69;33.49]	11.46 [6.25;18.91]	44.73 [24.04;63.40]
48M	12.74 [3.96;28.24]	19.61 [4.97;42.18]	19.35 [8.56;33.43]	11.64 [6.38;19.50]	42.47 [21.97;61.92]

Note : Fraction of variance (computed from the posterior median) of each endogenous variable explained by APP shocks at various horizons. The 68 percent probability intervals are indicated in brackets.

Results

Suppressing APP shocks



Note : Sample period : 2016.M01 — 2019.M12.

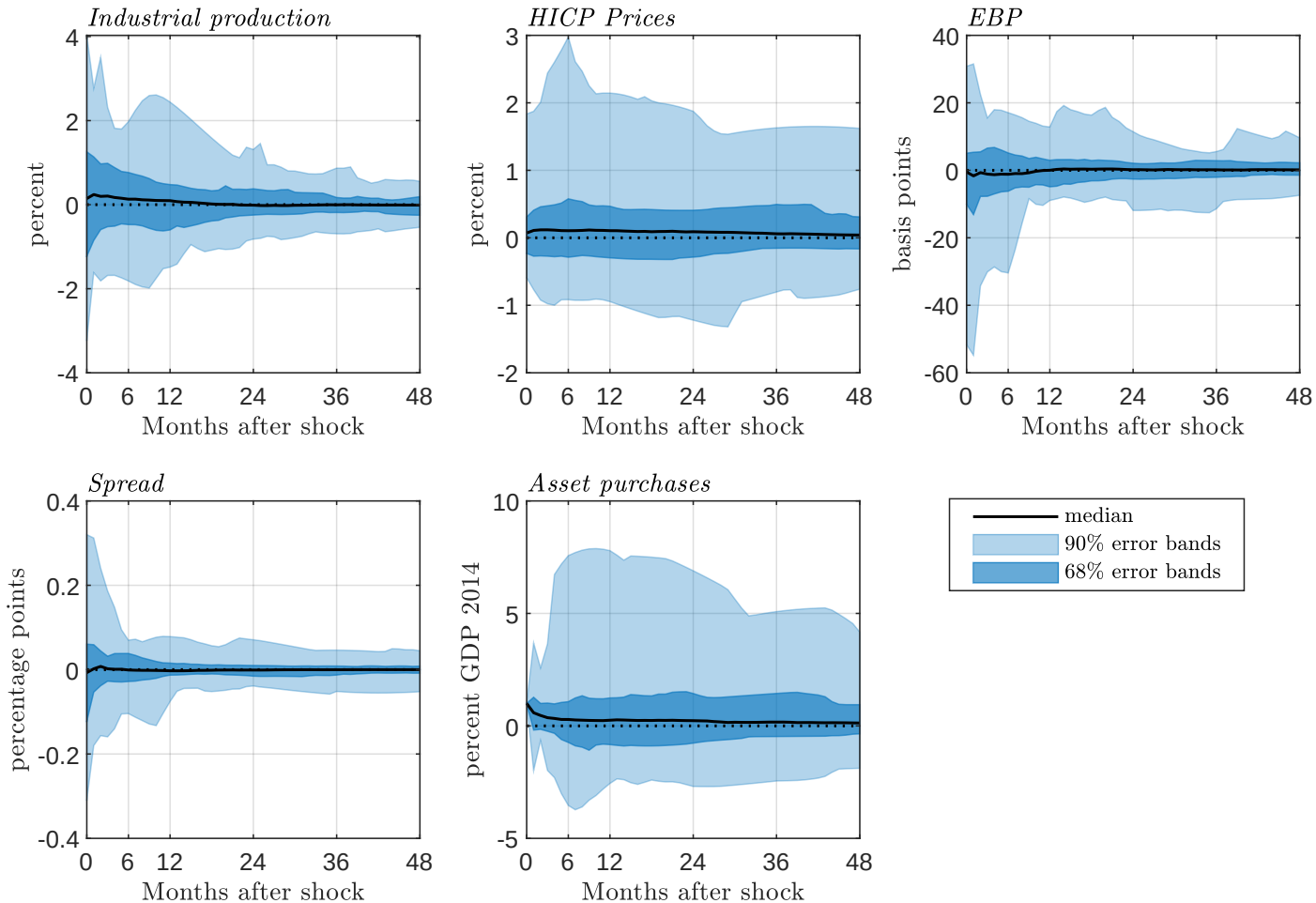
Results

Robustness Analysis

- Alternative proxy ▸ Results
  - → Recompute the surprises using only the answers by the respondents who expected an APP recalibration
  - → Minor differences with the baseline proxy ▸ Figure
- Proxy within a recursive VAR ▸ Results
  - → Employ an "internal instrument" strategy consisting in ordering the proxy first in a recursive (i.e., Cholesky) VAR
  - → Plagborg-Møller and Wolf (2020) : "internal instrument" VAR estimates the same impulse responses as LPs (Jordà, 2005)
- Free float as an alternative scaling method ▸ Results
  - → Definition similar to Eser et al. (2019) : *available debt in the market, corrected from the amount held by the ECB and by insurance and pension funds*

Comparison

Impulse responses to an APP shock using Altavilla et al.(2019)'s QE factor as a proxy



The Altavilla et al. (2019)'s QE factor is extracted from changes in yields of risk-free rates (OIS rates) at different maturities, spanning one-month to ten-years.

Historical Counterfactuals

- Most ECB actions have historically been systematic reactions to the state of the economy

- Assessment of the effects of APP policy, as opposed to the effects of unpredictable changes in policy (i.e., shocks), must therefore consider **what would have happen if the systematic component of APP were different**.

  → What would have happened if no APP recalibration ?

- Straightforward procedure

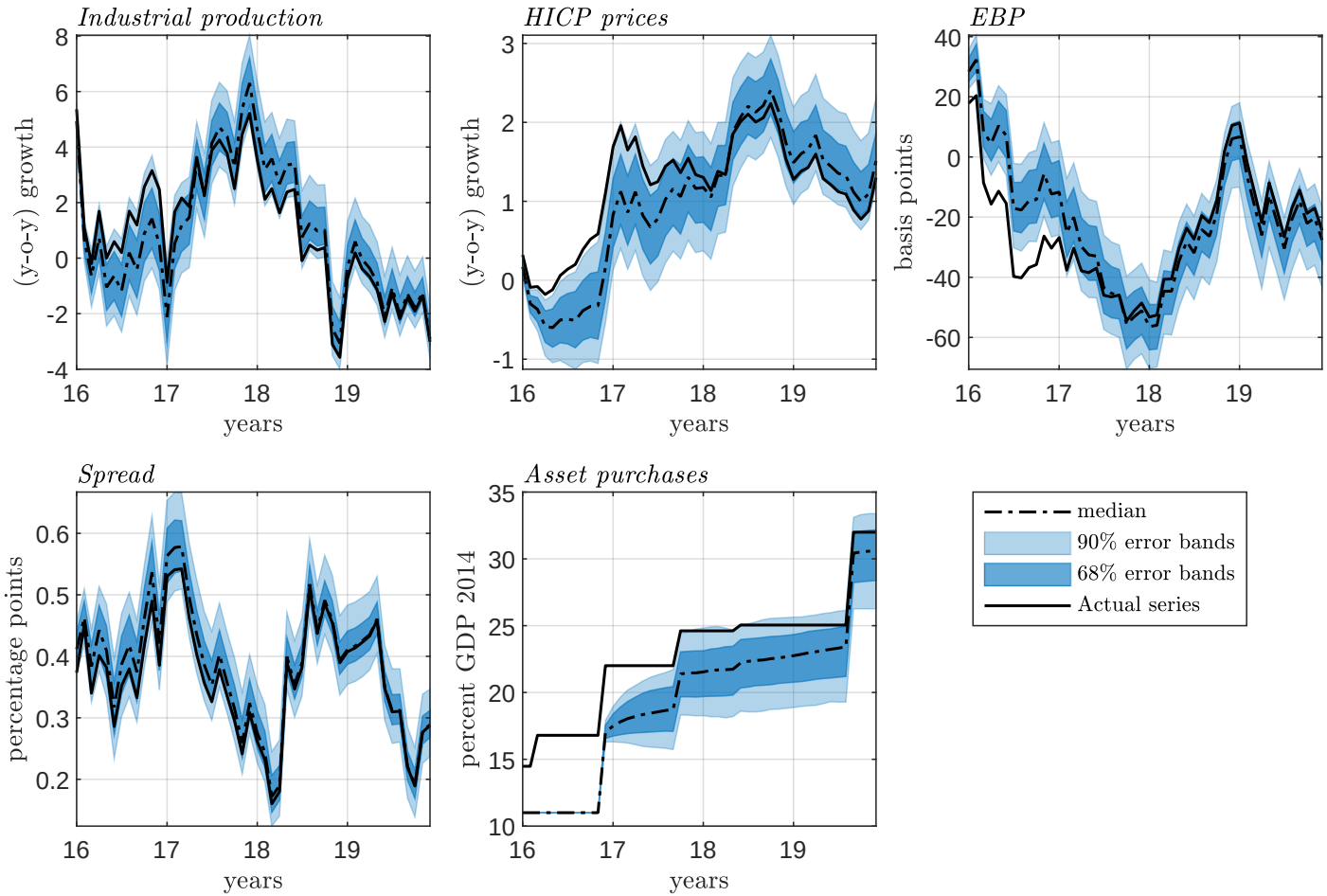
  → Generate a sequence of draws from the posterior distribution

