Using the payment system data to forecast the Italian GDP

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Outline

Motivation

Search for innovative data sets to improve the forecasting ability

Following the financial crisis, increasing need to link financial information with macro forecasts

Data from Payment system show suitable features to track the short-term evolution of the economic activity

- Compiled in real-time by a single source $\rightarrow$ timeliness and reliability
- No backward revisions
- Relevant amount compared to the GDP ▸ Figure

This paper

Describes the payment system data. A picture for Italy

Provides empirical evidence on the comovement between payment data and economic activity

Evaluates the ability of the payment data to forecast GDP q-o-q

- selection of targeted predictors LASSO
- MIDAS dynamic factor model with Kalman smoothing

Proves the contribution of the payment data to track the short-term evolution of the GDP

Overview of the literature

Duarte, Rodrigues e Rua 2016
ATM/POS data for nowcasting and forecasting the quarterly private consumption. MIDAS model.

Galbraith and Tkacz 2013
Values and volumes of debit and credit card as well as cheques to nowcast GDP growth for Canada. Simple OLS model with three regressors (Composite Leading Index, PD, lagged y).

Carlsen and Storgaard 2010 *Electronic payments by card to nowcast the retail sales in Denmark.*

Overview of the literature

Esteves 2009 *ATM/POS data as an indicator to estimate private consumption (the y-o-y growth of non-durable goods and consumption) in Portugal. Single-indicator models and different forecast combinations (Diebold 1988) assessed.*

Galbraith and Tkacz 2009 *Canadian debit card data as high-frequency indicators to analyze the very short-term impact of quite large and highly transitory economic events (extreme events as the terrorist attacks on 9/11 and electrical blackout on 8/13) on the economy. Only descriptive evidence.*

Galbraith and Tkacz 2007 *Debit cards payments to monitor the economic activity in real-time (correlation between PD and a) consensus forecasts errors, b) revisions on the first official estimate; the short-term impact of extreme events. No inference; only empirical evidence.*

Payment system

The set of instruments, procedures, rules and intermediaries that enable the circulation of money

Payments classified according to agents making the payment (P. Schioppa, Seoul May 2004)

Wholesale $\rightarrow$ within the **banking system**
Retail $\rightarrow$ within the circuit of **individuals and firms**

Different needs depending on the size and on the urgency of the payments

Payment system - historical notes

Monetary union entailed the harmonization of the infrastructure to transfer money

- effectiveness of the monetary policy
- security of the payments

Wholesale payments

- 1999 **TARGET**
- 2003 **TARGET2** (crucial contribution of the BoI)

