

Announcement and Implementation Effects of Central Bank Asset Purchases

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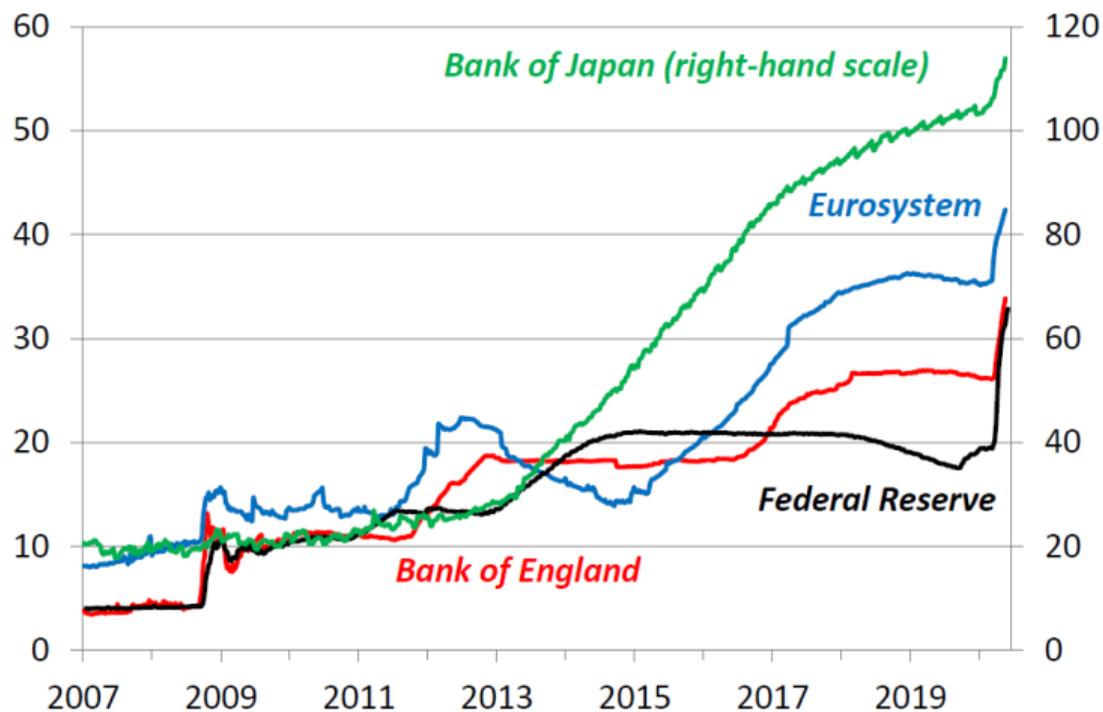
Banca d'Italia

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Asset purchases



- QE has become a key tool to support inflation at the ELB and to fight market dysfunction
- Some central banks (Fed, BoE, ...) now engaging with QT

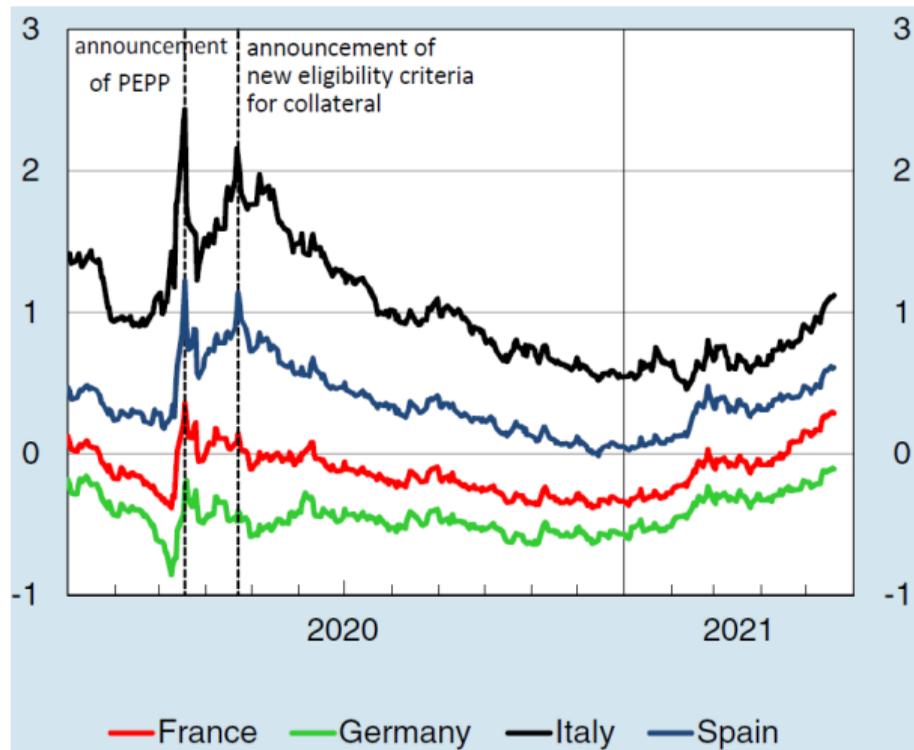
Channels and types of effects

- Asset purchases (APs) affects financial markets through several distinct channels: expectation, duration-risk, credit-risk, liquidity, ...
- Two types of effects can emerge through these channels: stock and flow effects
- In this presentation I am going to talk mostly about the *types of effects* (less about the *channels*)

Stock (announcement) effects

- Stock effects are set in motion by changes in the stock of assets held by the central bank in its balance sheet
- Because financial markets are forward looking, stock effects typically arise upon purchase announcements
- Large evidence of **announcement effects**, mainly based on event studies (Krishnamurthy and Vissing-Jorgensen, 2011; Szczerbowicz, 2015; Falagiarda and Reitz, 2015; Motto et al., 2015; Eser and Schwaab, 2016; Krishnamurthy et al., 2018; Bulligan and Delle Monache, 2018; De Santis, 2020; Lhuissier and Nguyen, 2021)

Example of announcement effects

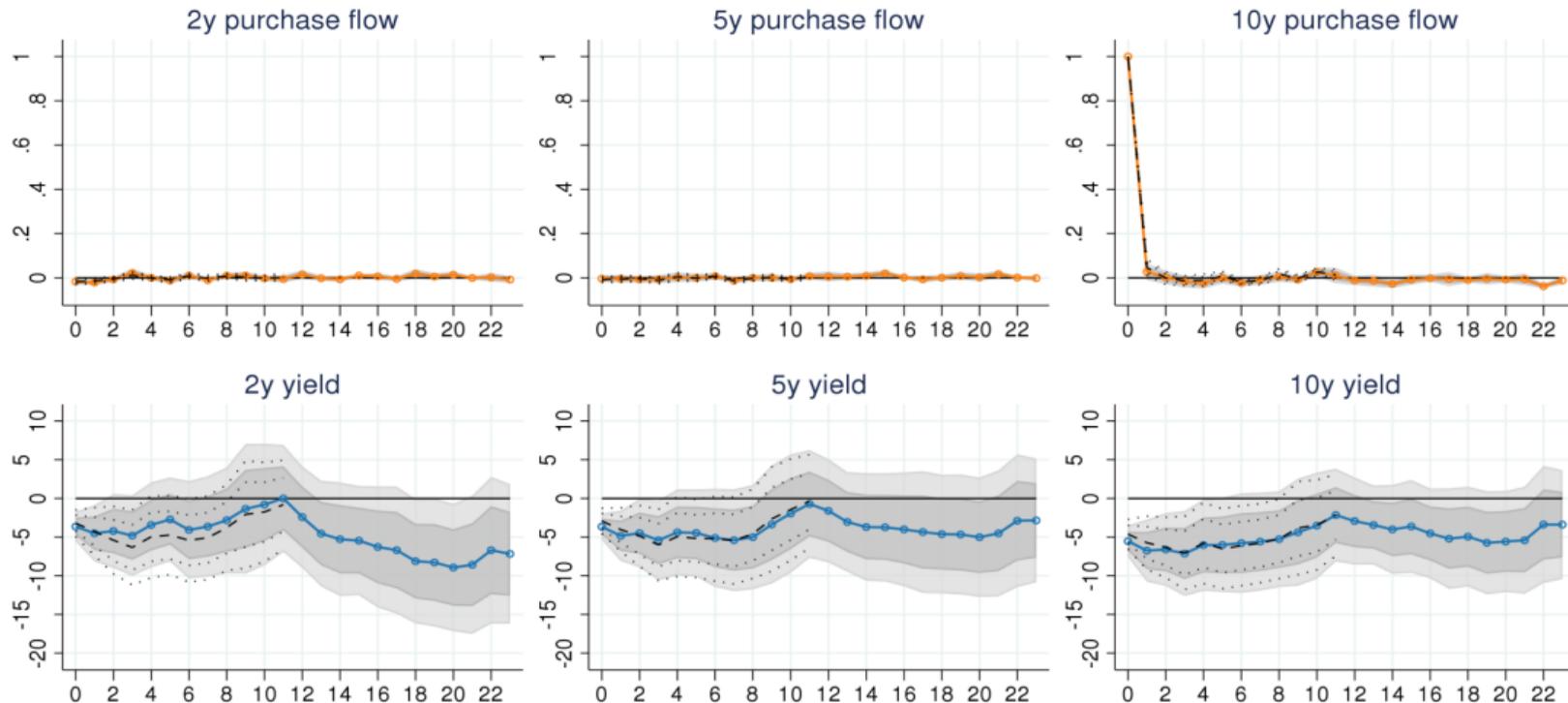


- Rapid and marked effect on financial markets upon announcements
- Long-term government bond yields and sovereign spreads decline significantly

Flow (implementation) effects

- Flow effects emerge with the actual implementation of APs in the market
- Several theoretical underpinnings can explain the existence of **implementation effects**
- From an empirical viewpoint, their existence is a strong empirical fact supported by an overwhelming body of evidence gathered across many countries and historical episodes (D'Amico and King, 2013; Casiraghi et al., 2016; Ghysels et al., 2017; De Pooter et al., 2018; Arrata and Nguyen, 2017; Schlepper and Hofer, 2017; De Santis and Holm-Hadulla, 2020; Bernardini and De Nicola, 2020)

Example of implementation effects



- A purchase of government bonds compresses the yield curve immediately and persistently
- These effects are driven by a compression of credit spreads ([Bernardini and De Nicola, 2020](#))

Gap in the literature

- Existing studies typically answer the following questions:
 - what is the *marginal* effect of an announcement?
 - what is the *marginal* effect of an actual purchase?
- Different questions are:
 - what is the *sum* of all these effects over time?
 - what is the *contribution* of announcements and implementation choices to such overall effect?

Recent commentaries

Policies cannot be evaluated simply based on announcement effects on yields.

– A. Vissing-Jorgensen (2020), *Bond markets in Spring 2020 and the response of the Federal Reserve*

The signal that asset purchases may send about the future path of policy rates is largely irrelevant when markets are not functioning well. **What matters in these circumstances are two criteria: a strong market presence and flexibility.**

– I. Schnabel (2021), *Asset purchases: from crisis to recovery*

Three main challenges

1. Dual-dimension of APs

- Announcement and implementation effects can interact with each other
- Need to consider both dimensions jointly

2. Persistence of the effects

- Upon a purchase, it is very likely that the market is still affected by previous purchases
- Need to consider current as well as past actions

3. Systematic component of APs

- Researchers typically focus on policy shocks, but monetary policy works mostly by responding endogenously to non-policy shocks
- Need to consider both the discretionary and systematic components of QE

This paper

- **The what:** we develop a **unified empirical dynamic framework** to compare and combine announcement and implementation effects of APs
- **The why:** understand the role of announcements and implementation choices in shaping the effectiveness of APs
- **The how:** **unique daily data** on ECB's purchases + **high-frequency identification** via external instruments and zero-sign restrictions

This work builds on Bernardini and Conti (2021), *"Assessing the flexible implementation of the ECB's pandemic asset purchases"*

Main findings

1. **Announcement and implementation effects are similar**: key to correctly disentangle them
2. **APs are largely endogenous**: key role played by the systematic reaction of APs
3. **Evidence of large effects of APs** on financial conditions and inflation expectations
4. **Implementation choices matter**: announcement effects are insufficient

Plan of the talk

1. Overview of the empirical framework
2. Transmission and relevance of asset purchase shocks
3. Decomposition of the overall effects into announcement and implementation
4. Wrap-up and possible extensions

