

Penetration of digital payments in Greece after capital controls: Determinants and impact on VAT revenues

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Outline

- Motivation & research question
- Data & descriptive statistics
- Drivers of digital payments' penetration
- Impact of card payments on tax compliance
- Discussion on policy measures
- Conclusions & further steps



Motivation

Global turnover of card payments exceeded cash transactions...
...for the first time in 2016 (Euromonitor)

Greece: case study of a traditionally cash economy under transition towards Electronic Modes of Payment (EMP)

- Implications on tax compliance
- Takeaways for policy making

Catalysts for Greece's transition

- Capital controls imposed in the summer of 2015
- Policy incentives during 2017 (law 4446)

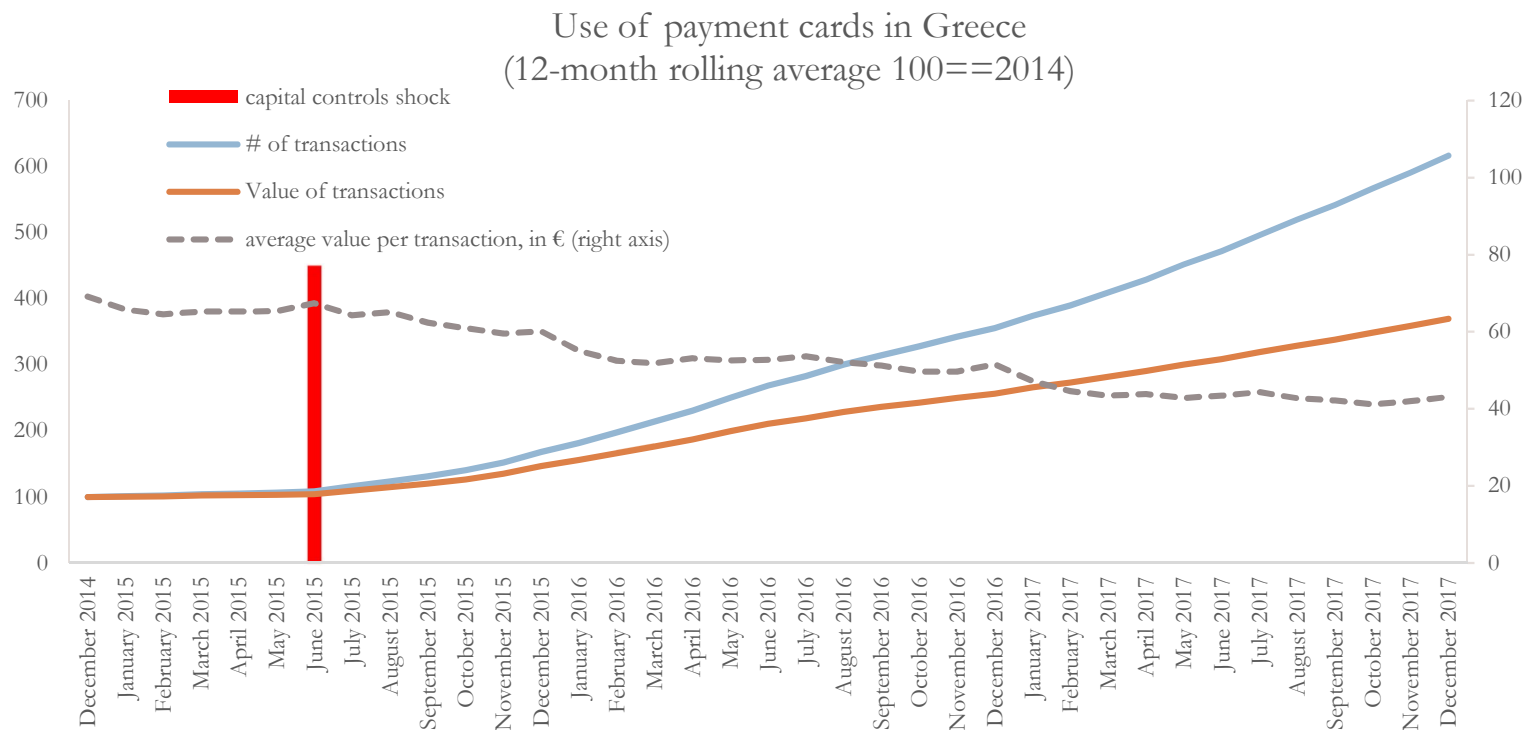
Challenges versus opportunities

- Growth versus level of EMP use
- VAT gap
- Policies for further potential fiscal gains



Motivation & research question (1)

1) Has the impact of capital controls on EMP use been one-off ?



Notice: Prepaid cards are not included

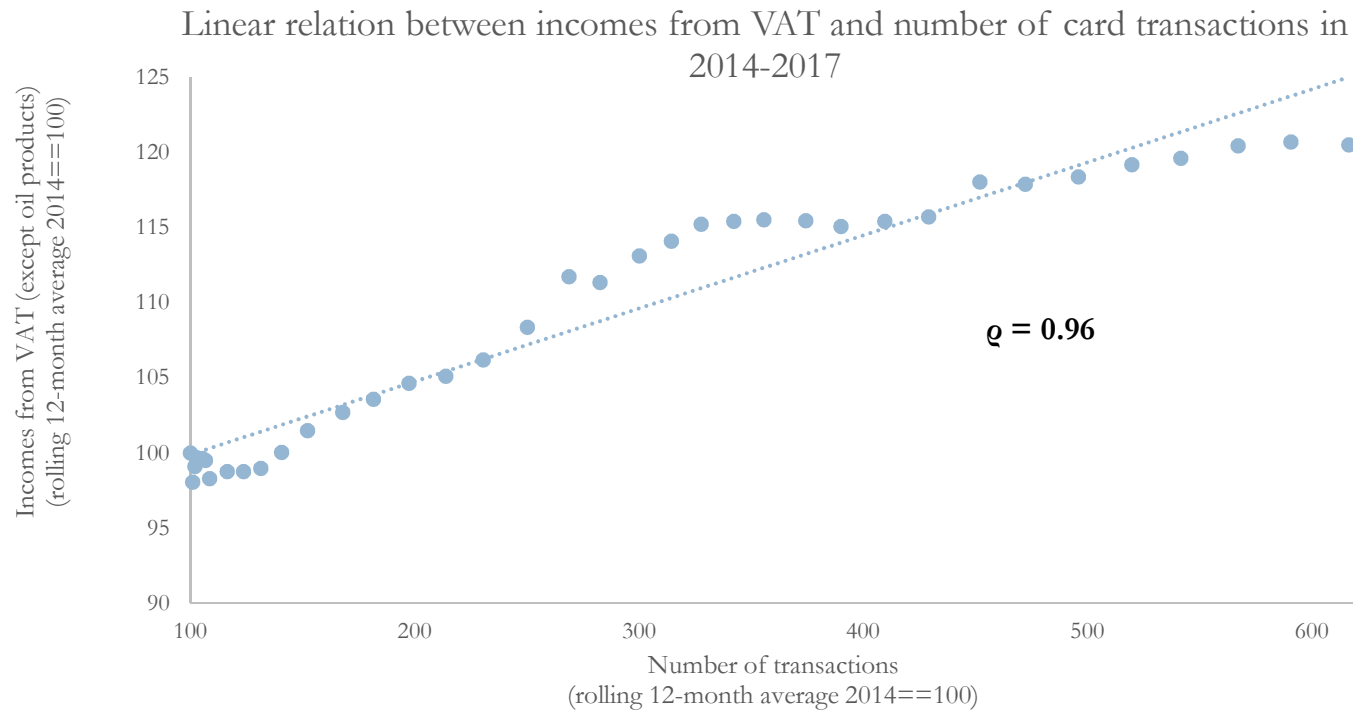
Sources: Member banks of Hellenic Bank Association, Data Analysis: IOBE

No. The spread of EMP use continued during 2016 & 2017 (mainly debit cards)



Motivation & research question (2)

2) Does the expansion of EMP affect tax revenues?



