BANCA D'ITALIA
EUROSISTEMA

Policy Uncertainty and Daily Consumer Card Payments

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* The views expressed are those of the authors only and do not involve the responsibility of the Banca d'Italia and of UPB.

Motivation

- The **Great Moderation period** was broken by the burst o the **Global Financial Crisis of 2007-2008** in **US** and the **Sovereign Debt Crisis** in **Europe**

- Since then, **uncertainty** was considered one of the key factors in **driving** the **recession**

- **Measuring Economic policy uncertainty (EPU)** and investigating its **economic impact** took a center stage in the academic and policy debate

- Can **daily Payment System data** help us in investigating **economic consequences of EPU innovations**?

The paper in one chart

EPU & E(P)U

- Bloomberg
- Twitter

Debit Card Payments

- POS
- ATM
- Daily frequency
- Strong seasonal patterns

Temporary decrease payments.

Precautionary channel

- Local projections

Main Findings

- **Interesting seasonal pattern** in **payment data**
- **Positive innovations in EPU** at the **daily frequency:**
  - Generate a **temporary reduction** in **debit card transactions (consumer spending)**
    - **Precautionary savings**
      Pistaferri-Jappelli,2010; Giavazzi-MacMahon,2013; Bayer et al., 2018
    - **Change** in the **quality** of **consumed goods**
      Wong-Jaimovich-Rebelo, 2019; Michelacci-Pozzi-Paciello, 2020
  - Induce a **temporary increase** in **Cash withdrawals**
    Frenkel-Jovanovic, 1980; Bayer et al., 2018
- At **monthly frequency** we find **significant** and **temporary effects** of EPU innovations on payments coherently with **daily frequency results**

Literature Review

Economic Policy Uncertainty and macro

Bloom & al. (2007); Bloom (2009); Bachmann & Bayer (2013); Bachmann, Elstner & Sims (2013); Jurado, Ludvigson & Ng (2015); Baker, Bloom & Davis (2016); Fernández-Villaverde, Guerron-Quintana & Kuester (2015); Caldara & Iacoviello (2018); Caldara, Iacoviello, Molligo & Prestipino (2019); Baker, Bloom & Terry (2020); Bloom & many al. (2020)

Payment systems data (Structural analysis)

Gelman, Kariv, Shapiro & Silverman (2014); Wang & Wolman (2016); Baker & Yannelis (2017); Baker (2018); Olaffson & Pagel (2018); Baugh, Ben-David & Park, Parker (2020); Chetty, Friedman, Hendren & Stepner (2020); Carvalho, Garcia, Hansen, Ortiz, Rodrigo, Rodriguez Mora & Riuz (2020); Dunn & Gholizadeh (2020); Huynha, Hob, Morin & Paarsch (2020); Baker, Farrokhnia, Meyer, Pagel, & Yannelis (2020)

Precautionary saving, income risk, and consumption

Jappelli & Pistaferri (2010); Giavazzi & McMahon (2012); Bayer, Lutticke, Pham-Do & Tjaden (2018); McKay (2017)

Payment systems data (Forecasting)

Carlsen & Storgaard (2010); Esteves (2009); Rodrigues & Esteves (2010); Galbraith & Tkacz (2013); Duarte, Rodrigues & Rua (2017); Aprigliano, Ardizzi & Monteforte (2018)

Big data and economic/financial applications

Giannone, Lenza & Primiceri (2017); Angelico, Marcucci, Miccoli & Quarta (2020); Buono, Kapetanios, Marcellino, Mazzi & Papailias (2017); Bok, Caratelli, Giannone, Sbordone & Tambalotti (2018)

Roadmap

1) **Daily payments data**
2) Seasonal Adjustment
3) EPU, E(P)U, EU
4) Econometric framework
5) Empirical results (Daily & Monthly freq.)
6) Conclusion

Payment System Data

- **BI-COMP:** Bank of Italy's clearing and settlement system with **daily aggregate info** about **value** and **number** of transactions
  - $\frac{BI-COMP\ tot.value\ 2018}{Italian\ nom.GDP\ 2018} = 1.1$
  - i) Debit card; ii) Checks; iii) Direct Debit; iv) Credit Transfers
- **Features**: 1) Collected in real time; 2) No revisions or observation errors
- According to the ***Bank of Italy's Survey of Household Income and Wealth*** (SHIW) **in 2016**:
  - **76%** of Italian households own a **debit card** (**main payment tool**) (56 millions in 2018)
  - **30%** hold a **credit card** (15 millions in 2018)
  - 25% hold a prepaid card (postal services)
- **Good indicator for the whole Italian market:** around **66% of debit card** payments at POS are settled *through the BI-COMP system*.

Payment System Data (Cont.)

- **POS** dynamics at quarterly frequency squares well with **NA consumption expenditure in non durable consumption + services** [figure] (Duarte et al., 2017)
  - **Av. Daily payment: 60 euros with POS; 160 euros ATM withdrawal**
  - **POS+ATM values in BI-COMP = 100 / 110 billions per year**
  - $\dfrac{\boldsymbol{POS+ATM\ values\ in\ BI-COMP}}{\boldsymbol{NON-DUR\ Consumption+Services}} = \mathbf{12.5}\%$

- $\dfrac{ATM}{POS}$ a measures of consumers' **preference for cash** is **countercyclical**, consistently with literature on cash demand (Stix, 2004, Ardizzi et al., 2014) [figure]

Roadmap

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2) **Seasonal Adjustment**
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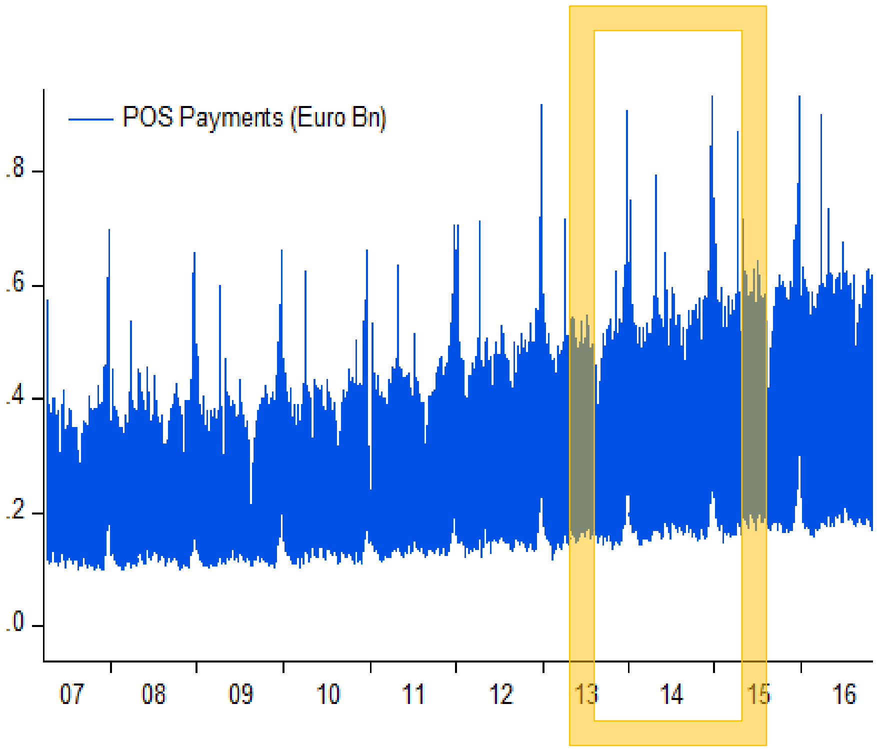
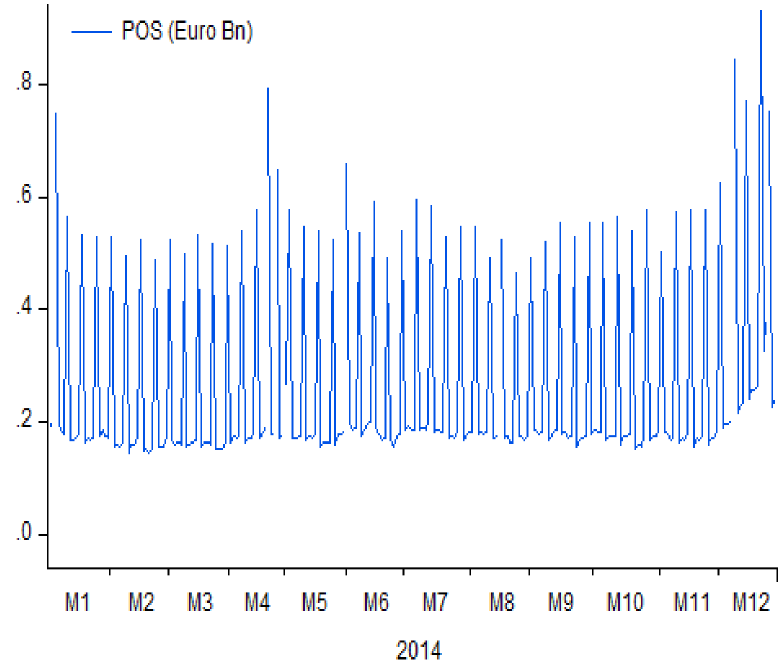
POS purchases at daily frequency





- **Daily POS purchases** from **BI-comp system:**
  - Sample: Apr. 2, 2007 – Sep. 30, 2016
- **Caveat:** strong **seasonal patterns** and **calendar effects.**