Empirical framework

Daily VAR for the euro area

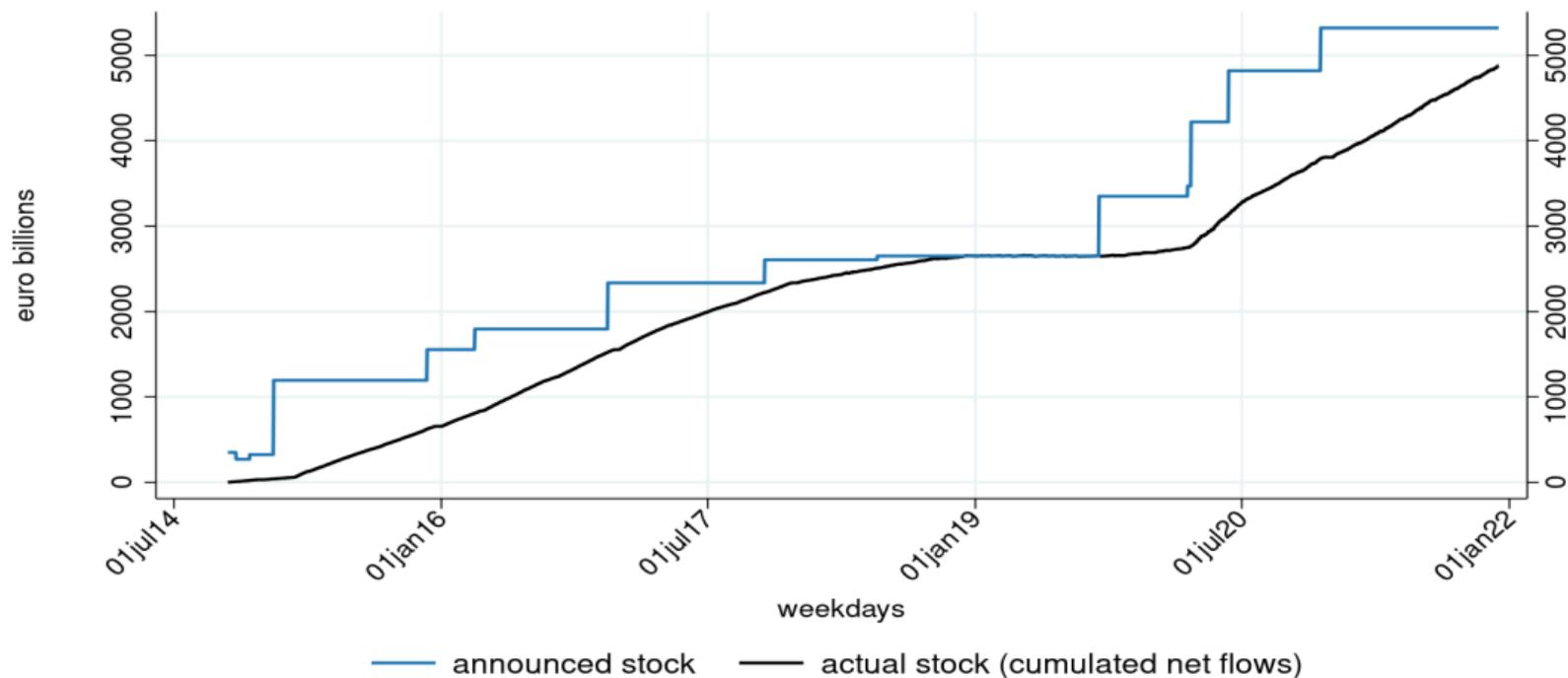
$$y_t = c + A(L)y_{t-1} + u_t \quad (1)$$

- Standard VAR model
- Euro-area data sampled at the daily frequency (weekdays)
- y_t comprises a block of 2 asset purchase variables and a block of 4 financial variables

Asset purchase variables: announced stock

- The first policy variable is the announced stock of purchases
- It is defined as the overall size of assets under the APP and the PEPP that the ECB's Governing Council anticipates to hold and which makes public after its monetary policy meetings (Weale and Wieladek, 2016; Lhuissier and Nguyen, 2021)
- Historically, changes in the announced stock have been provided indirectly (through the pace and time) or directly (through an envelope)
- It can be interpreted as the sum of all past, present *but also* future purchases

Announced vs. actual stock

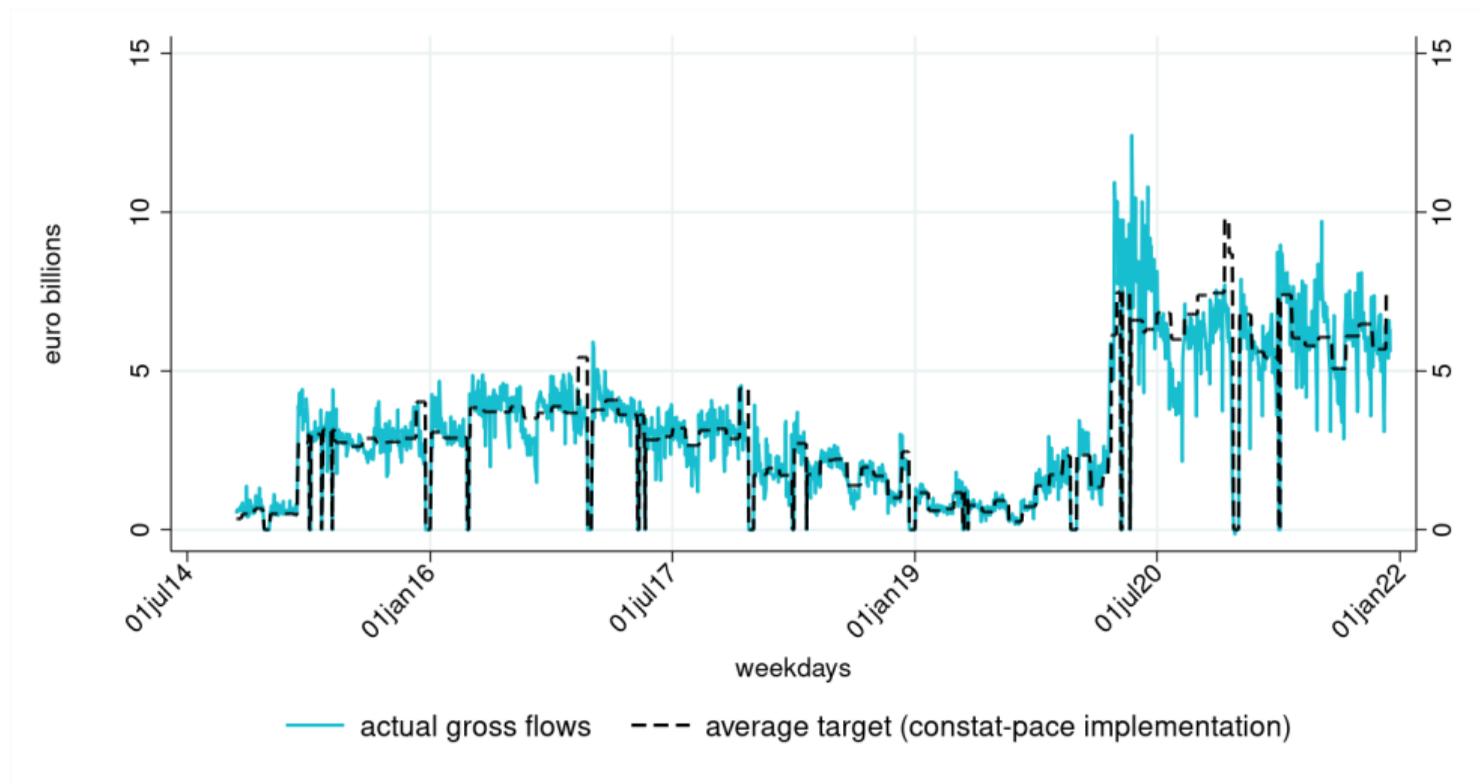


- A positive gap indicates all the purchases that have been announced but not yet implemented
- It closes during periods of zero net purchases, as in 2019

Asset purchase variables: implemented flows

- The second policy variable is related to the implemented gross purchase flows
- Part of the implementation is mechanical and known in advanced:
 - gross purchases are implemented according to an announced (net) target and the expected amount of redemptions coming due
 - gross purchases are implemented on a weekday schedule and are halted during preannounced holiday periods
- This (public) information allows to infer the daily gross purchases needed on average to meet each month the announced target

Implemented flows vs. underlying path

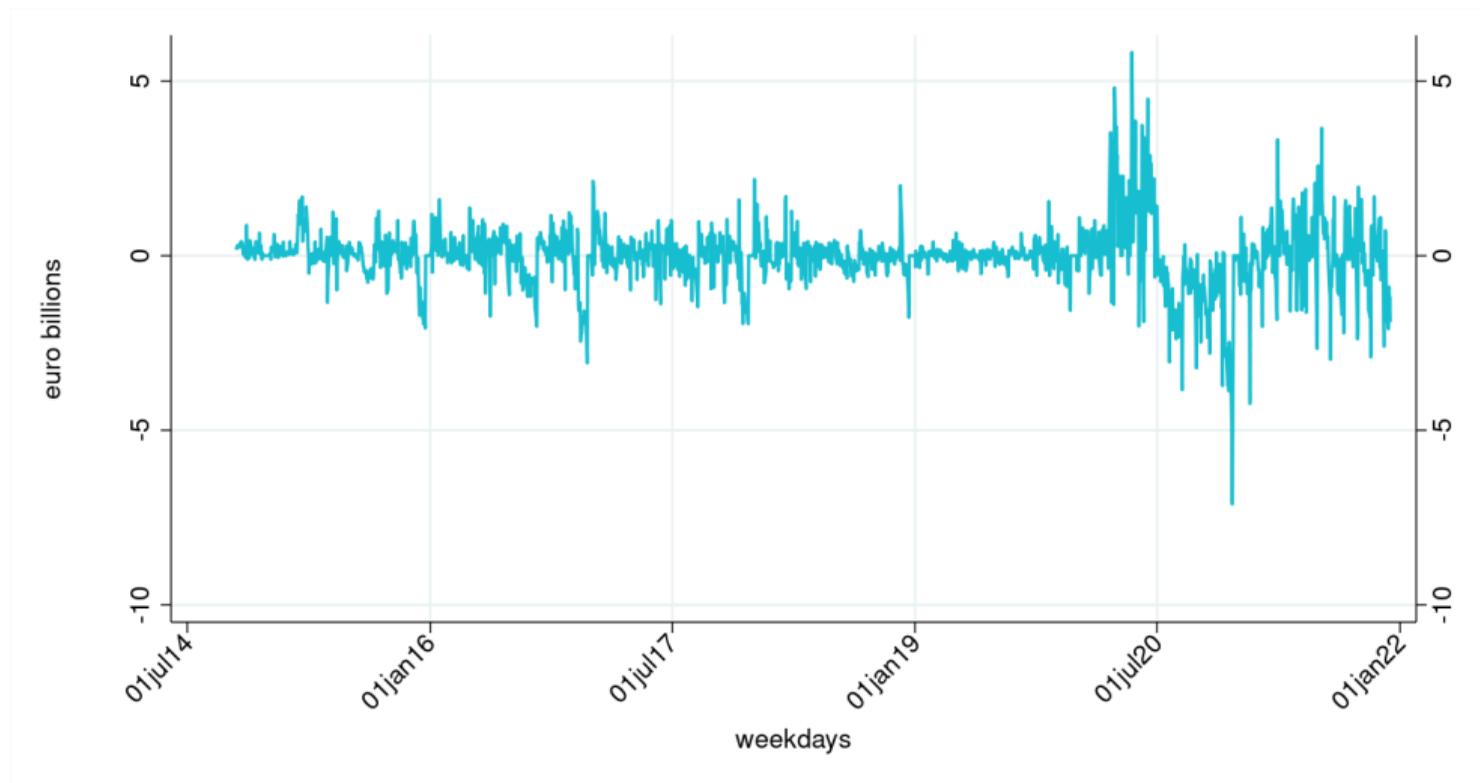


- Daily-frequency version of the graph published on the [ECB's APP website](#) using monthly data

Asset purchase variables: implemented flows

- The Eurosystem has always retained some forms of flexibility in the conduct of APs
- Market desks are allowed to deviate to some extent from a constant-pace implementation
- We include as second policy variable the gap between the actual gross purchase flows and its underlying announced average pace
- Effective way of taking care of *long and variable implementation lags* while focusing more directly on the role of implementation

Implemented-flows gap



- It has mean zero and its volatility has increased since 2020, due to the enhanced PEPP flexibility

Financial variables

- Yield slope

- spread between the 10-year GDP-weighted government bond and the 1-month OIS rate
- captures the overall effect of several channels: signalling, duration-risk, credit-risk, liquidity

- Yield spread

- spread between the 10-year GDP-weighted government bond and the 10-year OIS rate
- captures the specific contribution of the credit-risk and liquidity channels