  → For each draw, keep all the historical path of shocks, except for the one to the APP shocks

  → Recomputing shocks to APP such that the counterfactual path for the APP remain unchanged over next periods

Historical Counterfactuals

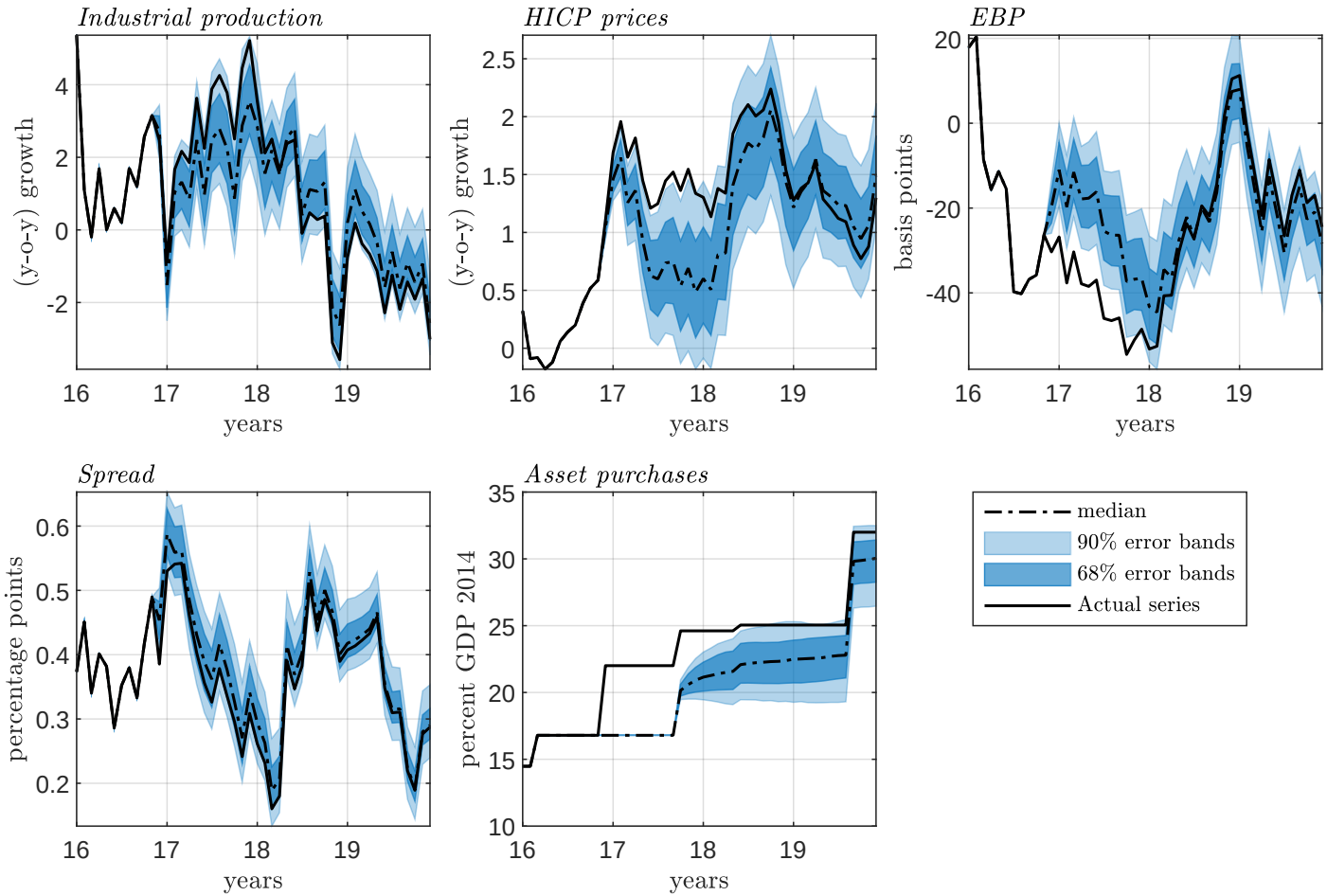
Effects of December 2015 & March 2016 APP recalibrations



Note : Sample period : 2016.M01 — 2019.M12.

Historical Counterfactuals

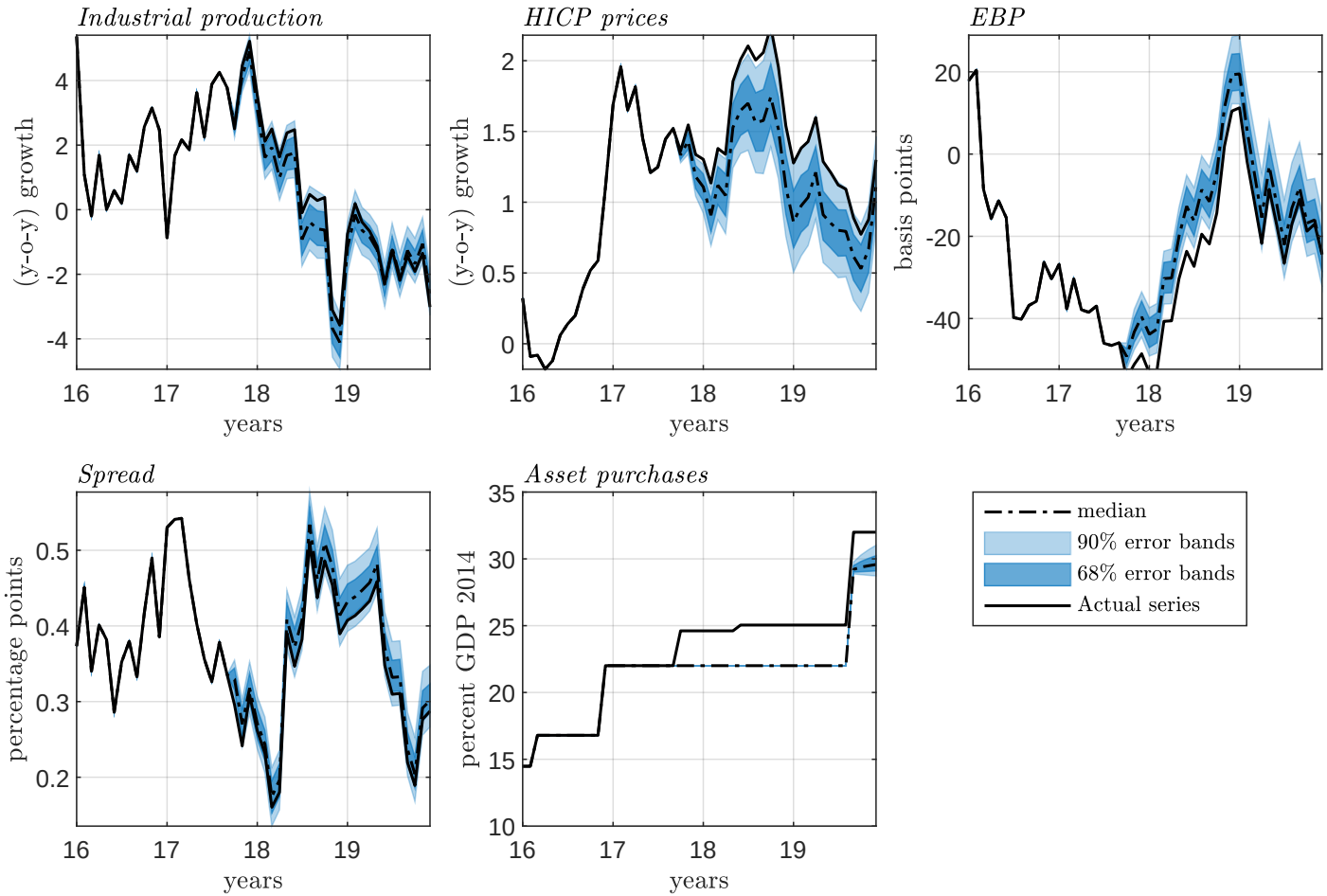
Effects of December 2016 APP recalibration