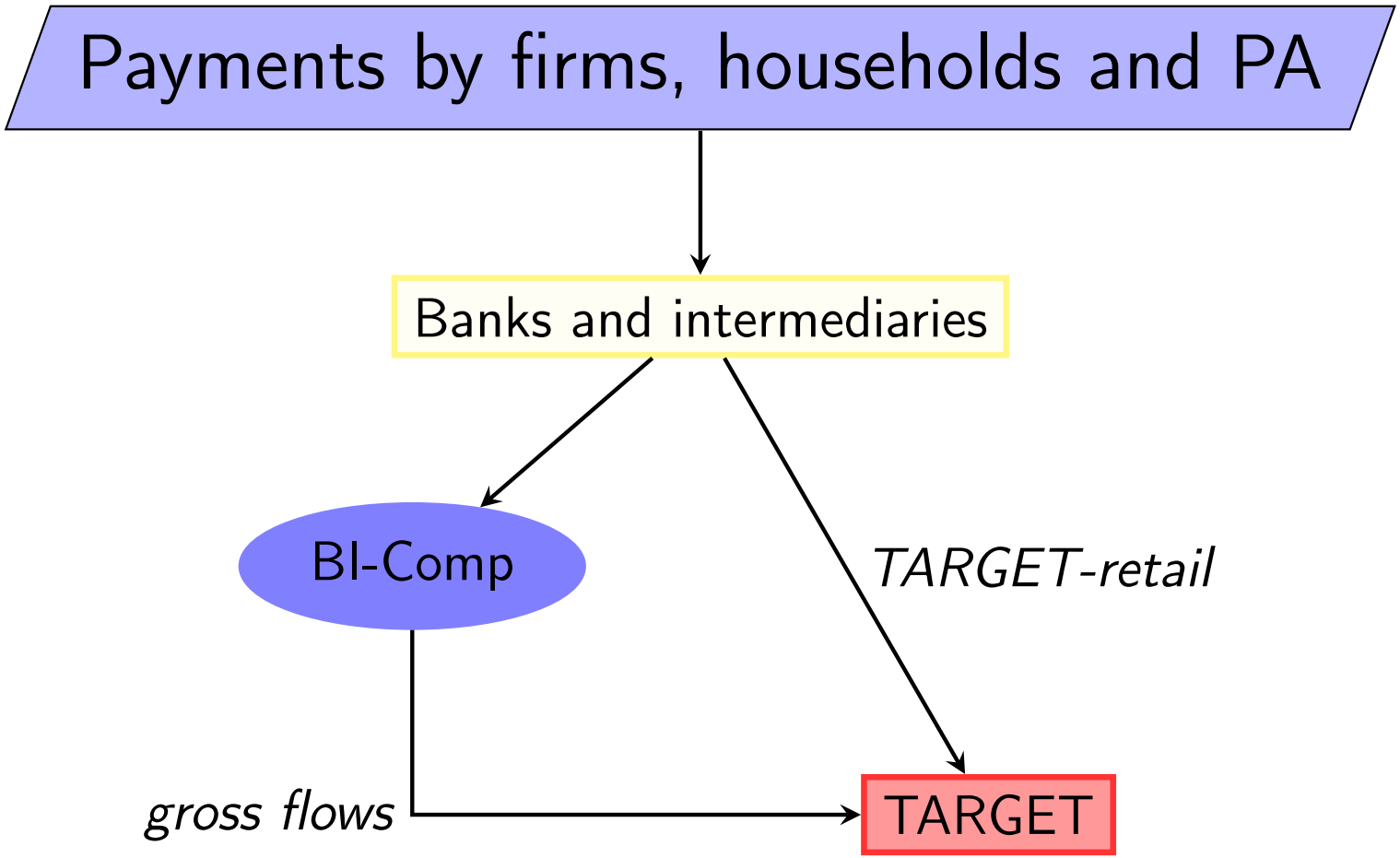
Retail payments

- multiple inter-countries links **BI-Comp**
- pan-European platform **STEP2**
- 2014 **SEPA**

Payment system - retail payment value chain

Trading

Clearing - Settlement



Payment instruments

Cash payments

Non-cash payments

Distinction based on the party submitting the payment order

- ***credit-based*** submitted by the payer
- ***debit-based*** submitted by the payee

A picture for Italy

Cash-payment is still highly widespread in terms of volume: 80% of the number of transactions

- ... but it accounts for 45% of the value of consumer-to-business transactions
- and 10% of all transactions (including business-to-business)

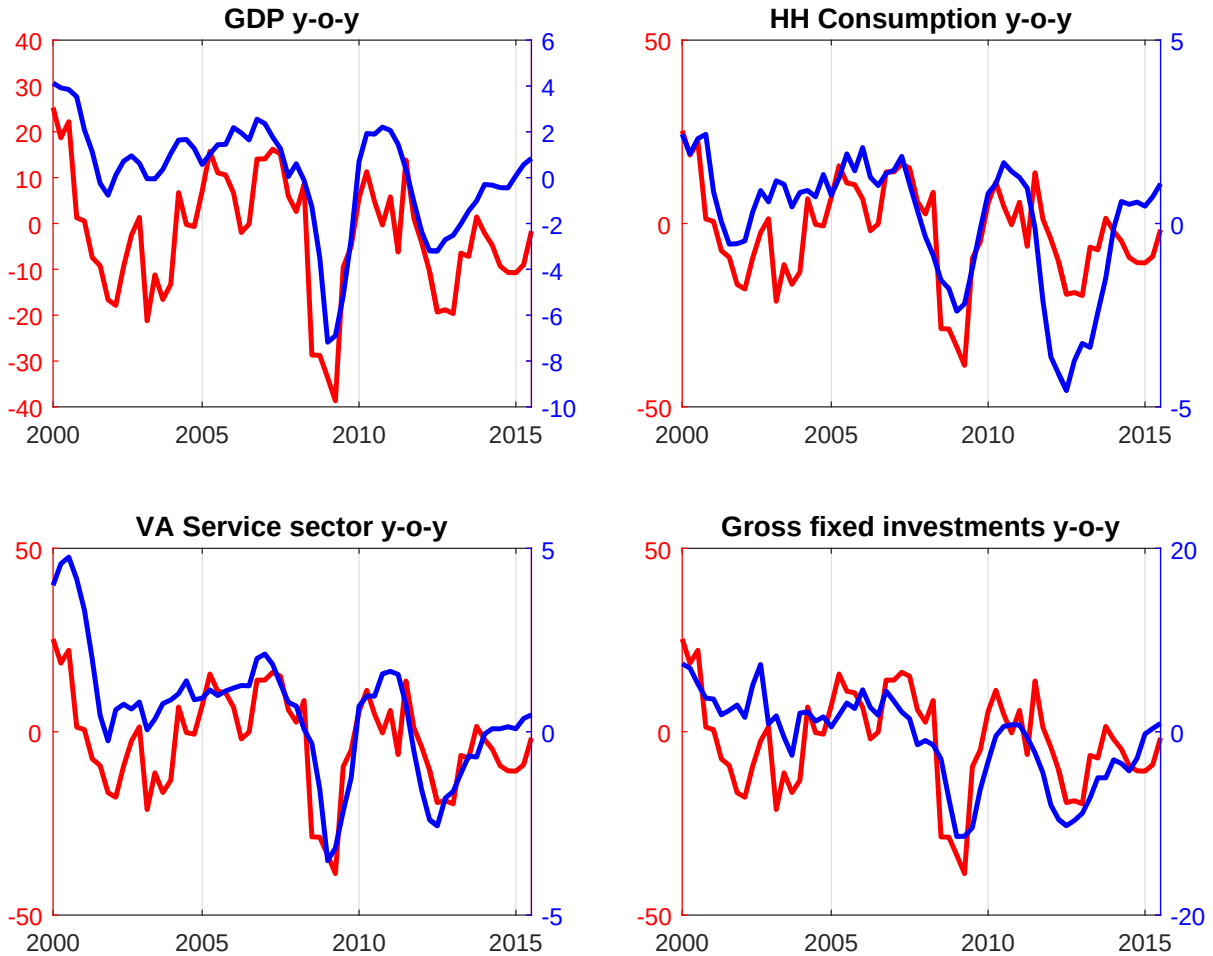
Retail non-cash payments settled through BI-Comp and T2 amount to 5 trillion € on yearly basis ▸ Figure

