

News and Consumer card payments

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FeBAF

Potenzialità informative e sfide metodologiche nell'utilizzo dei
Big Data: il caso dei servizi finanziari

Motivation and Research question

- Policy makers and academics are increasingly interested about the macroeconomic impact of shocks related to:
 - **Uncertainty**, especially due to institutional and global factors;
 - **Cyber-Security** and the safety of the electronic money.
- **This paper** investigates for Italy the **reaction of Italian households to news** about:
 - **Economic Policy Uncertainty** (see Visco 2017);
 - Payment system frauds and **Cyber-risks** (see Draghi 2017).
- We use a unique **daily** data set on **debit card expenditures**, tracking private **consumption**.
- We apply **Big-Data techniques** on **Bloomberg** and **Twitter** to build daily indexes of news.

Literature

Economic policy uncertainty

Baker, Bloom and Davis (2016); Bachmann and Bayer (2013); Bachmann, Elstner and Sims (2013); Bloom, Bond and Van Reenen (2007); Bloom (2009).

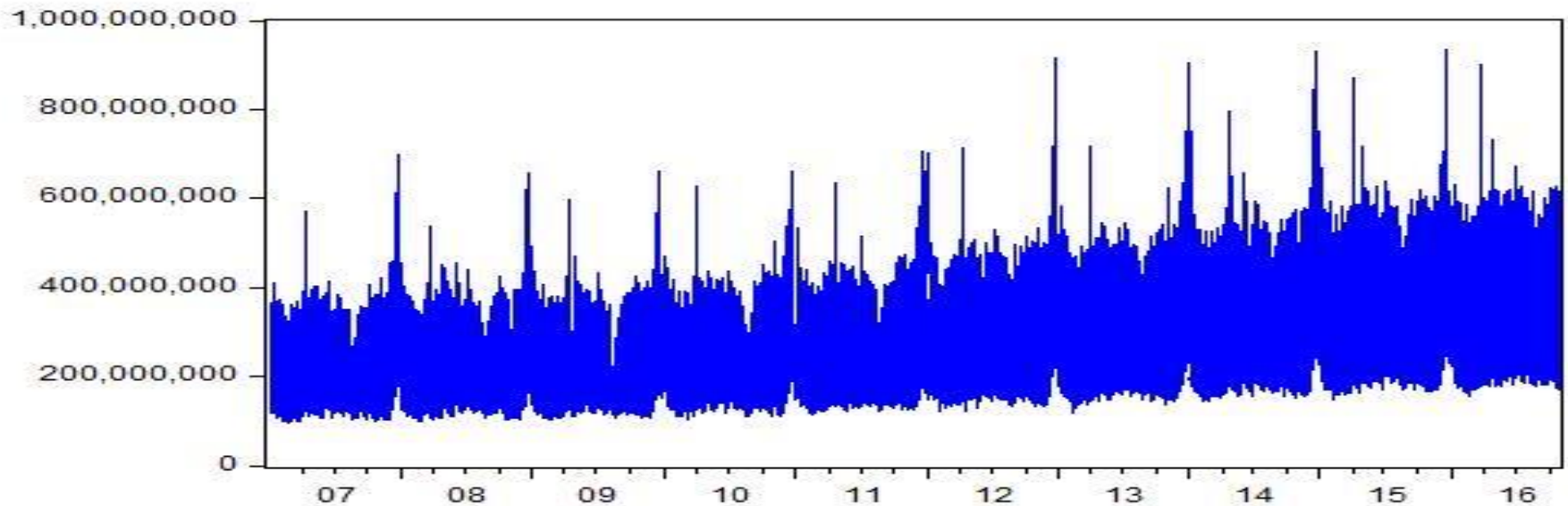
Payment system and Macro applications

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

Credit/Debit card frauds news, Cyber-security

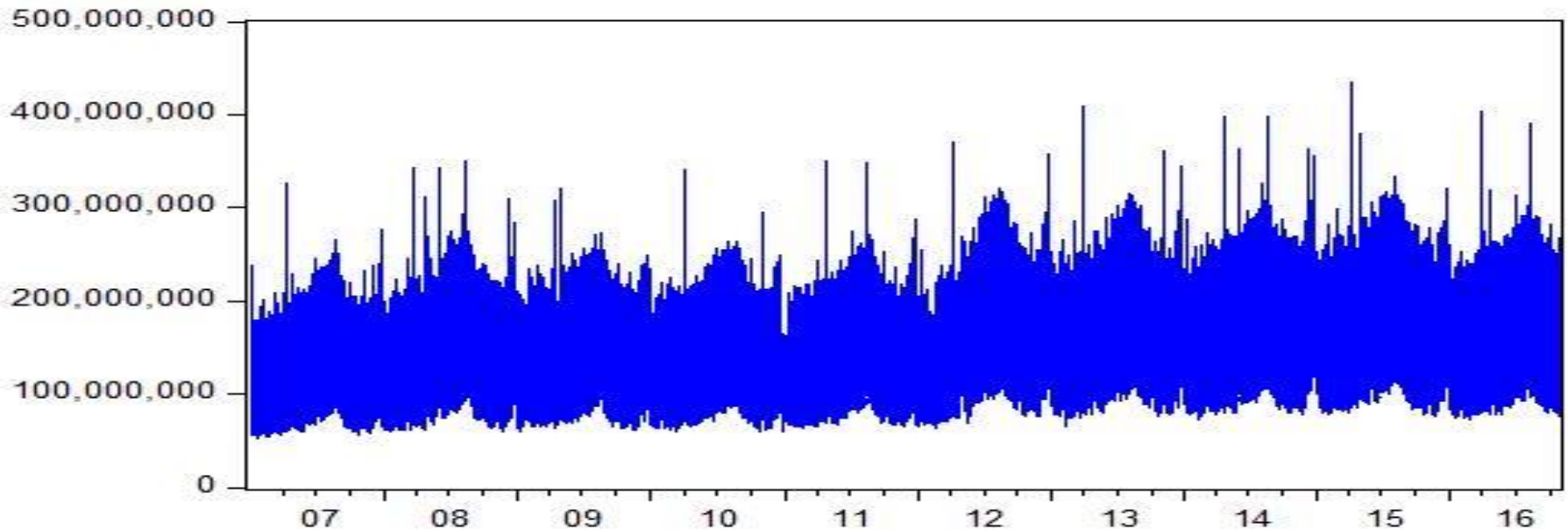
Biancotti (2017); Khan and Linares-Zegarra (2012); Kosse (2013).

Payment System Data: POS



- **Daily POS purchases** extracted from the **Italian payment system BI-comp** (2007-2016); no revisions and observation errors.
- The dynamics is **in line with consumption**, as in Duarte et al. (2017) [C&P](#):
 - 75% of Italian households own a card, according to the SHIW survey;
 - 1.8 Billions transactions in 2016 (approx. 70 Billions of euros).
- **Caveat:** strong **seasonal patterns** and **calendar effects**. [Bplot](#)

Payment System Data: ATM



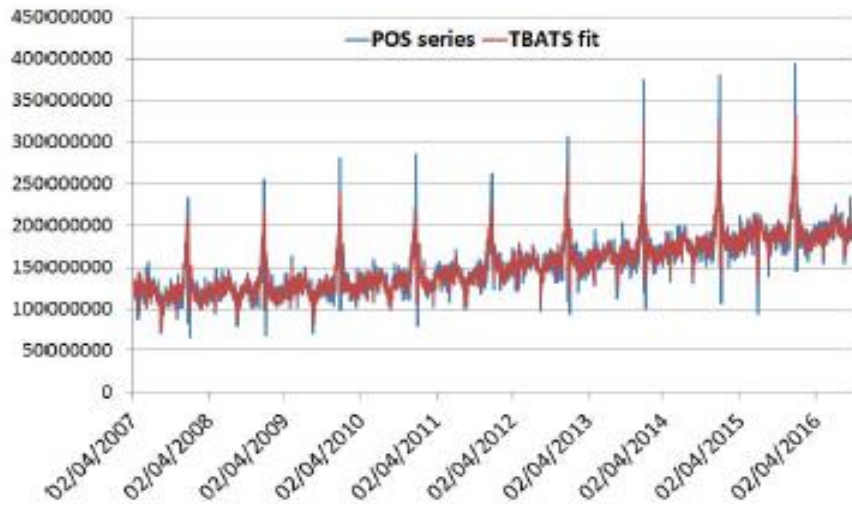
- **ATM** withdrawals extracted **BI-comp**.
- Comparison with POS: similar seasonality; around half of the amounts.
- The **ratio ATM/POS** is considered a proxy for the **preference for cash** (see Ardizzi et al. 2014). [Chart ATM&IP](#)
- **Caveat:** We only refer to the withdrawals charged by a fee, as made by customers of other banks (so called “not on us operations”).

Seasonality of Payment Data (2)

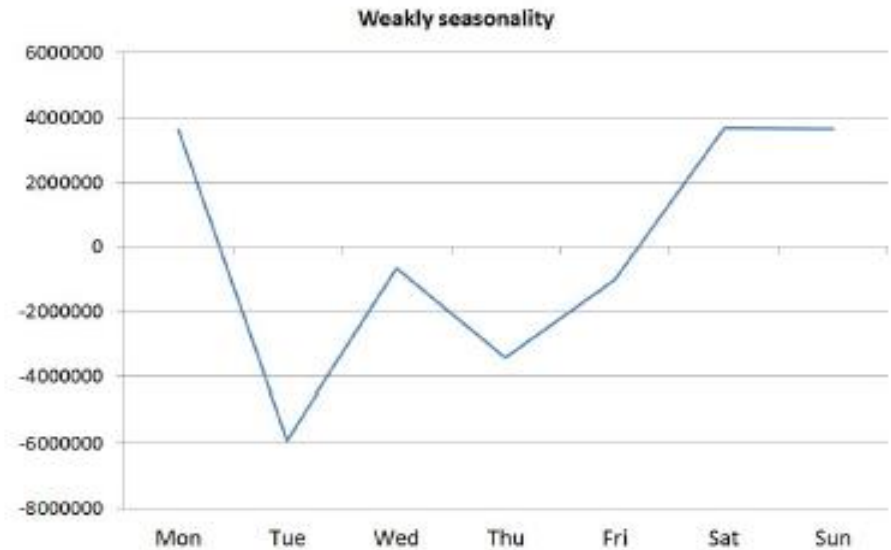
Seasonality is a **salient feature** of our daily data on payments:

- Day-of-the-week;
 - Day-of-the-month;
 - Day-of-the-year;
 - Fixed Holidays (eg. Christmas, June the 1^o , May the 1^o);
 - Moving Holidays (eg. Easter).
-
- **We investigate the seasonal components with two approaches:**
 - **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; [TBcycles](#)
 - **Prophet**, by Taylor and Lethman (2017), is a flexible bayesian model that decomposes the time series with complex seasonal patterns in a) trend, b) seasonal components and c) calendar effects.