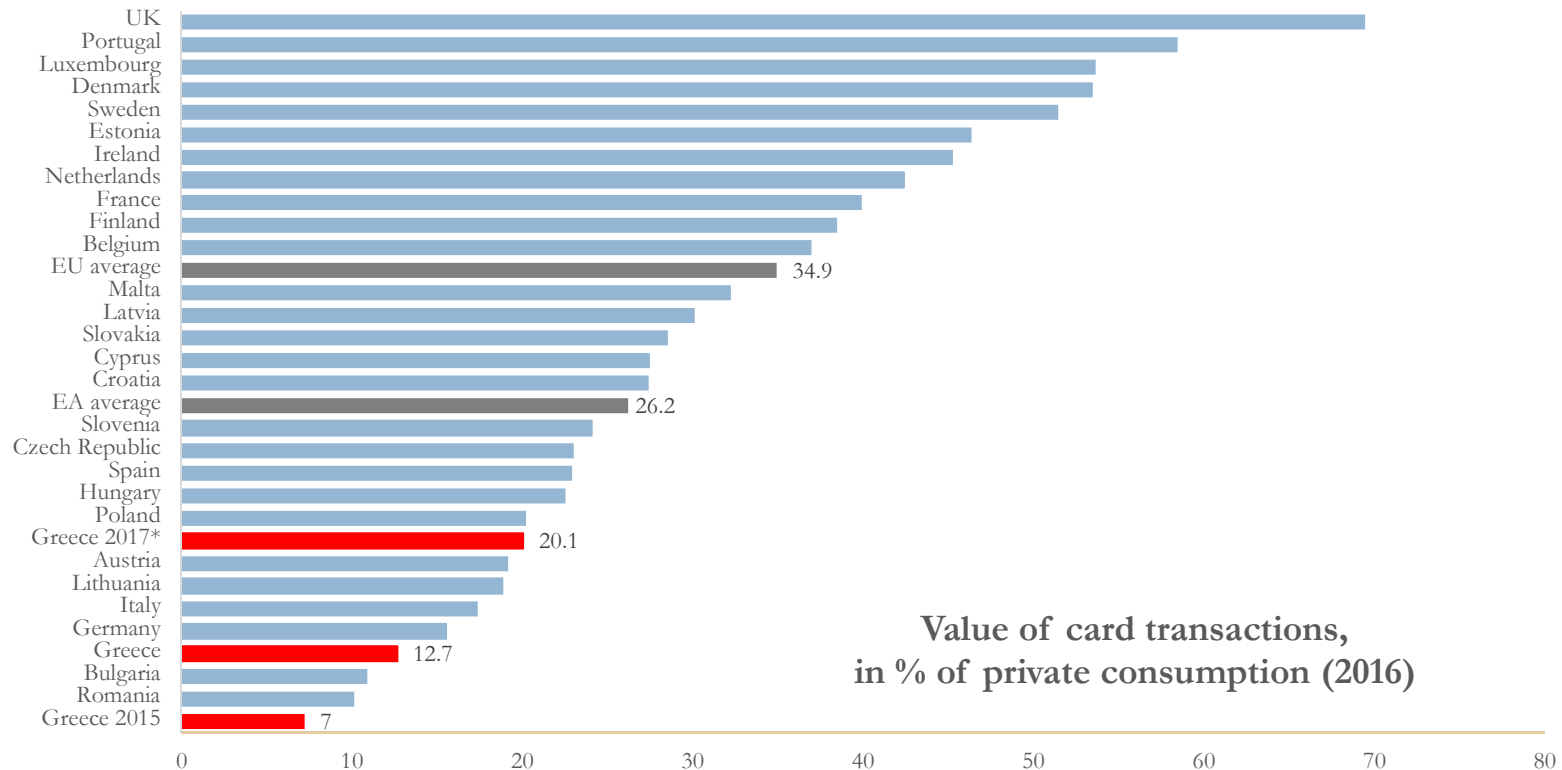
Source: Member banks of Hellenic Bank Association, Independent Authority for Public Revenues (AADE)
Data analysis: IOBE

YES. After controlling for macro and tax policy factors.



Motivation & research question (3)

3) Is there still potential for further increase of EMP in Greece?



Source: ECB (Data for 2016 and Greece 2015); Member banks of Hellenic Bank Association (Data for Greece 2017), Data Analysis: IOBE

* Extrapolation by IOBE for 2017

YES. The degree of use remains below EU average => Policy making opportunities

Tackling the research questions - Data

- Approach
 - Highlight the trends of EMP expansion
 - Identify the impact of policy incentives on EMP use
 - Isolate the impact of card use on VAT revenues

- Unique data set

Sample: Four Greek systemic banks, covering 97% of total financial system assets

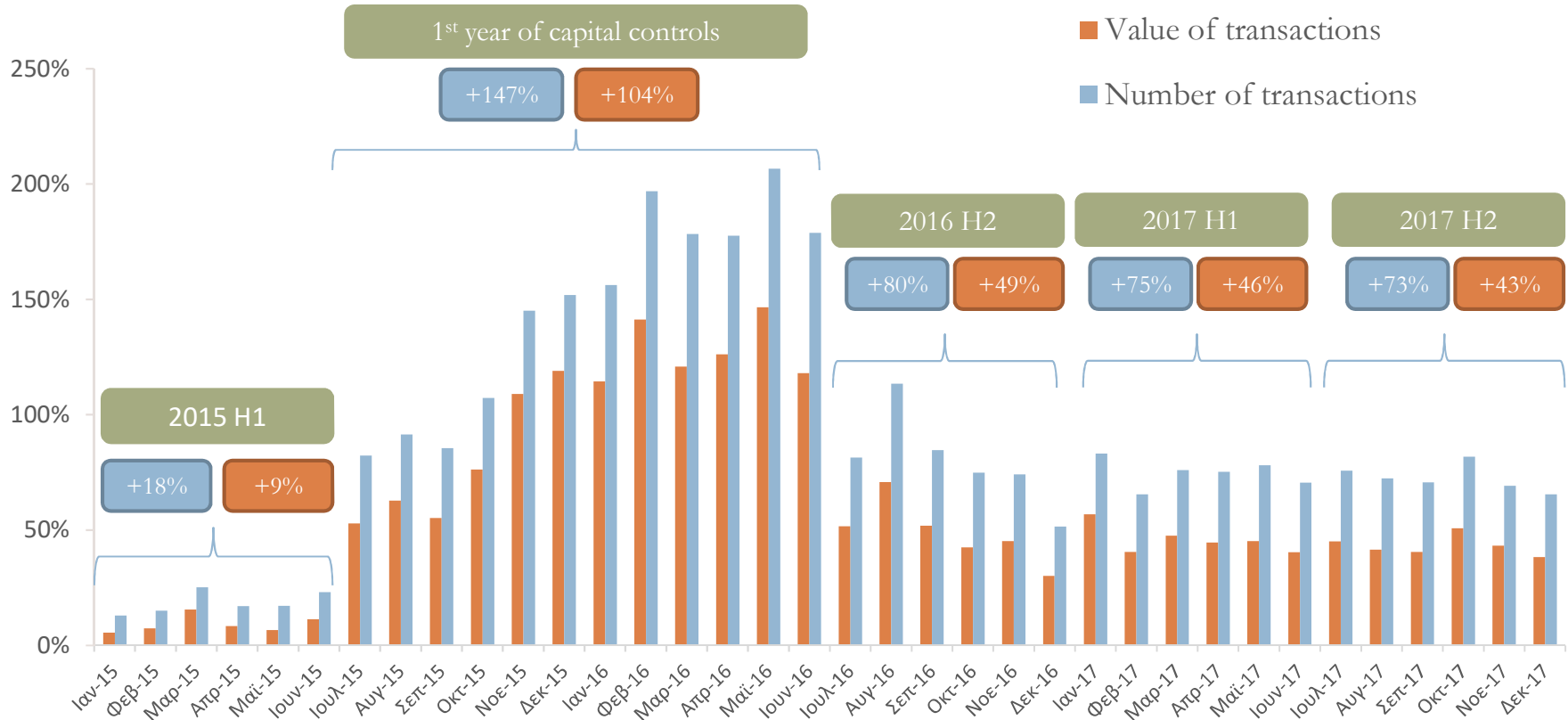
Time span: January 2014 – December 2017, monthly frequency

- Value and number for all transactions executed by domestically issued cards, by type of card, sector and region (HBA)
- Number of active e-banking users (HBA)
- Gross VAT revenues (AADE)
- Macro variables (Eurostat)



Descriptive statistics (1)

Use of payment cards in Greece (y-o-y change in %)