Note : Sample period : 2016.M01 — 2019.M12.

Historical Counterfactuals

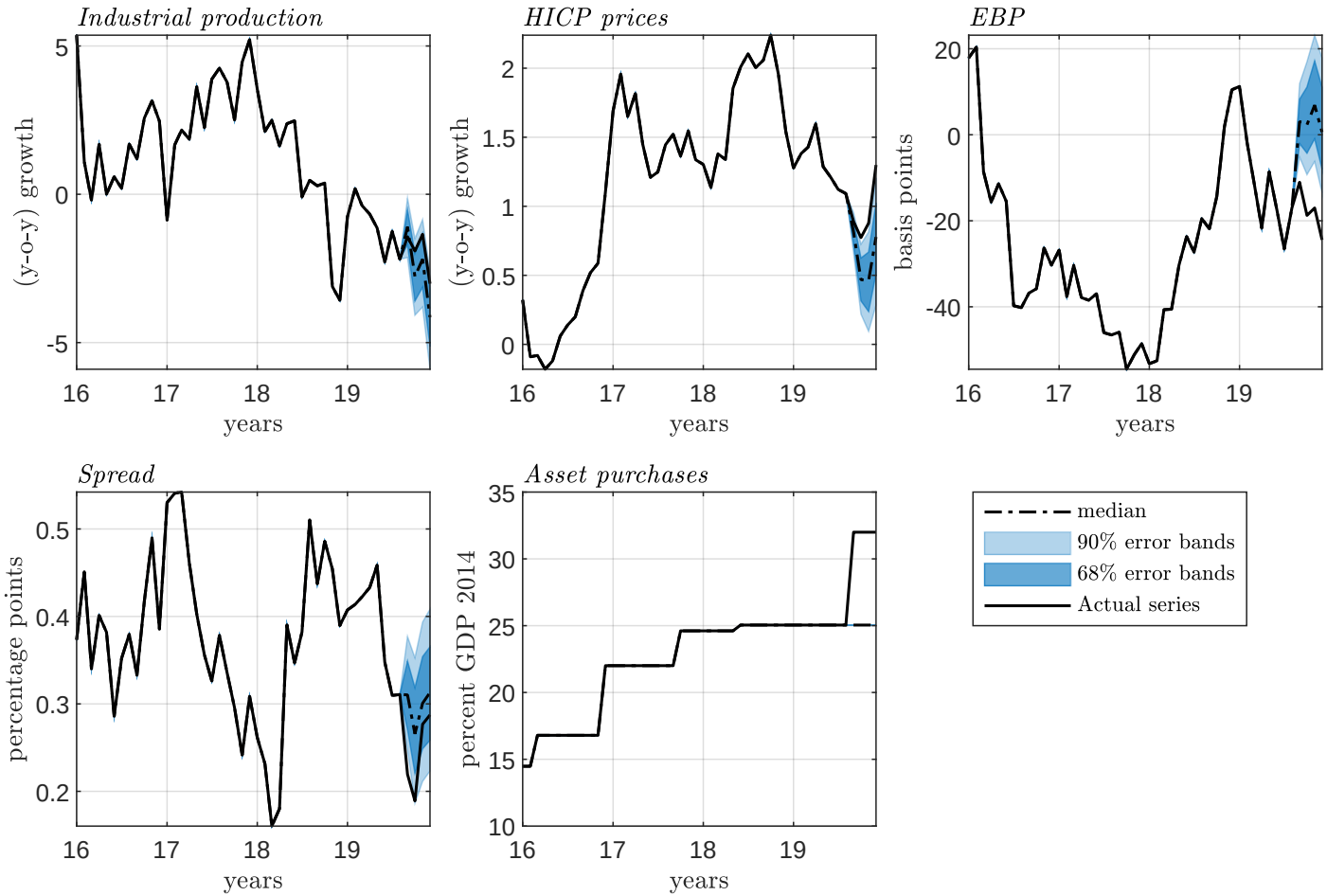
Effects of October 2017 & June 2018 APP recalibrations



Note : Sample period : 2016.M01 — 2019.M12.

Historical Counterfactuals

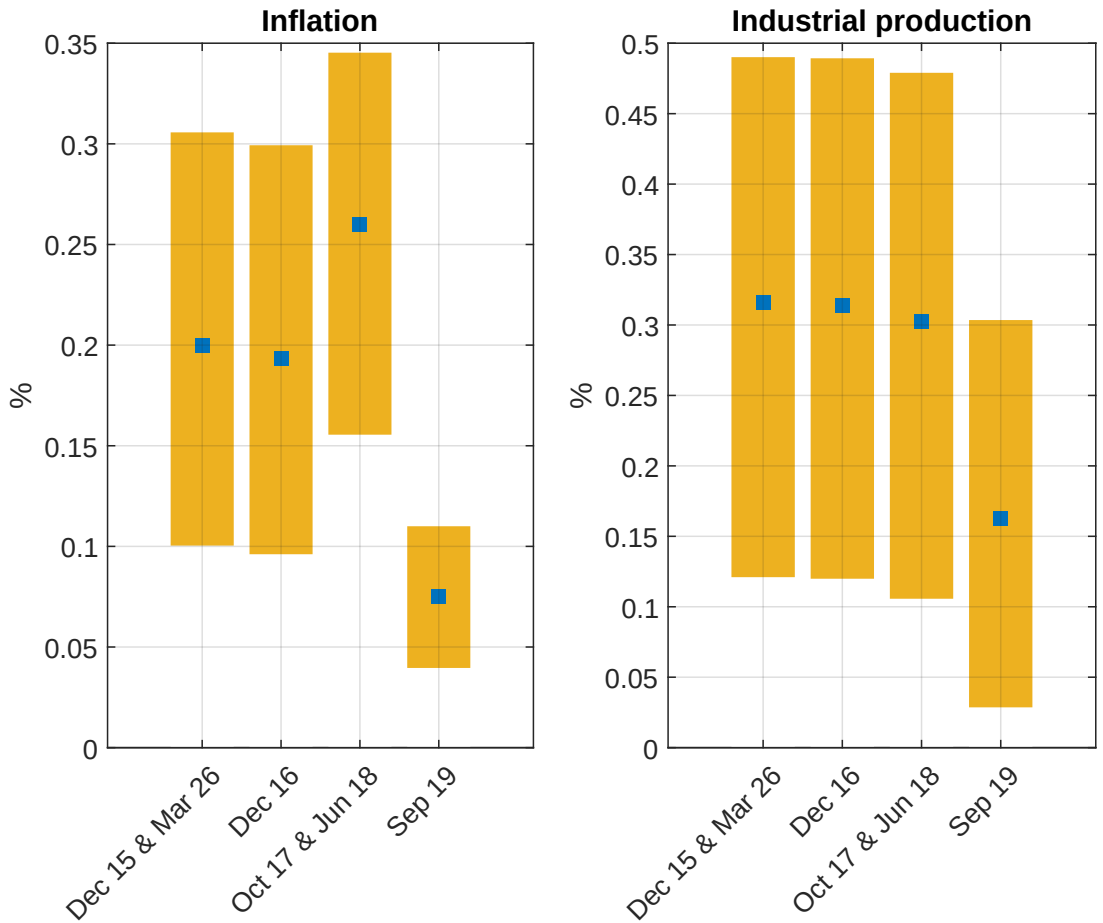
Effects of September 2019 APP recalibration