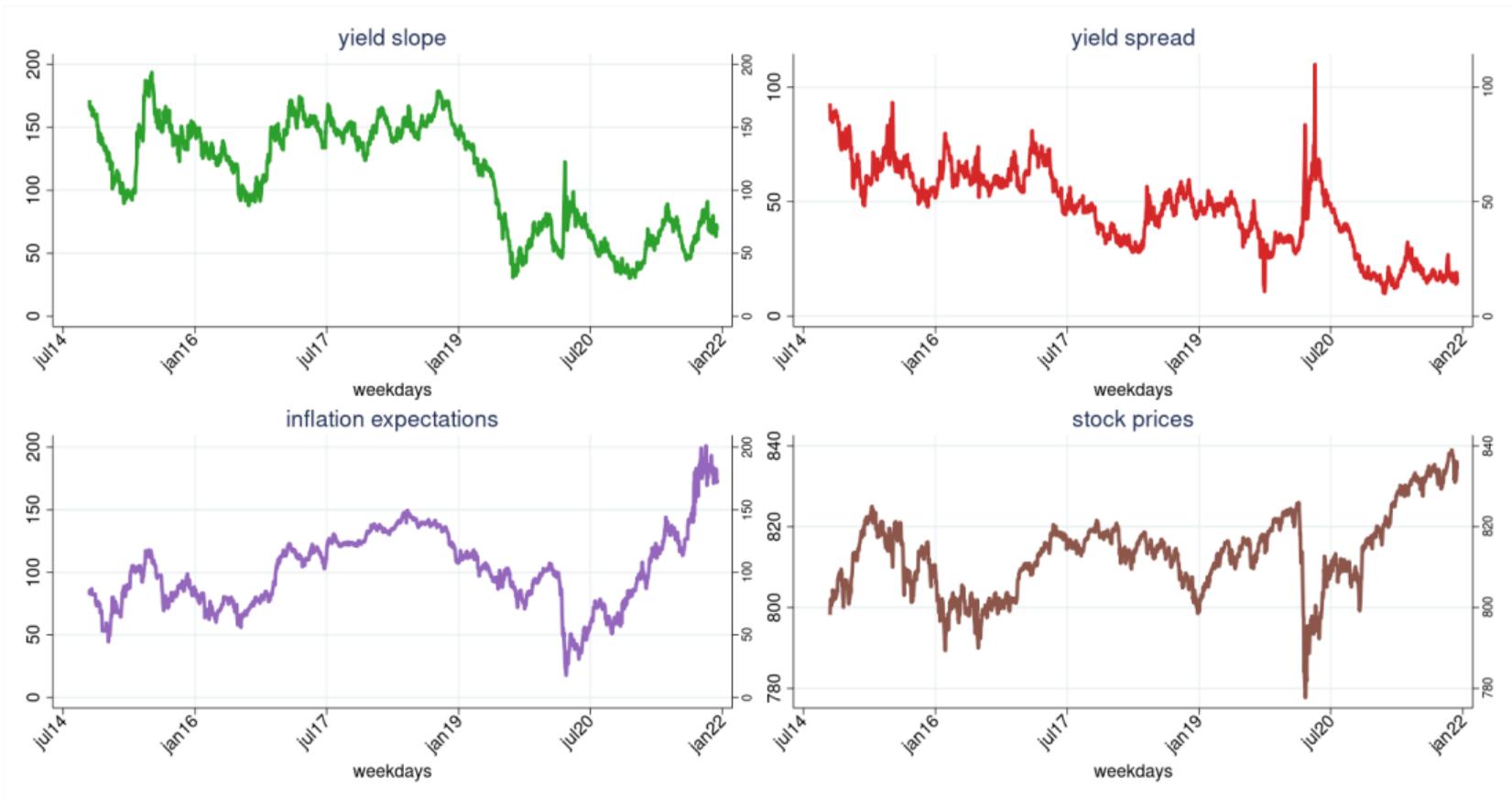
- Medium-term inflation expectations

- 2-year 1-year forward ILS rate
- measures the (risk-neutral) expected average inflation rate over the two-year period that begins one-year later

- Stock prices

- Euro Stoxx 50
- provides a forward-looking proxy of output in high-frequency models

Financial variables



High-frequency identification

- The forecast errors u_t are assumed to be a linear combination of structural shocks ε_t :

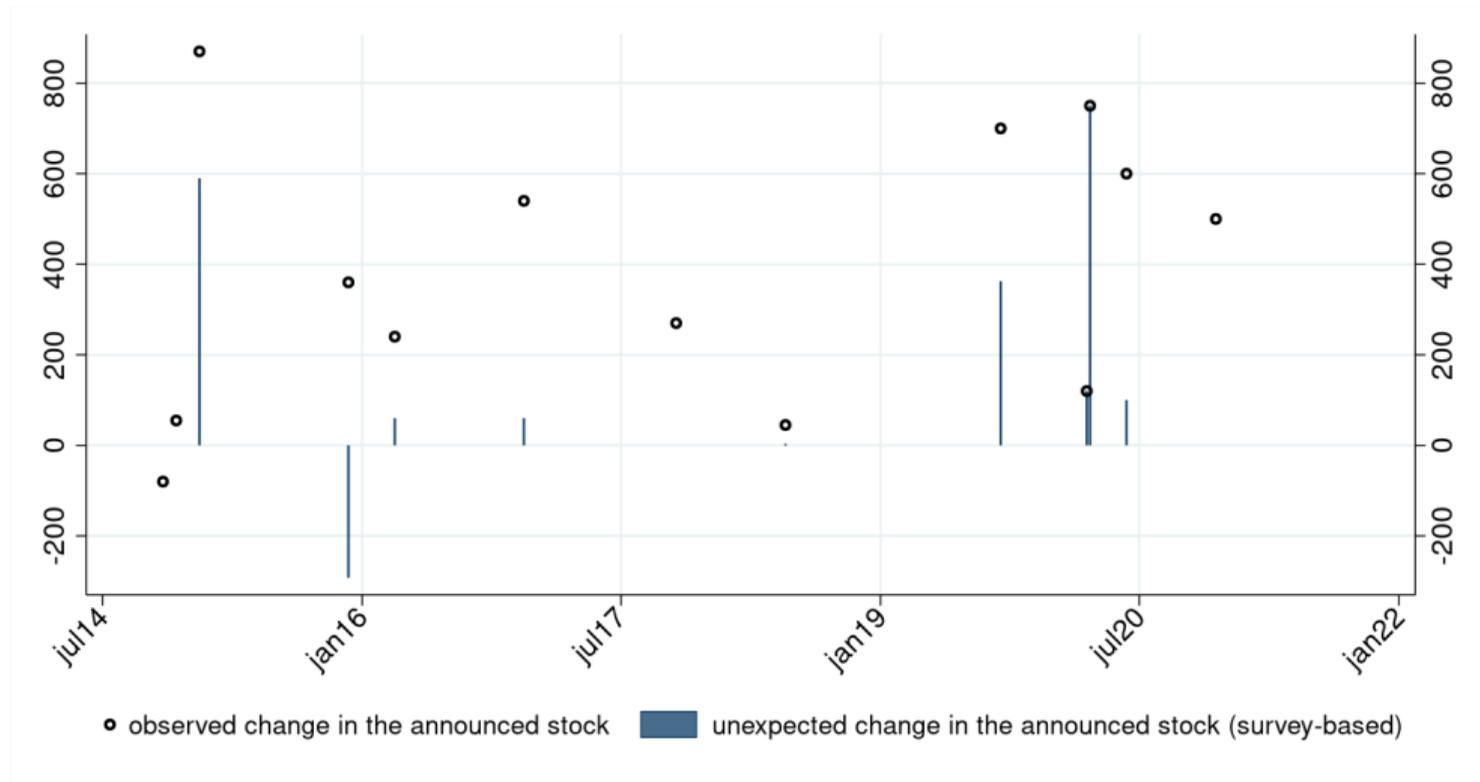
$$u_t = B\varepsilon_t \tag{2}$$

- We isolate two AP shocks: announcement and implementation shocks
- We group all the remaining shocks in two broad categories
- To achieve that we impose a limited set of within-day restrictions on B , based on a mix of external instruments and zero-sign restrictions ([Cesa-Bianchi and Sokol, 2021](#))

Identification of announcement shocks

- Shocks to the announced stock of purchases are identified using an external instrument
- The instrument (or proxy) measures survey-based surprises about the announced stock ([Lhuissier and Nguyen, 2021](#))
- Technically, we assume that the instrument is correlated with announcement shocks but is uncorrelated with all the other shocks ([Mertens and Ravn, 2013](#); [Stock and Watson, 2018](#))

External instrument



- In many cases announcements were anticipated or even overestimated by market analysts

Identification of implementation shocks

- Shocks to the implemented purchase flows are identified with sign restrictions
- We assume that these shocks generate on impact a positive co-movement between actual purchase flows and asset prices
- This assumption is supported by a growing body of evidence on flow effects

Identification of non-AP shocks

- The other shocks are split in two broad categories using zero-sign restrictions
- Class #1: shocks that trigger a stabilizing within-day response by the central bank in terms of gross purchase flows (Ghysels et al., 2017; De Santis, 2020; Bernardini and De Nicola, 2020)
- Class #2: all the other shocks do not induce a within-day response by the central bank in terms of gross purchase flows, as their effects are assessed approximately every 6-7 weeks by the ECB Governing Council

Identifying restrictions in brief

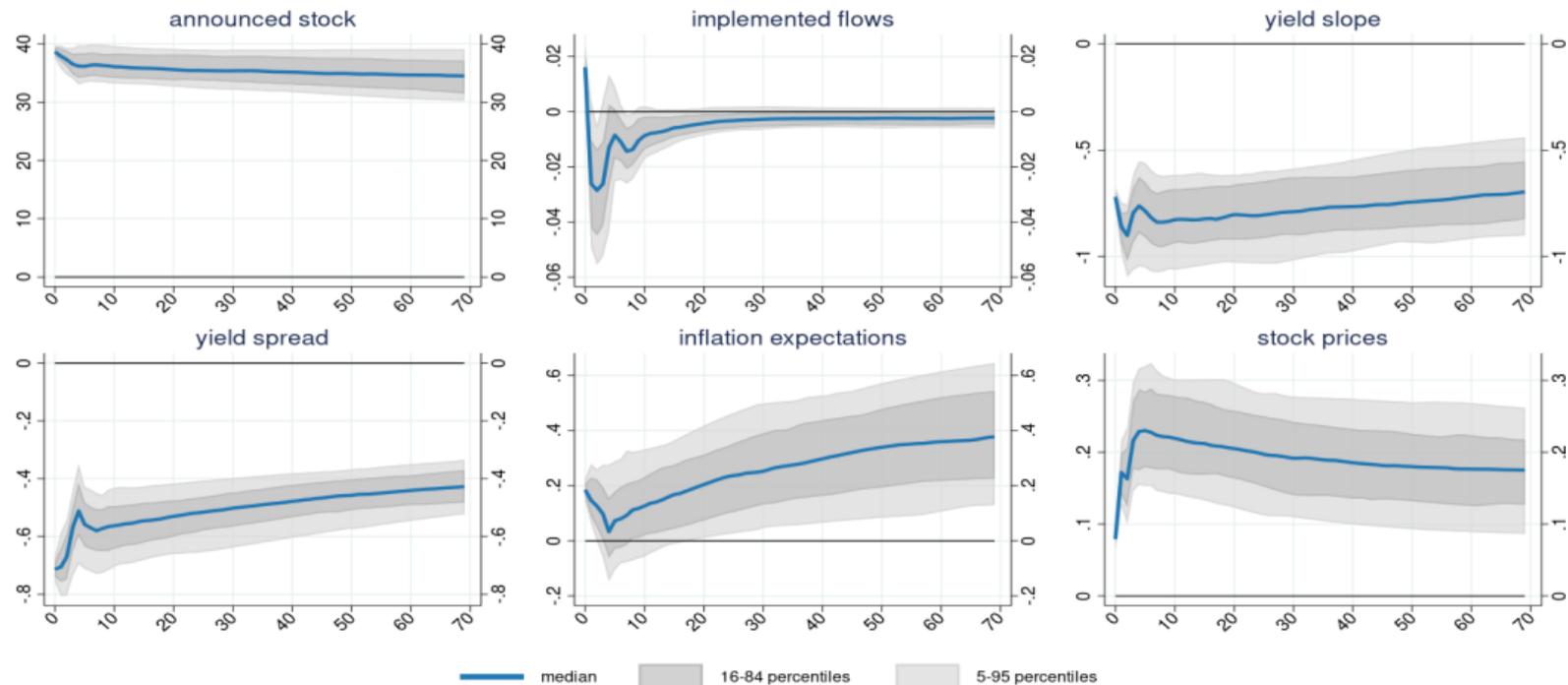
	AP shocks		non-AP shocks		
	announcement	implementation	within-day response	lagged response	
announced stock	proxy				
implemented flows	proxy	> 0	> 0	$= 0$	$= 0$ $= 0$
yield slope	proxy	< 0	> 0		
yield spread	proxy	< 0	> 0		
inflation expectations	proxy				
stock prices	proxy	> 0	< 0		

Bayesian estimation

- The sample covers the **whole history of ECB's APs** over the period 20 October 2014 – 10 December 2021
- **One week of lags** ($L = 5$)
- Standard **Minnesota prior** to deal with the large number of parameters
- **Gibbs sampler** used to obtain inference [▶ details](#)