Notice: Prepaid cards are not included

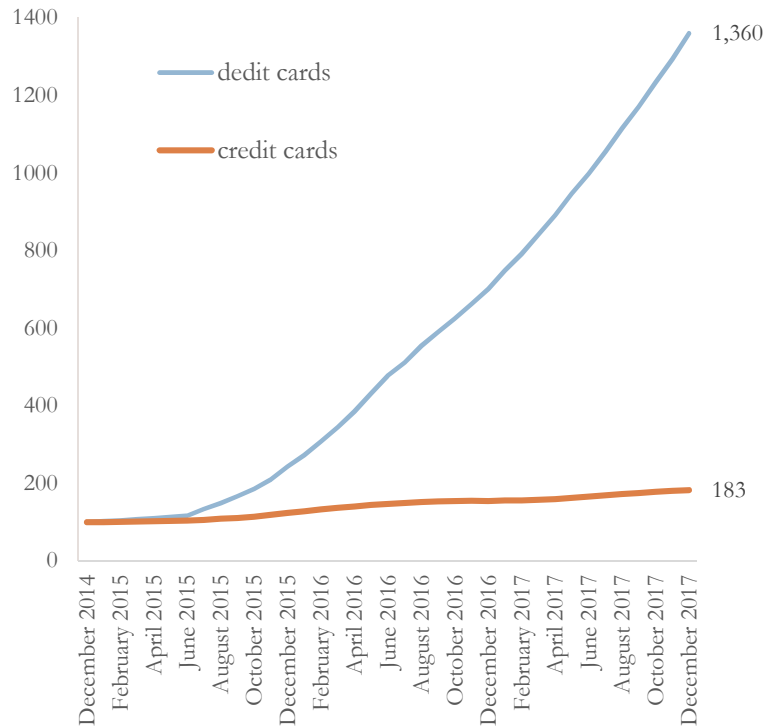
Sources: Member banks of Hellenic Bank Association, Data Analysis: IOBE

Percentage growth rates peaked during the 1st year of capital controls, but continued to be large while macro trends have been relatively flat

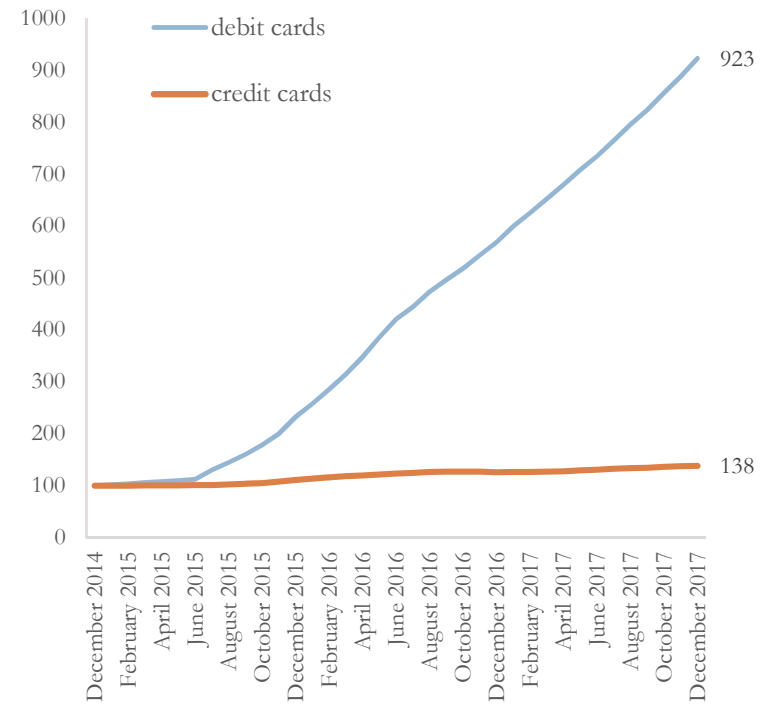


Descriptive statistics (2)

Number of transactions by type of card
(12-month rolling Index 2014==100)



Value of transactions by type of card
(12-month rolling Index 2014==100)



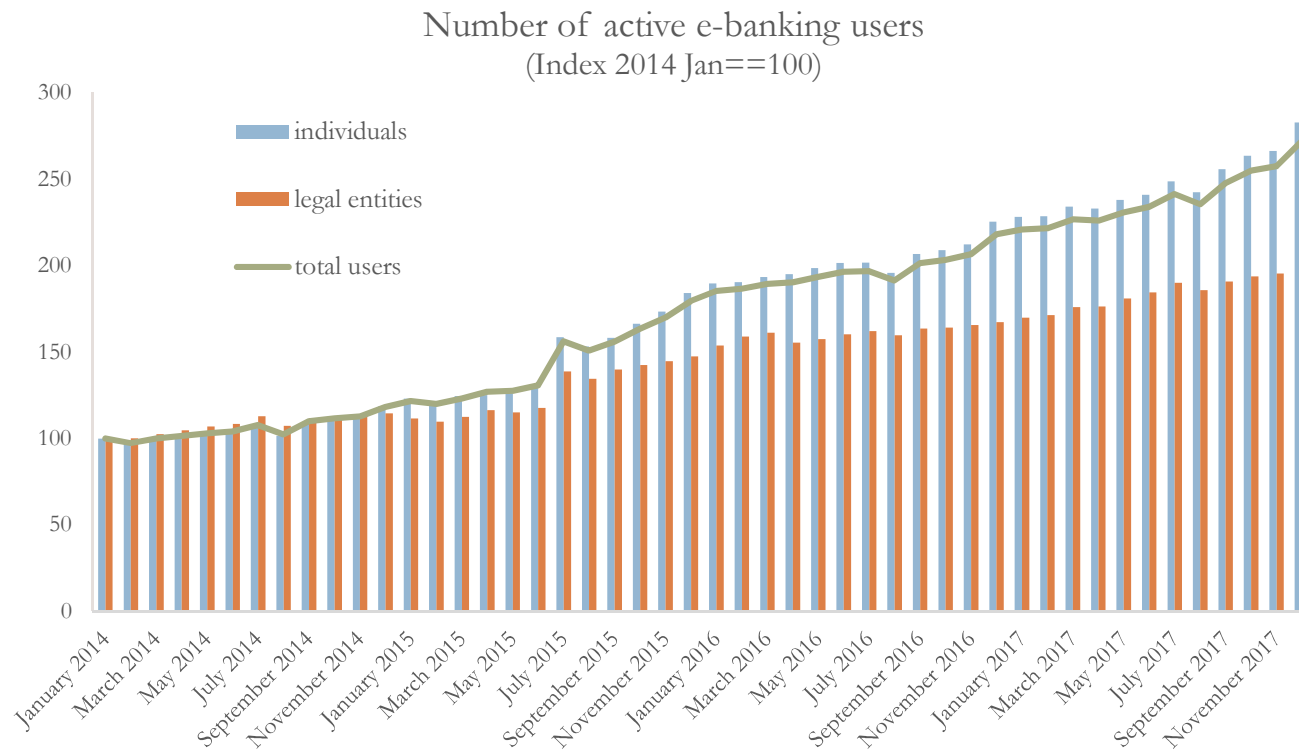
Notice: Prepaid cards are not included

Sources: Member banks of Hellenic Bank Association, Data Analysis: IOBE



Cards' expansion stems mainly from debit cards

Descriptive statistics (3)



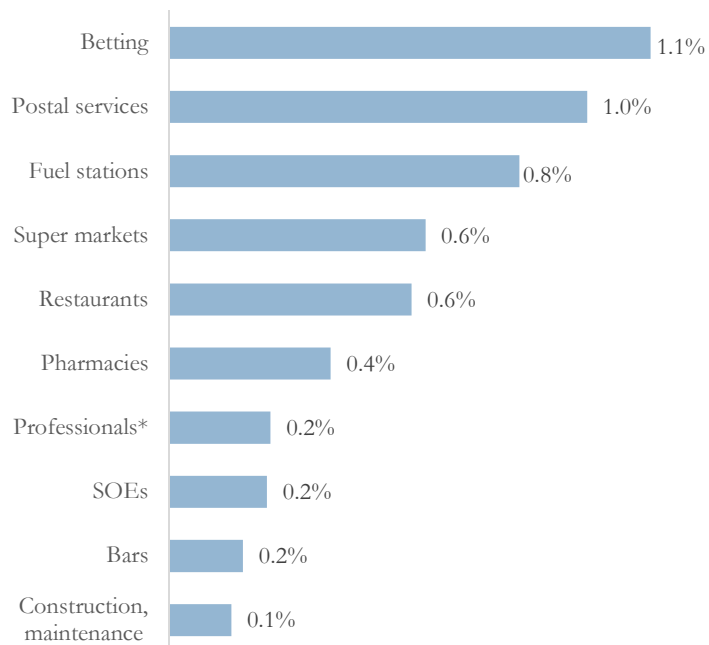
Sources: Member banks of Hellenic Bank Association, Data Analysis: IOBE