- 60% of the total value of retail non-cash payments
- 80% if we consider only the electronic payments

Credit transfer represents the largest share of the total non-cash transactions (55%) ▸ Figure

Payment data and macroeconomic aggregates

Strong empirical evidence on the tight relationship between macro aggregates (bl) and payment flows (rl)



Payment data and macroeconomic aggregates

Strong empirical evidence on the tight relationship between macro aggregates (bl) and payment flows (rl)

Correlation between payment flows and macroeconomic indicators

Payment flows	GDP	Private Consumption	Gross Fixed Investment	Value added service sector
Cheques	-44.4	-2.1	-37.2	-35.6
Cards	1.4	-12.3	16.4	4.0
Credit Transfer	59.1	61	65.3	59.5
Direct Debts	52.1	39.4	48.7	54.4
BI-Comp	71.8	70.5	74.3	68.4
TARGET-retail	79.4	67.7	64	74.3
BI-Comp + T2	90.7	82.5	82.3	85.9
Other indicators				
M2	-38.1	-11.5	-20.4	-45.6
Industrial production	92.8	68.7	74.3	79.8
Business Confidence	68.5	74.9	67.3	64.3
Consumer Confidence	9.9	40.0	14.3	19.7

Targeted Predictors

We started to compile $N = 50$ variables

LASSO selected n_L targeted predictors

$$\hat{L}_{n_L} = \{j \in \{1, 2, \ldots, N\} : |\hat{\beta}_{L_j}| > 0\}$$

Post-LASSO selection $\hat{I} \supseteq \hat{L}_{n_L}$

▸ Data

Factor-MIDAS with Kalman smoothing

The **dynamic factor model**

$$\mathbf{X}_t = \Lambda_s(L)\mathbf{f}_t + \xi_t$$

can be mapped into the...
... **static factor model**

$$\mathbf{X}_t = \mathbf{D}\mathbf{F}_t + \xi_t$$

where

$$\mathbf{F}_t = \mu + \Psi_1\mathbf{F}_{t-1} + \cdots + \Psi_l\mathbf{F}_{t-l} + \mathbf{u}_t$$

We assume

$$\mathbf{u}_t = \mathbf{R}\epsilon_t$$

$\mathbf{u}_t$ has dimension r and ϵ_t is a q-vector of primitive shocks.
Σ_u has rank $q < r$
Unrestricted MIDAS model

$$y_{t_q} = c + \beta_0\mathbf{F}_{t_q} + \beta_1\mathbf{F}_{t_q-1/m} + \cdots + \beta_p\mathbf{F}_{t_q-p/m} + \epsilon_{t_q}$$

Forecasting application

We compare $\hat{I}$ and $\hat{I}_{-PS}$

out-of-sample forecasts (pseudo real-time simulations)

Rolling window (length 78 months)

RMSFE of the models $\hat{I}$ and $\hat{I}_{-PS}$

RMSFE			
	Sample [2008.Q2 - 2015.Q2]		
	Backcast	Nowcast	Forecast 1-step
$\hat{I}$	0.909	0.984	0.991
$\hat{I}_{-PS}$	0.911	1.028	1.038
	Sample [2011.Q3 - 2015.Q2]		
$\hat{I}$	0.517	0.529	0.544
$\hat{I}_{-PS}$	0.528	0.543	0.572