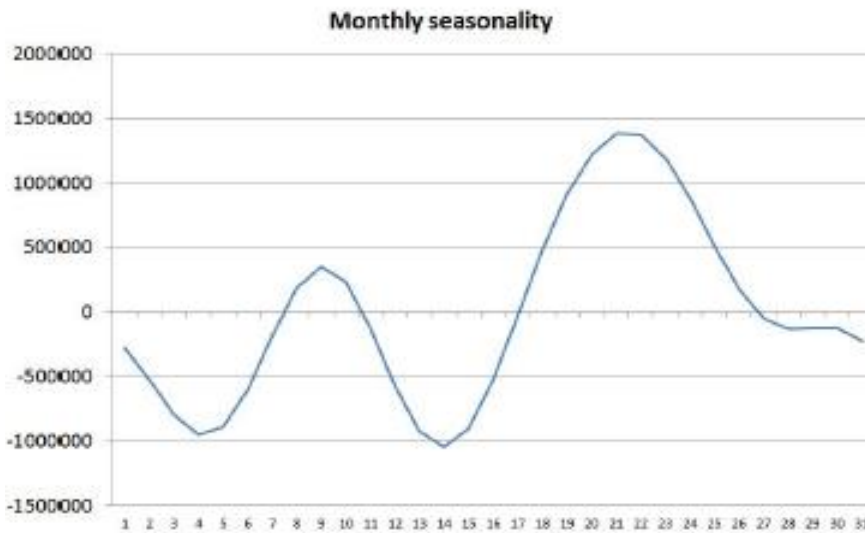
Seasonality of POS in TBATS



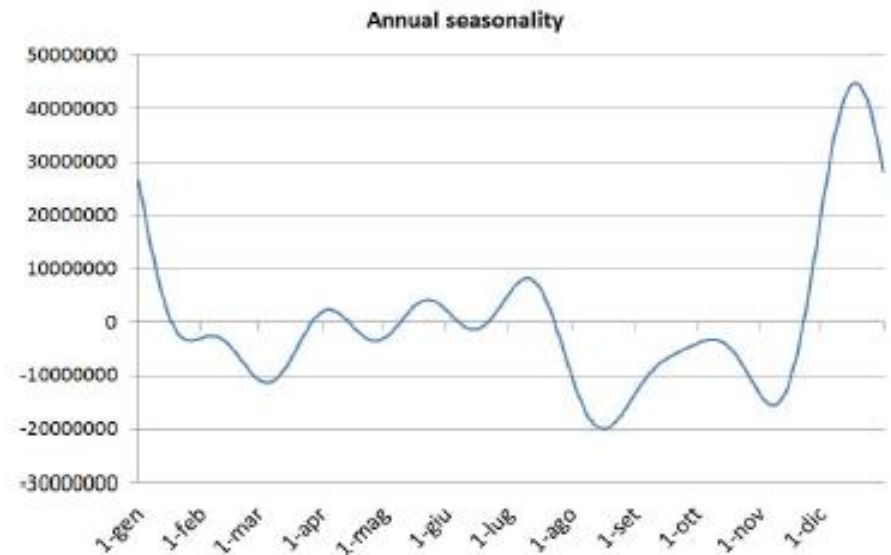
(a) POS daily series fitted with *TBATS*



(b) POS daily series - weekly seasonality



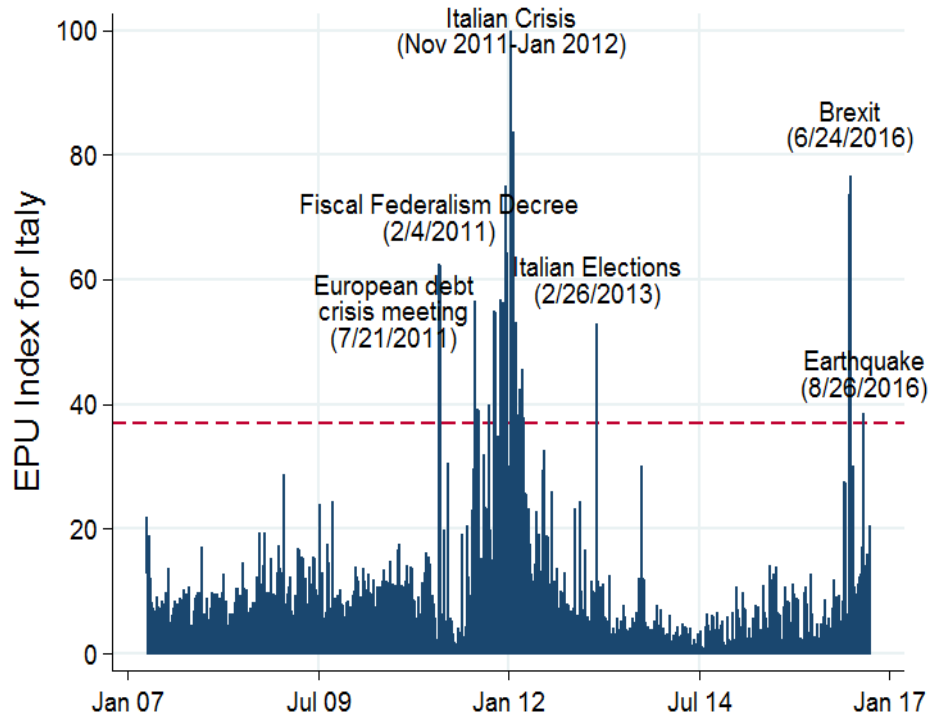
(c) POS daily series - monthly seasonality



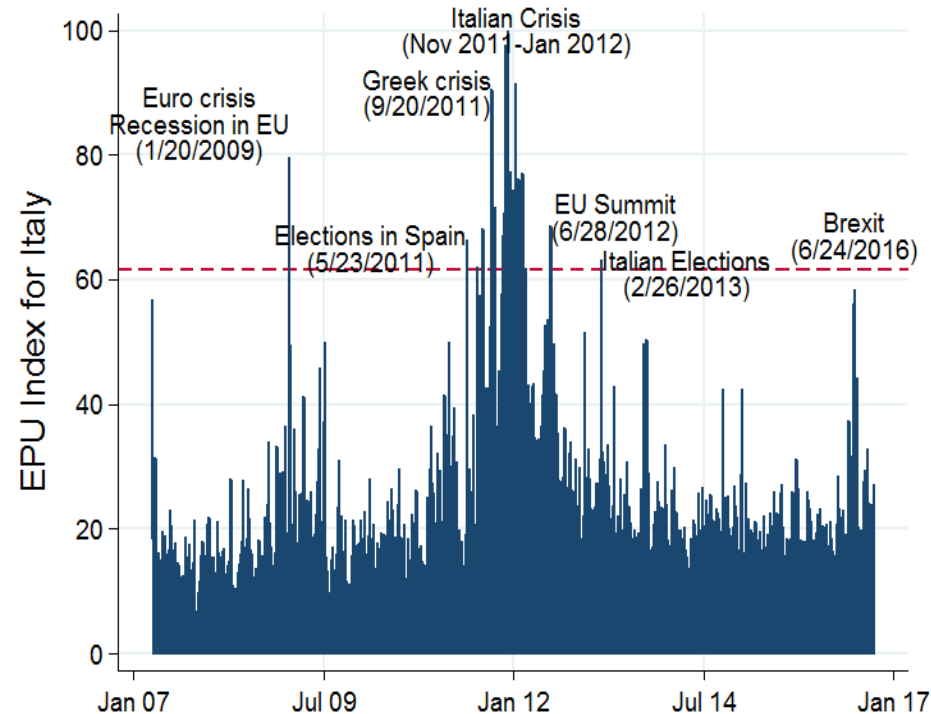
(d) POS daily series - annual seasonality

Daily E(P)U indexes for Italy

EPU Italy

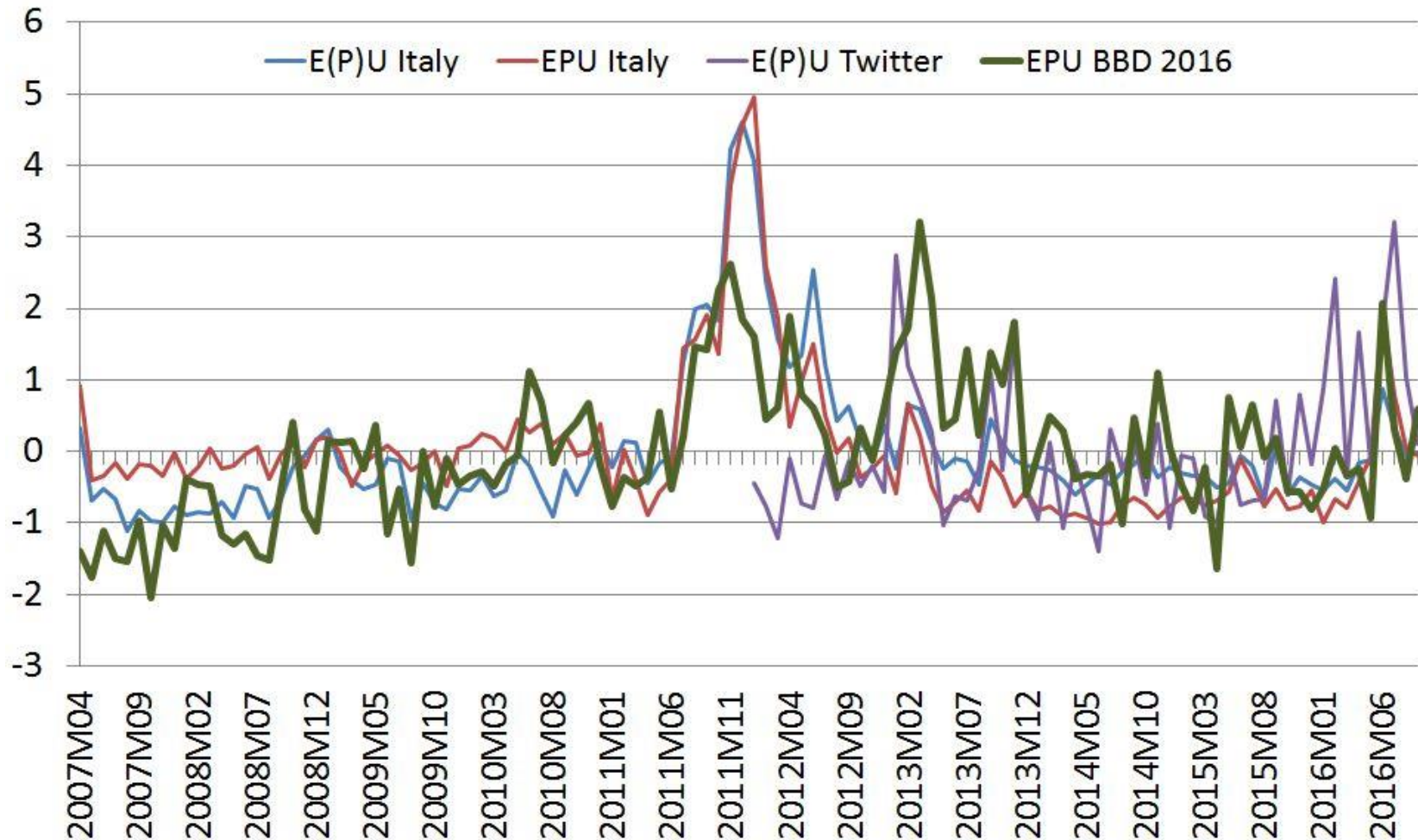


E(P)U Italy



Notes: indexes computed with Bloomberg. E(P)U contains at least the keywords (E) and (U). The dotted red line shows the 99 percentile. [Keywords](#)

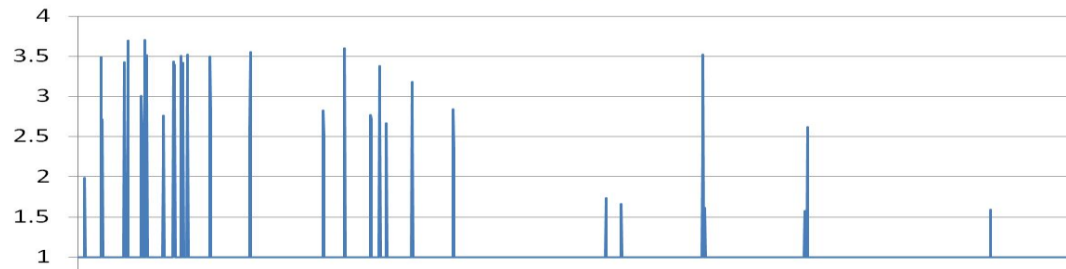
Monthly EPU indexes



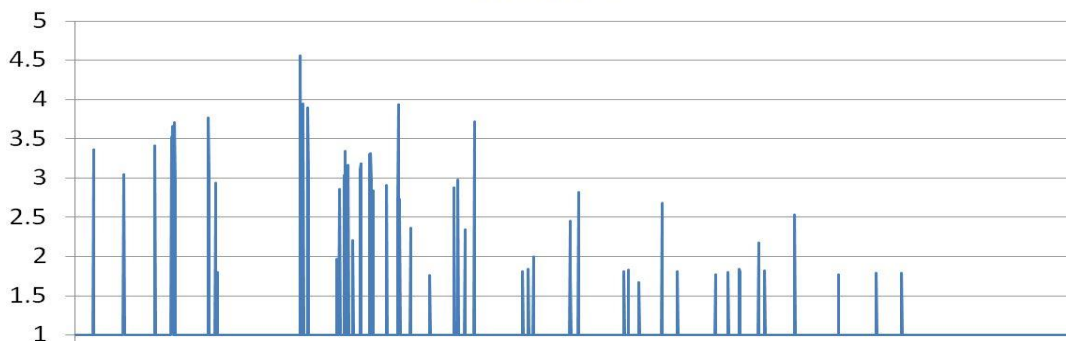
Our indexes are consistent with the series of Baker et al. (2016); The Twitter based index excludes the P keywords.