Note : Sample period : 2016.M01 — 2019.M12.

Historical Counterfactuals

Median peak effects of APP recalibrations - rescaled for 1% of euro area GDP



Note : Blue squares denote the median and yellow bars the 68% probability intervals.

Standardized peak effects on prices and output

	Country	Model	Prices (%)	Output (%)
Baseline estimates	E.A	SVAR	0.21	0.31
Andrade et al. (2016)	E.A	DSGE	0.41	0.12
Garcia Pascual and Wieladek (2016)	E.A	SVAR	0.09	0.13
Gambetti and Musso (2020)	E.A	SVAR	0.04	0.02
Baumeister and Benati (2013)	U.K	SVAR	0.06	0.08
Baumeister and Benati (2013)	U.S	SVAR	0.06	0.09
Weale and Wieladek (2016)	U.K	SVAR	0.46	0.30
Weale and Wieladek (2016)	U.S	SVAR	0.96	0.96
Chen, Cúrdia, and Ferrero (2012)	U.S	DSGE	0.02	0.02
Kim, Laubach, and Wei (2020)	U.S	SVAR	0.19	0.93

Note : This table summarizes the standardized peak effects on prices and output in the literature. The effects are standardized to a common increase size equal to 1% of the respective country's GDP around the time asset purchases was first introduced. ▸ details here

Historical Counterfactuals

The plausibility of counterfactual scenarios

- Our counterfactual scenarios potentially ignore the Lucas critique
- But simulations can be viewed as "modest policy interventions" in the sense of Leeper and Zha (2003)
  - → "*Change in policy that does not significantly shift agents' belief about policy regime and does not generate quantitatively important expectations-formation effects*"
- Quantify how plausible our APP counterfactual scenarios are using the "modesty statistics" developed by Antolín-Díaz et al. (2020)
  - → Check plausibility from the perspective of a forecast
  - → How "far" the distribution of APP shocks (compatible with counterfactual scenarios) is from the unconditional distribution of APP shocks ▸ Forecasts
  - → Kullback-Leibler (KL) divergence

Historical Counterfactuals

The plausibility of counterfactual scenarios

	KL divergence	Calibrated q
Dec 2015 & Mar 2016	31.87	0.72
	[29.57 ; 35.30]	[0.72 ; 0.73]
Dec 2016	24.54	0.70
	[23.45 ; 25.64]	[0.69 ; 0.70]
Oct 2017 & Jun 2018	55.24	0.78
	[52.96 ; 57.61]	[0.78 ; 0.79]
Sep 2019	10.28	0.63
	[9.53 ; 11.56]	[0.63 ; 0.64]

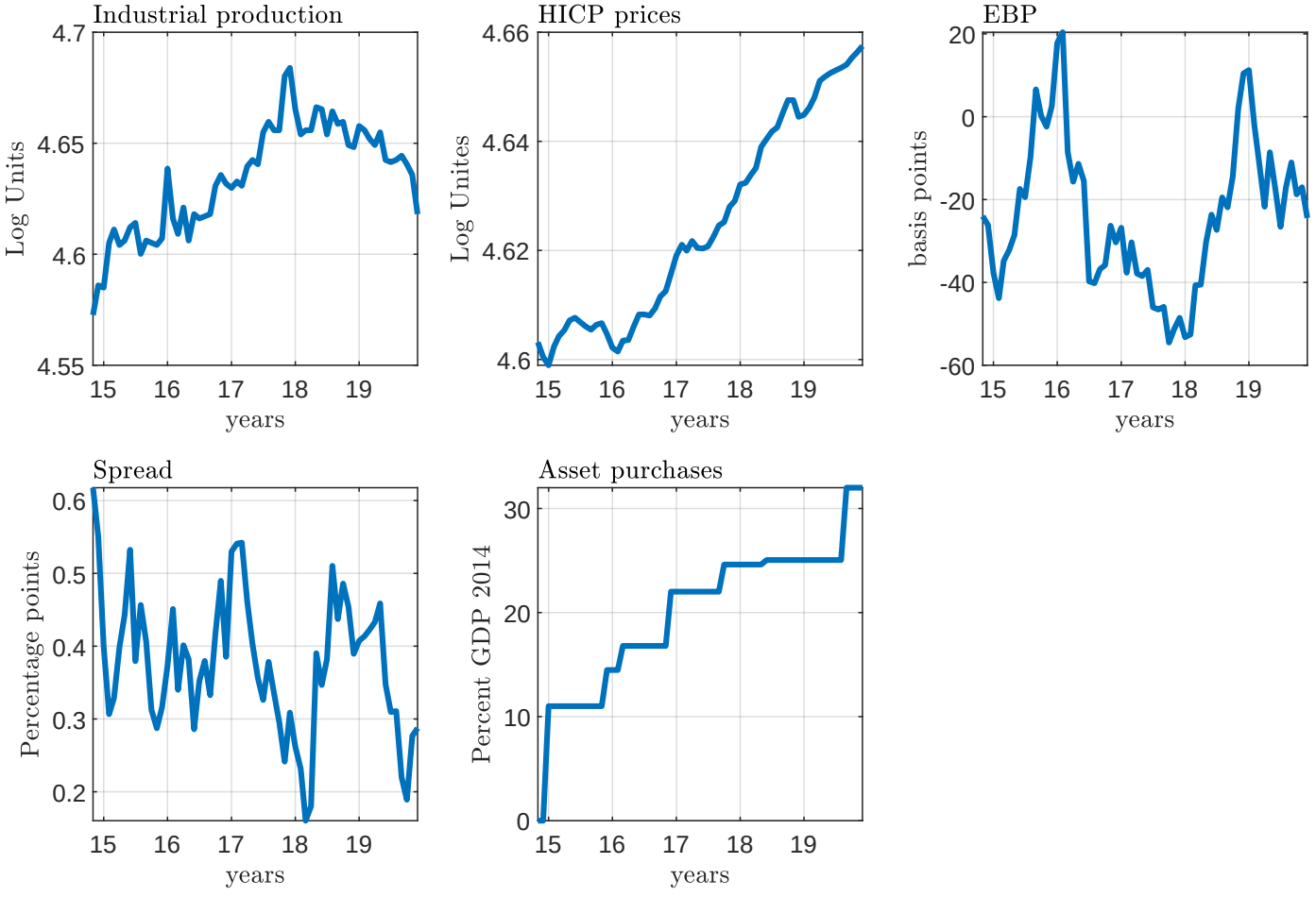
Note : Median of the KL divergence and the calibrated q (i.e., KL divergence is translated into a comparison between the flip of a fair and a biased coin). The 68 percent probability intervals are indicated in brackets.