E-banking users have been increasing

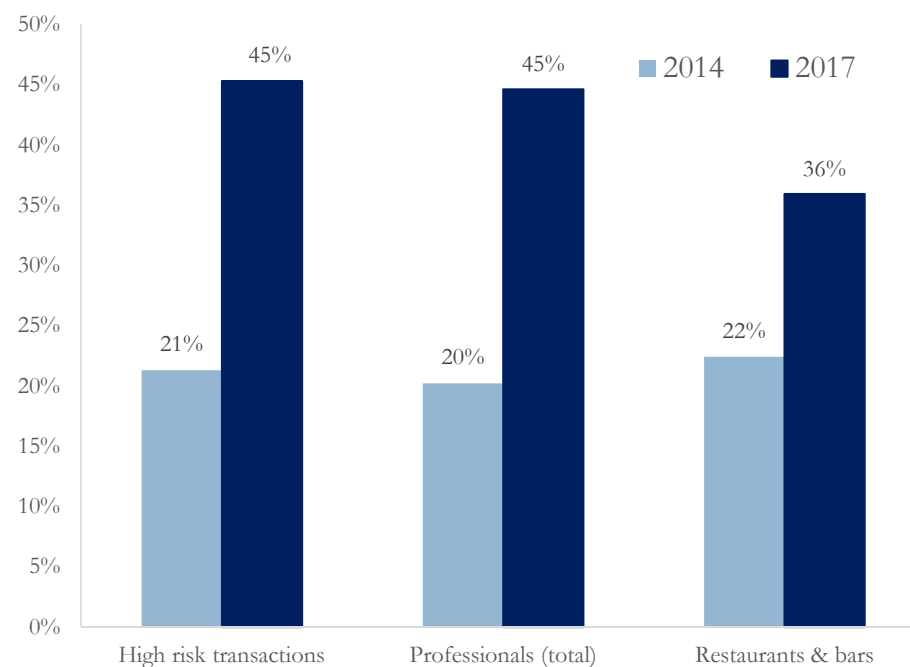


Descriptive statistics – Sectoral trends

10 sectors with significant increase of card use
(value share increase during 2017, in ppts)



Cards use adjusted for consumption, by sector
(sector share in cards use / sector share in private consumption)



Source: Member banks of Hellenic Bank Association, Eurostat **Data Analysis:** IOBE

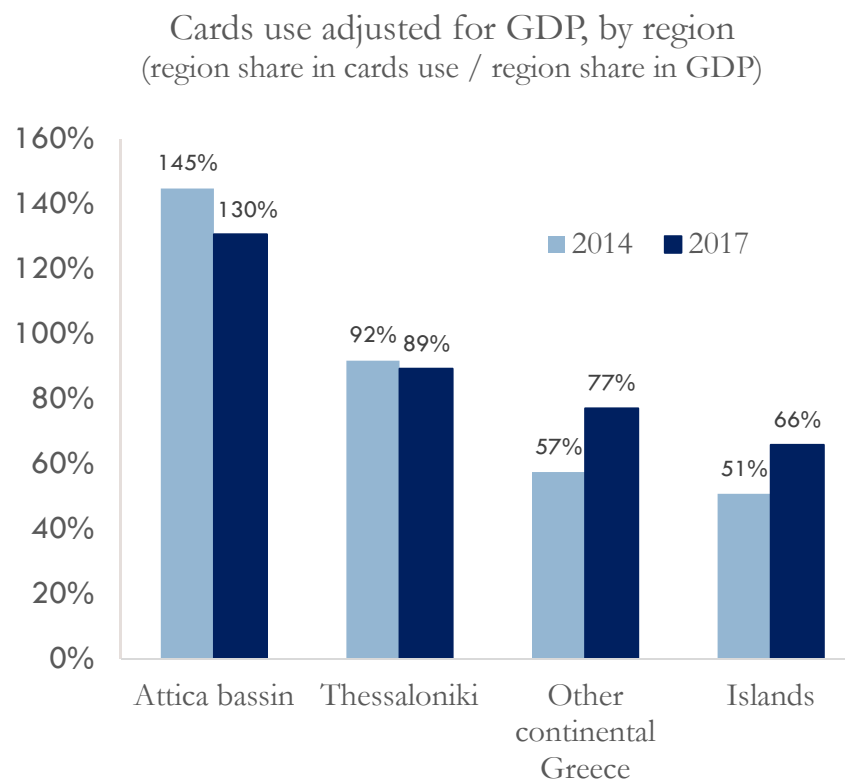
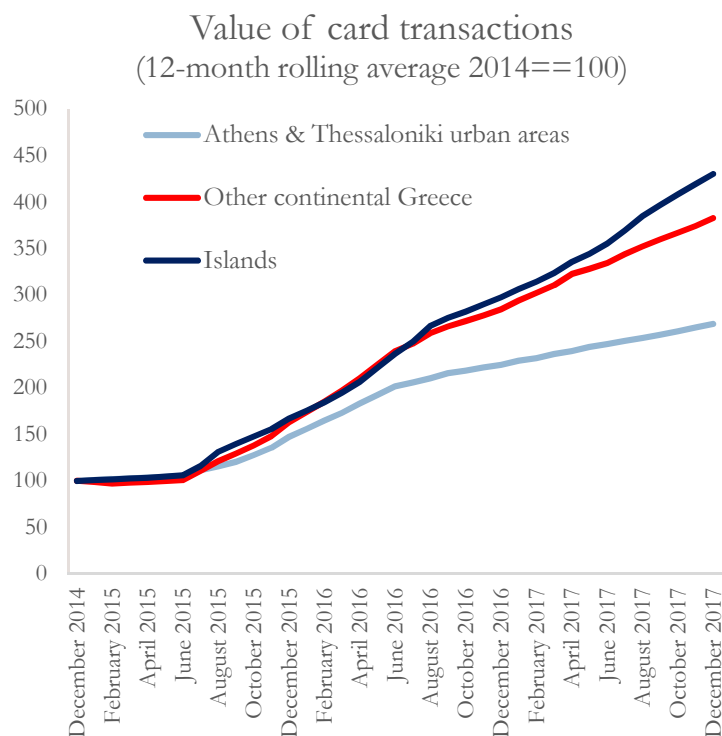
Notice: “Professionals” include doctors, lawyers, engineers, tax consultants, accountants, nurses & psychologists.

“High-risk” sectors include construction/maintenance services and transactions with professionals (e.g. doctors, lawyers, engineers, accountants, nurses, psychologists). Sector data analysis refer to the sample of two systemic banks

- The share of card transactions in sectors affected by law 4446/2016, increased in 2017
- In some sectors, card transactions remain less frequent than what their share in private consumption would suggest



Descriptive statistics – Geographical trends



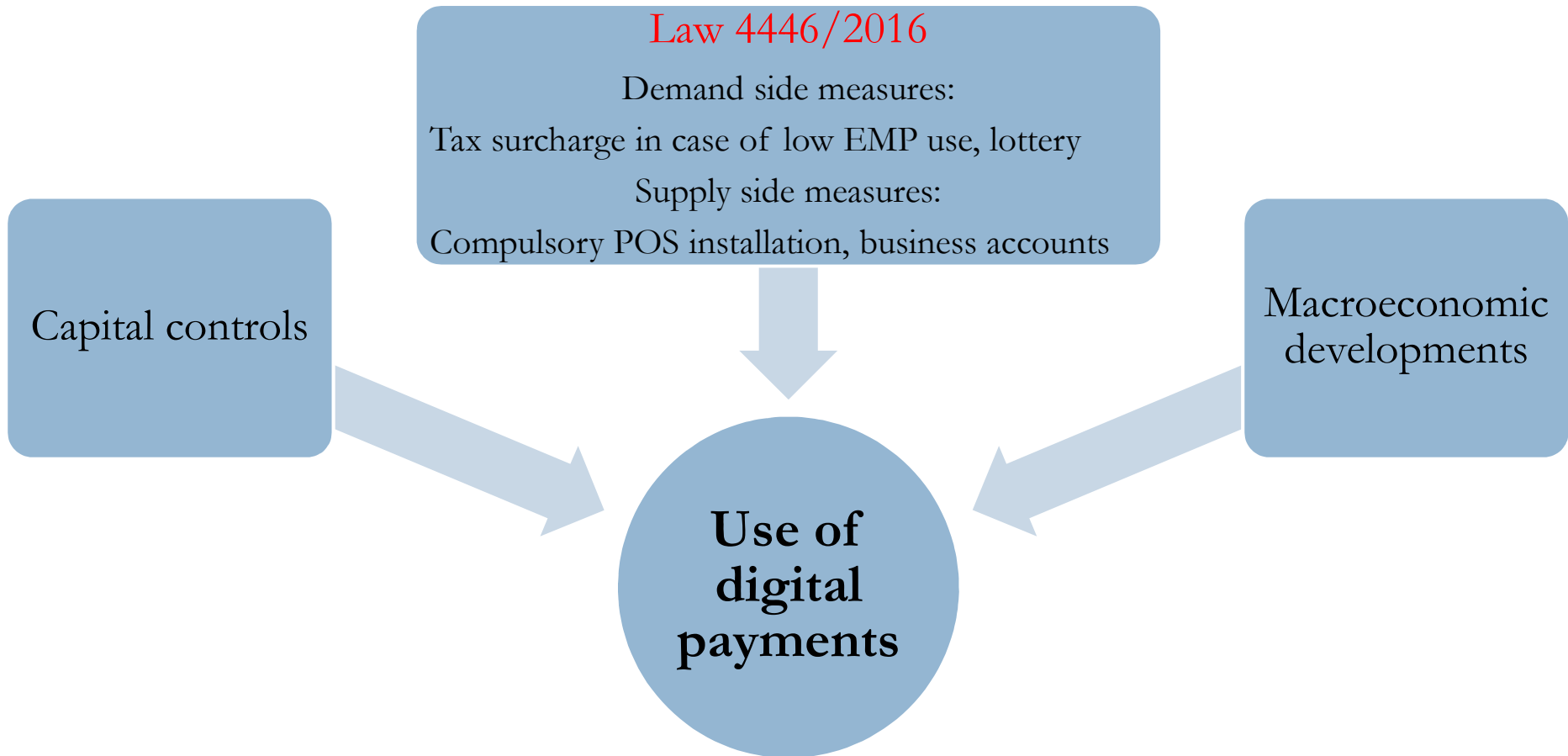
Source: Member banks of Hellenic Bank Association, Elstat, **Data Analysis:** IOBE