News on Card Frauds/Cybersecurity

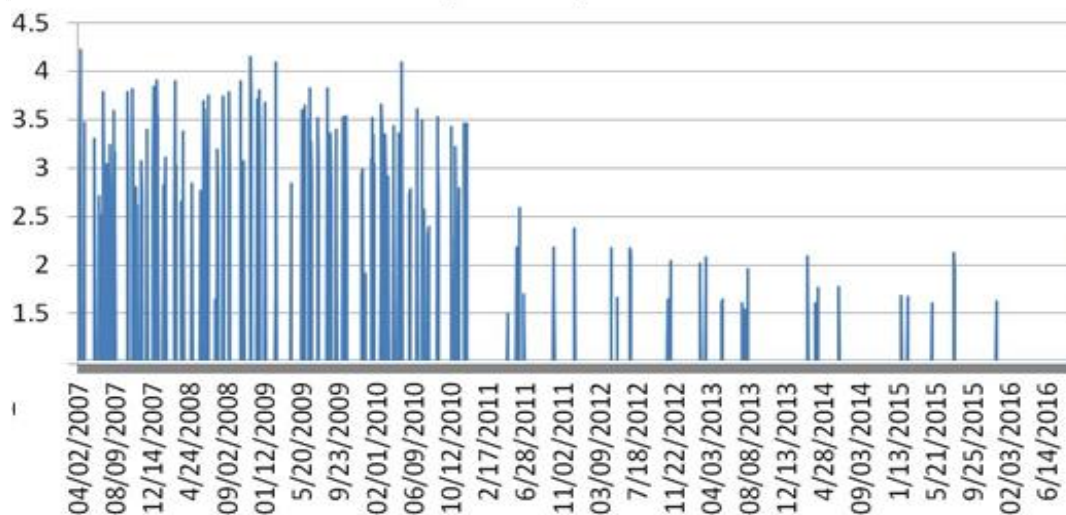
POS frauds



ATM frauds



Cybersecurity frauds



- **Index focused on POS.**
Keywords: `FRAUD' AND `PAYMENT' AND `POS' AND `ITAL*'

- **Index focused on ATM.**
Keywords: `FRAUD' AND `ATM' AND `ITAL*'

- **Index focused on Cybersecurity.**
Keywords: `CYBER*' AND `FRAUD' AND `PAYMENT' AND `ITAL*'

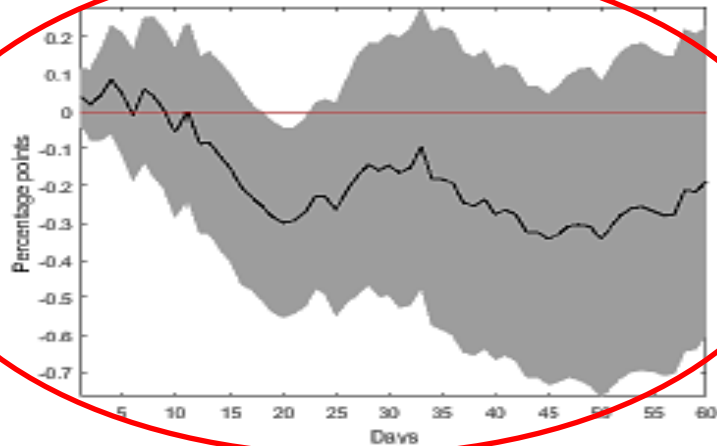
Econometric framework

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

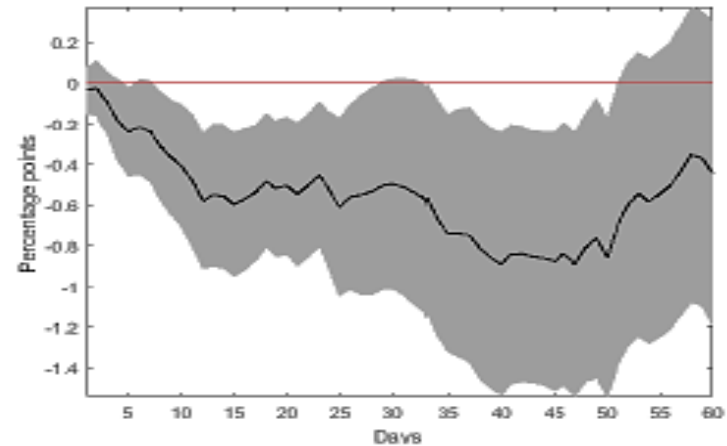
$$y_{t+h} - y_t = \alpha_h \text{Index}_t^v + \sum_{i=0}^I \beta_i y_{t-i} + \sum_{j=1}^J \gamma_j \text{Index}_{t-j} + \dots$$
$$\dots + \text{det}_t + \varepsilon_t, \quad h = 1, \dots, H, \quad v = \{EPU, \text{Frauds}\}.$$

- 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 more **robust** than VAR to **misspecification**, the more for large horizons of the IRFs => given the lack of macroeconomic daily observables.

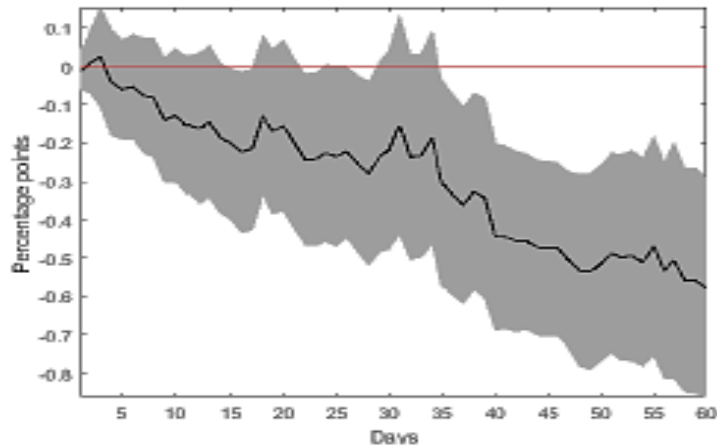
POS and EPU: whole sample



(a) Impulse of payments to a shock in uncertainty (EPU with words in English).



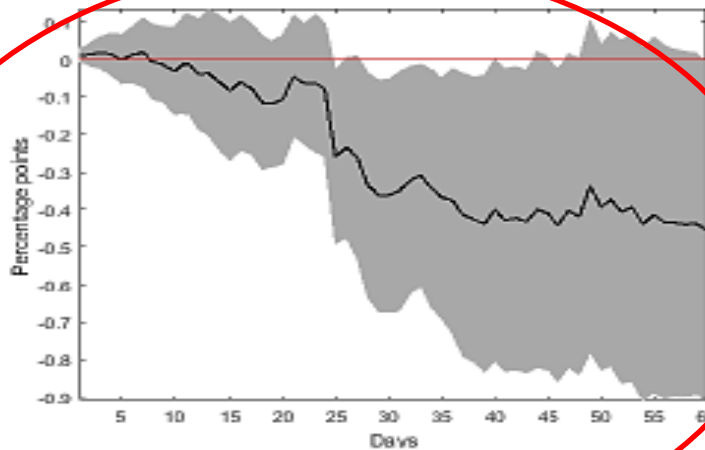
(b) Impulse of payments to a shock in uncertainty (EU with words in English).



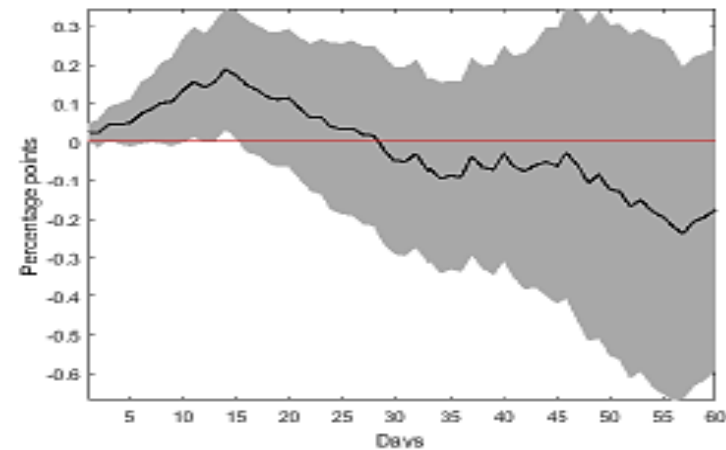
(c) Impulse of payments to a shock in uncertainty (Twitter). Sample January 2012- September 2016.

- EPU generates a **non negligible reduction in purchases**.
- The effects **tend to vanish after 1-2 months** (except for the Twitter measure).
- Baker et al. (2016) find a contraction on production and employment.

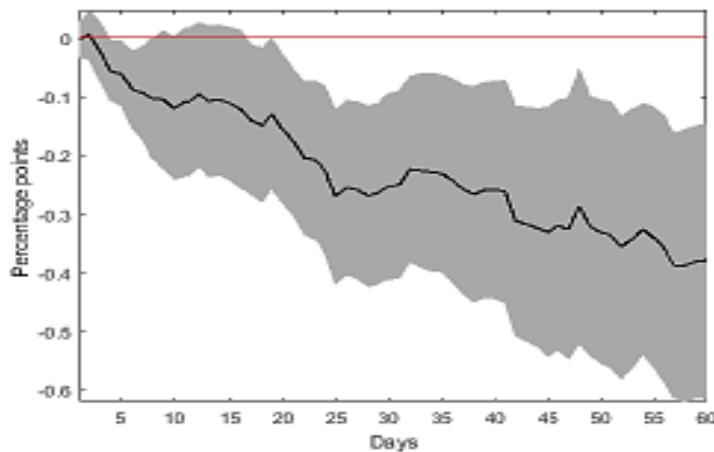
POS and news about frauds/cyber-risks



(a) POS response to increase in POS fraud index.



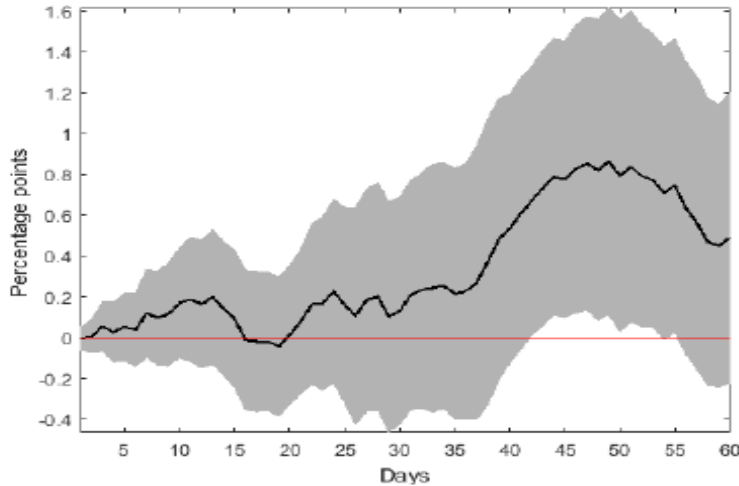
(b) POS response to a temporary increase in the ATM fraud index.



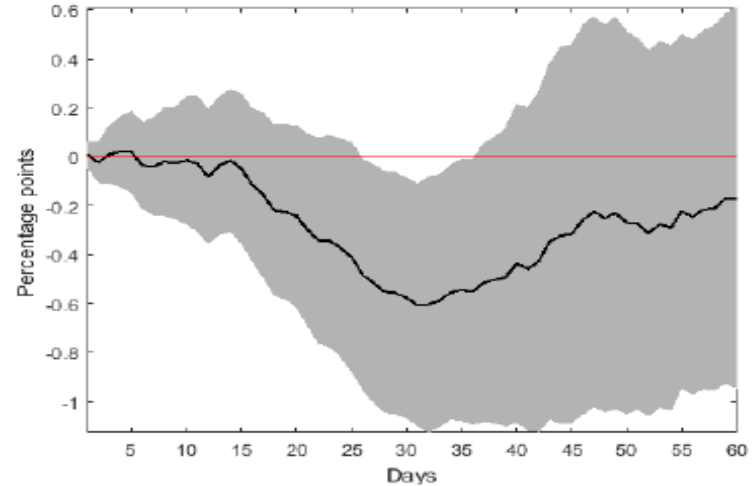
(c) POS response to a temporary increase in the Cyber-security fraud index.

- An increase of the news about frauds related to POS or Cyber-attacks has a persistent impact on expenditures.
- Kosse (2013) finds similar effects, on the number of transactions for Netherland.