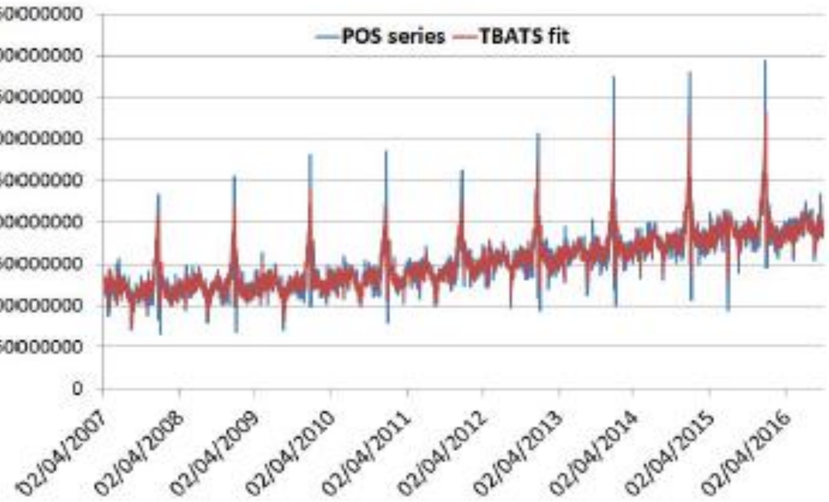
Seasonality of Payment Data (2)

Seasonality is **a salient feature** of our daily data on payments (we could use **dummies**, but **too many parameters** to be estimated**):**

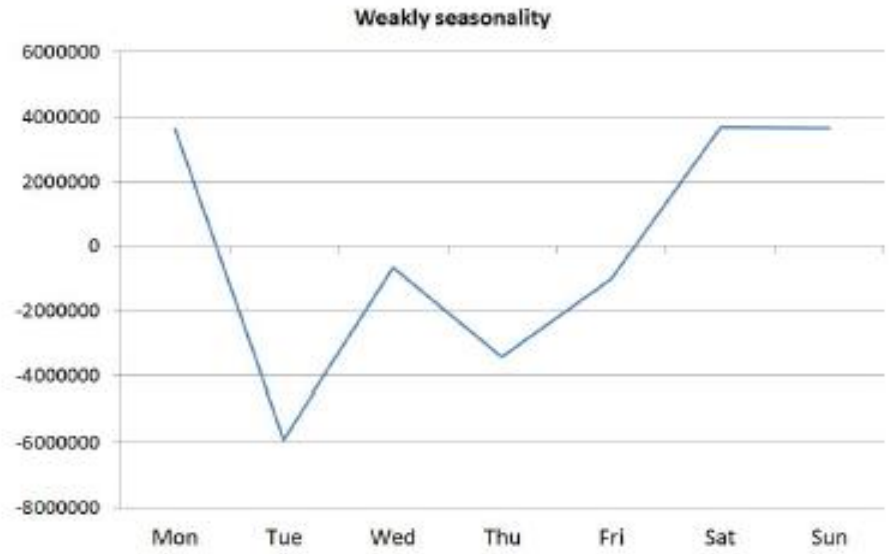
- **Day-of-the-week**
- **Day-of-the-month**
- **Day-of-the-year**
- **Fixed Holidays** (e.g. Christmas, June 1st , May 1st);
- **Moving Holidays** (e.g. Easter).

- **Two approaches for daily seasonal adjustment**:
  - **TBATS**, by De Livera, Hyndman and Snyder (JASA 2011) is based on state space models, as in Harvey, Koopman and Riani (1997) but allows for a larger parameter space
  - **Prophet**, by Taylor and Lethman (2017) from **Facebook research**, is a flexible bayesian model that decomposes the time series with complex seasonal patterns in a) trend, b) seasonal components and c) calendar effects.

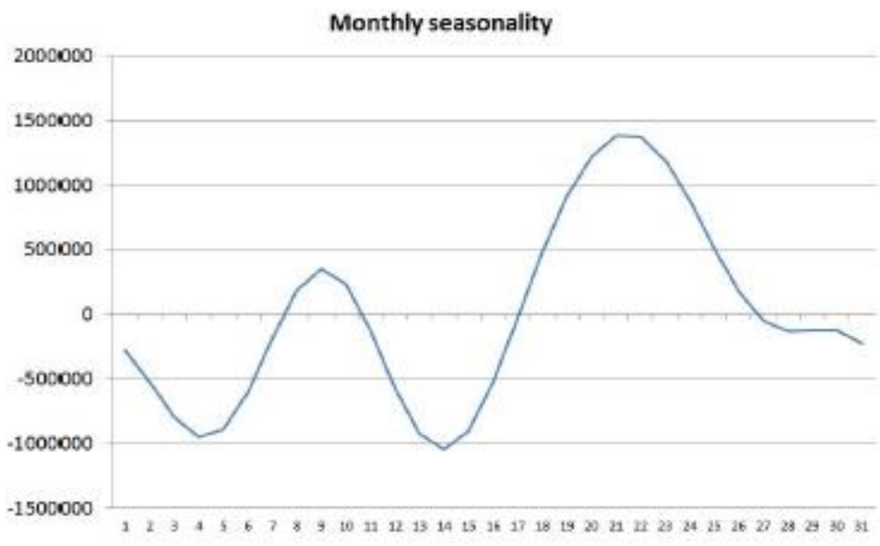
Seasonality of POS in TBATS



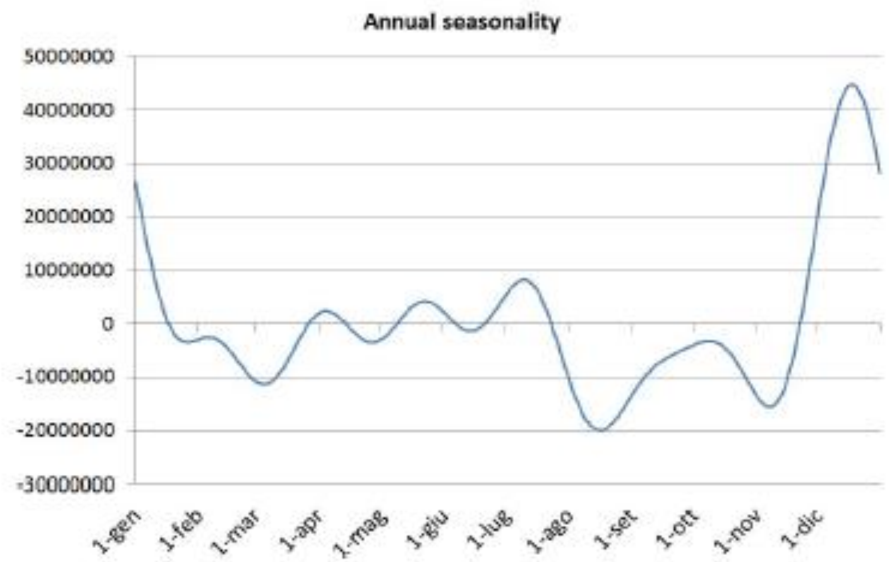
(a) POS daily series fitted with *TBATS*



(b) POS daily series - weekly seasonality



(c) POS daily series - monthly seasonality



(d) POS daily series - annual seasonality

Roadmap

1) Motivation
2) Data on payments
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4) **EPU, E(P)U**
5) Empirical results
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EPU, E(P)U Indexes for Italy

- We follow the methodology proposed in Bloom, Baker and Davis (2016) selecting articles(/tweets) in Bloomberg (/Twitter) through **keywords** related to **3 broad categories:** (E)conomic (P)olicy (U)ncertainty

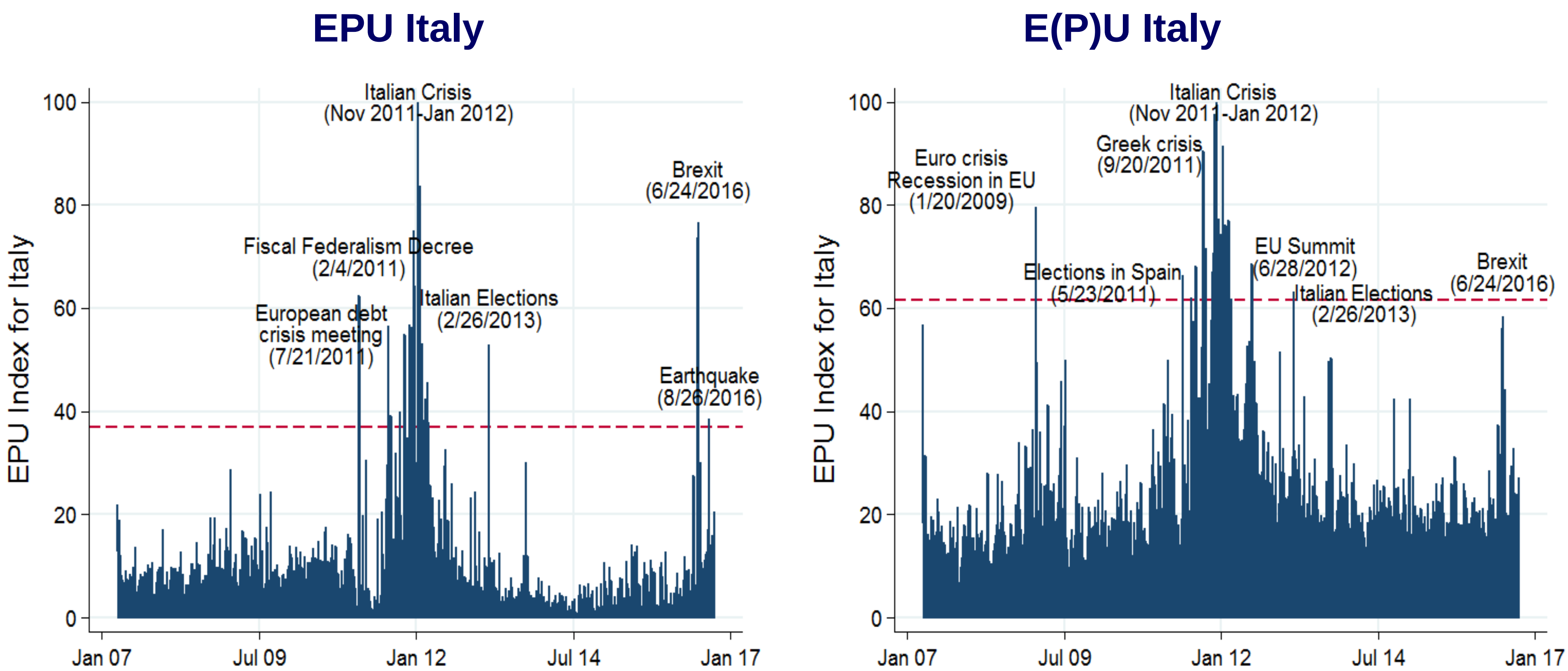
$$EPU\ index_t = \frac{\#\ of\ articles\ satisfying\ EPU\ \mathbf{keywords}\ in\ day\ t}{Total\ \#\ of\ articles\ in\ day\ t}$$