Forecasting application

The smoothed state vector can be expressed as the weighted sum

$$\mathbf{FF}_{t|T} = \sum_{j=1}^{T} w_j(\mathbf{FF}_{t|T})\mathbf{X}_j$$

Let us assume current month November 2015

- backcast GDP growth on 2015.Q3
- nowcast 2015.Q4
- one-step-ahead forecast 2016.Q1

▸ Figures

Wrap-up

The flows of retail payments

- track the short-term evolution of the economic activity
- stand out among other business cycle indicators

Caveat

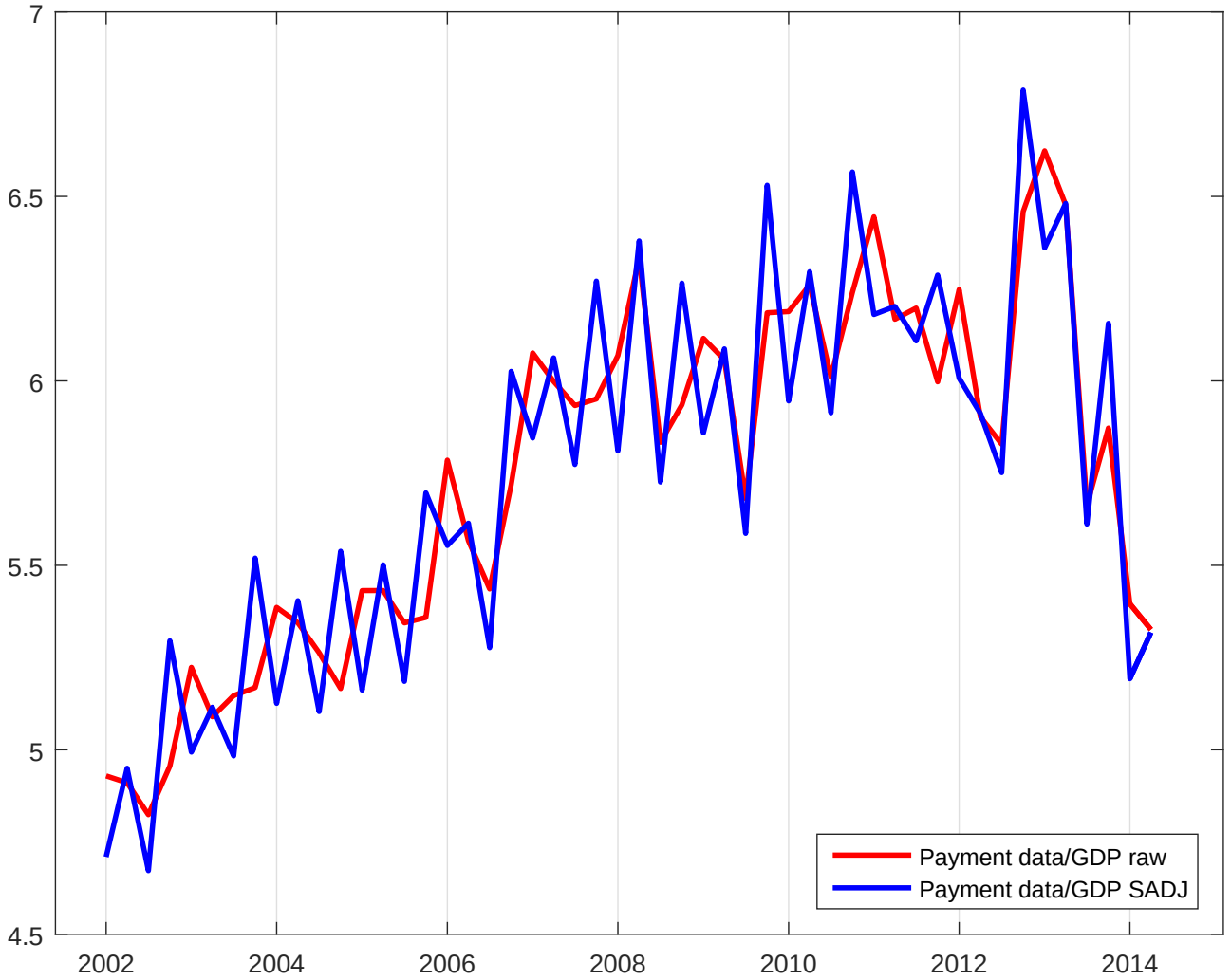
the structure of the retail payment system is changing after the introduction of the SEPA standards

Way forward

- density forecast assessment
- forecast of both the supply/demand-side components of the GDP