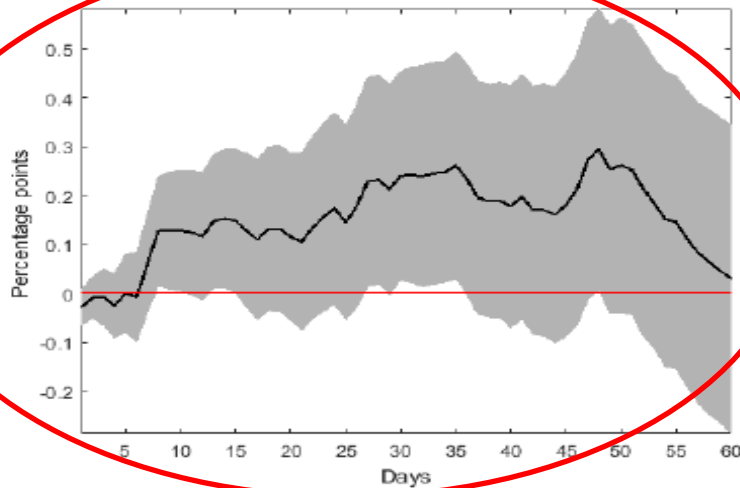
Preference for cash and cyber-risks



(a) ATM/POS ratio response to increase in POS fraud index.



(b) ATM/POS ratio response to a temporary increase in the ATM fraud index.



(c) ATM/POS ratio response to a temporary increase in the Cybersecurity fraud index.

- **News about frauds and cybersecurity increase the ratio ATM/POS.**
- This is consistent with the finding (see Alvarez and Lippi, ECA, 2009) that consumers increase the cash withdrawals when the probability of theft increases.

Conclusion: main results

- The series of **payments with cards** are correlated with quarterly consumption; at daily frequency have strongly **seasonal components**.
- Our indexes on **news on EPU** are consistent with those of Baker, Bloom and Davis (2016).
- **EPU shocks** have **temporary but not negligible contractionary effects on purchases**, mainly during the crisis => **“Protracted (political) instability may undermine confidence”**.
- The fears about **the security of the payments** have a **clear negative impact both on POS and ATM** => **the safety of the payment system is key to sustain the use of debit cards**.
- The **preference for cash increases following cyber-attacks** => **In the age of cryptocurrencies cash remains the safe haven**.

Thanks!

... a box in the Annual Report...

INCERTEZZA SULLE POLITICHE ECONOMICHE E CONSUMI DELLE FAMIGLIE

La disponibilità di grandi volumi di informazioni basate sulle tecnologie digitali, poco strutturate ma osservabili tempestivamente (i cosiddetti big data), sta accrescendo notevolmente le opportunità di analisi, monitoraggio e previsione dei fenomeni economici e finanziari. Le banche centrali si stanno avvalendo in misura crescente di strumenti finalizzati a consentire l'utilizzo di queste informazioni, per realizzare indicatori innovativi dell'attività economica a supporto delle decisioni di politica economica¹.

Queste nuove fonti informative possono agevolare l'indagine di fenomeni difficilmente osservabili e quantificabili, quali la percezione dei rischi da parte degli operatori. Uno di questi rischi riguarda l'incertezza sulle politiche economiche; per misurarla S.R. Baker, N. Bloom e S.J. Davis² hanno proposto nel 2016 un indicatore (*economic policy uncertainty index, EPU index*) basato sulla frequenza con cui i giornali riportano alcune parole chiave, come ad esempio “tasse”, “spesa”, “incertezza”, “economia”, “bilancio”, “banca centrale”.

Uno studio per l'Italia, condotto con tecniche big data, costruisce un *EPU index* secondo la metodologia suggerita dai tre autori utilizzando oltre agli articoli dei giornali, altre fonti informative quali i siti internet di notizie e i messaggi sul social media Twitter (in Bloomberg)³. Lo studio produce un indice di incertezza, basato sulle stesse parole chiave utilizzate da Baker, Bloom e Davis, e analizza l'impatto di tale incertezza sulla spesa effettuata con carte di debito (tramite POS)⁴. Queste ultime costituiscono lo

... a presentation at the ECB...



EUROPEAN CENTRAL BANK

EUROSYSTEM

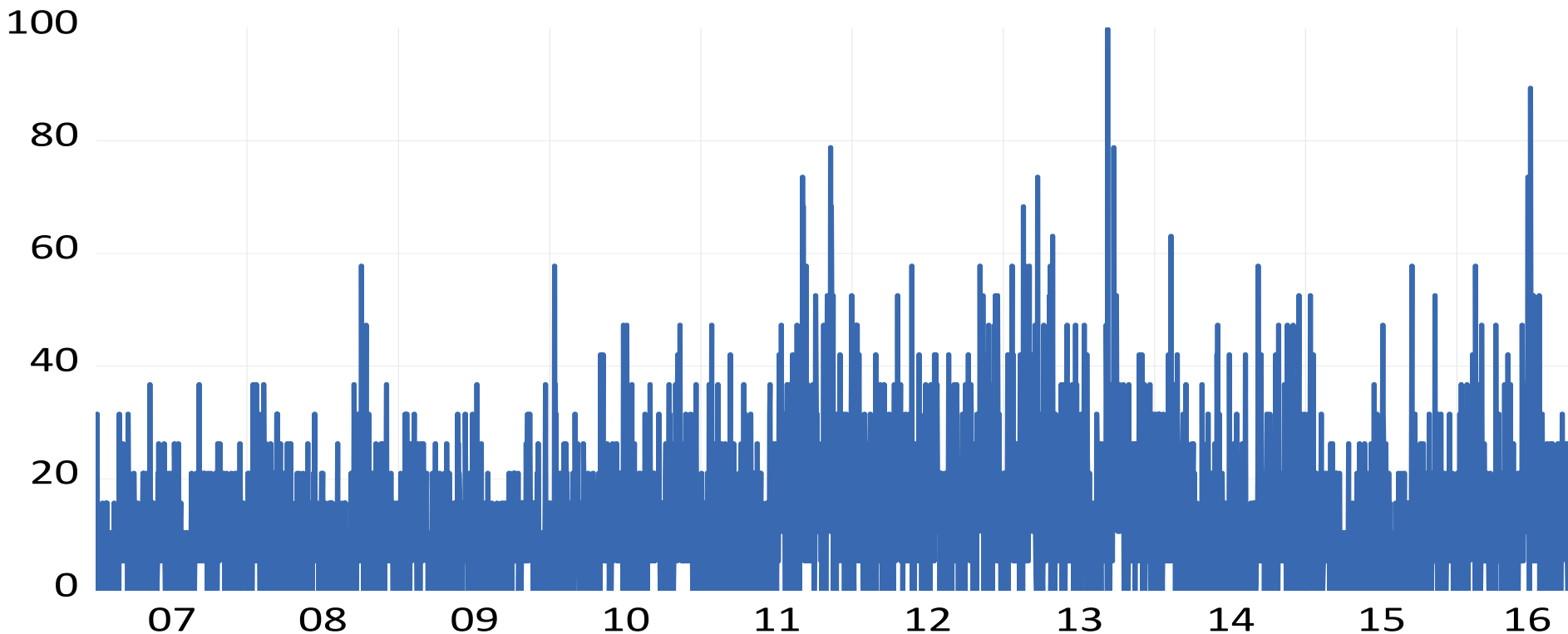
ECB-PUBLIC

European Central Bank workshop on
Household Heterogeneity and Macroeconomics

Tuesday, 22 May 2018 - ECB Main Building, C2.05
and Wednesday, 23 May 2018 - ECB Main Building, C3.10
Frankfurt am Main

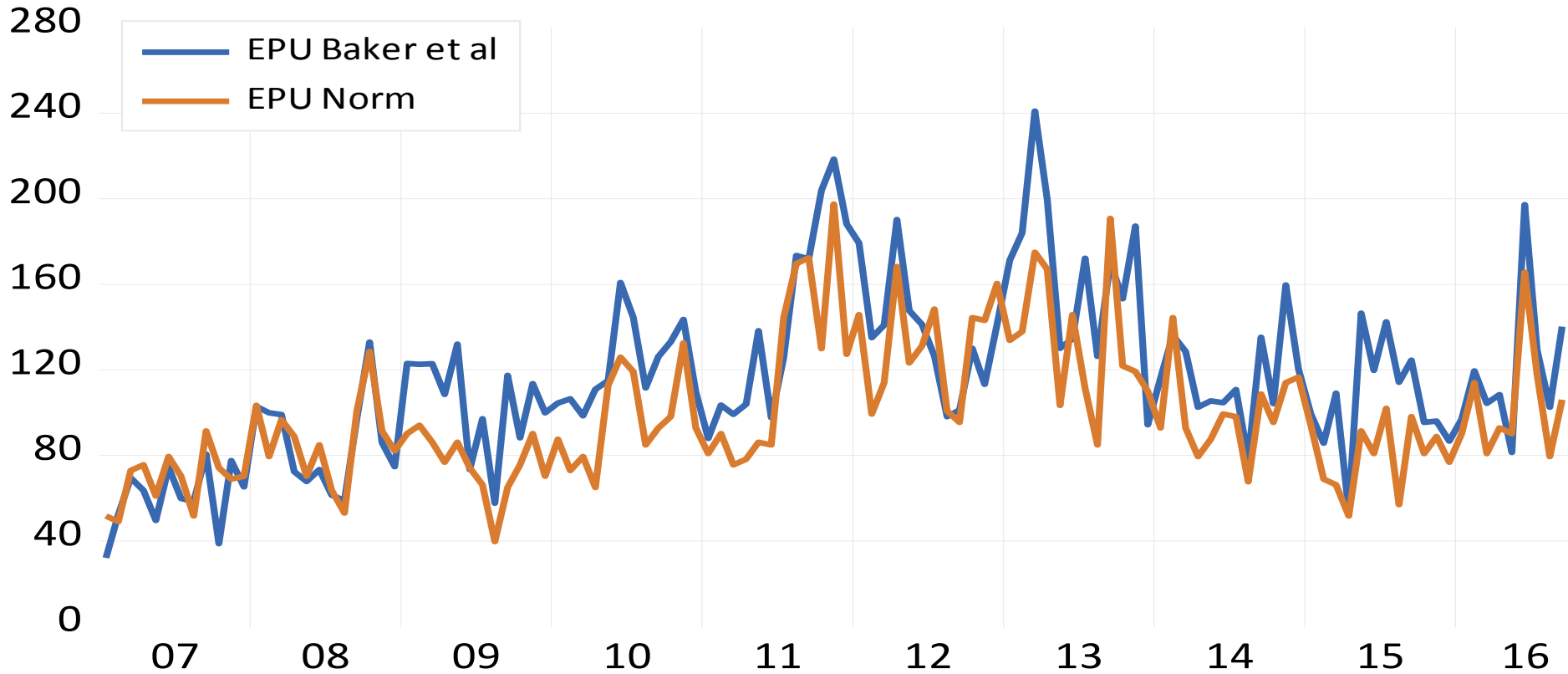
...new EPU indexes, with Factiva (daily)...

EPU Daily Std



- (economi*) AND (incert*) AND (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) on Repubblica and Corriere
- EPU Norm: Index: 100=Average of EPU counts over the sample Jan. 1, 2007 to May 31, 2018

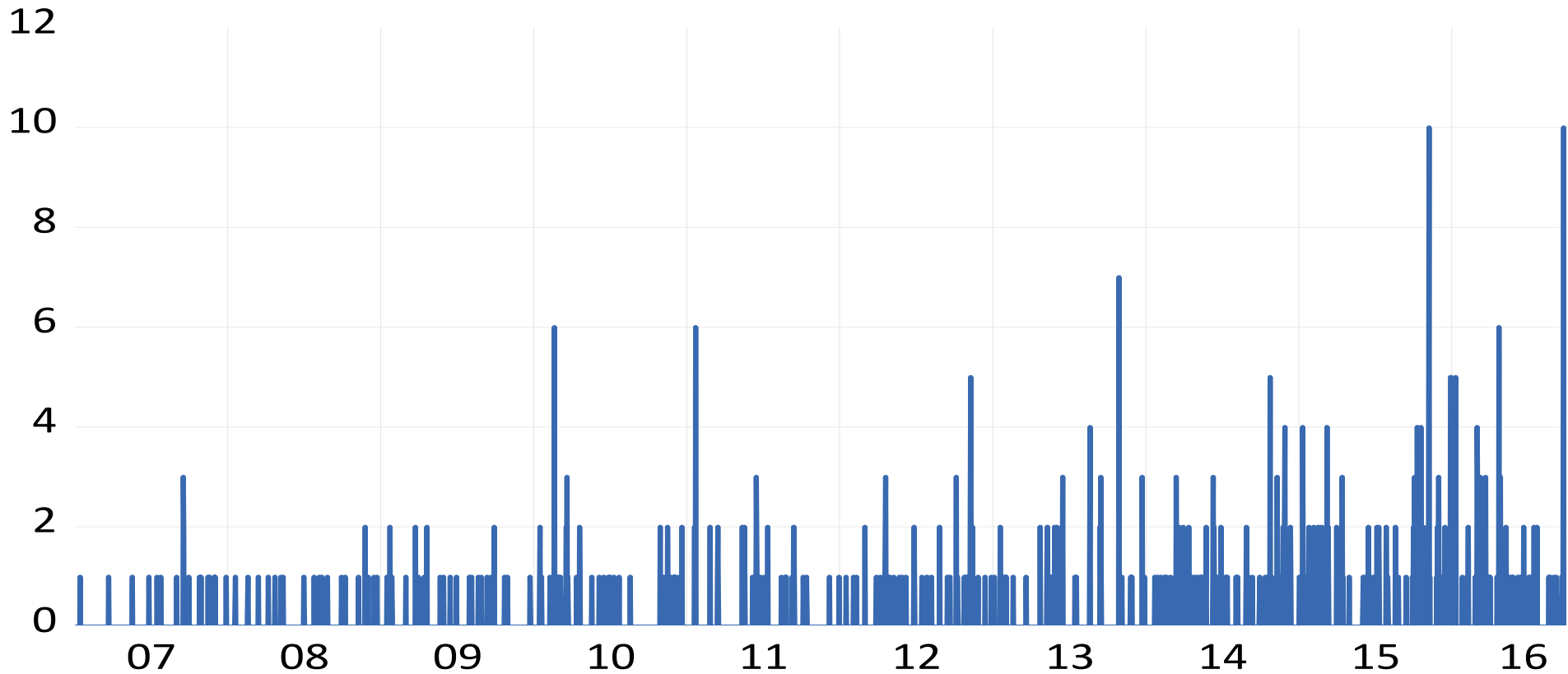
...new EPU indexes, with Factiva (monthly)...