- We construct **5 daily indexes** for Italy ranging from **1 January 2007** to **31 September 2016**

	Source	
Language	*Bloomberg*	*Twitter*
Italian	EPU	-
	EU	EU
English	EPU	-
	EU	-

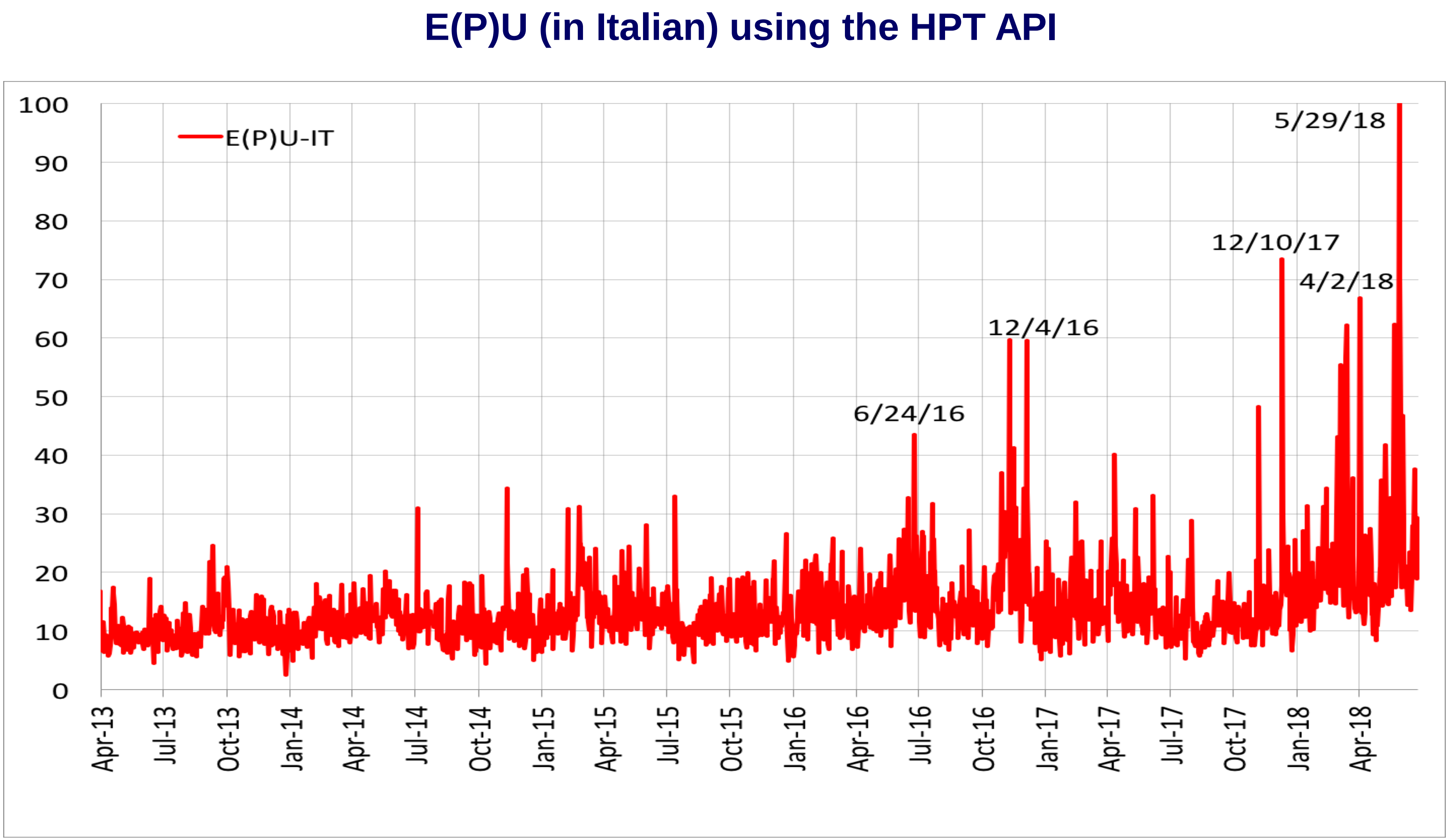
KeyBloombergIT KeyBloombergEN KeyTwitterIT

Daily EPU & E(P)U for Italy (Bloomberg, EN)

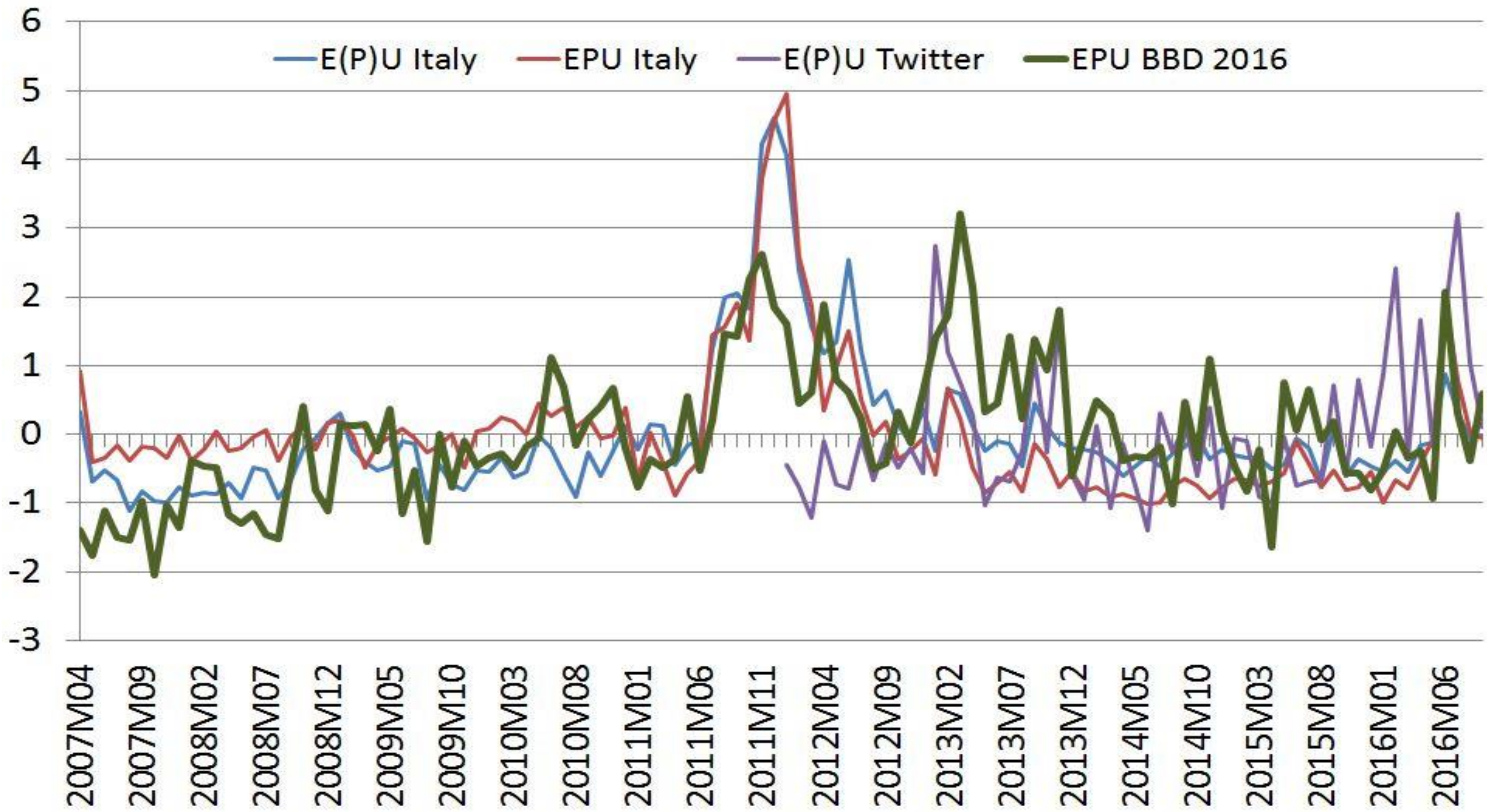


Notes: indexes computed with Bloomberg. E(P)U contains at least the keywords (E) and (U) AND "ITAL*" (**English language**). The dotted red line shows the 99 percentile. **"External" EPU**

Daily E(P)U in Italian (Twitter) (HPT API)



Monthly EPU indexes (standardized): Comparison with BBD (2016)



Consistent with the **monthly** series of BBD (2016);

Correlations: E(P)U-TW 0.50, EPU 0.60 E(P)U 0.43.