Notice: Geographical data analysis refer to the sample from one systemic bank

- The 2014-2017 expansion of card payments was significantly higher outside the two largest Greek cities
- However, the adjusted level of card penetration, remains significantly greater in the Attica basin



Drivers of EMP penetration



What was the measures' impact on digital payments, after controlling for the effects of macroeconomic factors and capital controls?

(E&Y, 2017)



Drivers of EMP penetration - Model

$$EMP\ use_t = f(EMP_{t-1}, macro\ base_t, capital\ controls\ 1st\ year, law\ implementation)$$

ARIMA specification, lags selected based on Akaike & Hannan-Quinn criteria

Maximum likelihood estimation (Berndt–Hall–Hall–Hausman algorithm)

Proxies for EMP use

- Value of card transactions, growth rate, per sector and region
- Number of card transactions, growth rate, per sector and region
- Number of active e-banking users, growth rate

Independent variables and controls:

- Dummy for the 1st year of capital controls (July 2015 – June 2016)
- Dummy for law 4446/2016 1st semester of implementation (Jan-Jun 2017), 2nd semester of implementation, including compulsory POS terminal installation (Jul-Dec 2017)
- Macroeconomic controls: Inflation, private consumption, GDP, population
- Lagged dependent variables

Limitations: Dummy approach, instead of direct measures (unobserved)



Drivers of EMP penetration - Results

$$EMP\ use_t = f(EMP_{t-1}, macro\ base_t, capital\ controls\ 1st\ year, law\ implementation)$$

	Total card payments		Debit cards		Credit cards		E-banking
	Value of transactions	Number of transactions	Value of transactions	Number of transactions	Value of transactions	Number of transactions	Number of active users
Law 4446 First semester	0.02***	0.04***	0.04**	0.05**	-0.01	0.01**	-0.01
Law 4446 Second semester	0.03***	0.05***	0.05***	0.06***	0.01**	0.02***	0.01
CC First year	0.07***	0.09***	0.12***	0.13***	0.03***	0.04***	0.02***
(Log) Private consumption	4.42**	7.47***	2.68***	6.25***	4.76***	5.30***	
(Log) GDP							0.93*
Model	ARMA(1,0)	ARMA(1,0)	ARMA(1,0)	ARMA(1,0)	ARMA(1,0)	ARMA(1,0)	ARMA(1,0)
Adjusted R ²	88.1%	92.0%	88.2%	90.2%	58.2%	72.6%	97.5%
Observations	36	36	36	36	36	36	36

Notice: The sample refers to the period 2014-2017. The statistical significance of the coefficients is denoted with ***, ** and * for significance at the 1%, 5% and 10% level respectively. The value of transactions is expressed in current prices. Private consumption is expressed in current prices in the regressions on value, in constant prices when estimating the number of transactions. The GDP is expressed in constant prices.

The impact of capital controls is larger than that of legislation, while both factors have a more significant effect on debit cards. Macro factors exhibit the expected sign.

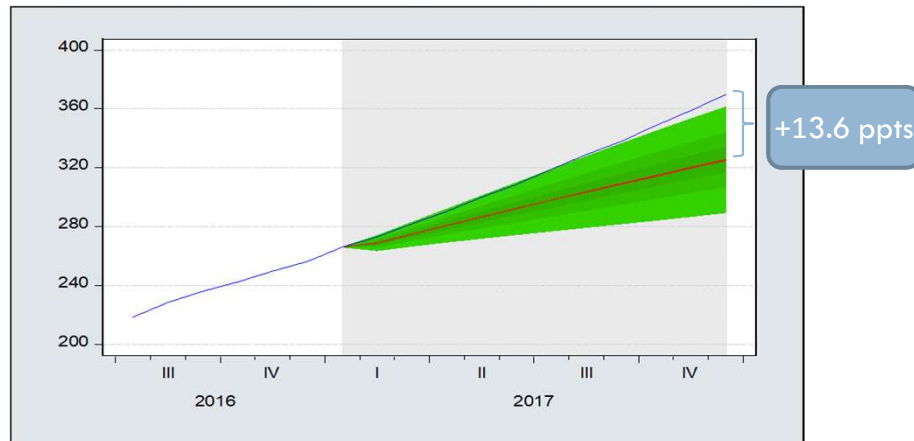


Drivers of EMP penetration – Out of sample robustness test

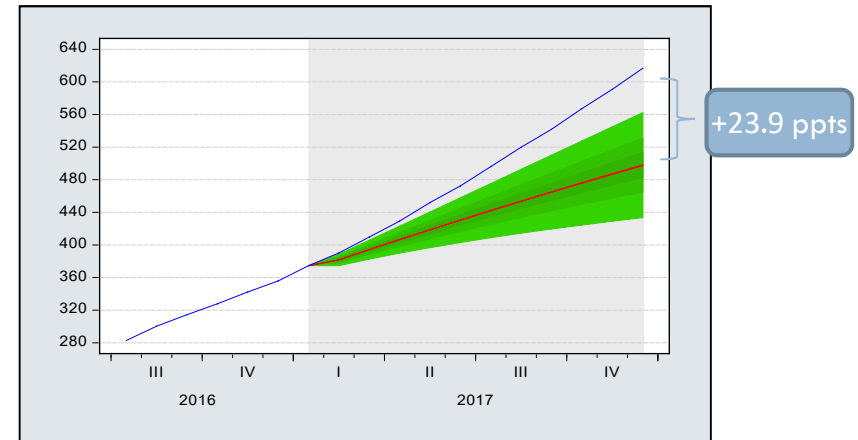
$$EMP\ use_t = f(EMP_{t-1}, macro\ base_t, capital\ controls\ 1st\ year)$$

- The model is estimated up until before the law's voting (December 2016).
- The model forecasts EMP use in 2017 under the null hypothesis of no measures
- Forecasts for 2017 are compared with actual EMP use after the voting of the law
- The discrepancy between forecasts and actual values can be attributed to the law's impact

Value of total card transactions



Number of total card transactions



Model forecast with no measures: Red line

Actual values: Blue line (12-month rolling index 2014=100)