- **(economi*) AND (incert*) AND (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) on Repubblica and Corriere**
- **EPU Norm: Index: 100=Average of EPU counts over the sample Jan. 1, 2007 to May 31, 2018**
- **Correlation: 82%**

...new POS Fraud indexes, with Factiva...

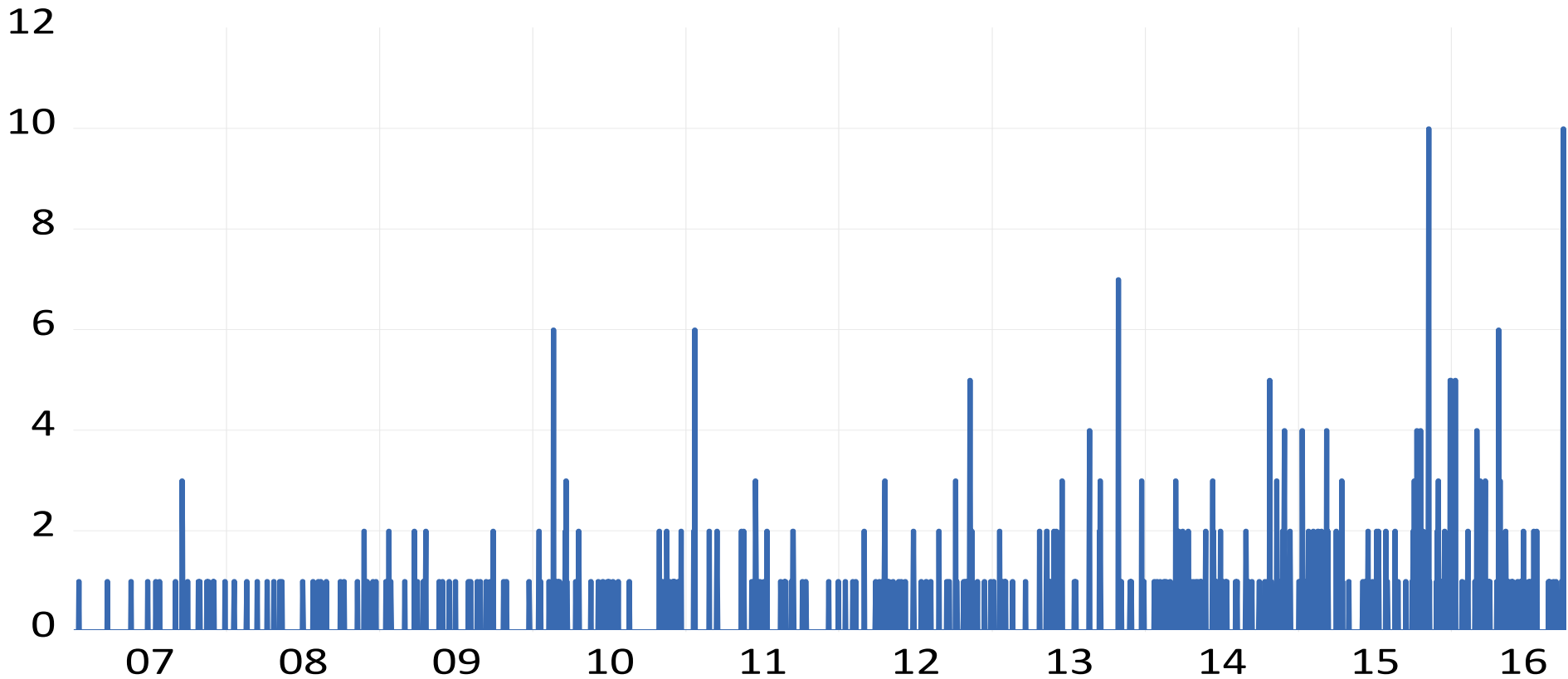
pos_fraud_index



- **(POS) AND (FROD\$1 OR FRAUD\$ OR CRIMIN\$ OR CLON\$ OR TRUFF\$) not atm not preliev\$ on CorSera, Repubblica, Messaggero, Mattino, La Stampa, Il Sole 24 Ore**
- **Just Counts; sample Jan. 1, 2007 to September 30, 2016**

...new cybersecurity indexes, with Factiva...

cyber_fraud_index



- **Cyber\$ and (POS or pagobancomat OR BANCOMAT OR CART\$1 W/2 DEBITO OR CART\$1 W/2 CREDITO) AND (FROD\$1 OR FRAUD\$ OR CRIMIN\$ OR CLON\$ OR TRUFF\$) on All Sources**
- **Just Counts; sample Jan. 1, 2007 to September 30, 2016**

...example of articles...

Carte clonate, due denunce in poche ore: acquisti a rischio

Il Messaggero , 18 April 2018, 274 words, (Italian)

segue dalla prima Secondo gli esperti di Sosconsumatori, infatti, «per quanto riguarda gli acquisti effettuati in modo tradizionale, il primo consiglio è quello di non perdere mai di vista la propria carta quando si paga. Sembra un consiglio...

Extension mai spedite e carta clonata al prete

Corriere Adriatico , 30 May 2018, 462 words, (Italian)

LA TRUFFA NOVAFELTRIA Era diventata super extension anche il tempo di consegna. Troppi giorni in attesa che quelle tre confezioni per allungare i capelli arrivassero e così, dopo aver pagato 165 euro tramite bonifico su carta Postepay, ha ...

Grandi affari per gli hacker con i pagamenti dei regali

Il Messaggero , 10 December 2017, 432 words, (Italian)

L'ATTACCO La corsa ai regali di Natale che tanto può stressare i consumatori entusiasma non una ma almeno due categorie di persone: i commercianti e gli hacker.



...example of articles

La banda delle carte clonate nei ristoranti di Roma; Inchiesta sui camerieri truffatori: strisciavano due volte la tessera, copiando i...

Corriere della Sera, 16 July 2017, 511 words, (Italian)

ROMA I camerieri infedeli - sette, dipendenti di quattro ristoranti centralissimi di Roma - si sceglievano facoltosi turisti stranieri, principalmente sudamericani e asiatici. E, poi, come da copione, servivano la truffa al momento del ...

Carte clonate, un pescarese nella banda

Il Messaggero, 6 March 2018, 438 words, (Italian)

L'INCHIESTA C'è anche un pescarese fra gli arrestati dalla Guardia di finanza nell'ambito dell'operazione Red card che a livello nazionale ha sgominato un'organizzazione criminale dedita all'utilizzo di carte di credito clonate. Sette in ...

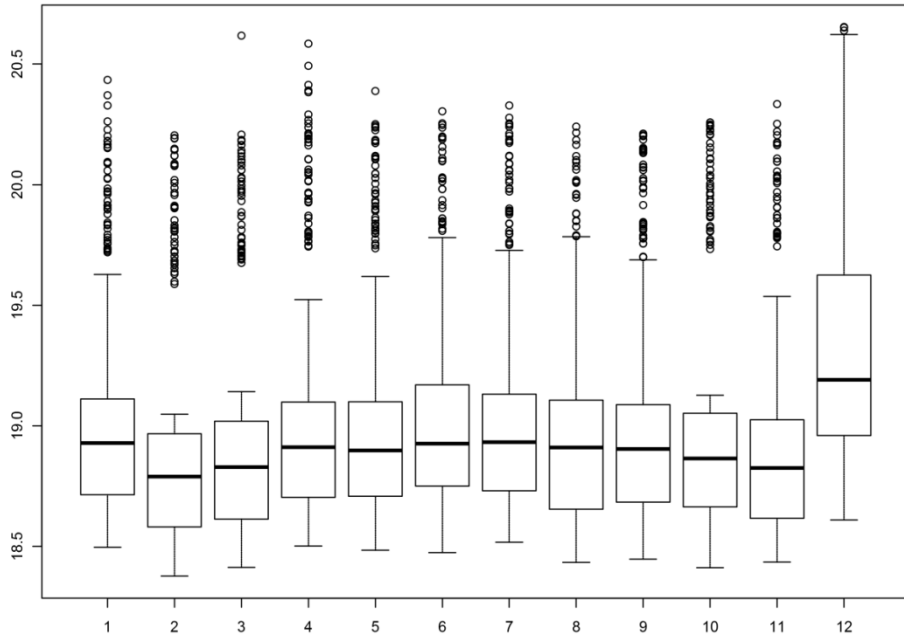
Cyberattacchi, Italia bersaglio eccellente. A rischio computer e Pos

Corrierecomunicazioni.it, 30 May 2018, 295 words, (Italian)

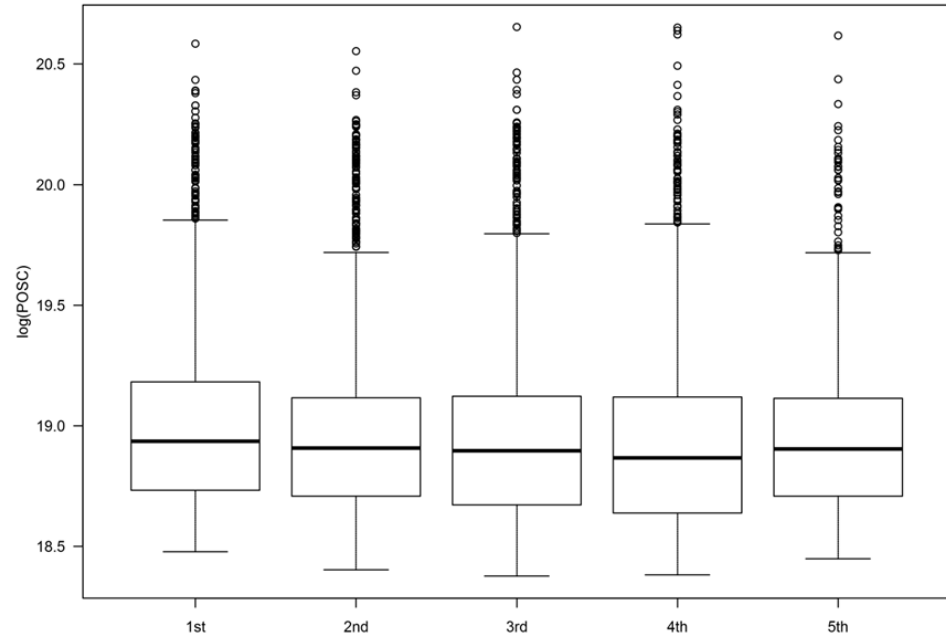
Il nostro Paese tra i più colpiti dalle infezioni che attaccano i dispositivi di pagamento e quarto al mondo per numero di macro malware (file Word e Excel). Trend Micro: "Nel mondo i tentativi di attacco sono aumentati del 24% in un mese"