THANK YOU

Ratio between Payment flows and GDP



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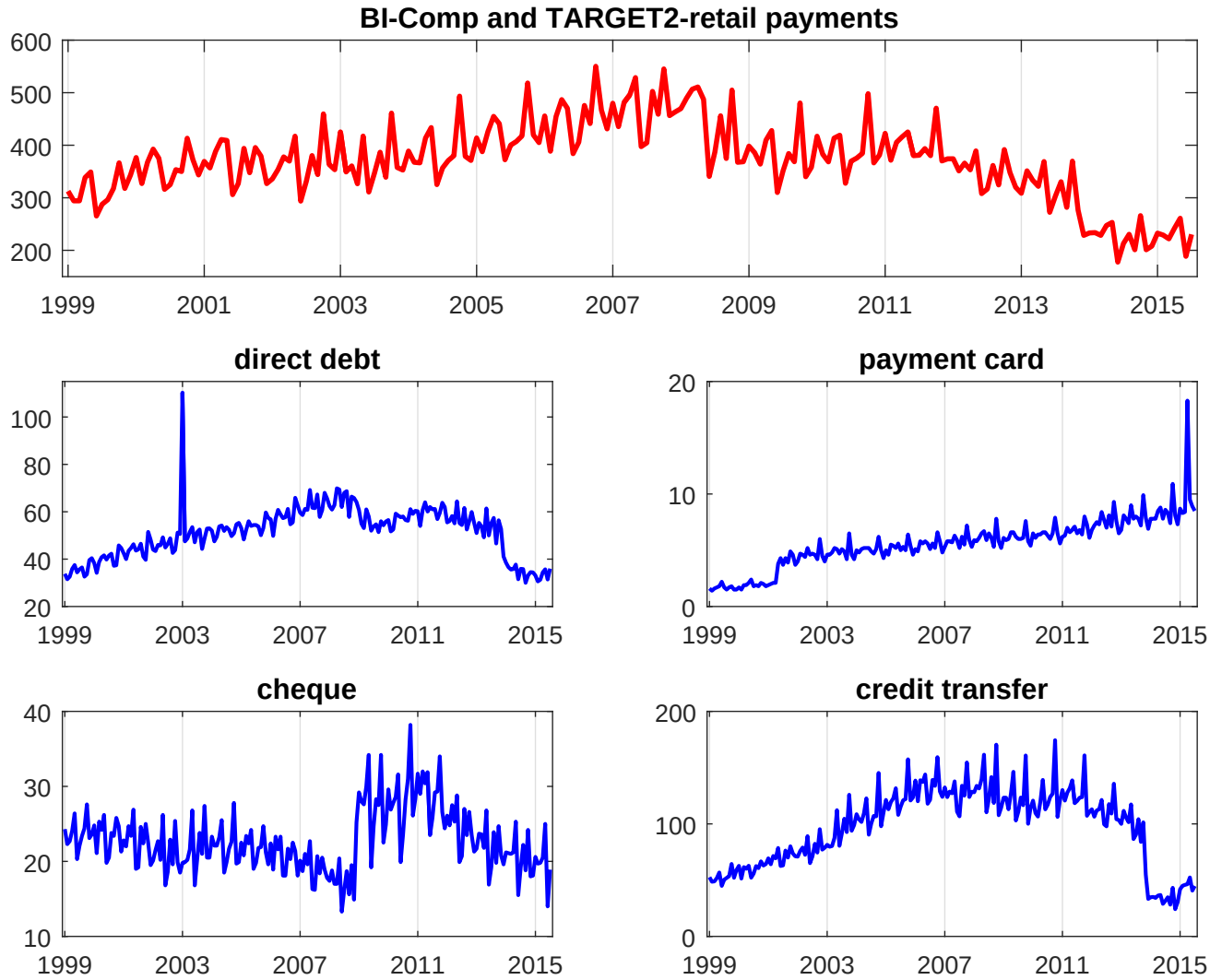
Total payments settled in BI-Comp and TARGET2-retail (trillion €)