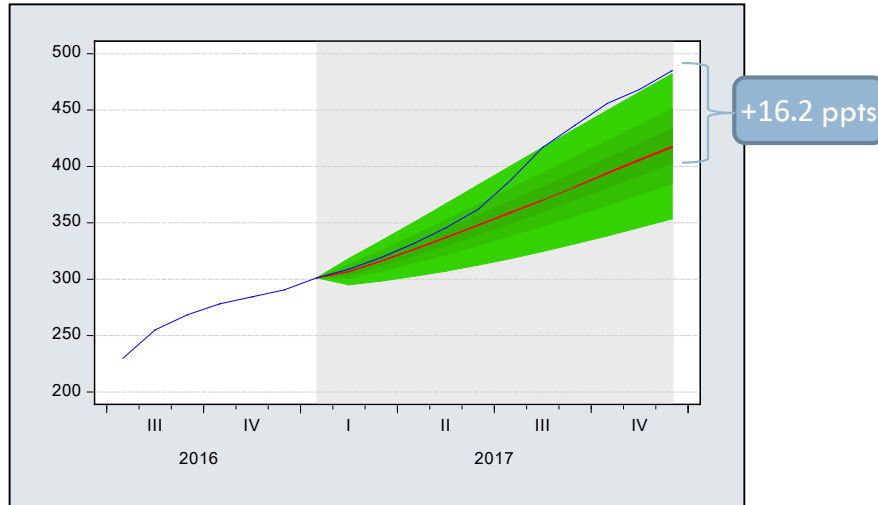
Confidence interval 30%, 60% and 90% with **bold**, **average**, **light** green shade respectively



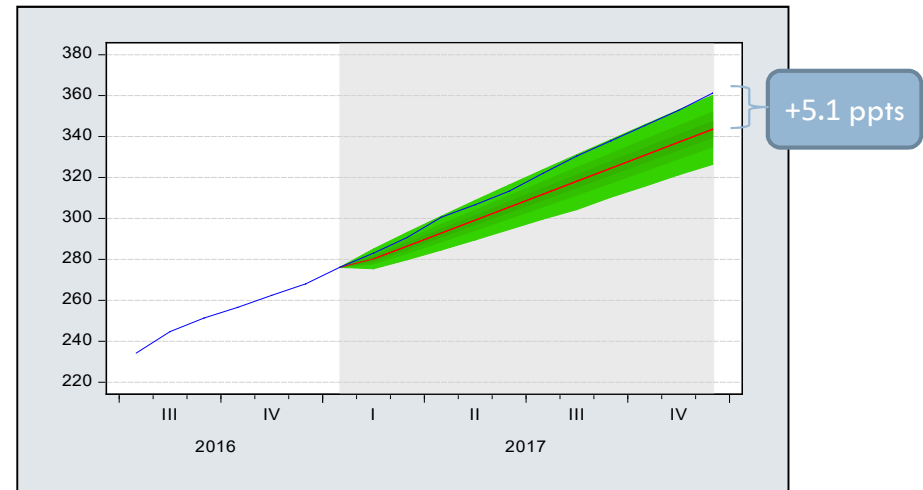
Drivers of EMP penetration – Out of sample robustness test

$$EMP\ use_t = f(EMP_{t-1}, macro\ base_t, capital\ controls\ 1st\ year)$$

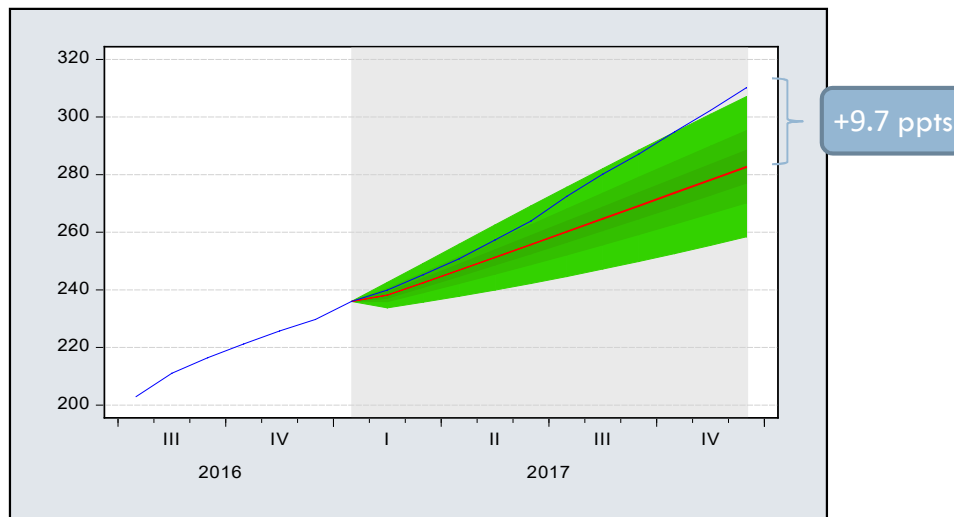
Card transactions in restaurants and bars



Card transactions outside Athens urban area



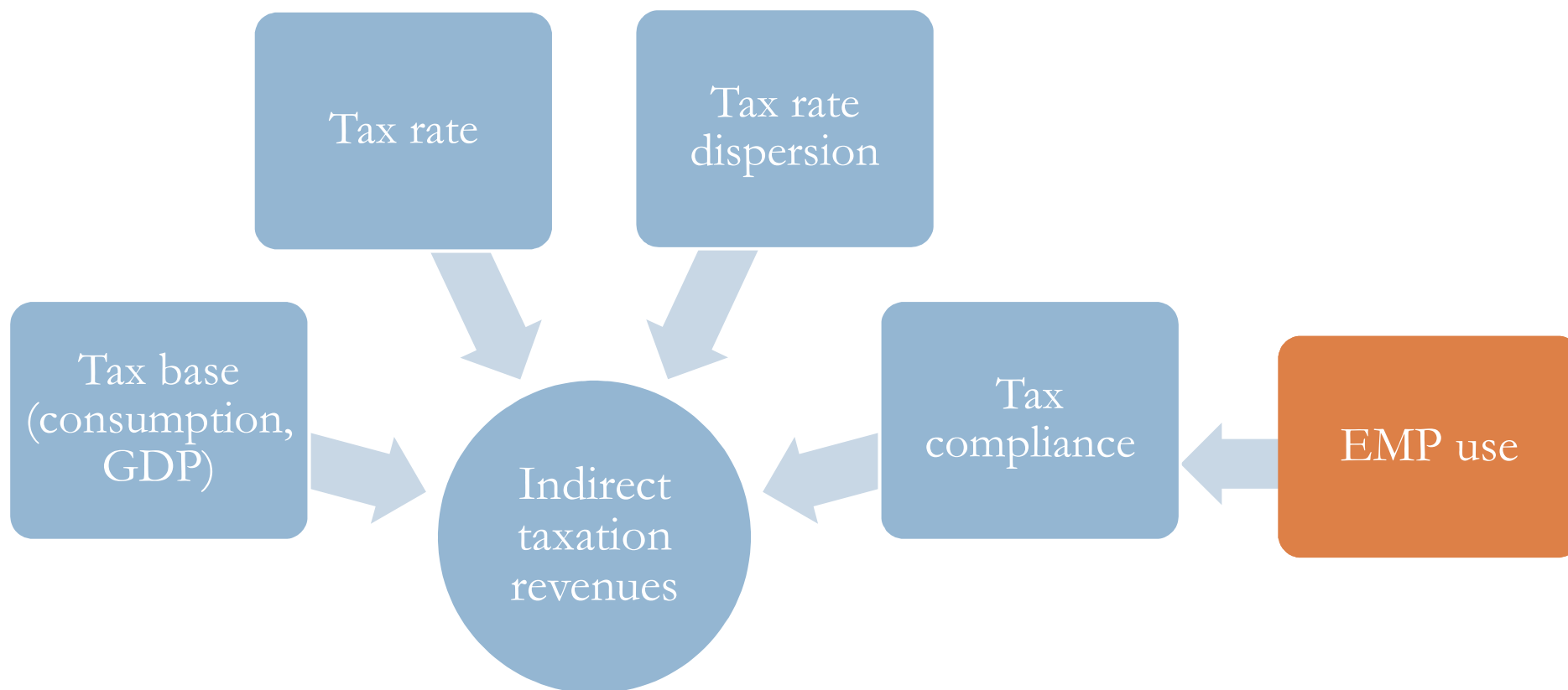
Card transactions in sectors that were affected by the 1st implementation phase of law 4446



Model forecast with no measures: Red line
 Actual values: Blue line (12-month rolling index 2014==100)
 Confidence interval 30%, 60% and 90% with bold, average, light green shade respectively



Card payments' impact on tax compliance



What was the impact of EMP use on VAT revenues, after controlling for changes in tax policy and other macroeconomic factors?