Seasonality of Payment Data (1)

log(POSC) by month of year

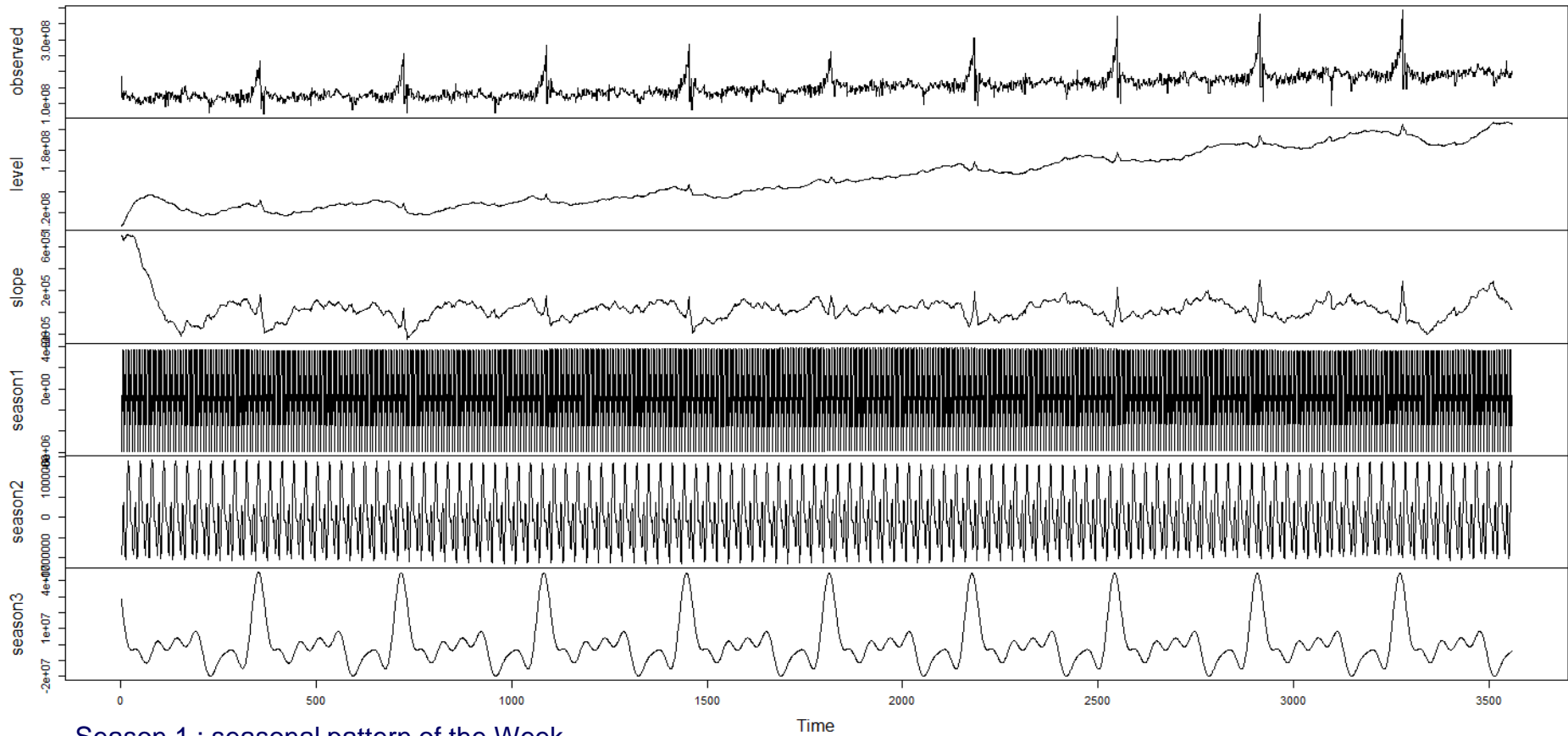


log(POSC) by week of the month



Seasonality of Payments in TBATS (1)

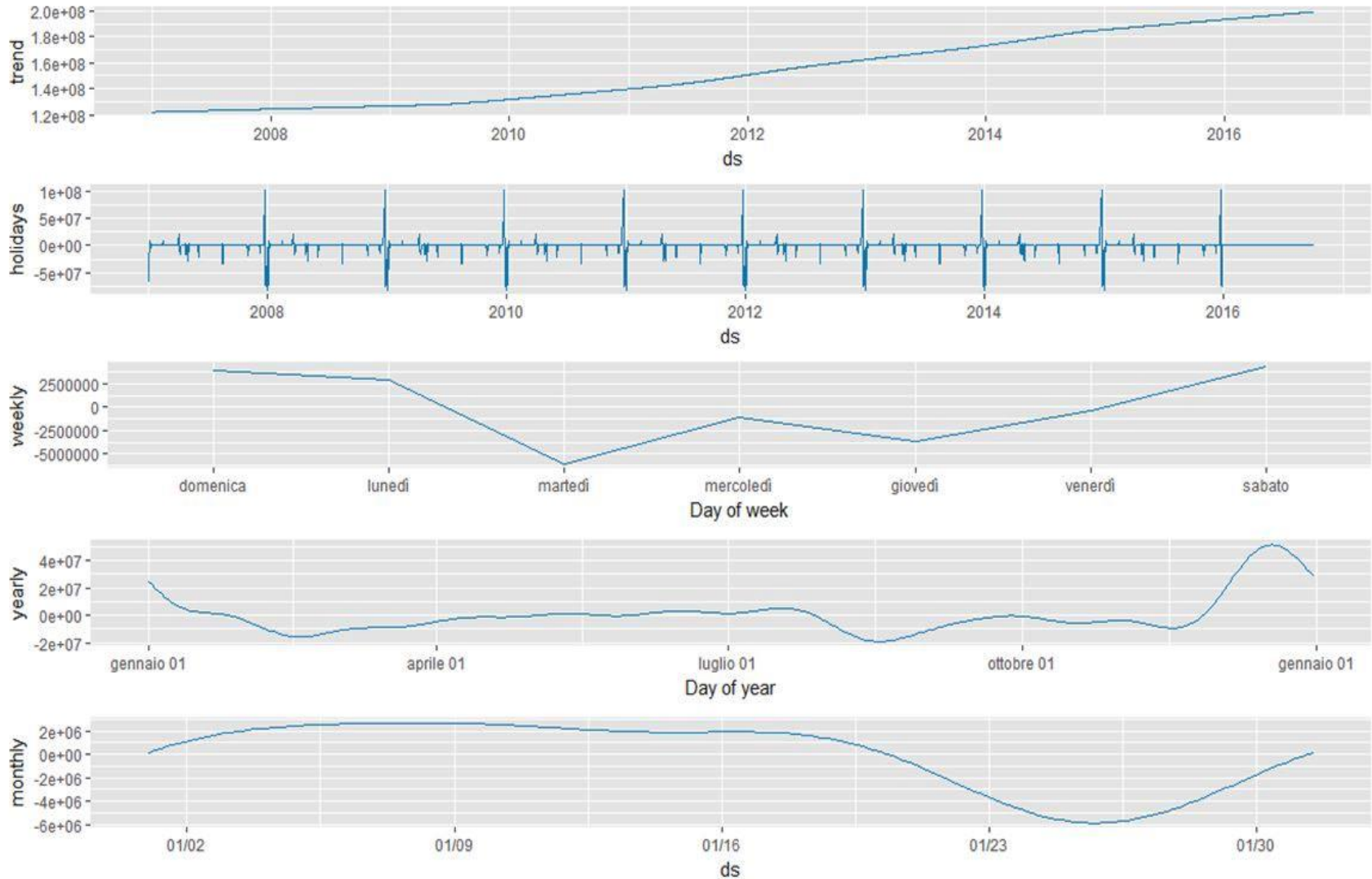
Decomposition by TBATS model



Season 1 : seasonal pattern of the Week
Season 2 : seasonal pattern of the Month
Season 3 : seasonal pattern of the Year



Seasonality of POS in Prophet



E(P)U 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»
- (U): «Incerto» or «Incerta» or «Incerti» or «Incerte» or «Incertezza»

As in Baker, Bloom and Davis (2016)

- If E(P)U, policy keywords not included to match Twitter



E(P)U 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»
- (U): «Uncertain» or «Uncertainty»
- (IT): AND «Ital*»

As in **Baker, Bloom and Davis (2016)** but adapted to Italian case



E(P)U Index in Italian from Twitter

- Computed from Twitter (EPU - Tweet counts normalized by the max à la Google Trends) containing

Keywords:

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

As in **Baker, Bloom and Davis (2016)**

- (P) part excluded for limited number of tweets. Remember: a tweet has max 140 characters (around 12/13 words)



Card Fraud/Cyber-security Index in Italian and English with country identifier

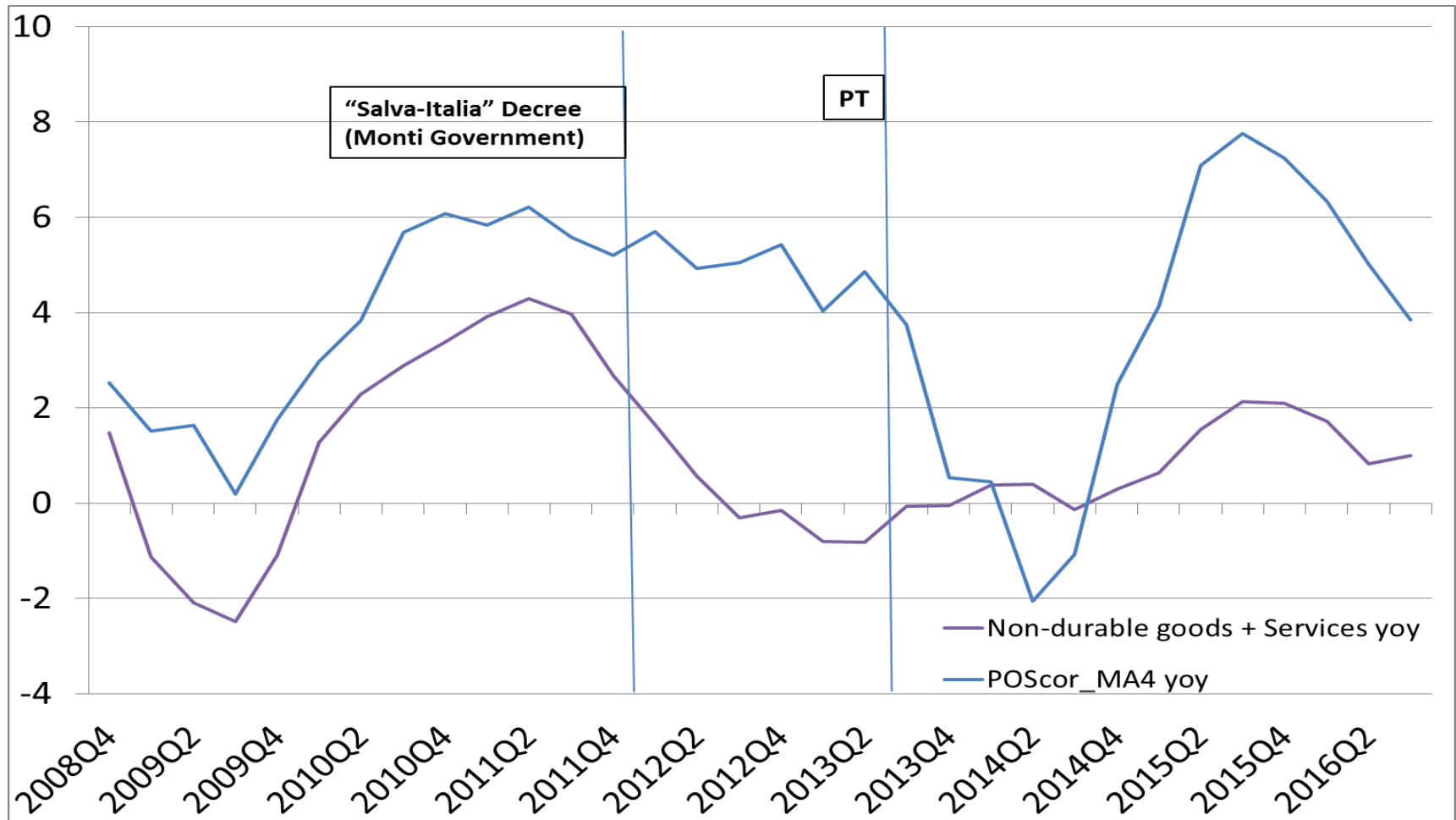
- Computed from Bloomberg (story counts normalized by the # of all news a la Google Trends) containing

Keywords:

1. ("debit card" OR "skimming fraud" OR "credit card" OR "skimming fraud" OR "ATM fraud" OR "debit card fraud") AND ITAL*
2. ("skimming fraud" OR "credit card fraud" OR "ATM fraud" OR "debit card fraud") AND ITAL*
3. (("PIN code" OR "debit card" OR "credit card" OR "magnetic stripe") AND ("crime" OR "copy" OR "victim" OR "hacking" OR "violation")) AND ITAL*
4. ("Bancomat" OR "carta di credito" OR "carta di debito" OR "POS" OR "ATM" OR "codice PIN" OR "striscia magnetica") AND ("frode" OR "frodi" OR "crimine" OR "crimini" OR "clonata" OR "clonate" OR "vittima" OR "truffa" OR "copia" OR "duplica*")
5. "FRAUD" AND "PAYMENT" AND "ITAL*"
6. "FRAUD" AND "CARD" AND "ITAL*"
7. ("BANCOMAT" OR "CARTA") AND ("FROD*" OR "FRAUD*" OR "CRIMIN*" OR "CLON*" OR "TRUFF*")