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5) **Econometric framework**
6) Empirical results (Daily & Monthly freq.)
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Econometric framework

- We build daily impulse response functions (IRFs) with **Local Projections** (LP-OLS, Jordà, AER 2005), with the following specification:

$$y_{t+h} - y_t = \alpha_h Index_t^{EPU} + \sum^{I} \beta_i y_{t-i} + \sum^{J} \gamma_i Index_{t-j}^{EPU} + \ldots$$

$$\ldots \quad + det_t + \varepsilon_{t+h}, \quad h = 1, \ldots, H.$$

- We fully exploit our data set, using **daily data** =>
  - Around 2400 observations (02/04/2007 – 30/09/2016);
  - No need of mixed frequency models; no time aggregation issues; negligible concerns for endogeneity.
- LP are rather **flexible** and **more robust** than VAR **to misspecification**, the more for large horizons of the IRFs => given the lack of macroeconomic daily observables.

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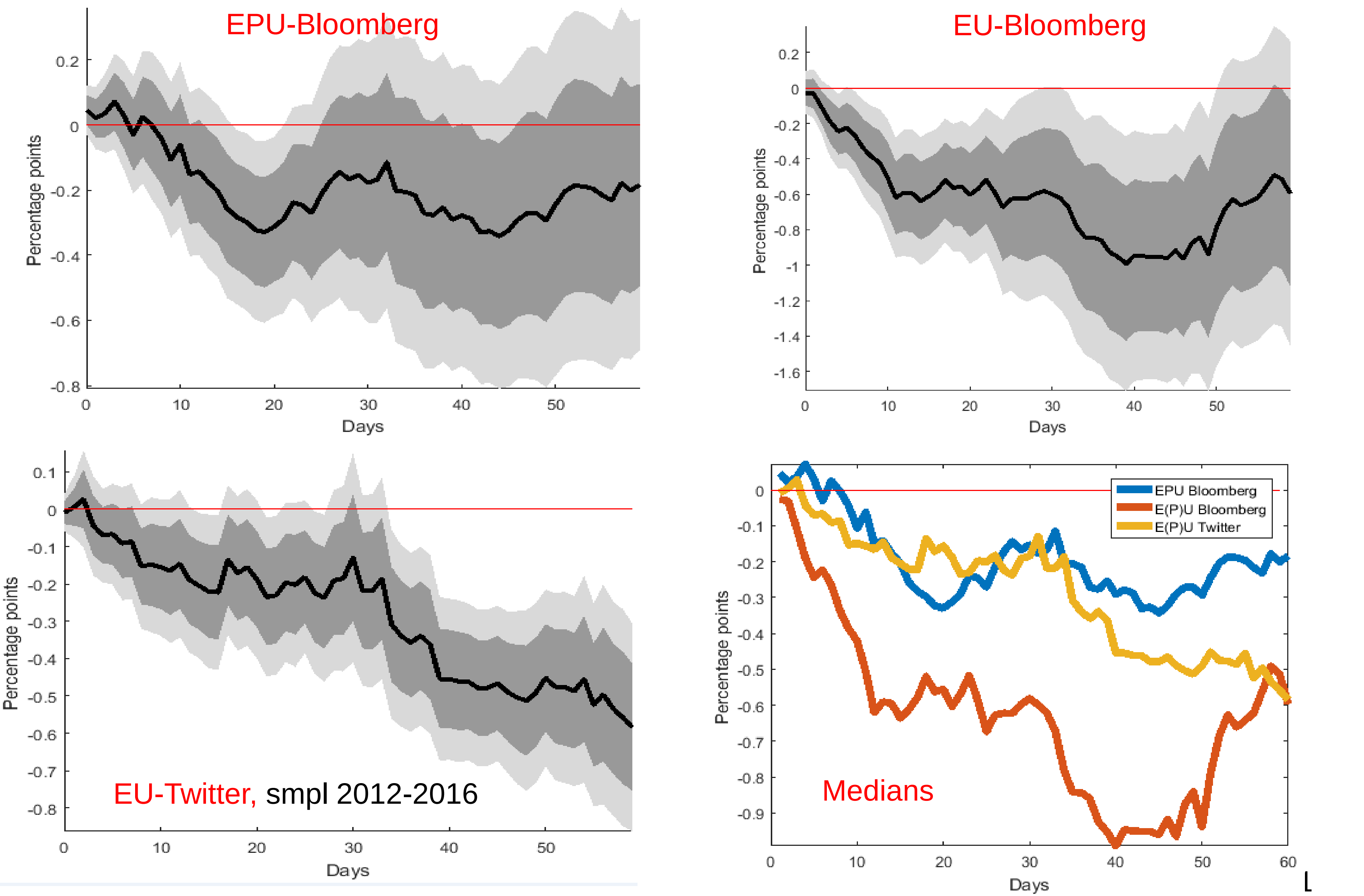
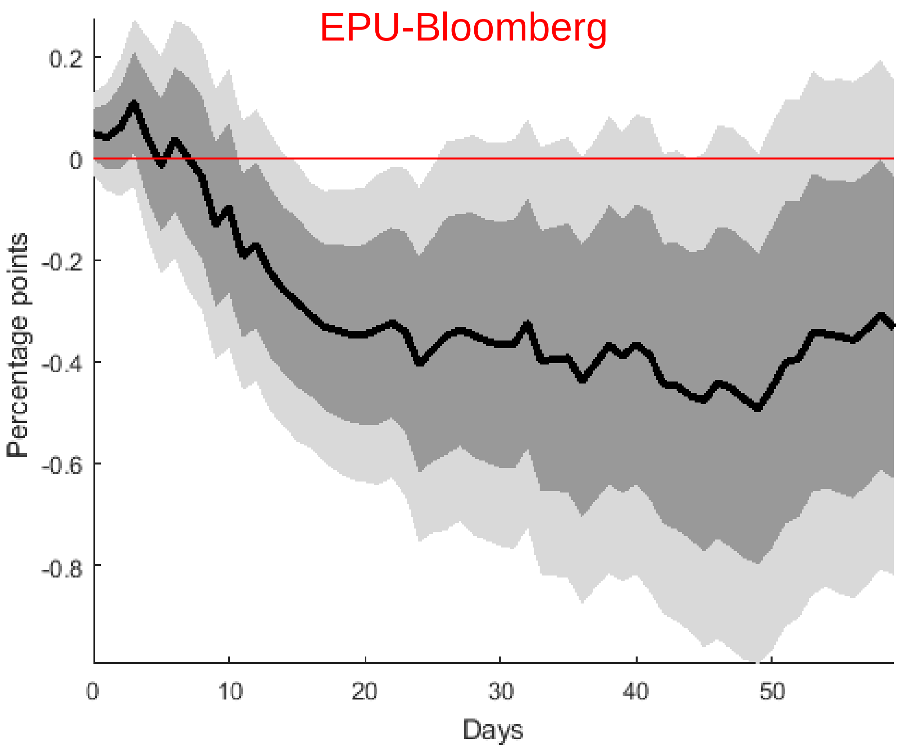
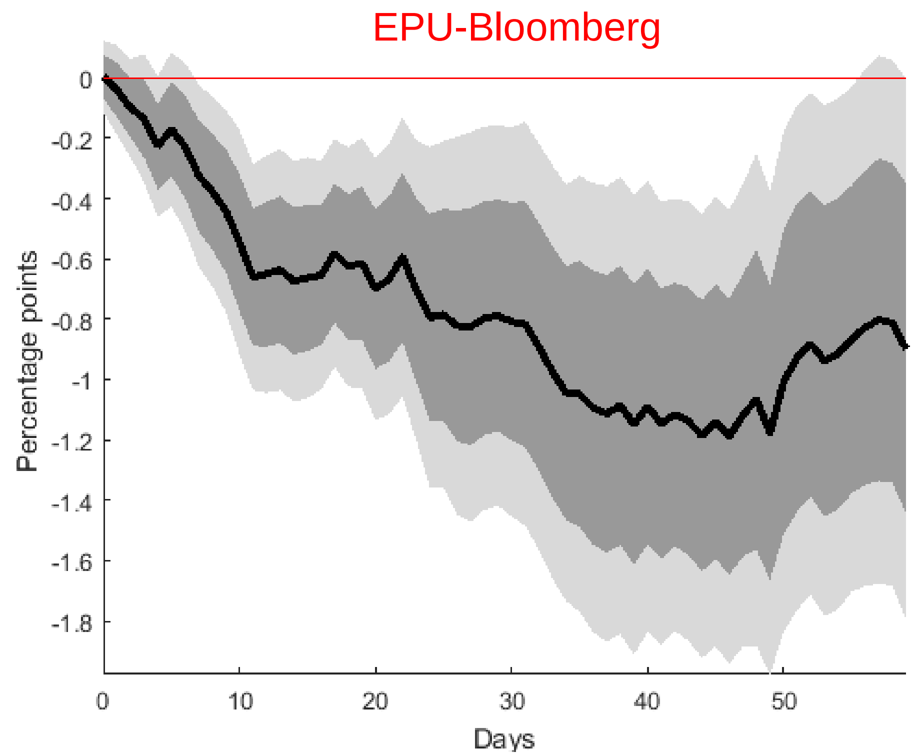
EPU → POS: whole sample (2007m4-2016m9)