Conclusion

- Novel proxy for exogenous APP shocks
  - → Proxy ≡ Unexpected changes in the size of additional purchases announced by the ECB
  - → Based on public expectations released in quantitative surveys
- Our Proxy-SVAR leads to the following conclusions
  - → APP shocks have expansionary effects
  - → Their contribution to business cycle fluctuations is modest but non-negligible
  - → Successive APP recalibrations were central in stimulating the economy *(e.g., preventing deflation in 2016)*
- Several interesting avenues for future research
  - → Examining potentially nonlinear effects of asset purchases
  - → Applying our Proxy-SVAR to other countries

Appendix

Data



Note : Sample period : 2014.M11 — 2019.M12.

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ECB APP announcements 2015M1 — 2019M12 ▸ Back

Event	Date	Start	End	Length (month)	Add. Pace (/month)	Add. amount (bn Eur)	Cumulated (bn Eur)
Announcement	22/01/2015	Mar-15	Sep-16	19	60	1140	1140
Extension	03/12/2015	Sep-16	Mar-17	6	60	360	1500
Extension	10/03/2016	Apr-16	Mar-17	12	20	240	1740
Extension	08/12/2016	Apr-17	Dec-17	9	60	540	2280
Extension	26/10/2017	Dec-17	Sep-18	9	30	270	2550
Extension	14/06/2018	Sep-18	Dec-18	3	15	45	2595
Re-start	12/09/2019	Nov-19	open-ended	-	20	700*	3315

Source : ECB, Bloomberg. *The September 2019 restart is announced in an "open-ended" way, i.e., the ECB commits only to a monthly size, but gives an indication : net purchases will stop "shortly before" the next interest rate hike. We infer the total size from this indication using surveys and OIS curve.

▸ details here

Appendix

Inferring the implicit APP size in Sept 2019 ECB announcement

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- In Sept 2019, open-ended restart of the APP : *"Net purchases will be restarted (...) at a monthly pace of Eur 20 billion as from 1 November. The GovC expects them (...) to end shortly before it starts raising the key ECB interest rates."*.
- Two important indications : APP extension is linked to the horizon of the first hike, and the net asset purchases will stop "shortly before" this happens.
- In the Sept. polls, the first DFR hike was expected around mid-2022 "shortly before" was interpreted as around 3 months. In the Bloomberg poll conducted on 16-Oct-2019, at the question *"The ECB says asset purchases will end "shortly" before the first rate increase. How do you define "shortly" ?"*, the median answer was 3 months, while the first rate hike was expected around end-2022.
- This means 2 months in 2019 + 3*12 months (in 2020, 2021 and 2022) - 3 months ("shortly before") : around Eur 700 billion
- We also cross check with another method : from the rate hike priced by the OIS curve, confirming our result.

Appendix

Forward OIS curve pre-September 2019 Governing Council meeting

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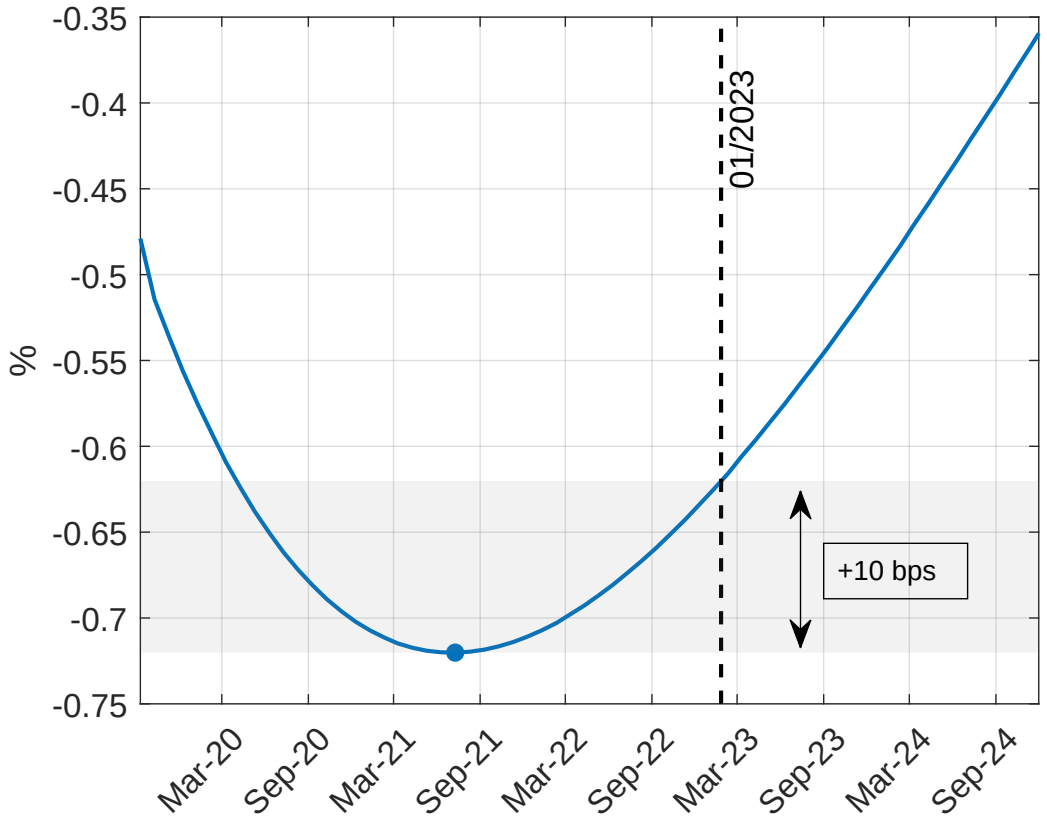

Note : Liftoff date is defined as +10bps above the minimum reached by the OIS curve. contracts from Bloomberg, as of 10-Sep-2019. We build the curve using standard Nelson Siegel procedure.

Appendix

Market expectations on APP announcement/re-calibration

Dates	Source and comments
22-Jan-2015	We use of a Bloomberg poll conducted on 19-Jan-2015. At the question *"Do you expect the ECB to announce QE at its Jan. 22 meeting ?"*, 93% of respondents answered "Yes", 7% 'No" (over 60 respondents). The median estimate for the total size of purchases was 550 billion Eur.
03-Dec-2015	We use a Bloomberg poll conducted on 30-Nov-2015. 100% of respondents (over 53) expected an announcement at the Dec-2015 GovC of an extension of APP. Information is sparse on the expected additional amount. At the question *"what will the ECB do ?"*, 79% answered *"extend QE program past Sept. 2016"* and 66% *"Increase purchases above EU60b/month"*. Separate pools (notably one cited by Reuters on 04-Dec-2015, 'ECB day : market tumbles as Draghi disappoint investors') indicate expectations of a 6 to 12 months extension at a 70-75 billion Eur/month pace. We take the average and set the additional amount of purchases at 652.5 billion Eur (9 months at 72.5 billion Eur)

Appendix

Market expectations on APP announcement/re-calibration

Dates	Source and comments
26-Oct-2017	We use a Bloomberg poll conducted on 18-Oct-2017. 98% of the 57 respondents expected a decision at the 26-Oct meeting regarding APP. The median estimate of additional purchases was 300 billion Eur.
14-Jun-2018	We use a Bloomberg poll conducted on 7-Jun-2018. At the question *"When Will ECB Announce QE End Date ?"*, 30% of respondents (over 56) answered "June 2018". The median estimates of additional purchases to be announced after Sep-2018 was 45 billion Eur.
12-Sep-2019	We use a Bloomberg poll conducted on 6-Sep-2019. 59% of respondents expected a decision regarding the restart of APP at the Sep. 12 meeting. The median estimate of additional purchases was 12 months at a pace of 32.5 billion Eur, or a cumulative additional amount of 390 billion Eur.