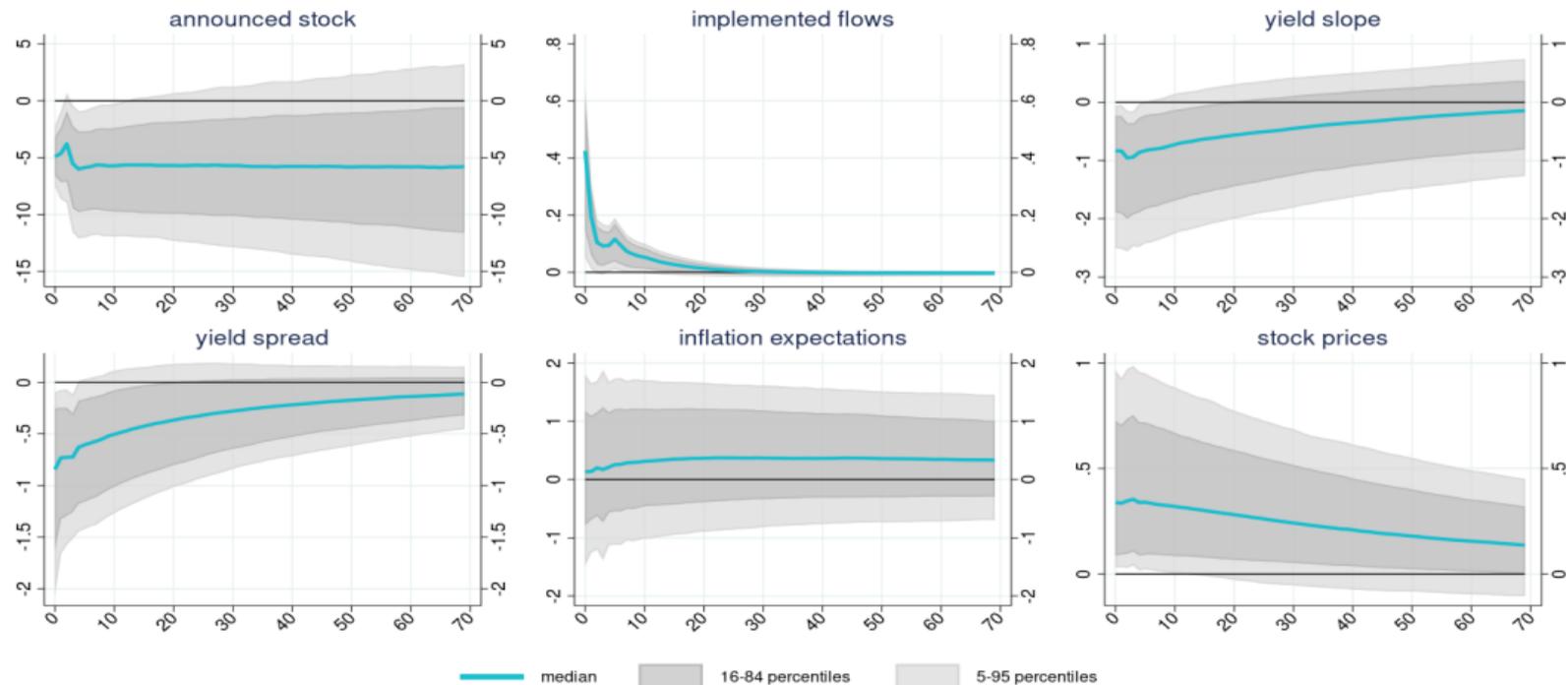
Transmission and relevance of asset purchase shocks

Transmission of announcement shocks ▶ non-AP shocks



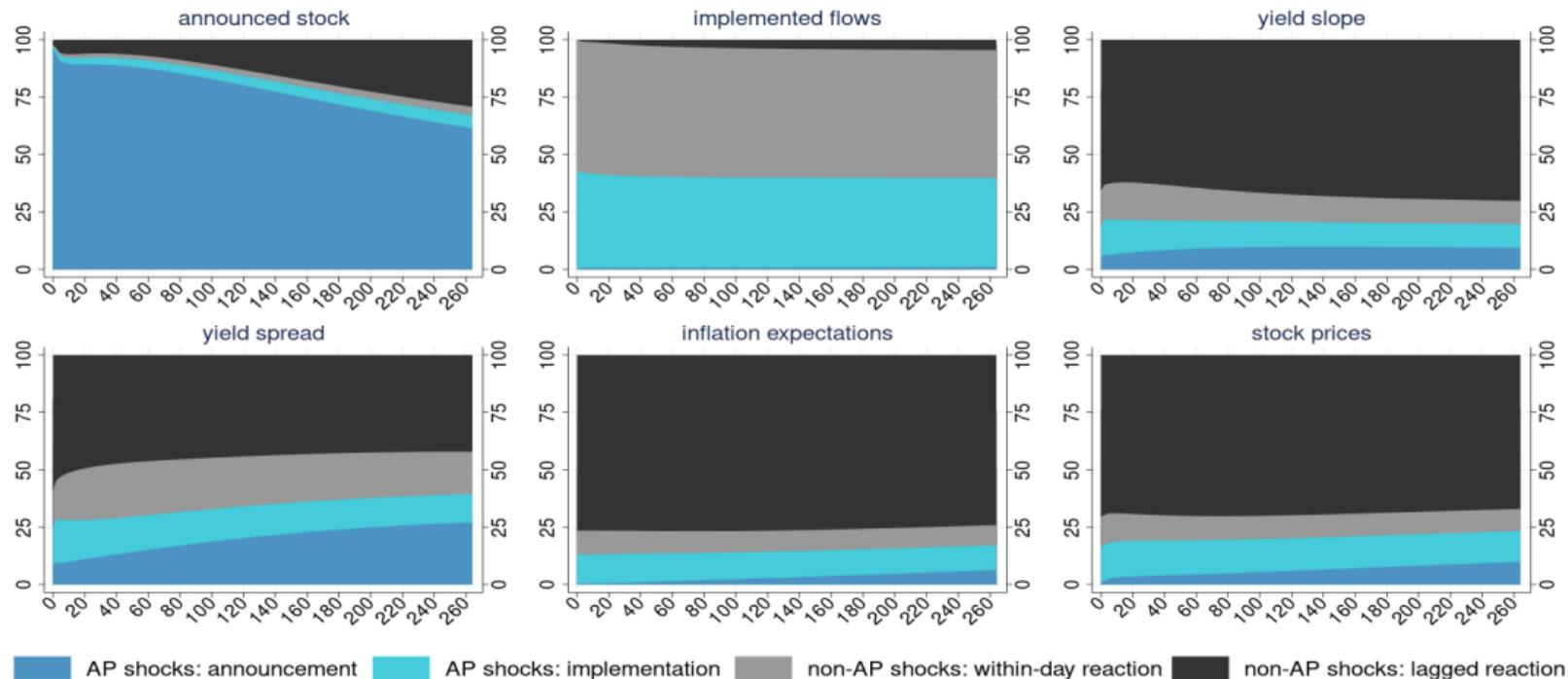
- Announcement (stock) shocks exert highly persistent effects
- They ease financial conditions and raise inflation expectations

Transmission of implementation shocks ▶ non-AP shocks



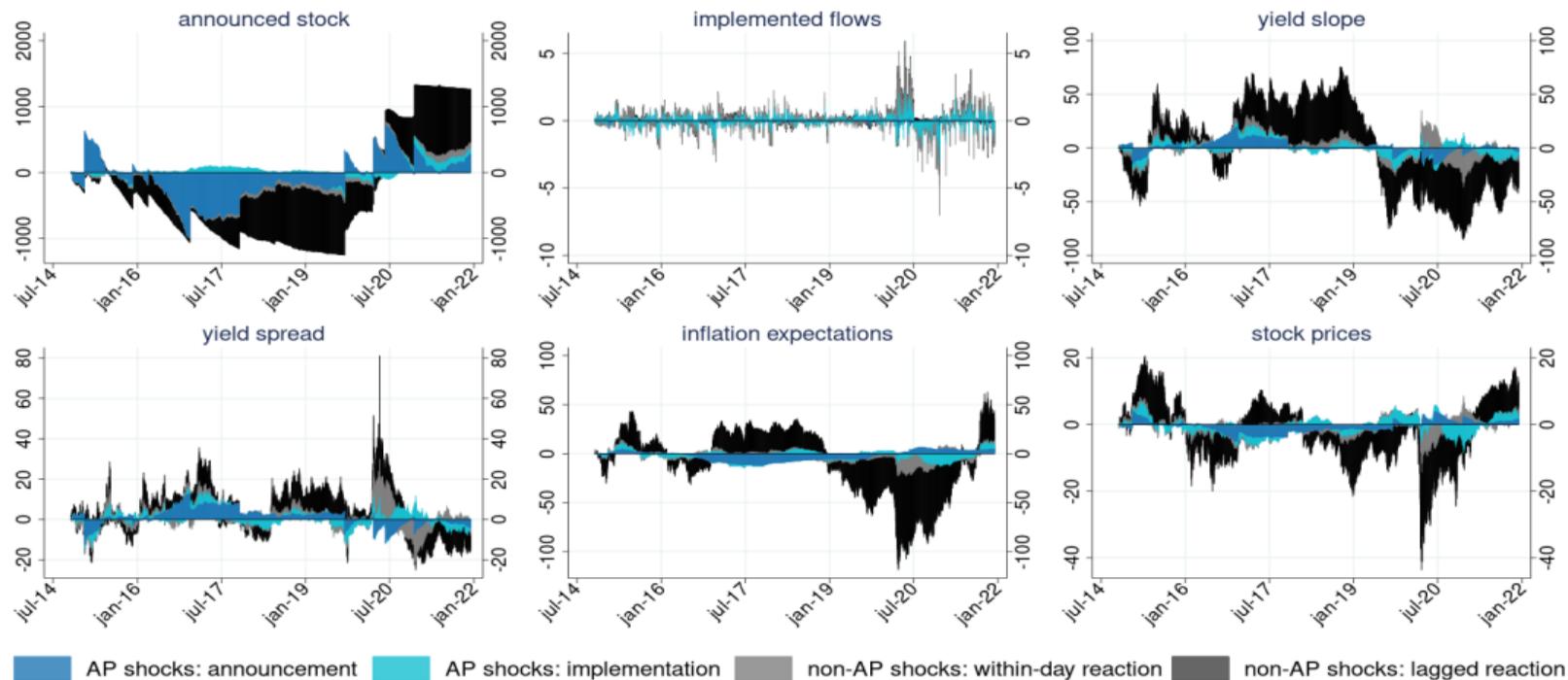
- Implementation (flow) shocks exert qualitatively-similar effects
- They are however less persistent

Relevance of shocks on average



- Financial conditions and inflation expectations are predominately driven by non-AP shocks
- Over the long-run, APs tend to be shaped more and more by non-AP shocks

Relevance of shocks over time



- Strong evidence of *endogenous* responsiveness of implemented flows during the Covid-19 crisis
- Further validation of the model

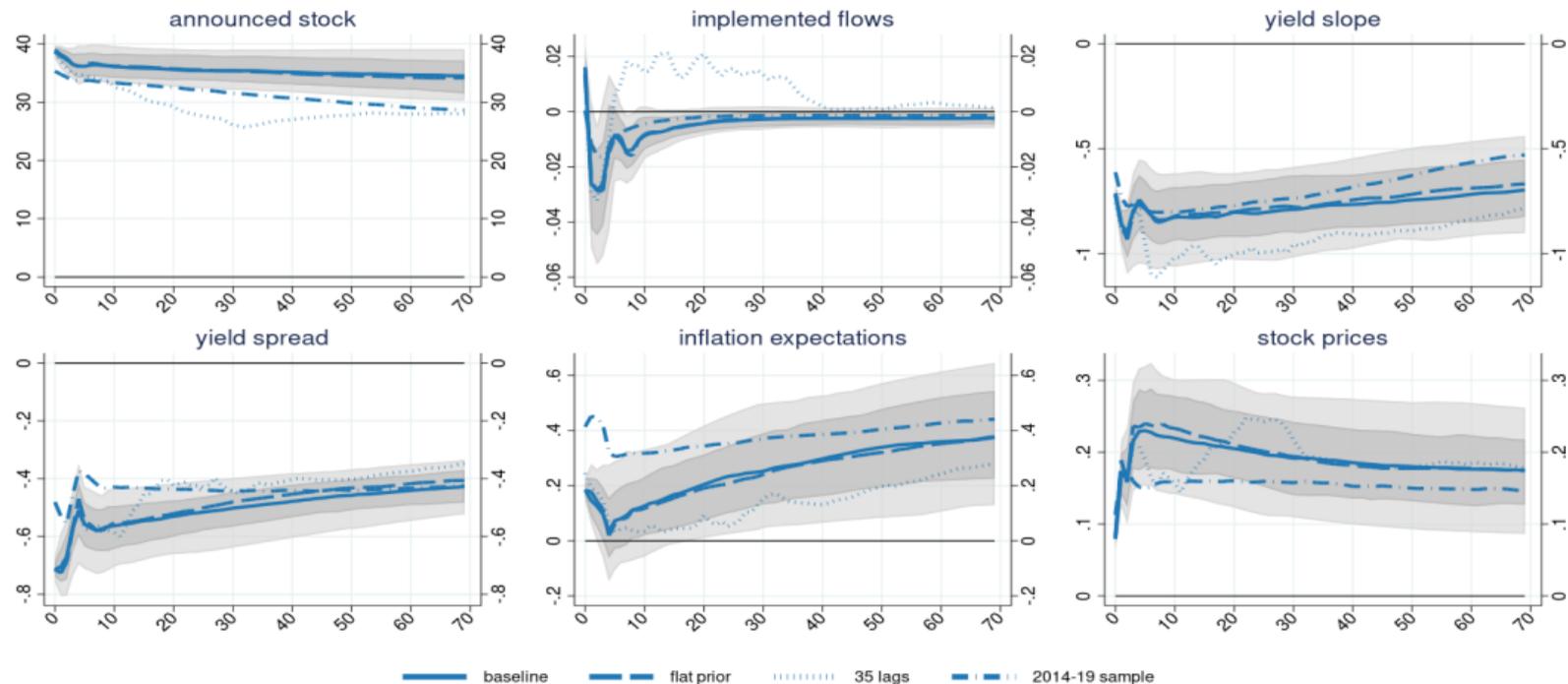
Robustness and extensions

Alternative specifications

- To what extent has the Minnesota prior an influence on the results?
- Shouldn't the lag order cover the time interval between two GovC meetings?
- To what extent are the results driven by the inclusion of the Covid-19 period?