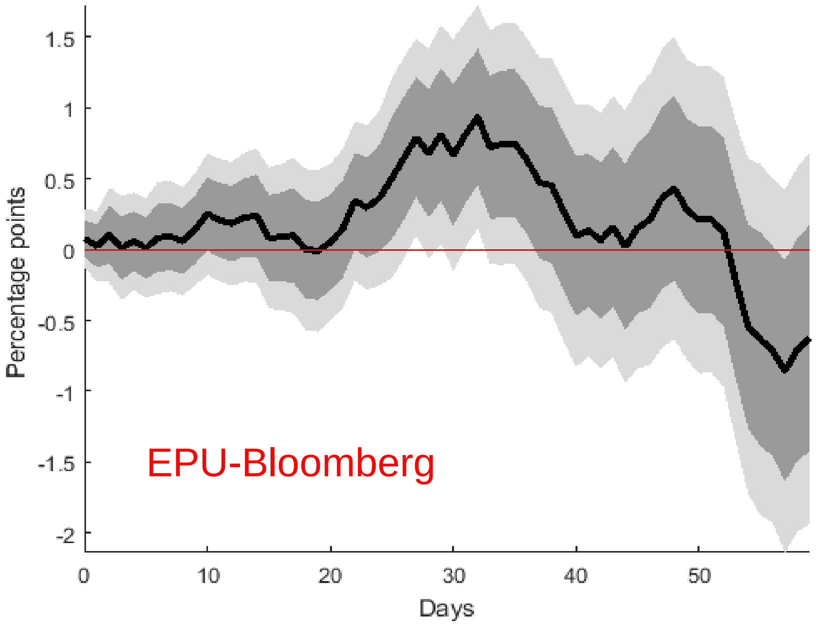
EPU → POS: subsample (2007m4-2013m12)

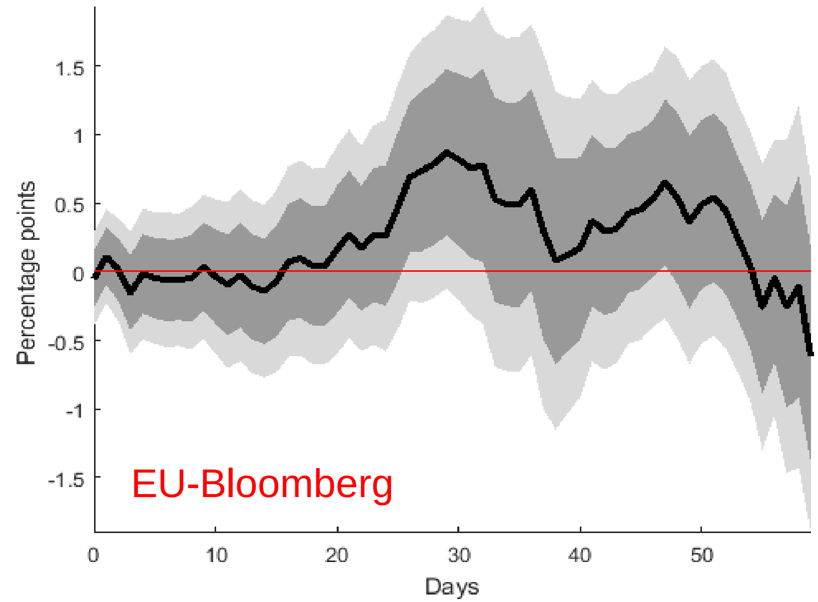


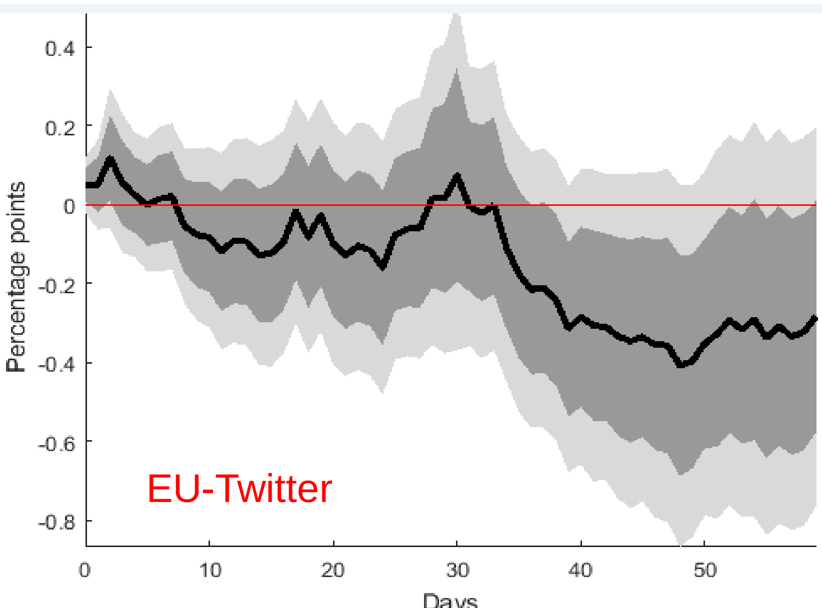


- EPU generates a **non negligible reduction in purchases in the first subsample**.
- The effects **tend to vanish after 2 months. No Twitter-based E(P)U**.

EPU → POS: subsample (2014m1-2016m9)