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Selected newspapers' accounts on APP

Dates	Source and comments
22-Jan-2015	FT : "Mario Draghi's bond-buying plan **outstrips expectations**"
03-Dec-2015	FT : "the measures seem to **have disappointed market participants** who were expecting even bolder steps".
10-Mar-2016	FT : "The European Central Bank has **unleashed a bigger than expected package of measures** to stimulate the eurozone economy, [...] The ECB raised the amount of bonds the eurozone's central bankers buy each month under QE from Eur 60bn to Eur 80bn — a greater sum than many analysts had expected."
12-Sep-2019	NYT : "The European Central Bank took **unexpectedly aggressive steps** on Thursday [...] The measures [...] go beyond what many analysts were expecting."

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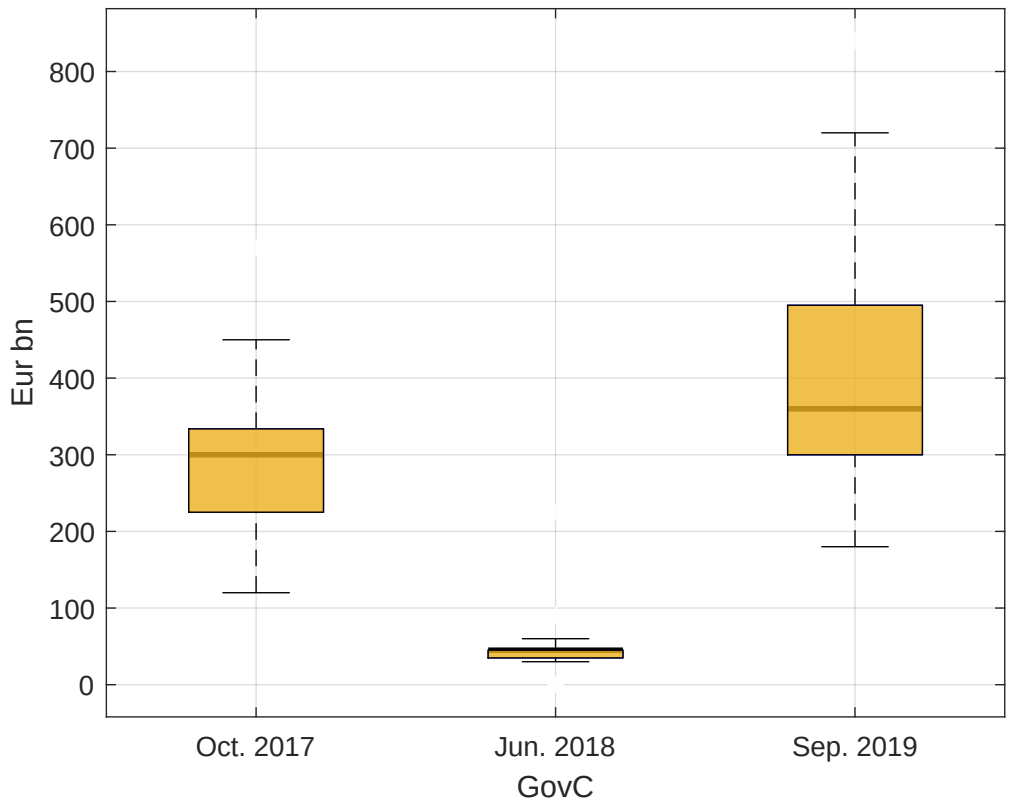
Distribution of market expectations on APP recalibrations



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Appendix

Effects of an asset purchase shock in the VAR literature

	Country	Prices (%)	Output (%)
Baseline estimates	E.A	0.06	0.12
Garcia Pascual and Wieladek (2016)	E.A	0.075	0.11
Weale and Wieladek (2016)	U.K	0.32	0.25
Weale and Wieladek (2016)	U.S	0.62	0.58
Hesse, Hofmann, and Weber (2018)	U.K	0.20	0.20
Hesse, Hofmann, and Weber (2018)	U.S	0.20	0.20
Kim, Laubach, and Wei (2020)	U.S	0.16	0.68

Note : This table summarizes the median peak effects on prices and output in the literature. The size of the shock is scaled to induce an immediate increase in asset purchases of 1% of GDP.

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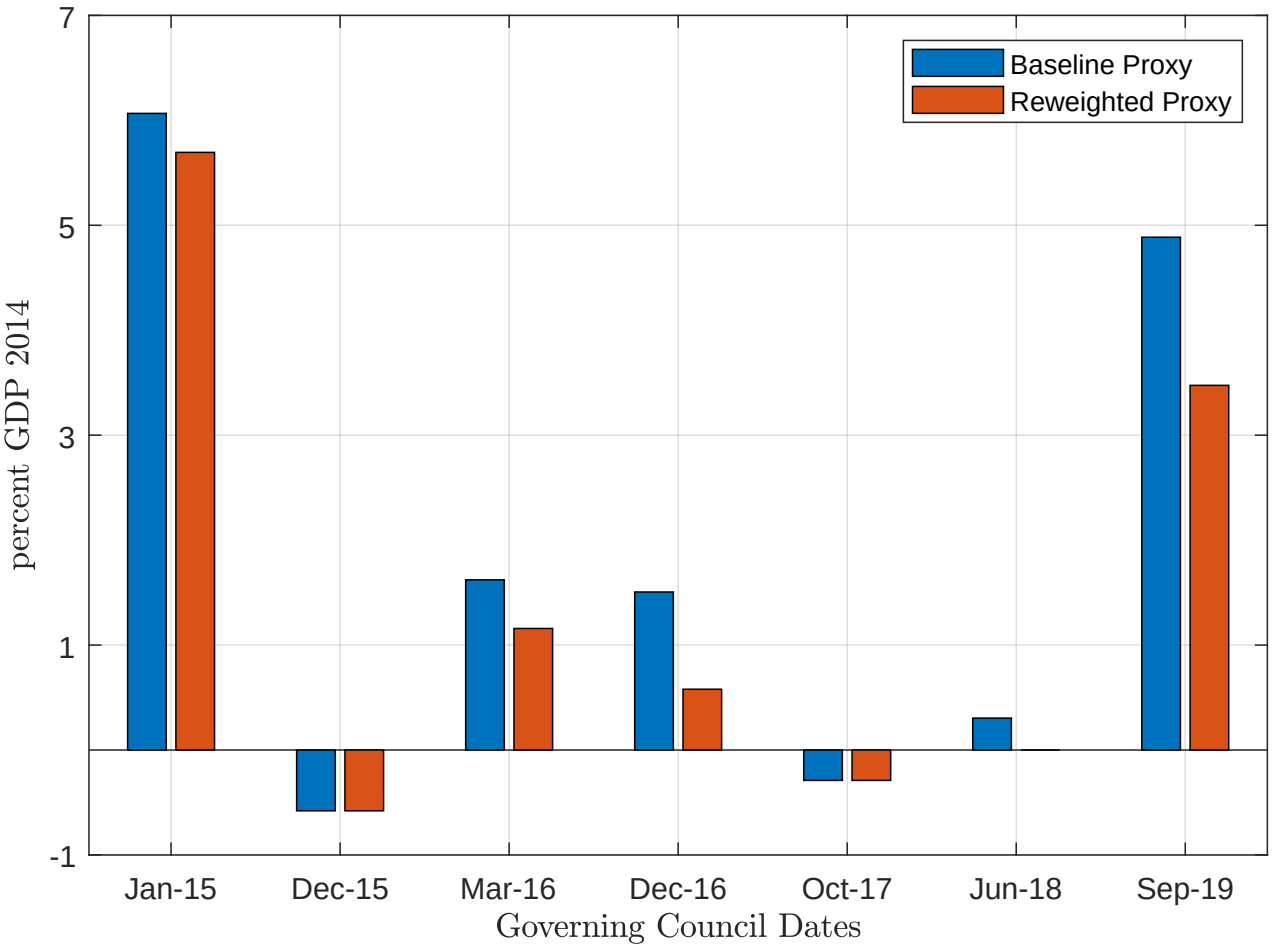
Baseline Proxy versus Reweighted Proxy around Governing Council Announcements