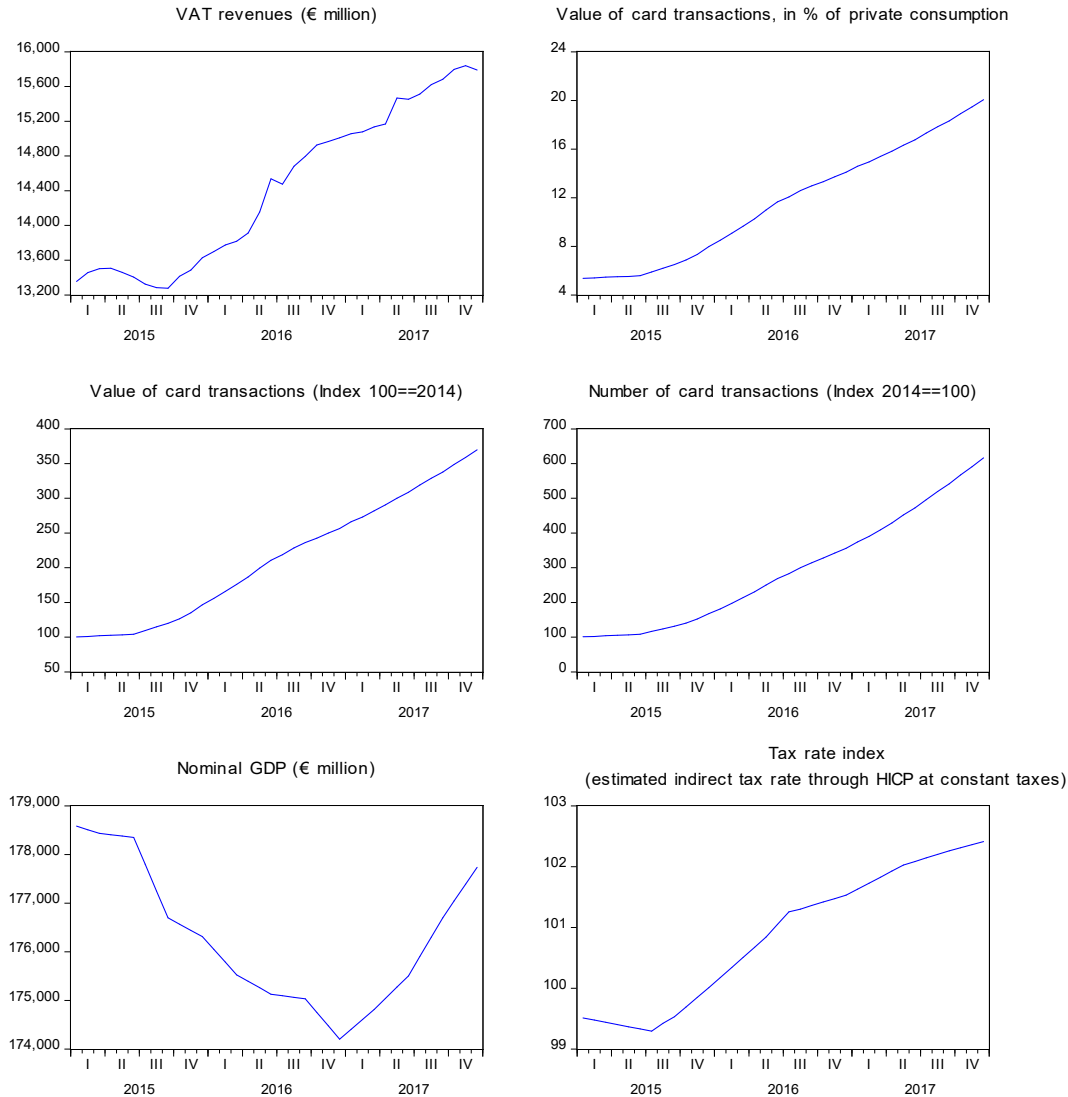
WB (1993), BoG (2014, 2017) working papers



Card payments' impact on tax compliance - Model

$$VAT\ revenues_t = f(\text{tax base}_t, \text{tax rate}_t, \text{tax rate dispersion}_t, EMP\ use_t)$$

Variables (12-month rolling window)



High correlation between tax rate and use of digital payments – problem of multicollinearity
 =>
 Use of appropriate econometric techniques (orthogonalization as in Bris et al., 2004)



Card payments' impact on tax compliance - Model

$$VAT\ revenues_t = f(\text{tax base}_t, \text{tax rate}_t, \text{tax rate dispersion}_t, EMP\ use_t)$$

2-step estimation

- **Step 1:** Isolate variations e_t in the use of EMP, which are not attributed to macroeconomic factors or changes in tax policy. Variations refer to the **degree of EMP penetration** (result of preferences, habits, network effects)

$$EMP_t = a_0 + a_1 \text{taxbase}_t + a_2 \text{taxrate}_t + a_3 \text{dispersion}_t + e_t$$

- **Step 2.** We estimate the impact of 4 variables on VAT revenues

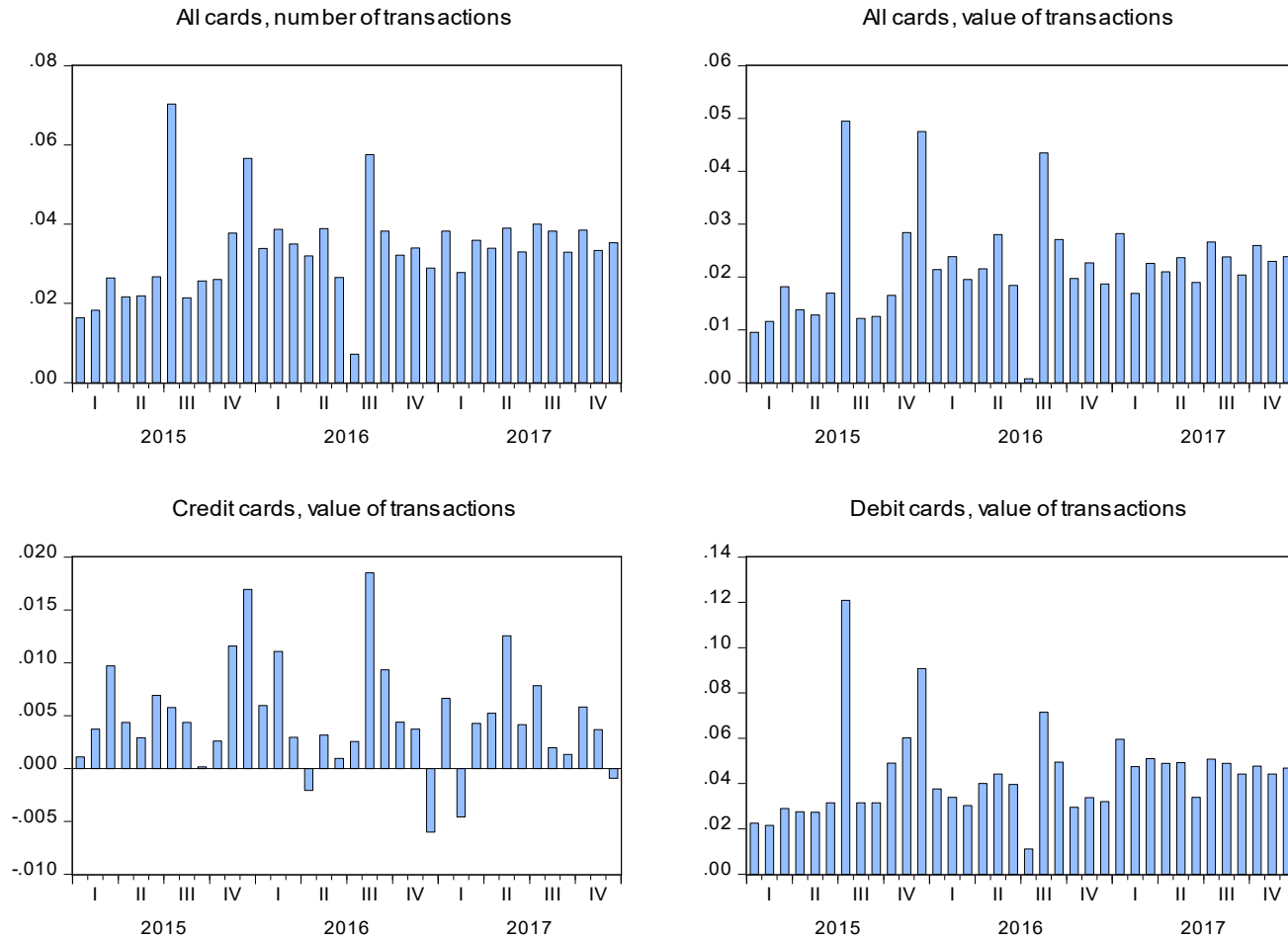
$$VAT\ revenues = b_0 + b_1 \text{base}_t + b_2 \text{rate}_t + b_3 \text{dispersion}_t + b_4 \hat{e}_t + \varepsilon_t$$