Announcement shocks under alternative specifications

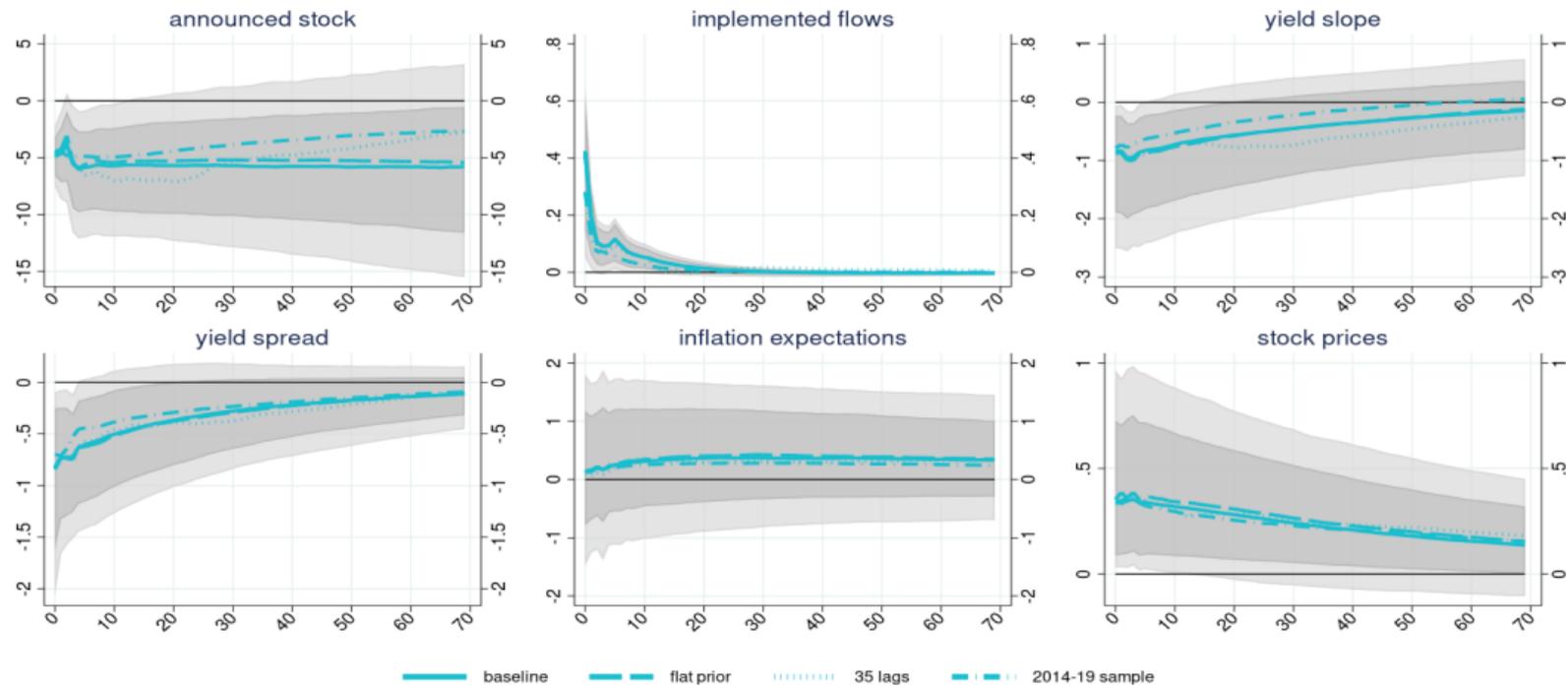
▶ non-AP shocks



- The results are robust to several perturbations of the baseline specification
- Ending the estimation sample in 2019 does not significantly affect our findings

Implementation shocks under alternative specifications

▶ non-AP shocks



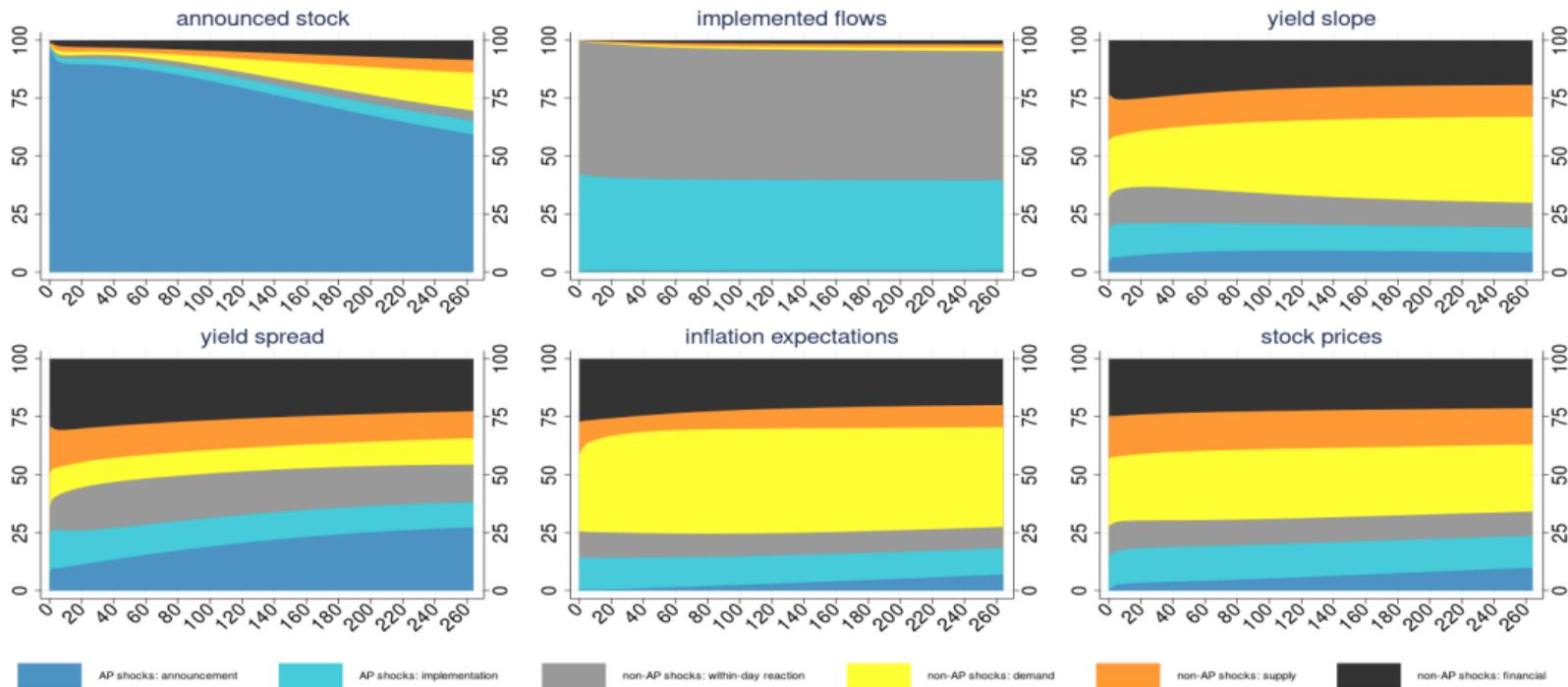
- The results are robust to several perturbations of the baseline specification
- Ending the estimation sample in 2019 does not significantly affect our findings

Further disentangling the non-AP shocks

	AP shocks		non-AP shocks			
	announcement	implementation	within-day response	lagged response		
				demand	supply	financial
announced stock	proxy					
implemented flows	proxy	> 0	> 0	= 0	= 0	= 0
yield slope	proxy	< 0	> 0	> 0	> 0	> 0
yield spread	proxy	< 0	> 0			> 0
inflation expectations	proxy			> 0	< 0	
stock prices	proxy	> 0	< 0	> 0	> 0	< 0

- The non-AP shocks (#2) can be further disentangled into demand, supply, and financial shocks
- By construction, the other shocks remain unaffected

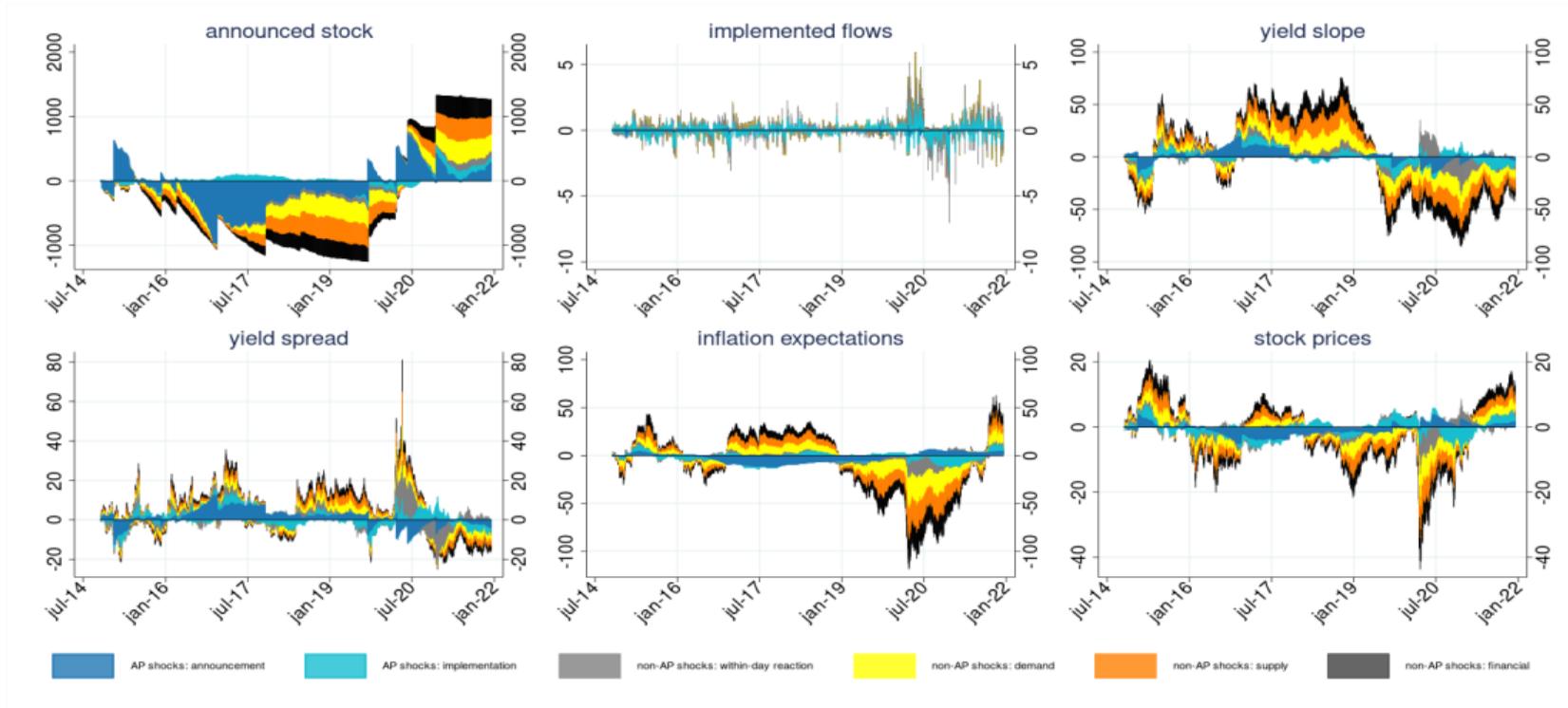
What hides behind the non-AP shocks (on average)?