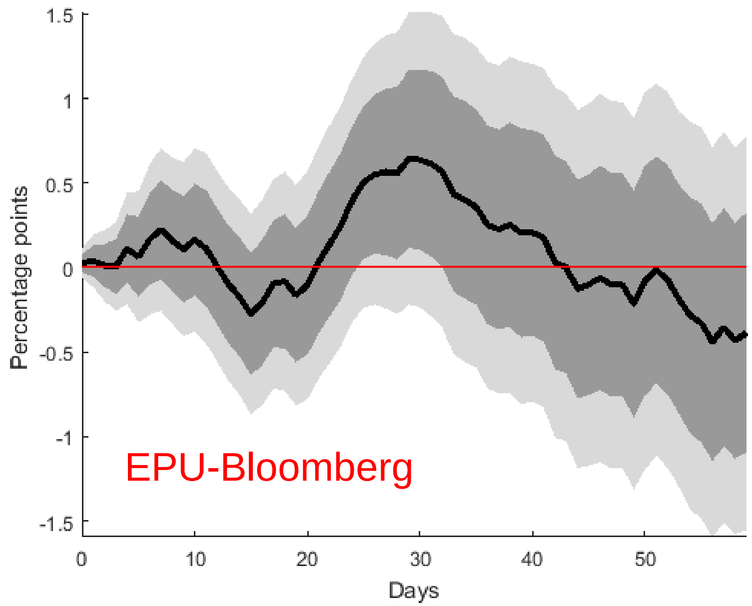


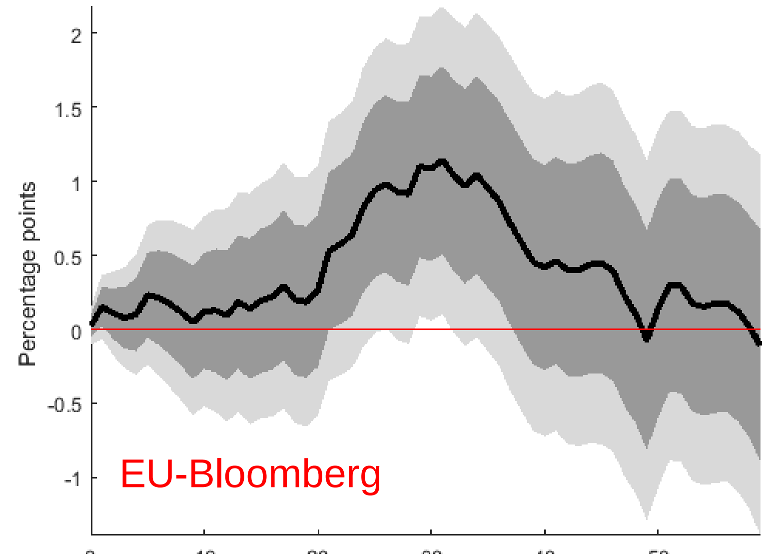


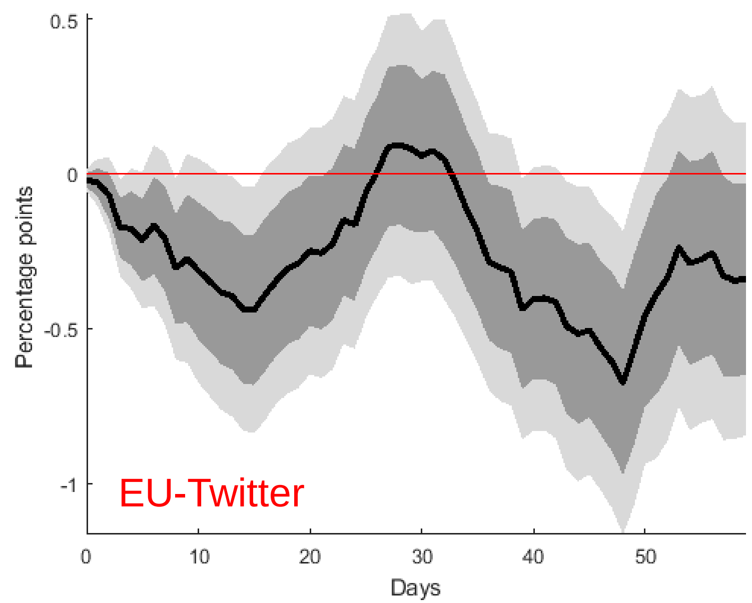


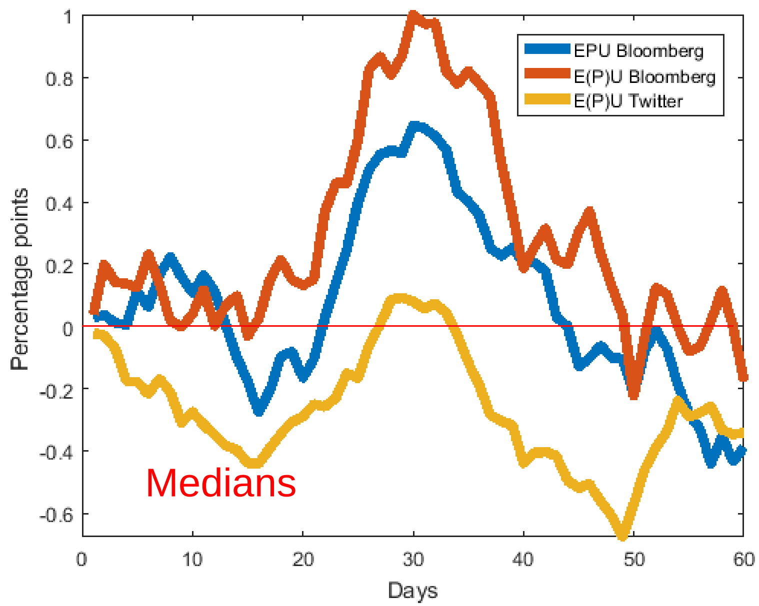
- Not significant effect on POS when using E(P)U from Bloomberg in the 2° sub-sample
- Marginally significant results when Using Twitter

EPU→ATM : whole sample (2007m4-2016m9)









Robustness at Daily frequency

EPU is a relevant source of uncertainty other than Financial Uncertainty

- Results remain robust after controlling for :
  - proxies of **daily Financial Uncertainty** (daily **Realized Vol**. of the FTSEMIB)
  - **Stock market returns** for Italy
  - 10y Sovereign debt spread ITA-GER and **5y CDS** for Italy

EPU jumps can be a proxy of bad news in the economy…

- We use **daily surprises** from several Italian **macro variables**
- **Daily suprises** = *data released – Bloomberg median forecast*
  - **Quarterly:** such as GDP, Private Consumption
  - **Monthly**: Unemployment rate, Consumer confidence, Industrial production, Manufacturing and services PMI

Monthly estimates

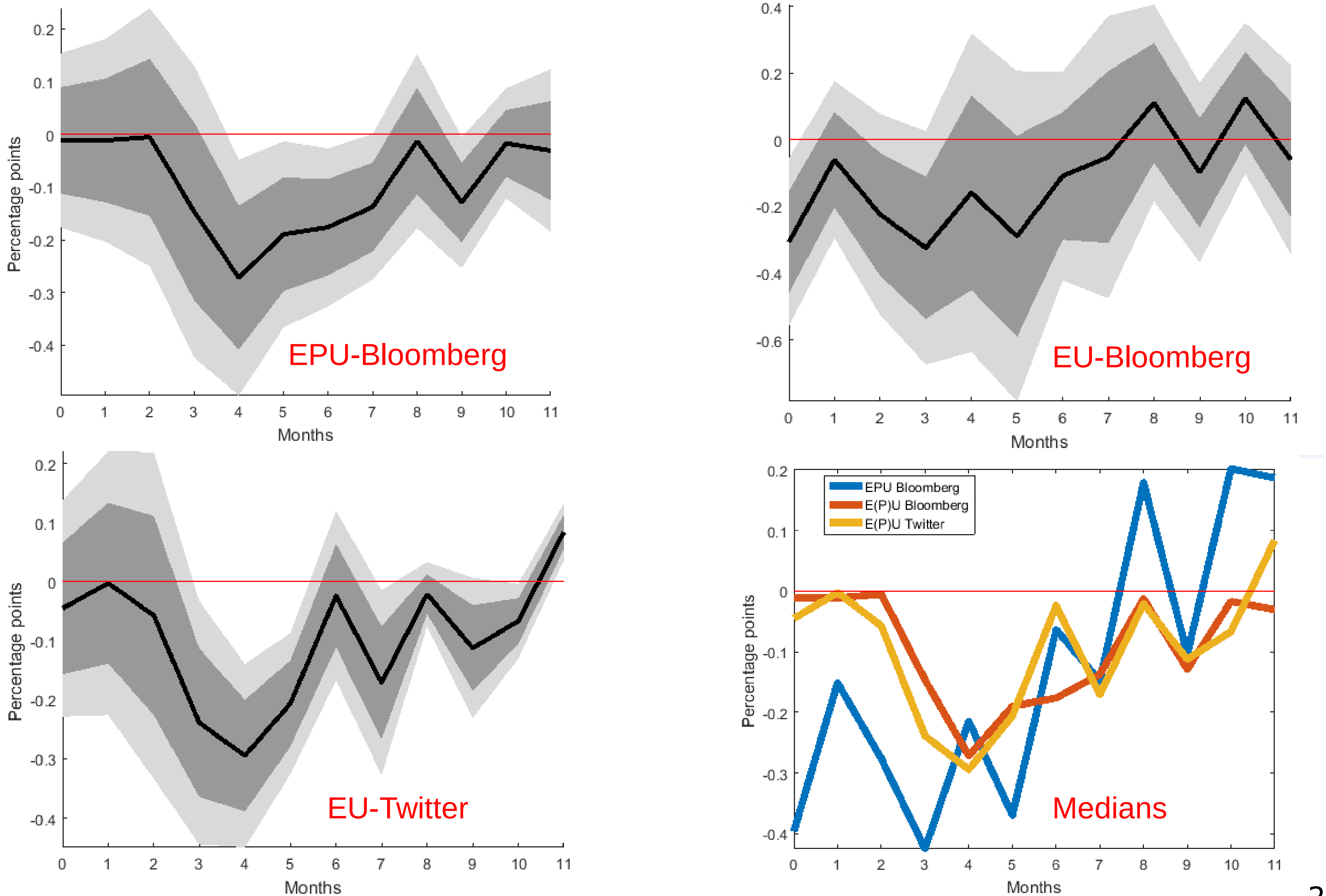
Monthly Local Projections

- It is crucial to identify shocks at daily frequency in order to rule **endogeneity problems**.
- To construct the **monthly EPU shocks** we follow the methodology put forward in Gazzani & Vicondoa (2019)

1. At the daily freq. we regress EPU indicators on EPU lags, POS lags, macro surprises and financial market variables
2. The monthly EPU shocks are the residuals in **step 1** aggregated at the monthly frequency

- We estimate the impact of EPU shocks on POS using LP-OLS adding other monthly controls such as **Industrial production** and **Consumer confidence measures**

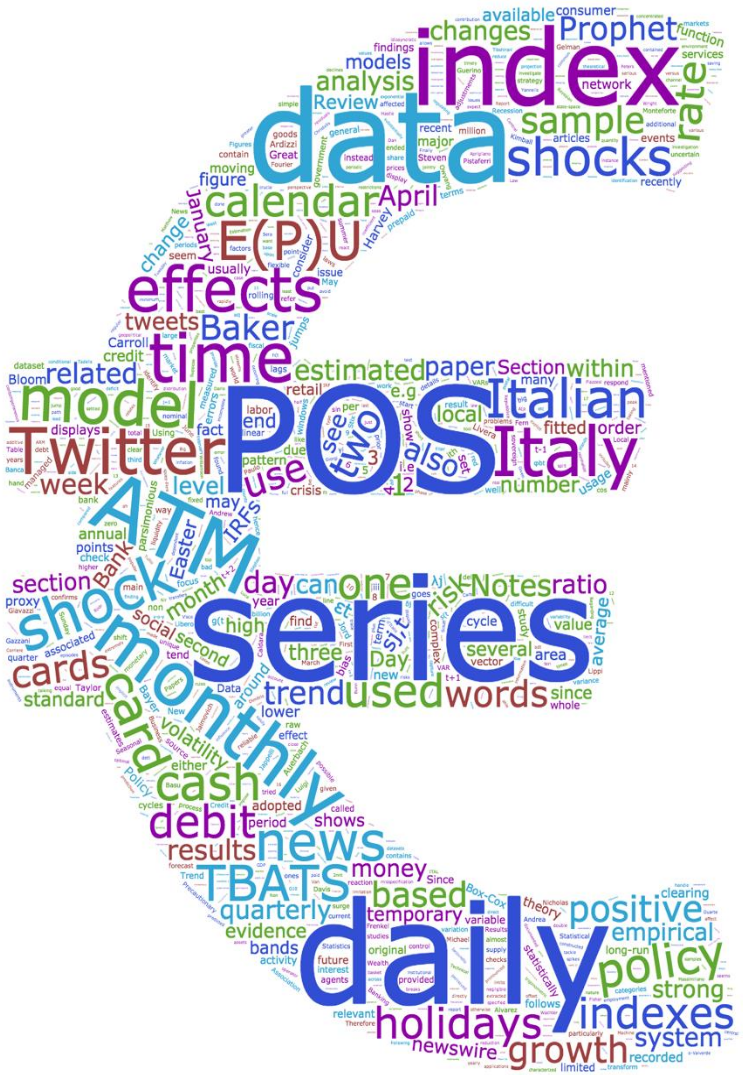
POS ← EPU: monthly level



Conclusions

- We use **daily debit card payments data** (adjusted for complex daily seasonal patterns)
- We build **EPU and E(P)U indexes** for Italy from different sources (Bloomberg, Twitter) all consistent with those of BBD (2016)
- We show that **EPU shocks** have **temporary but not negligible contractionary effects on purchases made by Italian consumers**, mainly during our first subsample characterized by the financial crisis (asymmetry). **ATM withdrawals increase**
- The effects found are **temporary** and **short-lived**, as theory predicts
- **Monthly frequency** results are consistent with the daily frequency ones