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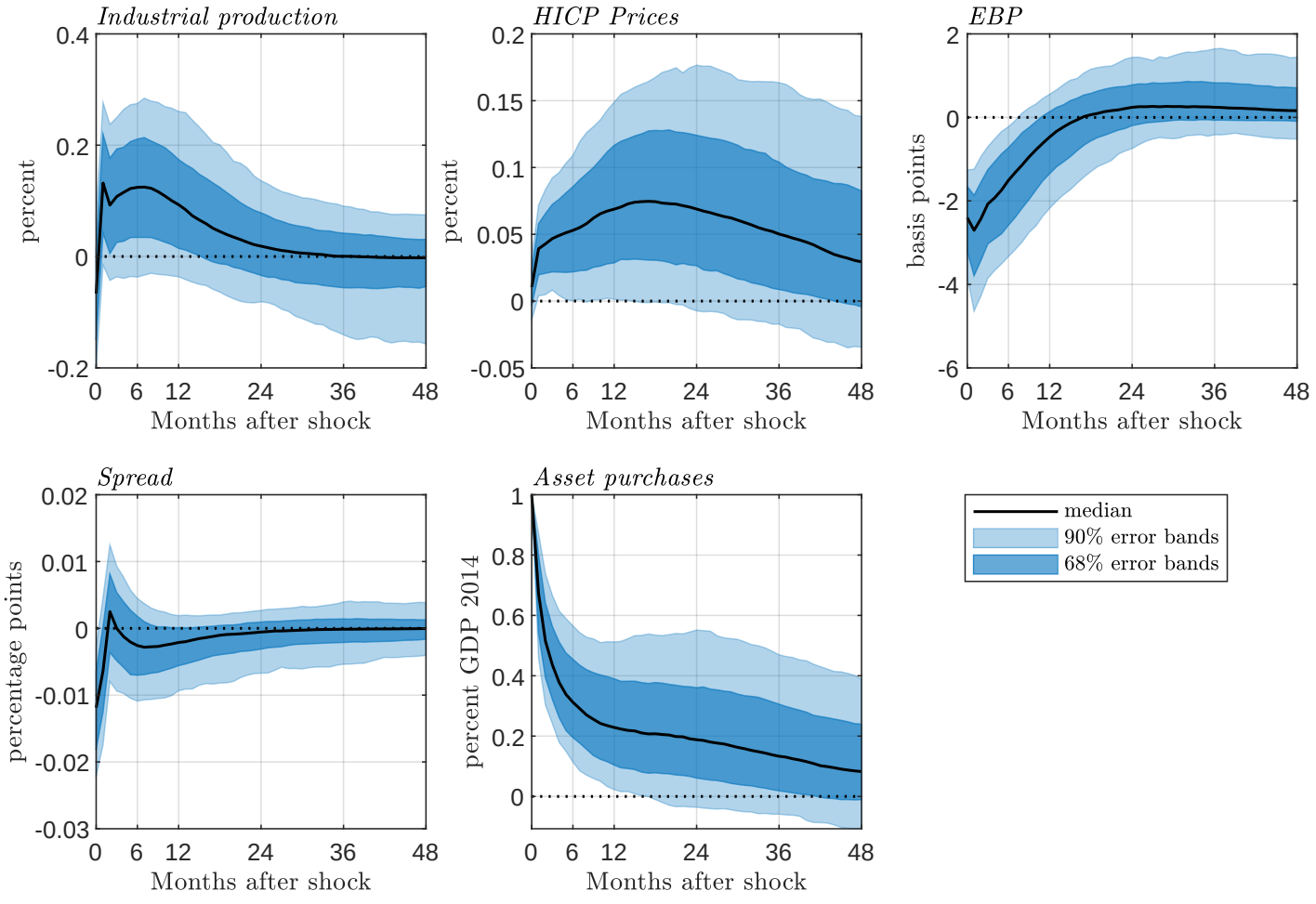
Impulse Responses to an APP shock using Reweighted Proxy



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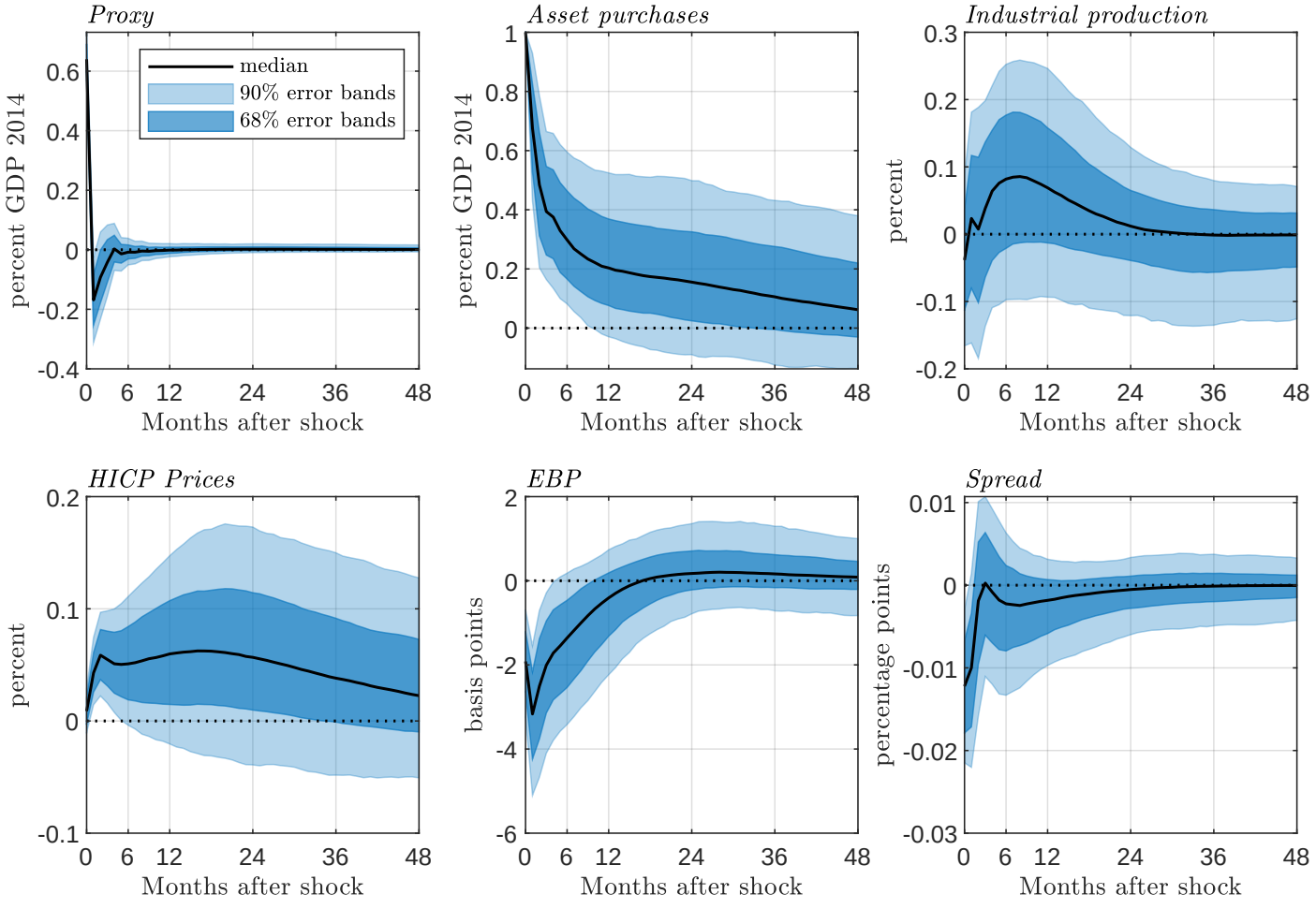
Impulse responses to an APP shock using an "Internal Instrument" Approach