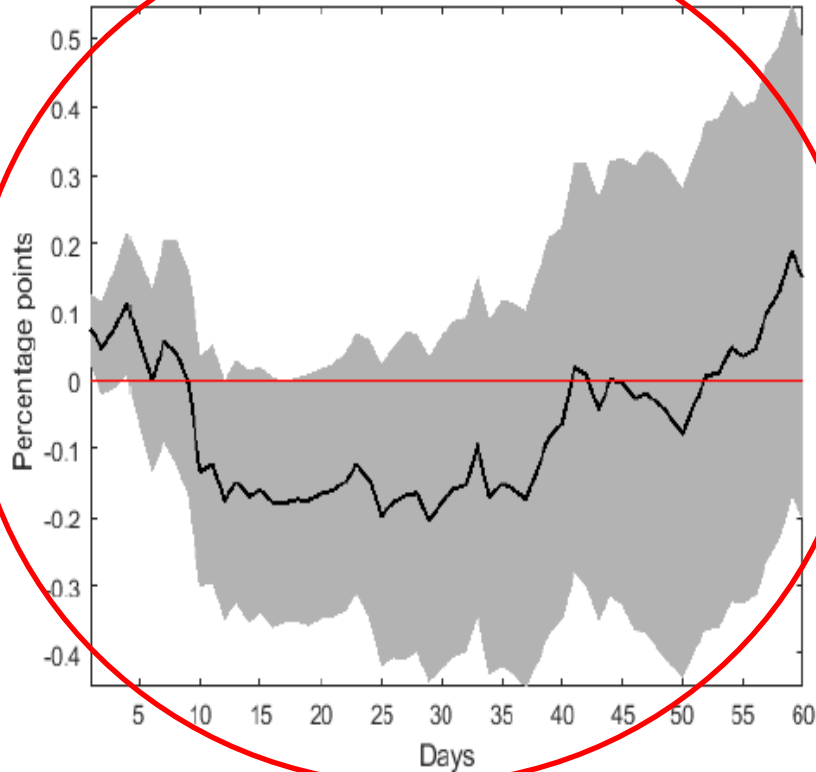
POS and Consumption



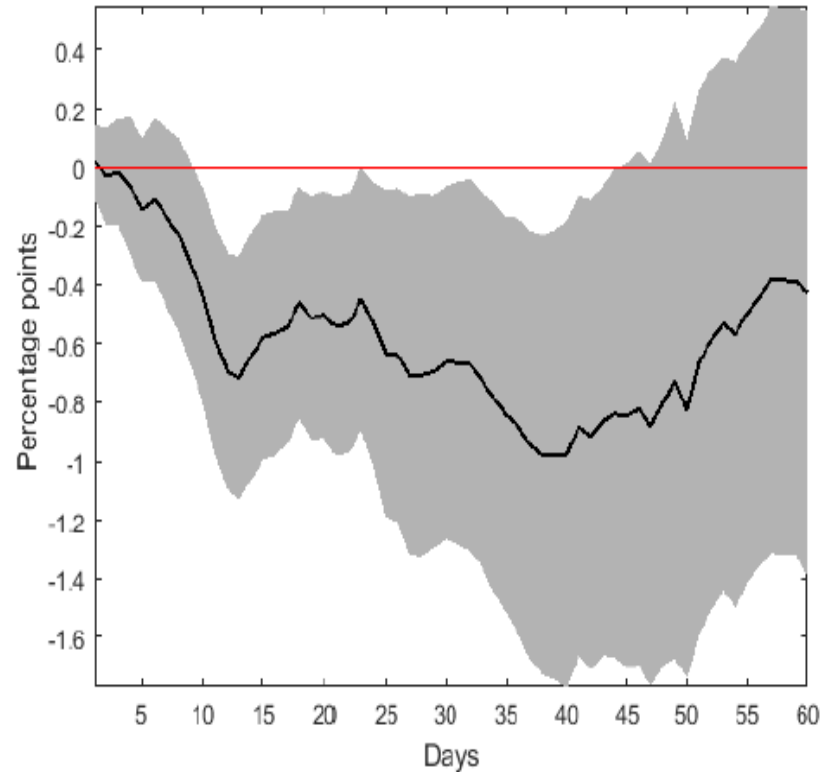
The correlation is close to $2/3$



POS and EPU: 2007-2012



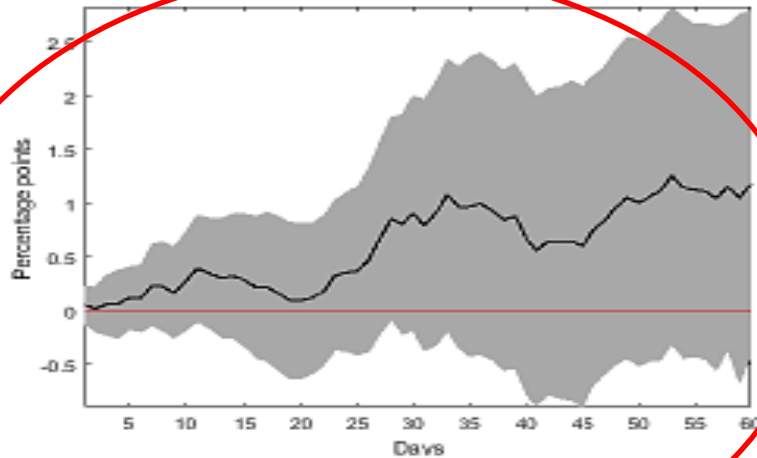
(a) Impulse of payments to a shock in uncertainty (EPU with words in English).



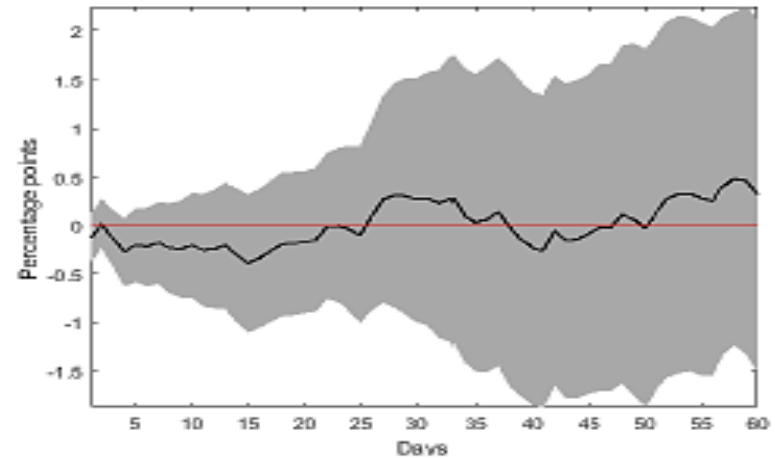
(b) Impulse of payments to a shock in uncertainty (EU with words in English).

In the **first half of the sample** of the whole sample the contractionary effect is **confirmed**

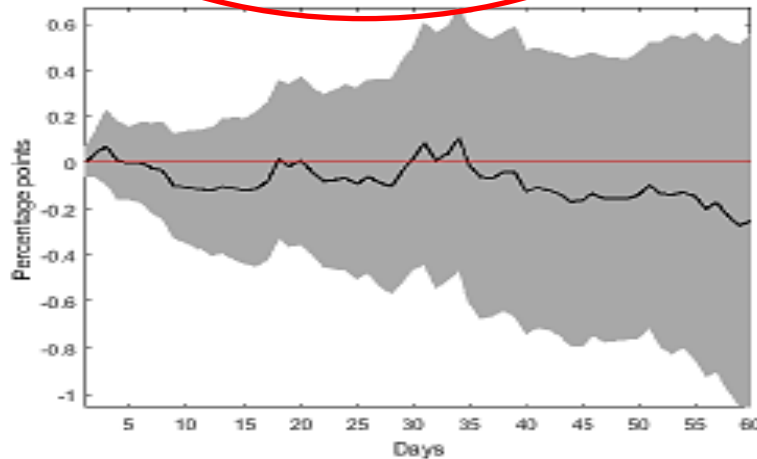
POS and EPU: 2012-2016



a) Impulse of payments to a shock in uncertainty (EPU with words in English).



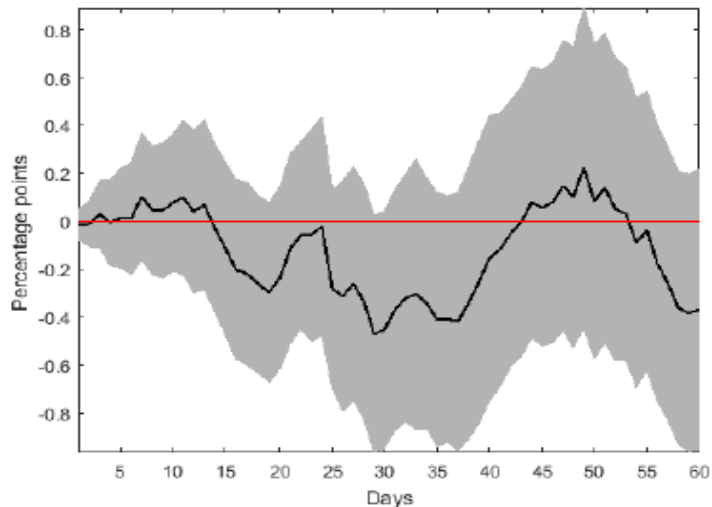
(b) Impulse of payments to a shock in uncertainty (EU with words in English).



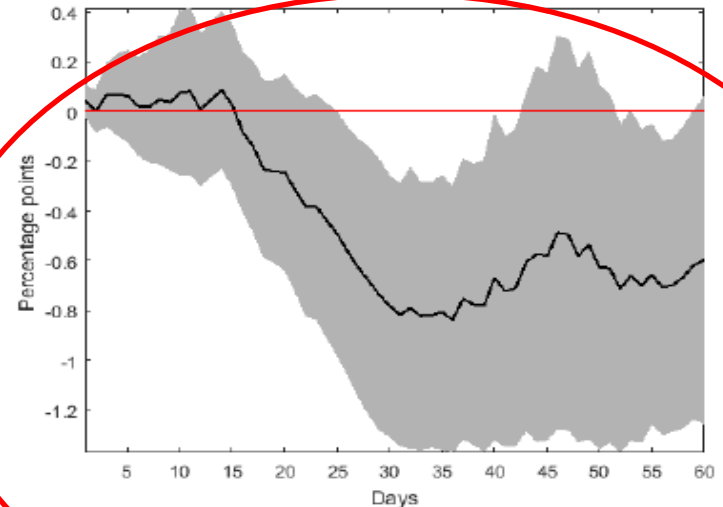
c) Impulse of payments to a shock in uncertainty (Twitter).

- In the **second half of the sample** an increase of the EPU index has **not statistically significant effects** on purchases.

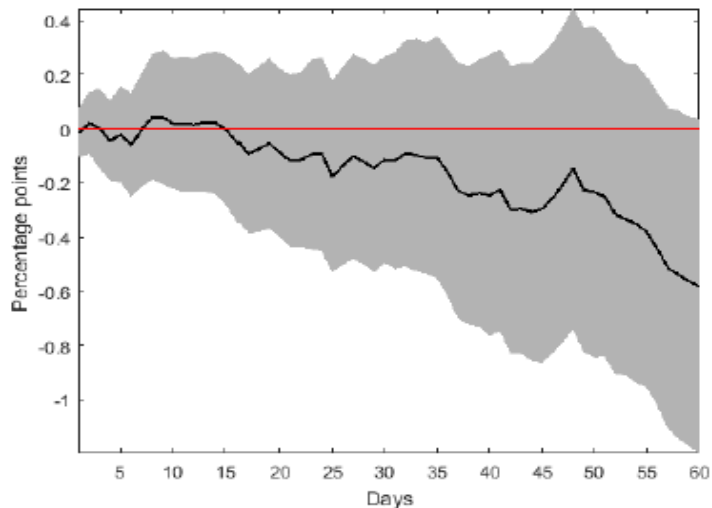
ATM and news about frauds/cyber-risks



(a) ATM response to increase in POS fraud index.



(b) ATM response to a temporary increase in the ATM fraud index.