- bla

- bla

What hides behind the non-AP shocks (over time)?



- bla

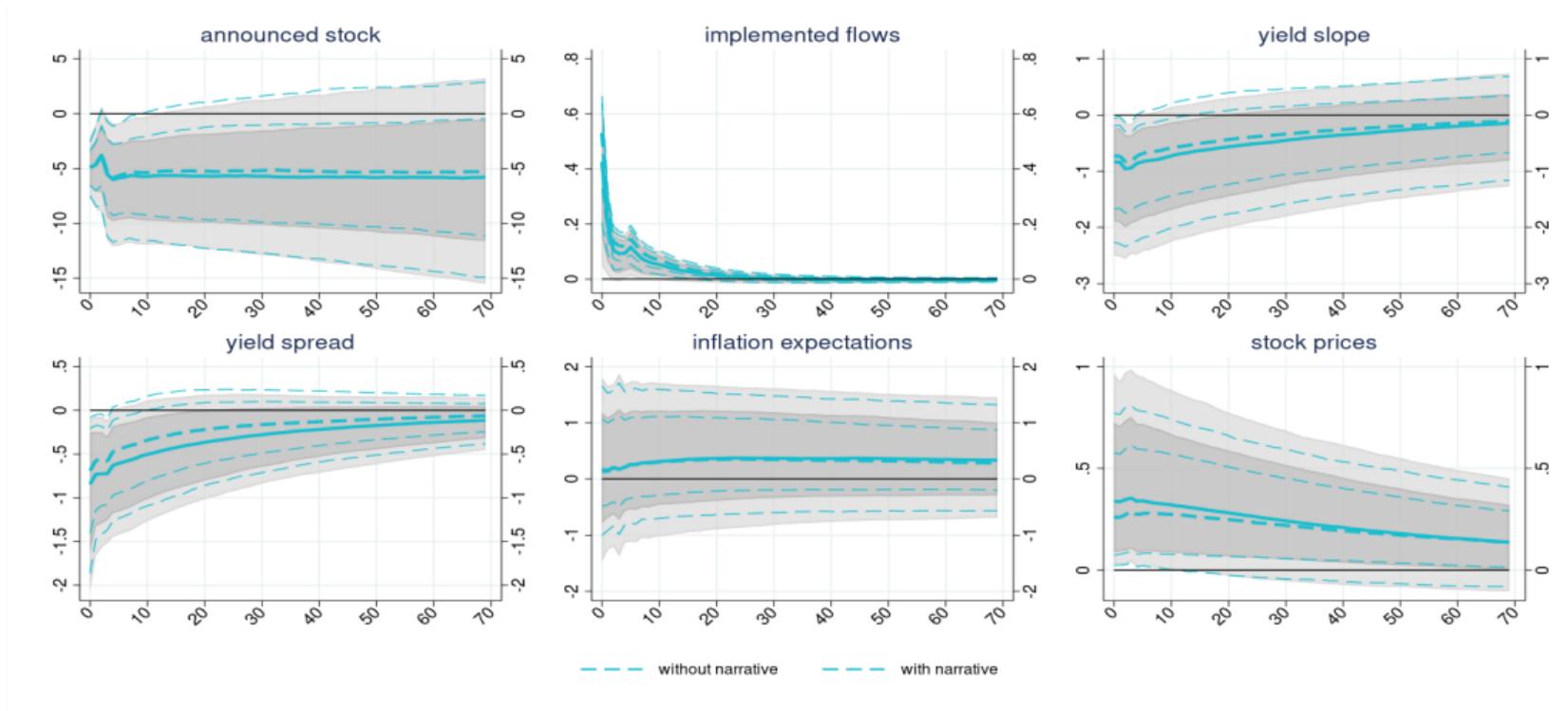
- bla

Narrative restrictions

- Advances on sign-restriction identification ([Antolín-Díaz and Rubio-Ramírez, 2018](#)):
 1. additional restrictions on the *sign* of a shock on a specific time period
 2. additional restrictions on the *relevance* of a shock on a specific time period
- Particularly suited to strengthen our daily-frequency identification of implementation shocks
- We further assume that implementation shocks were particularly relevant on:
 1. the first day of APP implementation (March 9, 2015)
 2. the first day of PEPP implementation (March 26, 2020)
- These are days in which the movement in the implemented-flows gap is particularly large

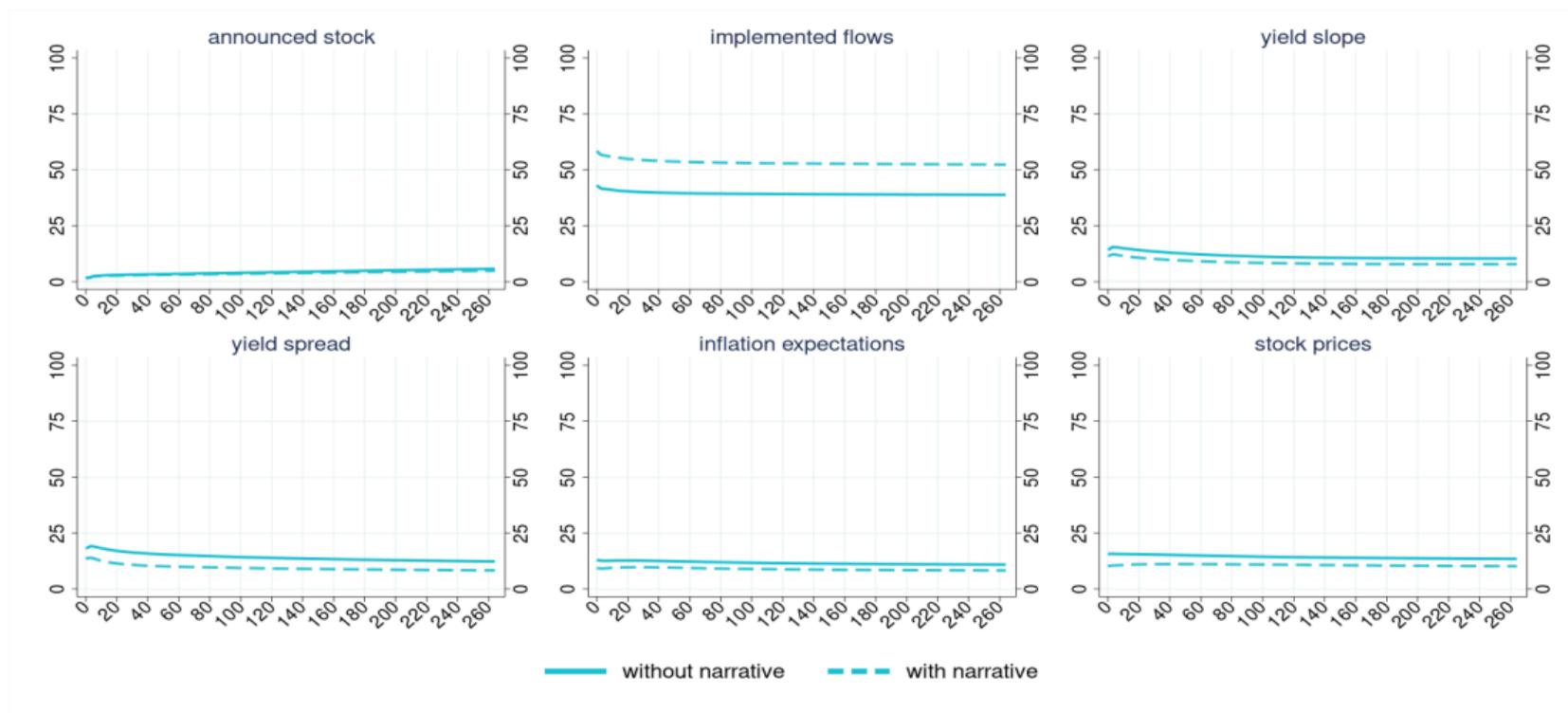
Transmission of implementation shocks under NR

▶ non-AP shocks under NR



- Qualitatively-similar IRFs, but...

Relevance of implementation shocks under NR



- ... larger share of implemented flows explained by implementation shocks

Overall effects of asset purchases
and contributions

The need for counterfactual scenarios

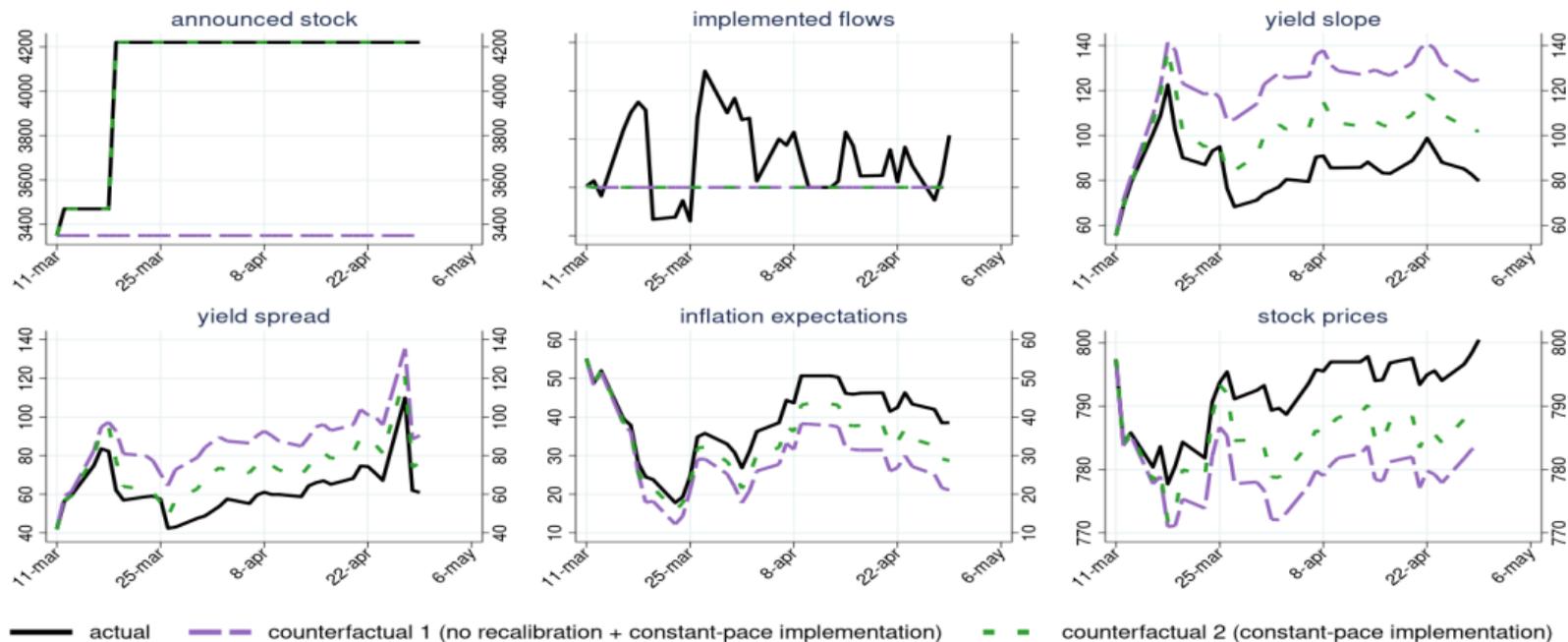
- Within the model, the evolution of APs over time can be decomposed in 3 components:
 1. **steady state**: baseline path [▶ go to](#)
 2. **systematic**: cumulative response to non-AP shocks
 3. **discretionary**: cumulative effects of AP shocks
- To assess the effectiveness of APs in their entirety (i.e., not just the discretionary component!), we rely on **counterfactual scenarios**

Key properties of our counterfactual scenarios

- Two key features to minimize concerns related to the Lucas' critique
- The counterfactual paths of the policy variables:
 1. are attributed only to the policy shocks
 2. are imposed over short-periods of time
- It is unlikely that, if surprised, agents will conclude immediately that the policy reaction function has changed, but rather wait a few weeks until the next MP meeting to get more information