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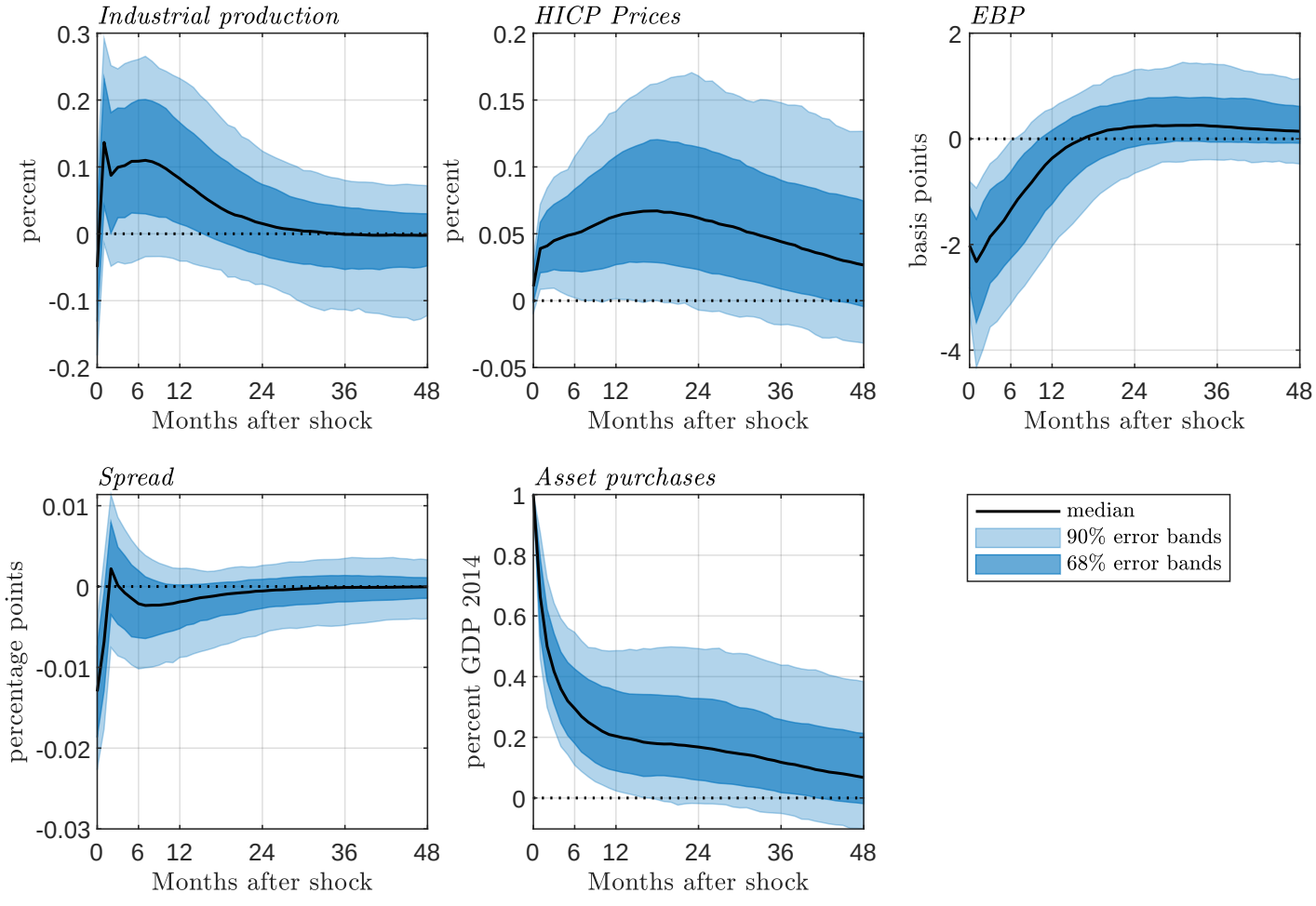
Impulse responses to an APP shock using "free float " as an alternative scaling method



Note : The size of the shock is scaled to induce an immediate increase in asset purchases of 1% of GDP.

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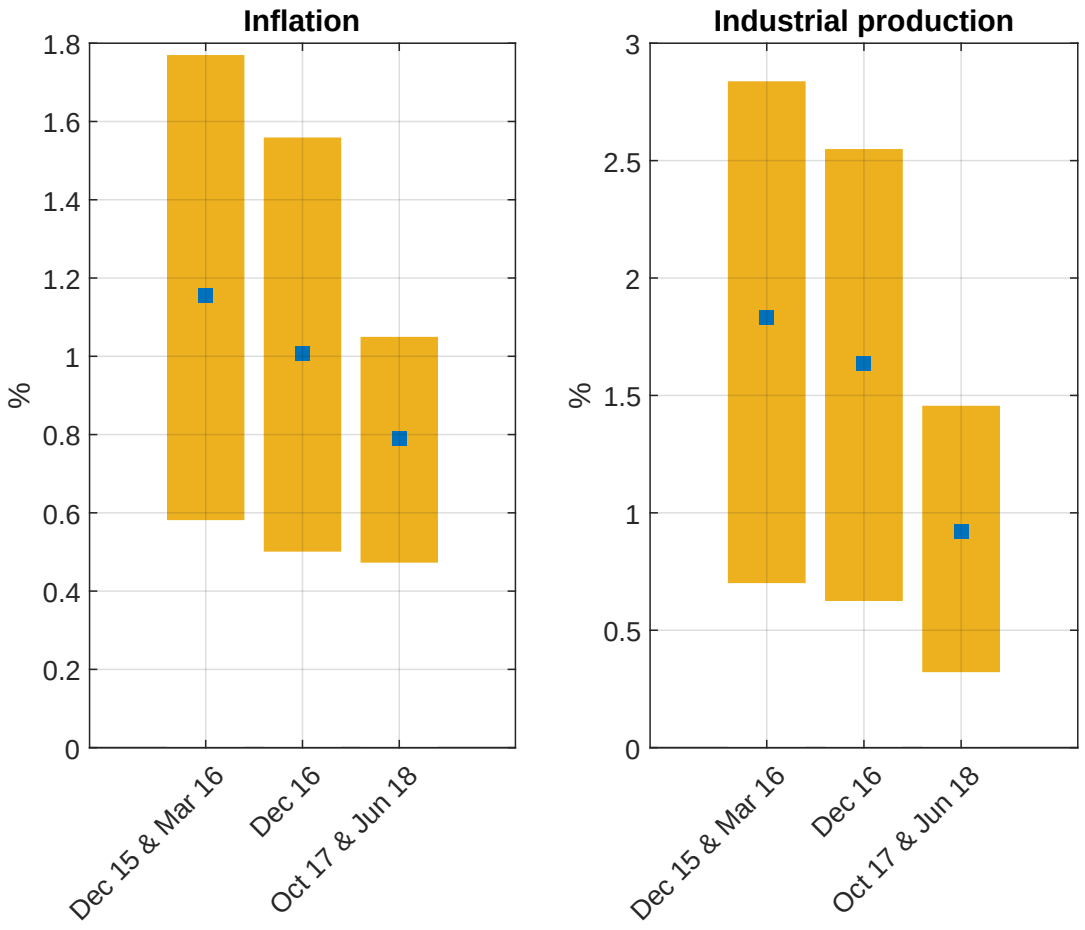
Median peak effects of APP recalibrations



Note : Blue squares denote the median and yellow bars the 68% uncertainty bands. Sep. 2019 recalibration not shown as its full impact may not be reflected in our sample ending in Dec 2019.

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Conditional versus Unconditional Forecasts

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