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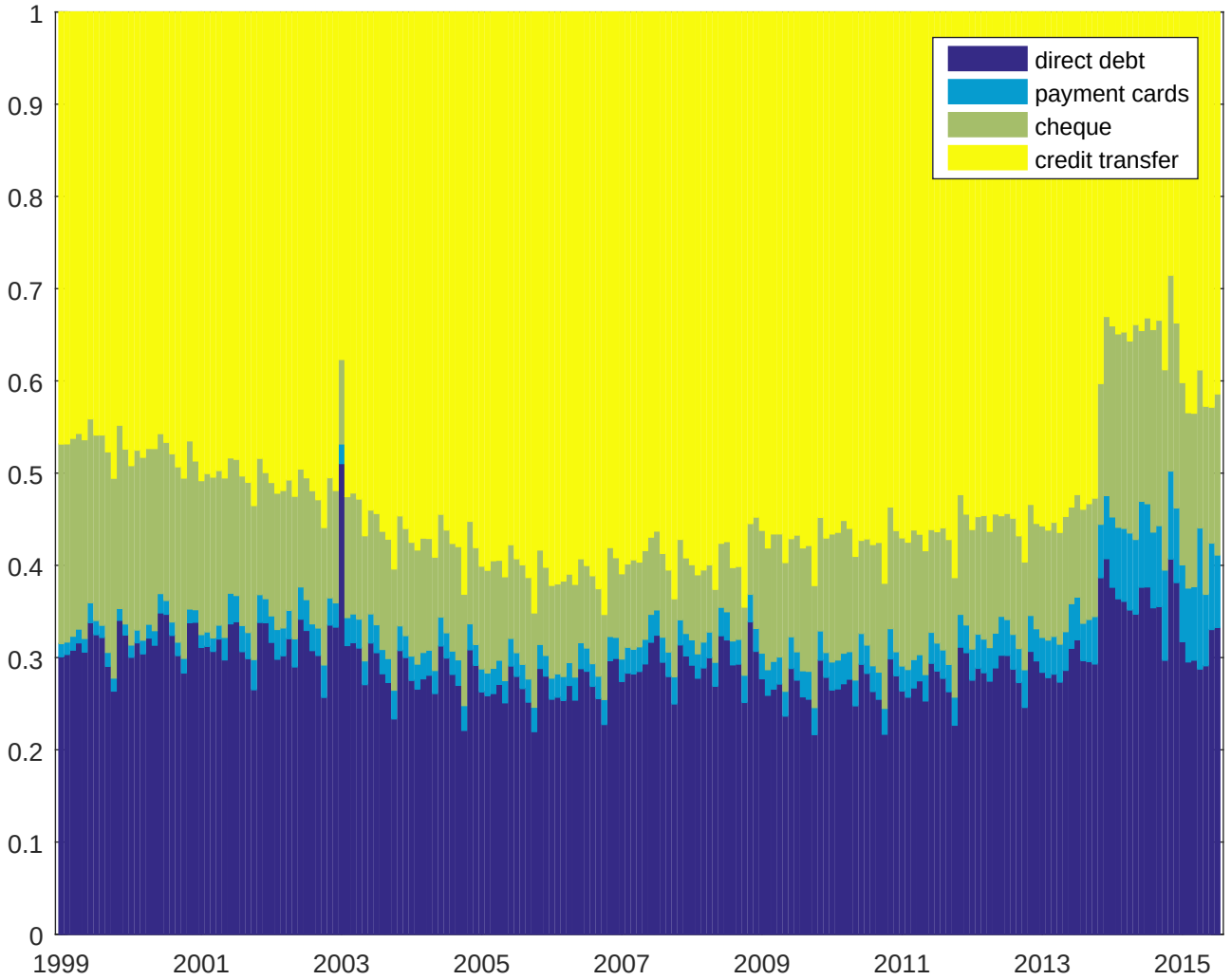
Quotas of the payment instruments



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N-sample compared to LASSO and post-LASSO samples

Indicators	Source	Treatment	Lasso selected	Added to Lasso selection
Total electricity consumption	Italian Electrical Net Society	(1-L)logSA	yes	yes
Industrial production	Istat	(1-L)log	yes	yes
Business Climate	Istat	SA	yes	yes
CCS - Future General Economic sit.	Istat	SA	yes	yes
CCS - Future Personal Economic sit.	Istat	SA	yes	yes
CCS - Unemployment exp.	Istat	SA	no	yes
CCS - Saving opportunities, next 12 mth	Istat	SA	yes	yes
CCS - Households balance sheet	Istat	(1-L)	yes	yes
CCS - Current saving opportunities	Istat	SA	no	yes
BCS - Current level of orders (intermediate goods)	Istat	SA	no	yes
BCS - Current level of production (int. goods)	Istat	SA	no	yes
BCS - Exp. level of production (int. goods)	Istat	SA	no	yes
BCS - Exp. level of orders (int. goods)	Istat	SA	no	yes
BCS - Future general economic sit. (int. goods)	Istat	SA	no	yes
BCS - Exp. level of liquidity (int. goods)	Istat	SA	no	yes
BCS - Current level of liquidity (int. goods)	Istat	SA	no	yes
BCS - Current level of orders (investment goods)	Istat	SA	no	yes
BCS - Current level of production (inv. goods)	Istat	SA	no	no
BCS - Current level of liquidity (inv. goods)	Istat	SA	no	no
BCS - Exp. level of orders (inv. goods)	Istat	SA	no	no
BCS - Exp. level of production (inv. goods)	Istat	SA	no	no
BCS - Future General Economic sit. (inv. goods)	Istat	SA	no	no
BCS - Exp. level of liquidity (inv. goods)	Istat	SA	no	no
BCS - Current level of orders (consumer goods)	Istat	SA	no	no
BCS - Current level of production (cons. goods)	Istat	SA	no	no
BCS - Exp. level of orders (cons. goods)	Istat	SA	yes	yes
BCS - Exp. level of production (cons. goods)	Istat	SA	no	no
BCS - Future General Economic sit. (cons. goods)	Istat	SA	yes	yes
BCS - Exp. level of liquidity (cons. goods)	Istat	SA	no	no
BCS - Current level of liquidity (cons. goods)	Istat	SA	no	no
Current accounts deposits (stock)	Bank of Italy	(1-L)logSA	no	no
Credit flows to firms	Bank of Italy	(1-L)logSA	no	no
HICP	Istat	(1-L)logSA	no	yes
FTSE Italy (Banks)	Datastream	(1-L)log	no	no
FTSE Italy (Insurance)	Datastream	(1-L)log	no	no
FTSE Italy (Transport)	Datastream	(1-L)log	no	no
PMI Services - Business activity	Markit	SA	no	no
PMI Services - New business	Markit	SA	yes	yes
PMI Manufacturing - New orders	Markit	SA	yes	yes
PMI Manufacturing - Output	Markit	SA	no	no
PMI Manufacturing - New orders	Markit	SA	no	no
PMI Manufacturing - Employment	Markit	SA	no	no
PMI Manufacturing - New export orders	Markit	SA	no	no
Freight truck	ASPI	(1-L)logSA	yes	yes
Retail trade - goods	Confcommercio	SA	yes	yes
Retail trade - services	Confcommercio	SA	no	no
BI-COMP	Bank of Italy	(1-L)logSA	no	no
TARGET RETAIL	Bank of Italy	(1-L)logSA	yes	yes
Payment system-total	Bank of Italy	(1-L)logSA	no	no