=> b_4 : the degree of enhancement of **tax compliance** from EMP penetration



Card payments' impact on tax compliance – Results (step 1)

**Estimated penetration of card payments
(Monthly changes of 12-month rolling window)**



The above trends are attributed to changes in consumer preferences



Card payments' impact on tax compliance – Results

		VAT Revenues			
		I	II	III	IV
All cards (penetration independent of macro-factors)	Value of transactions	0.26**			
	Number of transactions		0.19*		
Debit cards (penetration independent of macro-factors)	Value of transactions			0.07	
Credit cards (penetration independent of macro-factors)	Value of transactions				0.45**
Tax base (GDP)		0.71	0.71	0.71	0,71
Tax rate		4.36***	4.36***	4.36***	4.36***
Dispersion rate		0.01	0.01	0.01	0.01
Adjusted R ²		30.9%	29.0%	23.8%	29.8%
Observations		36	36	36	36



Positive and statistically significant impact of card penetration on tax compliance

Card payments' impact on tax compliance – Robustness test

Orthogonalization through 2-stage least squares

		VAT revenues					
		I	II	III	IV	V	VI
All cards	Value of transactions	0.14***					
	Number of transactions		0.11***				
Debit cards	Value of transactions			0.08**			
Credit cards	Value of transactions				0.44***		
Card value as share of GDP						2.04***	
Card value as share of private consumption							1.41***
Instrumental variables		Tax base (GDP), Tax rate , Dispersion rate					
Adjusted R ²		17.4%	15.6%	3.7%	14.7%	22.6%	22.2%
Observations		36	36	36	36	36	36



Positive and statistically significant impact of card penetration on tax compliance

Policy discussion – Potential for further gains

Potential VAT revenues based on good practices of other countries as per the ratio «transaction value over private consumption»

Card transaction value as a share of private consumption	Greece gap from other countries, in ppts	Potential VAT revenues (in € million)	Potential VAT increase vs 2017 (in %)
EU28 average	14.9 ppts	3,308	21.0%
Eurozone	6.2 ppts	1,368	8.7%
Portugal	38.4 ppts	8,541	54.1%

Notice: Based on estimation through 2-stage least squares

- Annual VAT revenues would be higher by 21% (€3.3 billion) if Greece reaches the average EU level of card use
- Need for more targeted measures, better balance between “carrot & stick” incentives



Policy discussion – Indicative policy measures

Demand side - Consumers

- Return 5% of card transaction value in targeted sectors or geographical regions
- Income tax discount awarded in cases of large EMP use in risky sectors
- Incentives for formal complaints against firms that don't accept EMPs (including cases where a POS is installed, but it repeatedly faces “technical problems”)

Supply side - Businesses

- Lottery or tax deduction for self-employed who meet EMP penetration targets
- Tax deductibility of professionals' expenses to be conditional upon their electronic payment
- Implementation of digital billing

Government

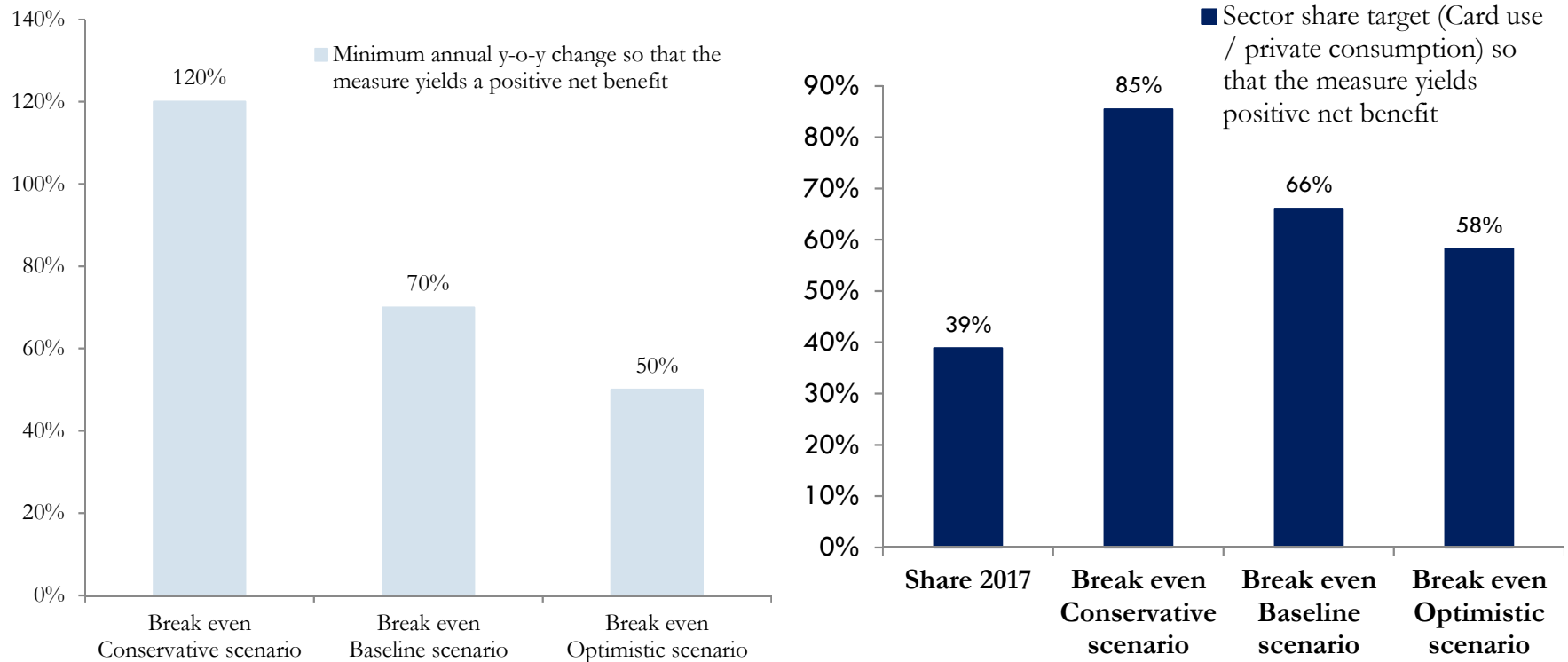
- Supervision that ensures expedient and effective implementation of law 4446
- Compulsory declaration of all professional accounts held by businesses and self-employed, by specific deadlines and imposition of penalties for non-compliance



Policy discussion – Break Even analysis

What should the yield of the measure be, in terms of annual increase of card transaction value or share of total consumption, so that its benefit is equal or higher than its cost?

**5% return measure, applicable only on targeted transactions*,
with maximum return of €500 per household.**



* Simulations are based on the application of the measure in transactions with professionals (doctors, lawyers, engineers, accountants, nurses, psychologists) and in catering and construction services.

Conclusions – Further steps

- The imposition of capital controls and policy measures both provided significant boost to EMP use in Greece during 2015-2017. The boost has lasting features
- Total card use penetration had a significant positive effect on tax compliance, contributing to at least 50% of total annual VAT revenues' increase in 2017
- The level of cards use converged to EU28 average at the fastest pace in 2017, however it remains relatively low and heterogeneous across sectors and regions
- Potential for further fiscal gain from greater use of EMP
- Focus on incentives targeting EMP penetration in “medium” & “high” risk sectors and regions with low use
- Merit in quantifying alternative policy scenarios, simulations at the sectoral level

ANNEX 1

Drivers of EMP penetration – Quantification of law's impact

	Total card payments	
	Value of transactions	Number of transactions
Yield of law measures (annualized new card use in December 2017 compared to scenario without measures)	€2.97 bln.	110 mln.

The law contributed to an increase of card transactions' penetration up until December 2017 by **€3 billion and 110 million** (on an annual basis), in terms of value and number respectively.



ANNEX 2 –

Card payments' impact on tax compliance – Results recap

1% increase in annual VAT revenues is caused by:

7.1% annual increase in the value of card transactions

13.0% annual increase in the value of debit card transactions

9.3% annual increase in the number of card transactions

0.7 percentage point increase in the card value share in private consumption

0.5 percentage point increase in the card value share in GDP

In 2017, total VAT revenues increased by 5.2% y/y (€780 million).

- The law contributed to about 1/3 of total annual VAT revenues' increase in 2017
- The total impact of card use penetration on VAT revenues was significantly higher, contributing to at least 50% of total annual VAT revenues' increase in 2017