Actual and counterfactual paths

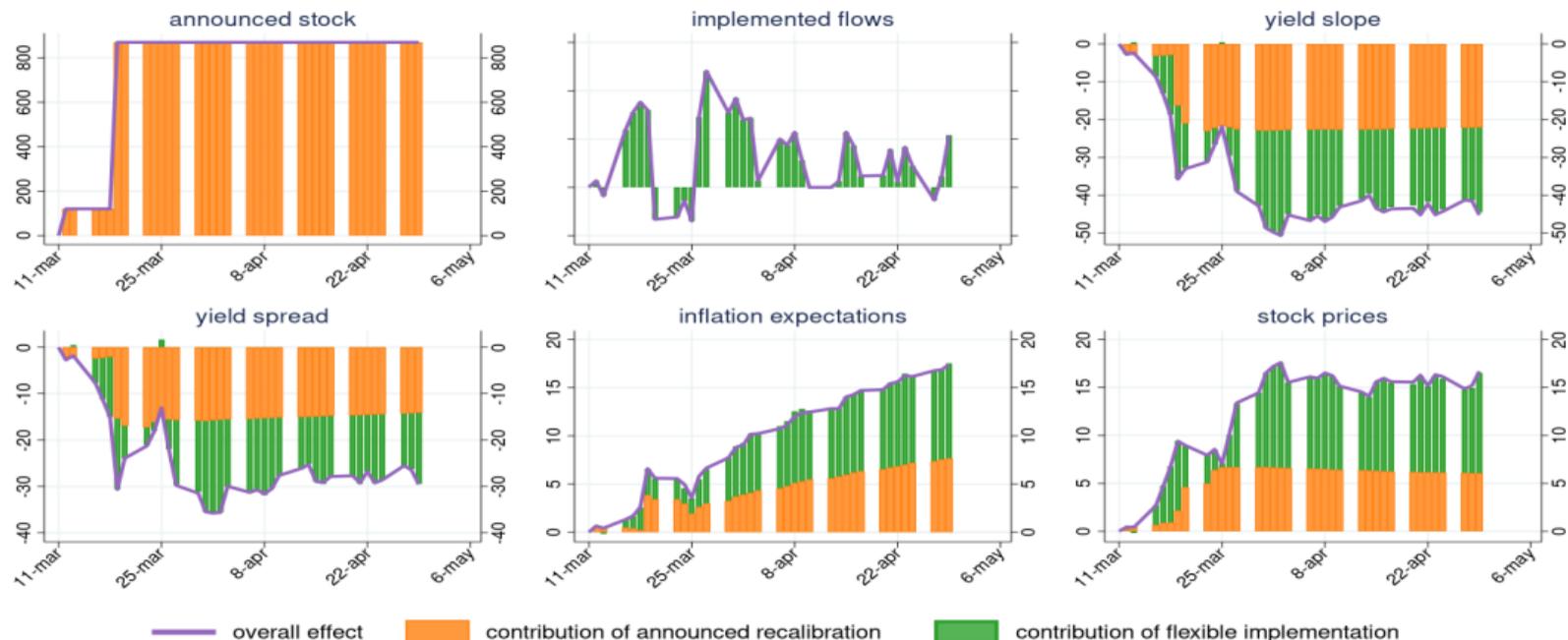
March 2020 recalibrations



- CF#1: the ECB **does not recalibrate** its APs and **implement** them at a **constant pace**
- CF#2: the ECB **does recalibrate** its APs but **implement** them at a **constant pace**

Decomposition of the overall effects of APs

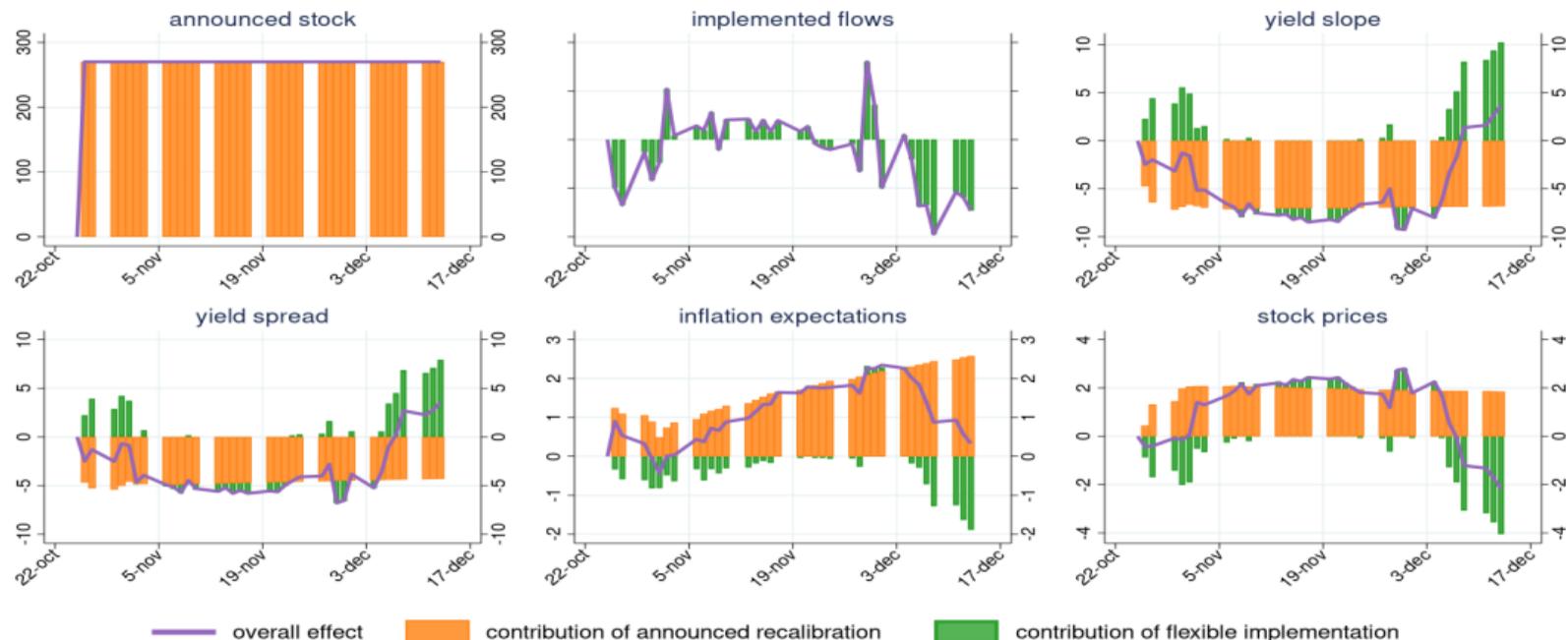
March 2020 recalibrations (substantial frontloading)



- Substantial frontloading: around €45 bn over the analyzed period
- Evidence of **sizable effects of APs**, partly driven by flexible implementation

Decomposition of the overall effects of APs

Oct 2017 recalibration (placebo test)



- Small, temporary and symmetric deviations from constant-pace
- The role played by the implementation is less relevant

Final remarks

Takeaways

1. **Novel dynamic framework** to evaluate and compare announcement and implementation effects of APs
2. **Announced and implemented APs exert similar effects**: key to correctly disentangle them
3. **APs are largely endogenous**: they are mainly driven by the systematic reaction of the central bank to macro and financial shocks
4. **APs exert strong effects** on financial conditions and inflation expectations when accounting for the systematic component of APs
5. **APs cannot be evaluated simply based on announcement effects**: the way actual purchases are implemented matters

Avenues for future research

1. **Temporal heterogeneity** (time-varying or state-dependent model)
2. **Cross-country heterogeneity and spillovers** (multi-country model)
3. **Full transmission of QE to credit and financial markets** (larger-scale model)
4. **Transmission of QE to the real economy** (mixed-frequency model)

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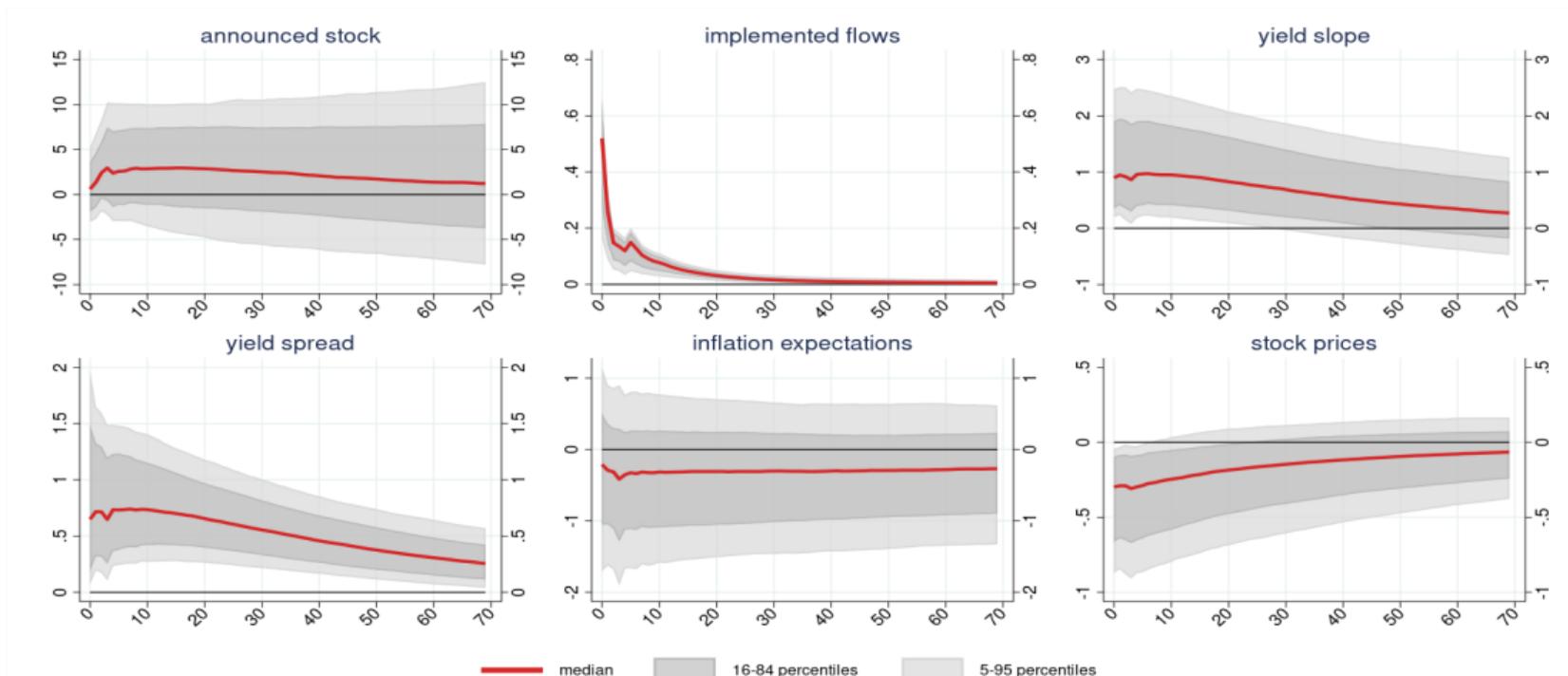
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Backup slides

Gibbs sampling ▶ back

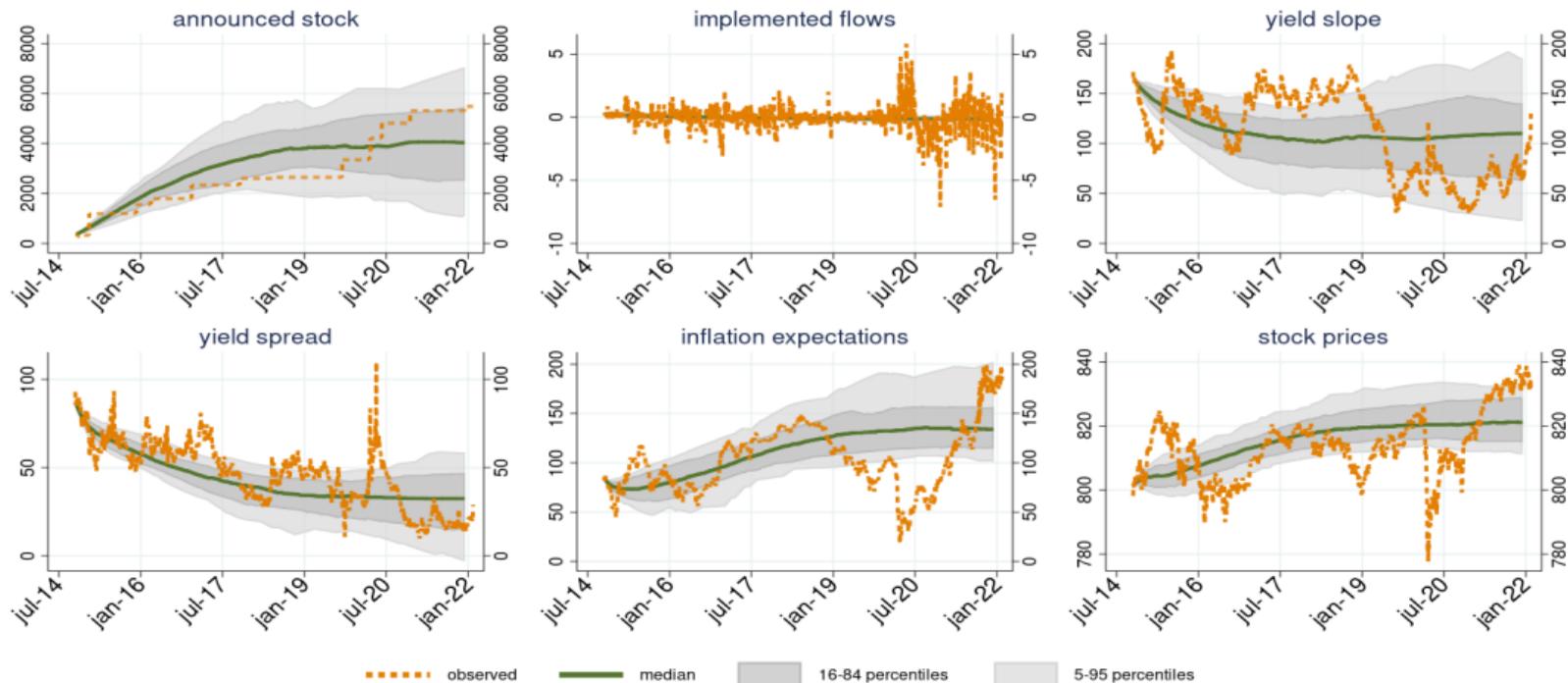
- the posterior distribution of the VAR belongs to the Normal-Wishart family
- we draw the (stacked) vector of reduced-form VAR coefficients α given the reduced-form variance covariance matrix Σ , whose inverse has a Wishart distribution $W(T - p \times N - 1)$
- conditional on Σ , the vector of coefficients α has mean and variance evolving according to the Minnesota prior (prior settings are standard)
- we then draw the reduced-form variance covariance matrix Σ given α
- for each draw, we run the IV-SR identification proposed by [Cesa-Bianchi and Sokol \(2021\)](#)
 - we pin-down the 1st column of the B matrix (structural relations matrix) via IV
 - we then rotate 100 times the remaining 2nd - n^{rd} columns of the B matrix
- for each accepted rotation, i.e. a B matrix that fulfils our desired zero&sign restrictions, we compute multiple objects of interest (IRFs, elasticities, FEVD, HDs, counterfactuals, ...)
- we repeat these steps until we obtain 2000 draws, with a burn-in period of 25%
- we finally summarize the distribution of the analyzed objects