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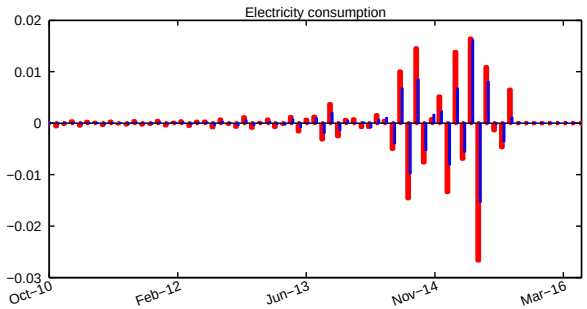
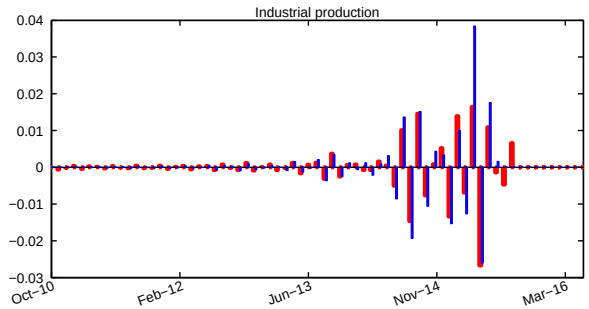
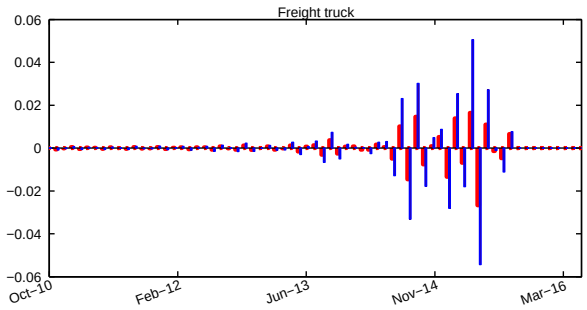
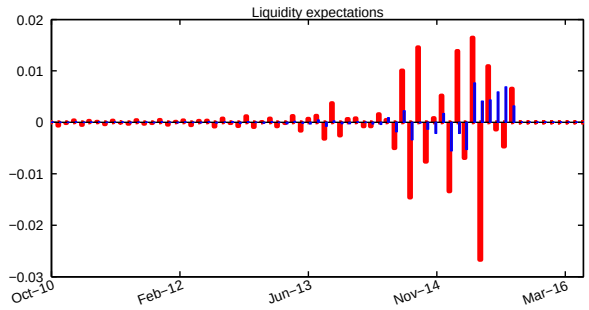
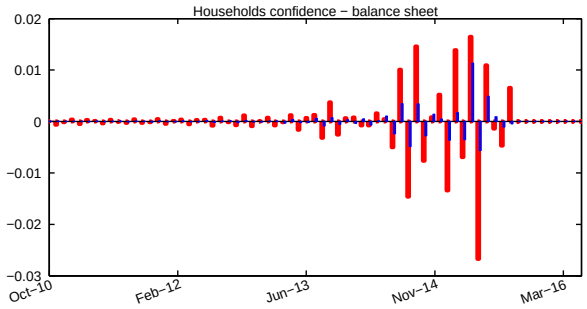
Weights for **backcasting** (PS red bar; other variable blue bar)