Thanks!!!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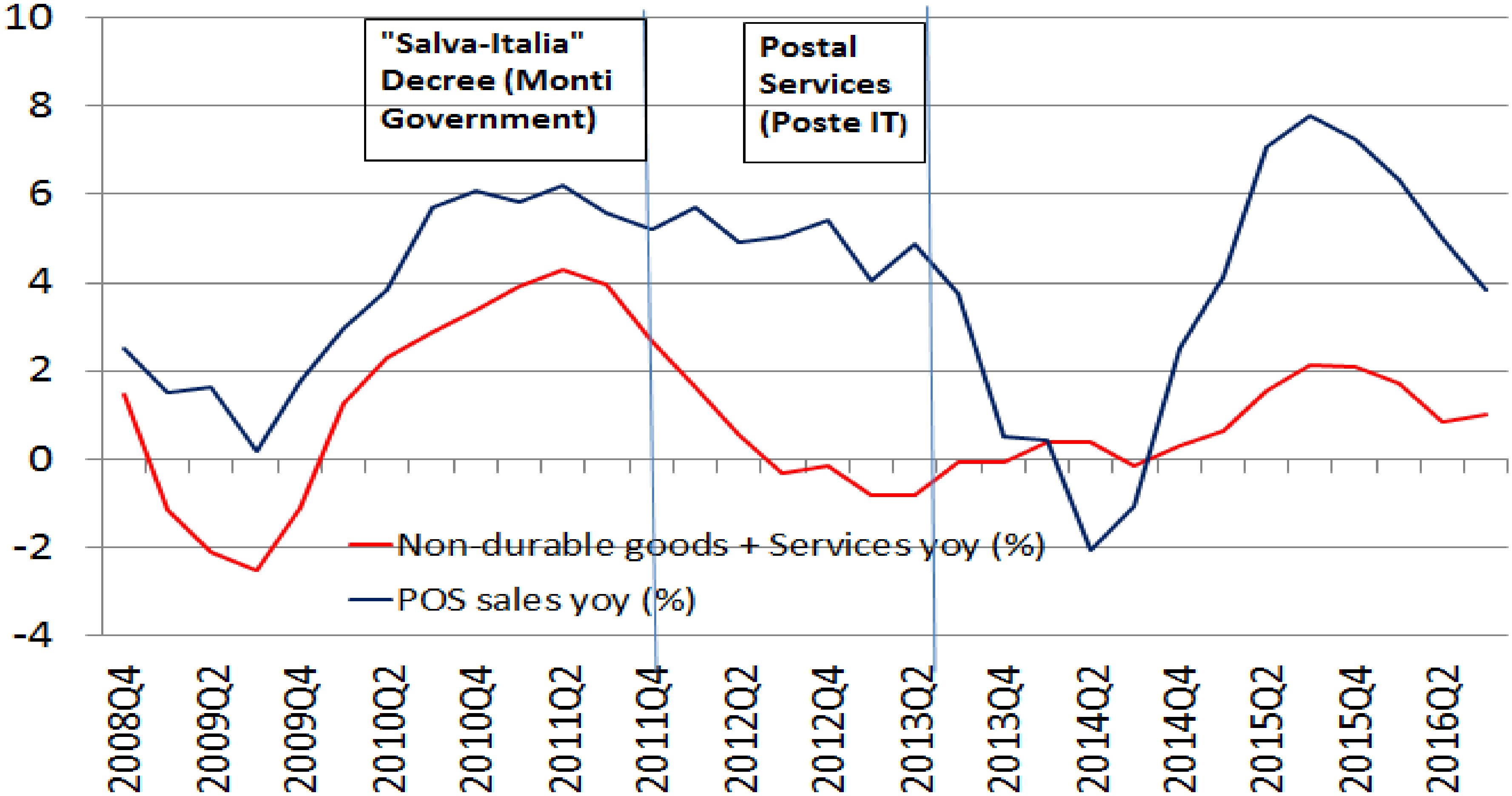
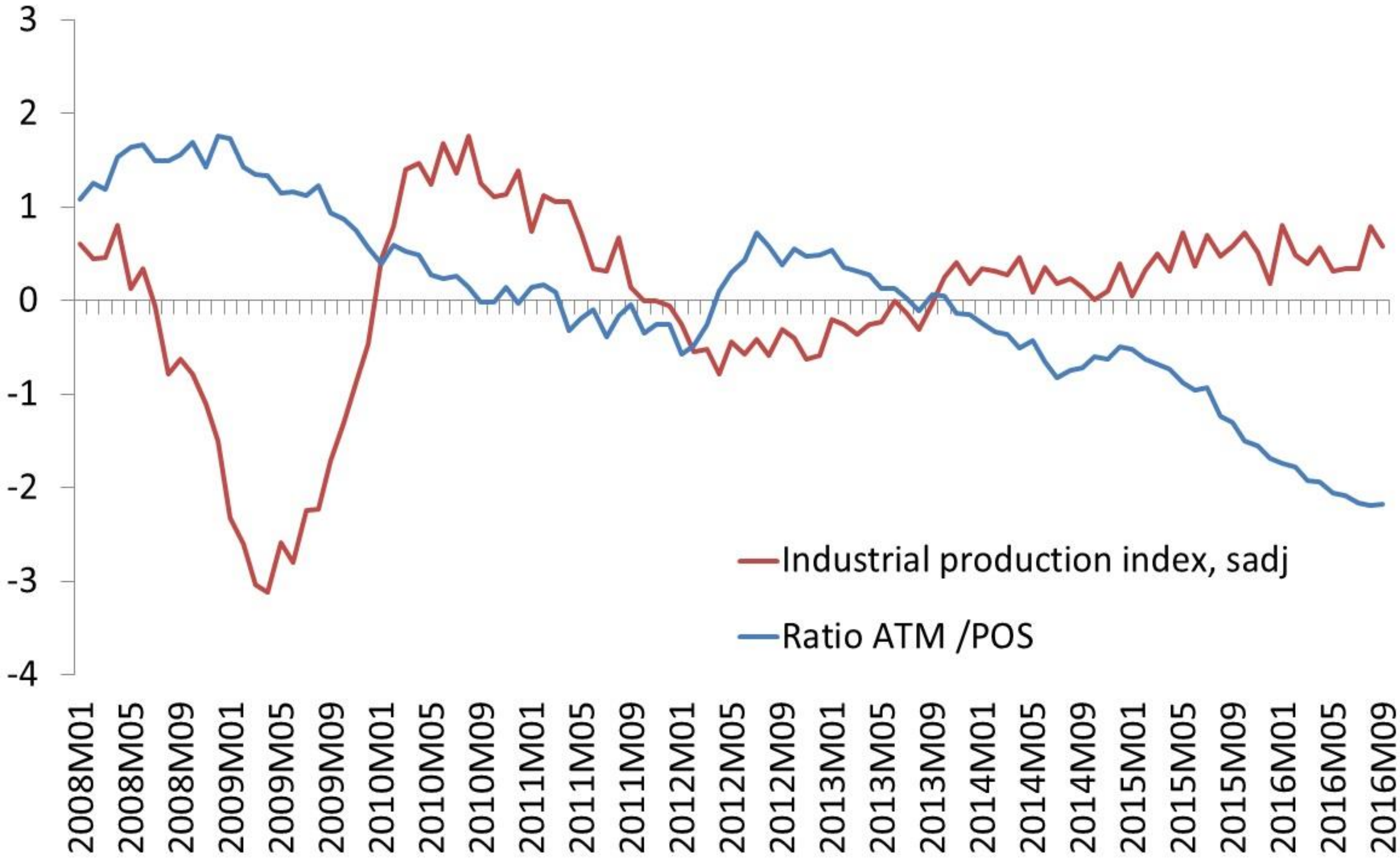
Background slides