(c) ATM response to a temporary increase in the Cyber-security fraud index.

- An increase of the news about **frauds related to ATM** has a **persistent impact on withdrawals**.
- **News on Cyber-attacks** (and POS frauds) are basically irrelevant.

Robustness check: monthly estimates

- **Monthly Local Projections**

- We claim that the daily frequency, is crucial as it rules out problems of endogeneity and is suited to identify effects within the quarter.
- In order to check the relevance of the frequency we also estimate local projections of **EPU on POS** with data.
- Whatever the index or the horizon, there are **no effects on purchases** monthly LP.

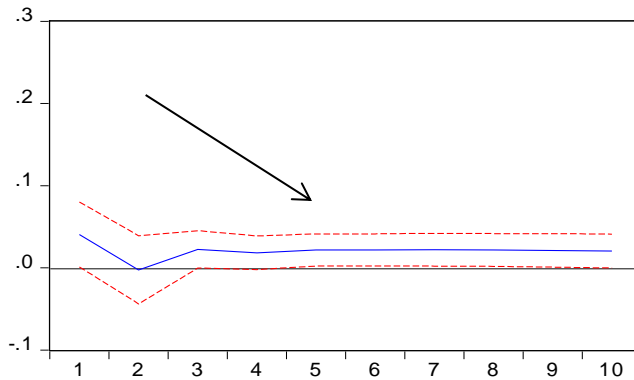
- **Monthly VAR with Cholesky identification.**

- **Variables:** EPU, industrial production, HICP and POS purchases.
- Both **payments** and **industrial production do not to respond** to **EPU** at monthly frequency IRFs.
- **Not claim** that **EPU shocks** are not relevant => At **monthly frequency** the macro effects can be **masked** by the profile of the response within the month.

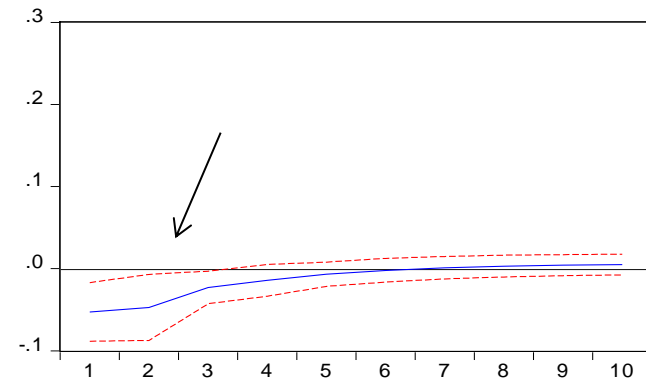
Effects of EPU on POS payment data, Monthly data

Response to Cholesky One S.D. Innovations ± 2 S.E.

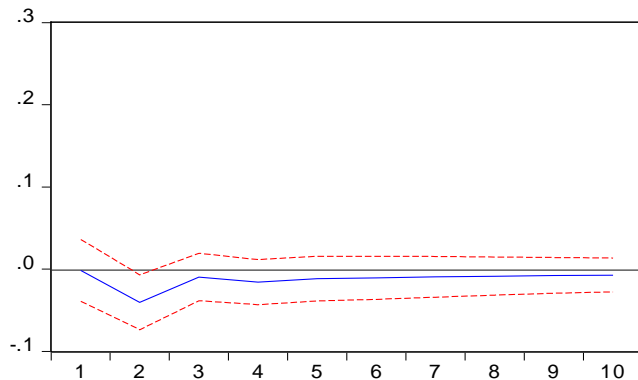
Response of POS payment to Industrial production



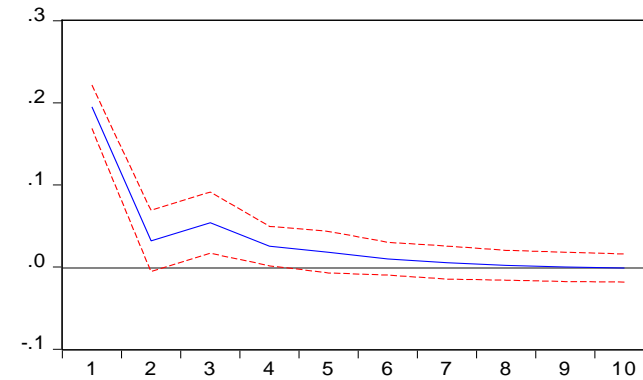
Response of POS payments to HICP index



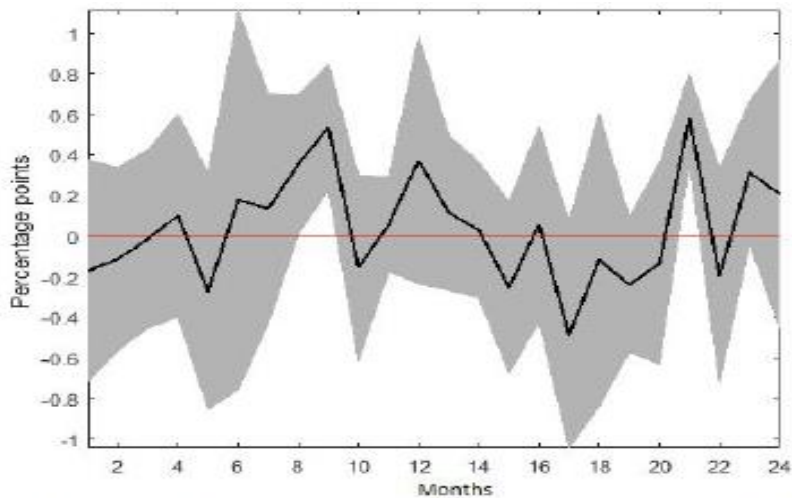
Response of POS Payments to Uncertainty index (EPU Italy)



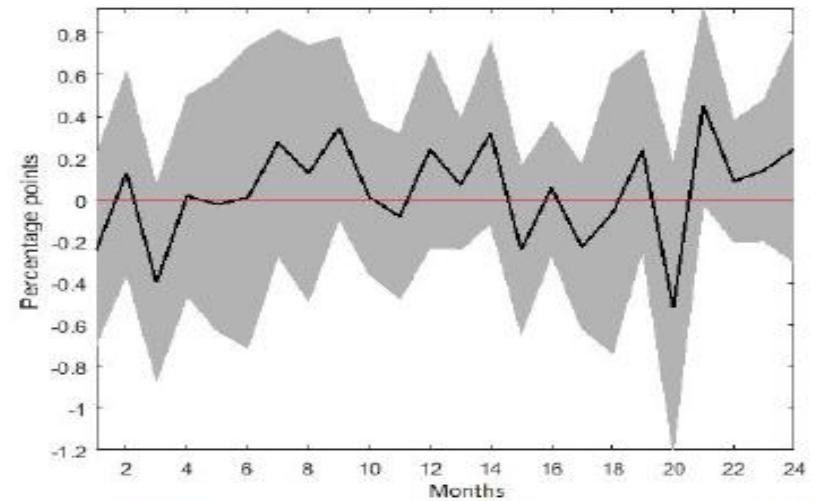
Response of POS payment to POS payment



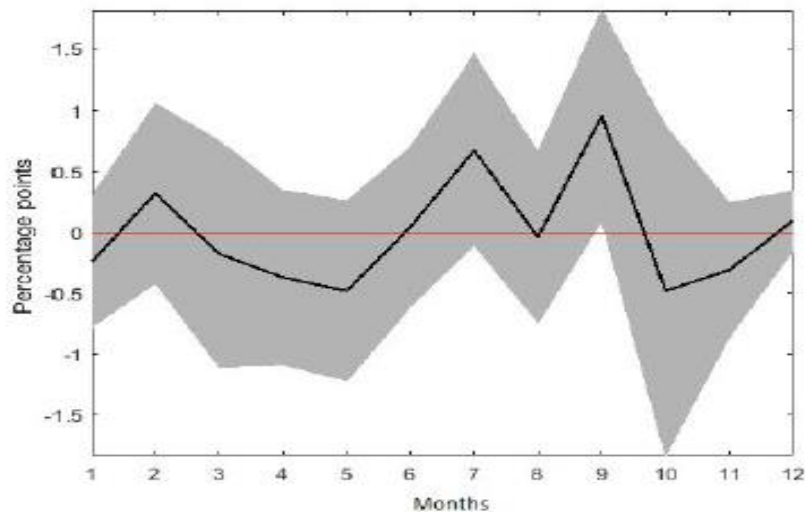
Monthly LP of EPU on POS



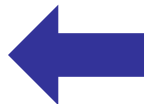
(a) Impulse of payments to a shock in uncertainty (EPU with words in English).



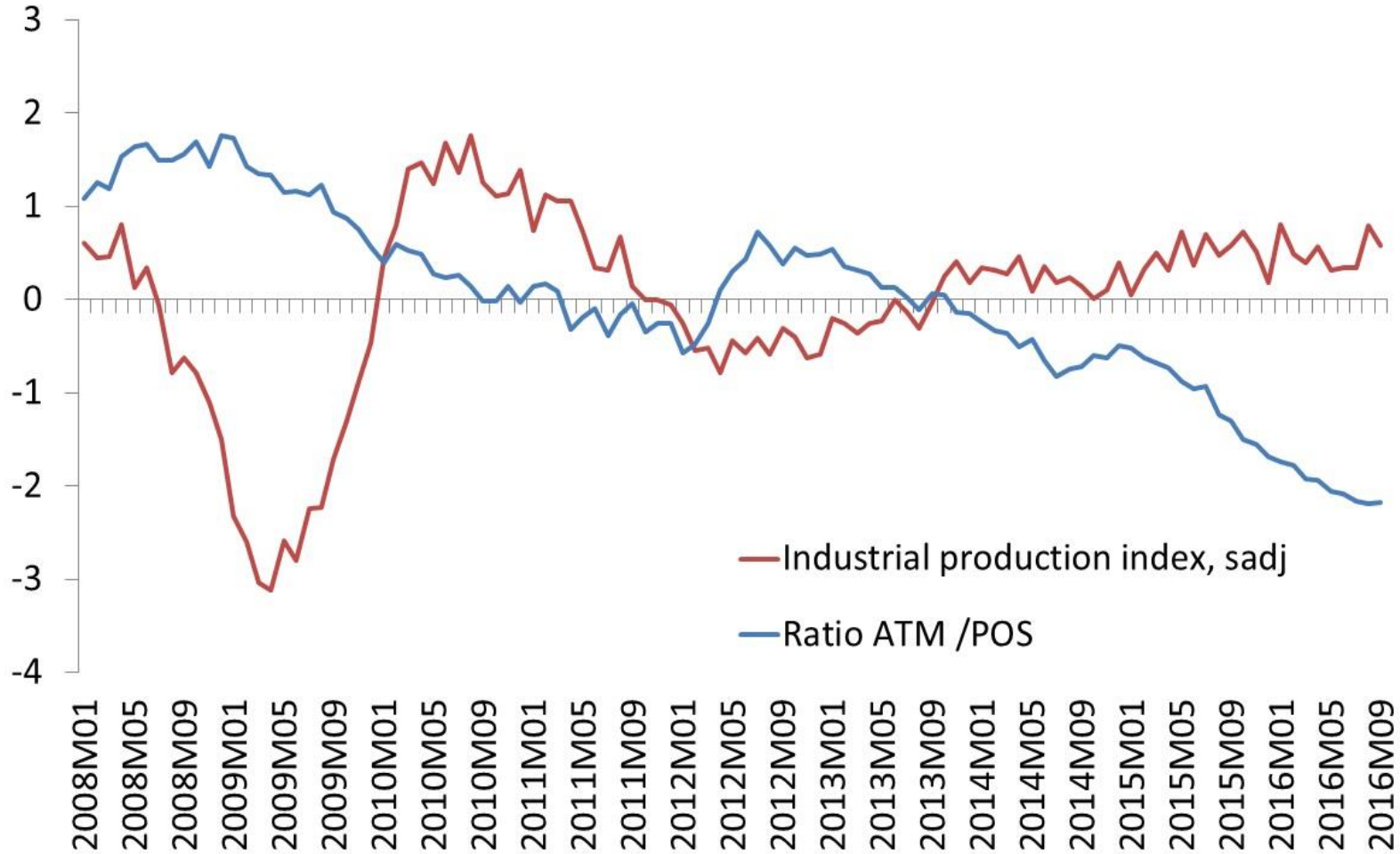
(b) Impulse of payments to a shock in uncertainty (EU with words in English) - monthly frequency.



(c) Impulse of payments to a shock in uncertainty (Twitter) - monthly frequency. Sample January 2012- September 2016.



ATM/POS is counter-cyclical



The correlation is about -0.50%