Transmission of non-AP shocks (#1) [▶ back](#)



- Stabilization interventions are typically followed by announcements of AP recalibrations

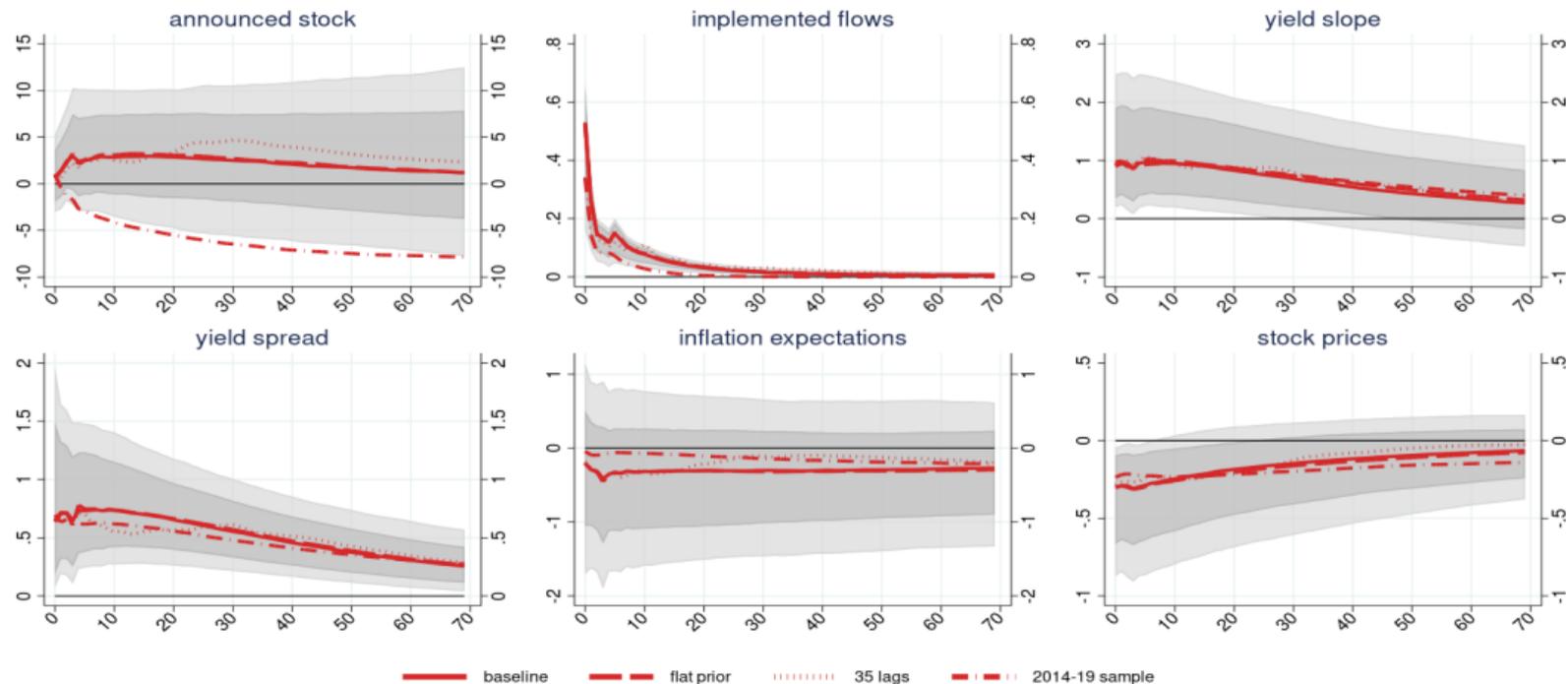
Steady-state components [▶ back](#)



- The overall impact of APs might be partly captured by their deterministic component
- A steady-state increase in the stock of APs associated with a steady-state decline in spreads

Transmission of non-AP shocks (#1) under different specifications

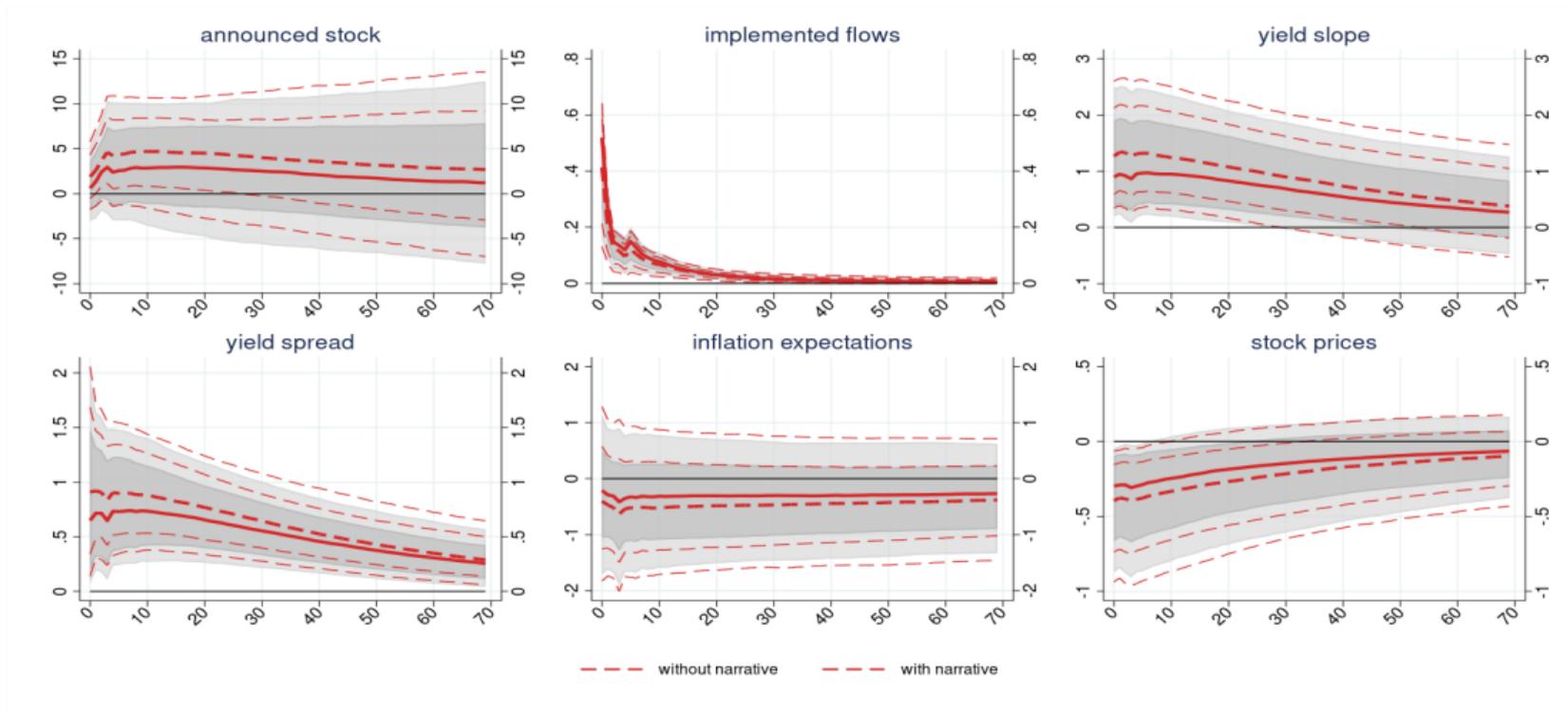
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- The results are robust to several perturbations of the baseline specification
- Ending the estimation sample in 2019 does not significantly affect our findings

Transmission of non-AP shocks (#1) under NR

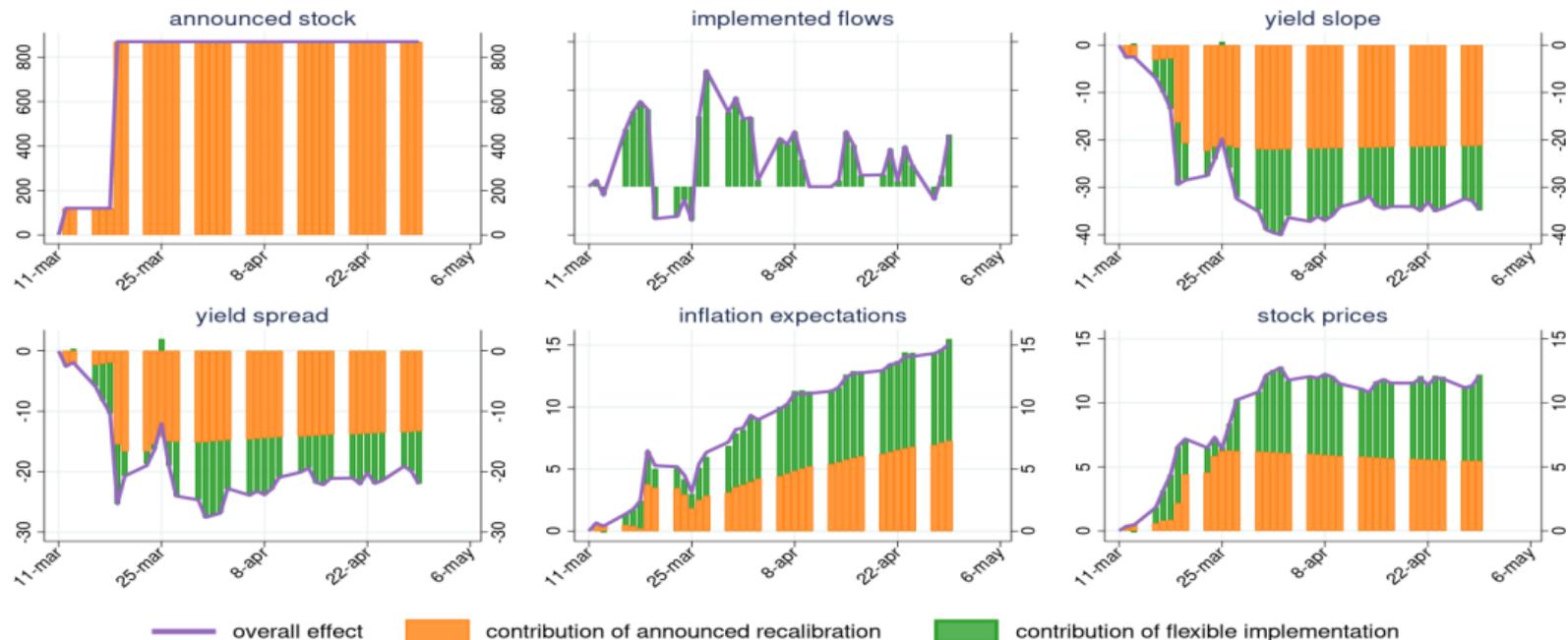
[▶ back](#)



- Qualitatively-similar IRFs

Decomposition of the overall effects of APs under NR [▶ back](#)

March 2020 recalibrations (substantial frontloading)



- Slightly lower relative share of slope and spread attributable to implementation