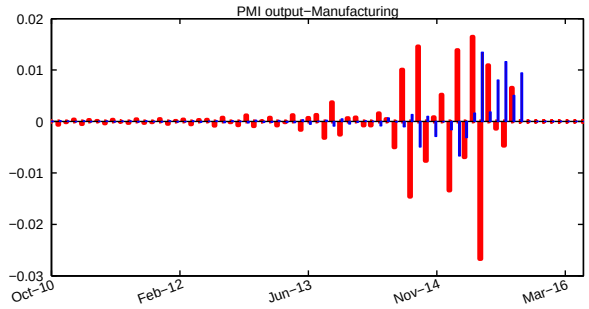




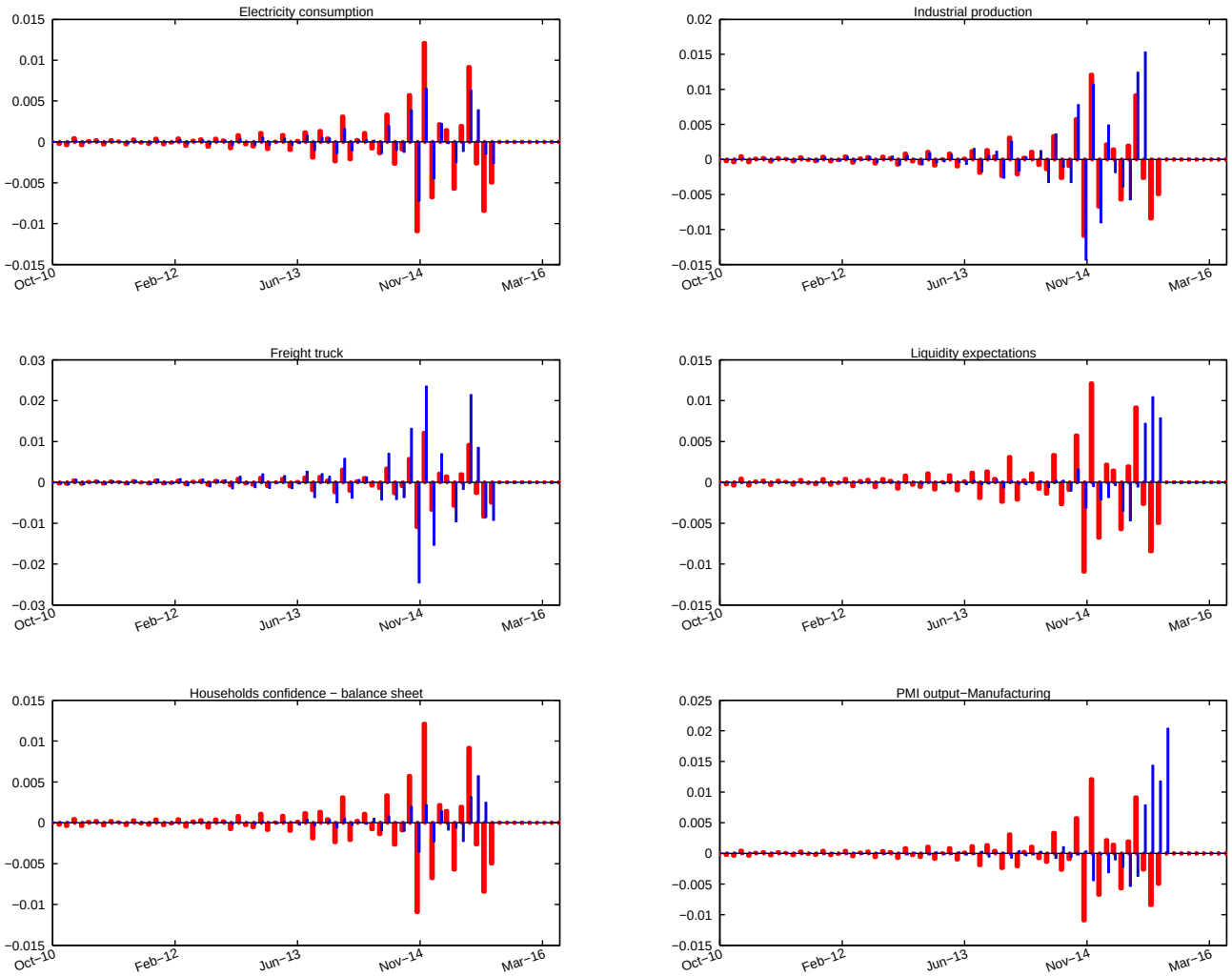








Weights for **nowcasting** (PS red bar; other variable blue bar)



Weights for **1-step ahead forecasting** (PS red bar; other variable blue bar)