POS sales YOY and consumption



The correlation is close to 66%

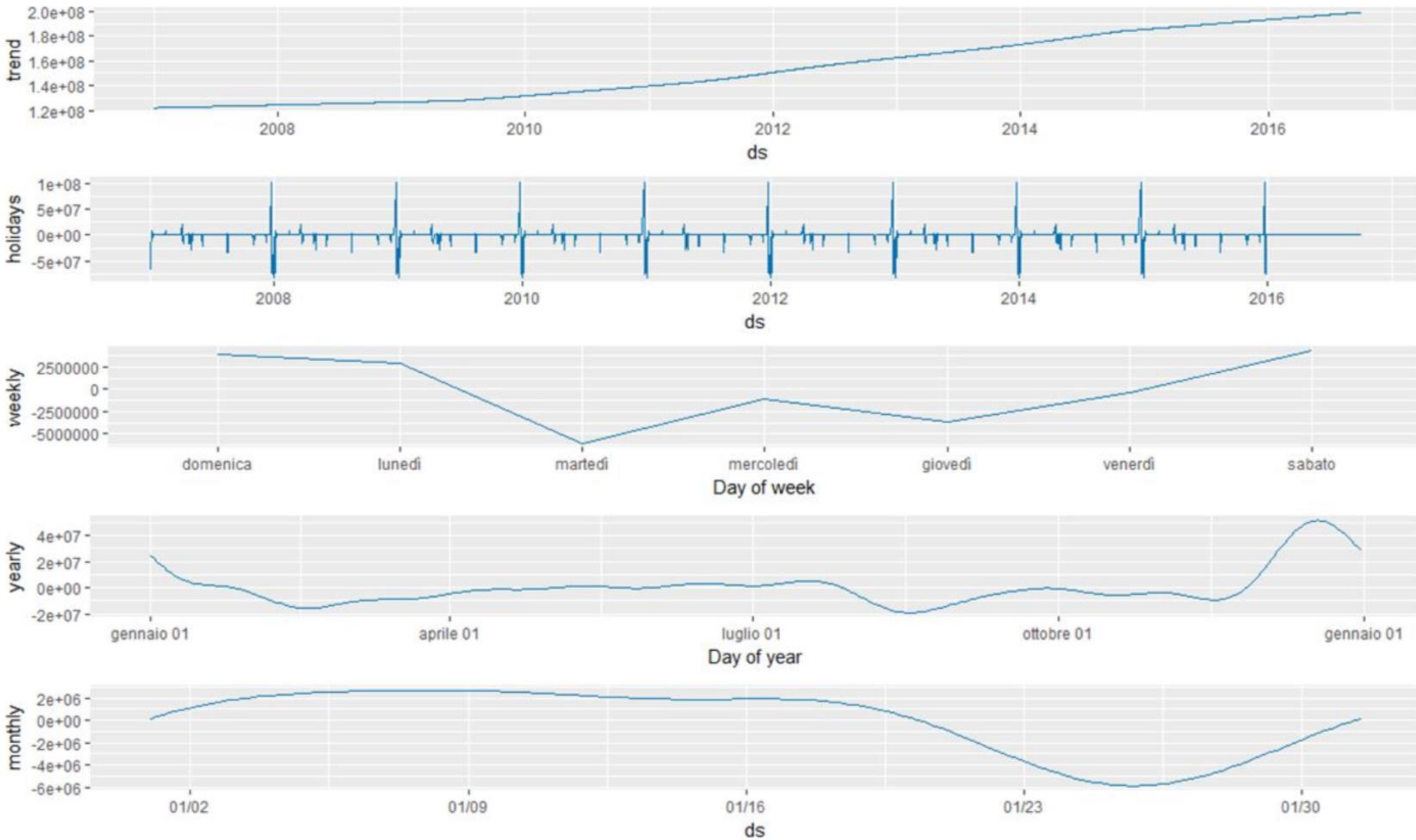
ATM/POS is counter-cyclical



The correlation is about -0.50%

Seasonality of ATM in Prophet

Figure 8: POS daily series fitted with *Prophet*.



EPU Index in Italian

- Computed from **Bloomberg** **(EPU - story counts normalized by the # of all news a la Google Trends)** containing

Keywords:

- (E): «Economia» or «Economico» or «Economica» or «Economici» or «Economiche»
- (P): «Tassa» or «Tasse» or «Politica» or «Regolamento» or «Regolamenti» or «Spesa» or «Spese» or «Deficit» or «Banca Centrale» or «Banca d'Italia» or «Budget» or «Bilancio» or «BCE»
- (U): «Incerto» or «Incerta» or «Incerti» or «Incerte» or «Incertezza»

As in BBD (2016)

- **If E(P)U, policy keywords (P) not included to match Twitter**
- Sort of **Internal EPU**, i.e how Italians perceive EPU

EPU-I Index in English with country Identifier

- Computed from **Bloomberg** **(EPU - story counts normalized by the # of all news a la Google Trends)** containing

Keywords:

- (E): «Economic» or «Economy»
- (P): «Congress» or «Bank of Italy» or «Legislation» or «Regulation» or «Parliament» or «Government» or «Deficit» or «Central Bank» or «Budget» or «ECB»
- (U): «Uncertain» or «Uncertainty»
- **(IT): AND «Ital*»**

As in **BBD (2016)** but adapted to the Italian case

- Kind of **external EPU** (how the rest of the world perceive EPU in Italy)

E(P)U Index in Italian from Twitter

- Computed from **Twitter** **(EPU - Tweet counts standardized by the max)** containing

Keywords:

- (E): «Economia» or «Economico» or «Economica» or «Economici» or «Economiche»
- (U): «Incerto» or «Incerta» or «Incerti» or «Incerte» or «Incertezza»

As in BBD (2016)

- **(P) part excluded for limited number of tweets.** Remember: a tweet has **max 140 characters (around 12/13 words)** including **emoji, tiny urls, #hashtags (**this until Nov. 7, 2017**)**
- **No normalization** because we couldn't get the **total number of tweets (sensible figure** for Twitter**)**

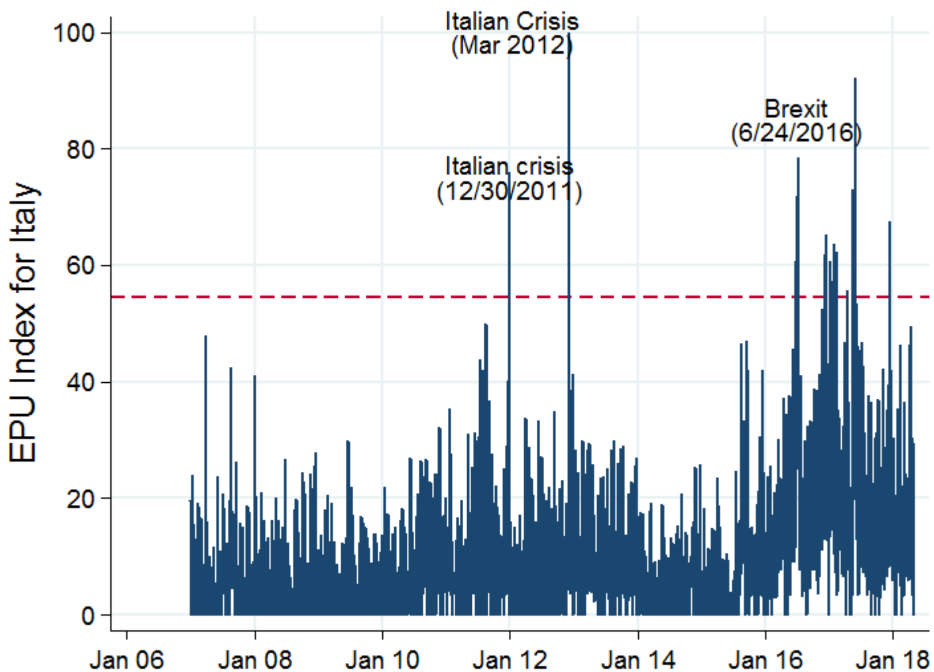
Payment System Data (Cont.)

- **How do people pay?** If Francesco (an Italian guy) buys:
  - Grocery shopping, Restaurants, Gym, Movies, Hair cut, etc.
- Francesco **can pay with the following 4 options**:

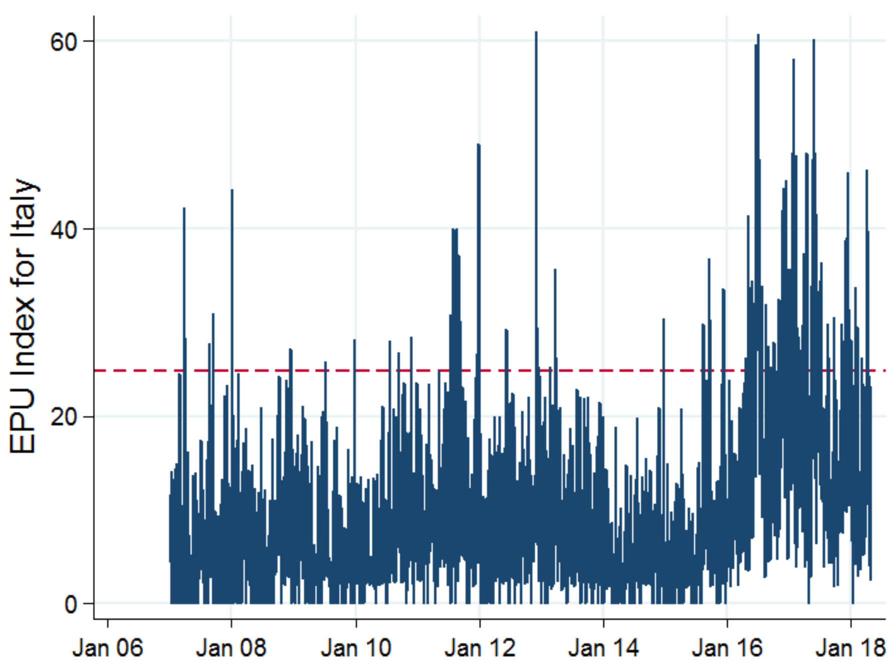
1. Cash (ATM) – "not-on-us" – "on-us"	2. Debit Card – Pagobancomat – Maestro
3. Credit Card	4. Pre-paid debit card

Daily EPU & E(P)U for Italy (Bloomberg, IT)

EPU in Italian



E(P)U in Italian



Notes: indexes computed with Bloomberg. E(P)U contains at least the keywords (E) and (U) (**Italian language**). The dotted red line shows the 99 percentile. **" Domestic" EPU**