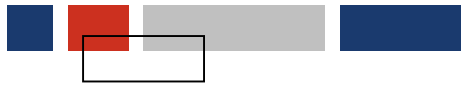**INSTITUTO NACIONAL DE ESTATÍSTICA**
STATISTICS PORTUGAL

» CPPI Data Compilation and Methodology in Detail

«

Workshop on CPPI,
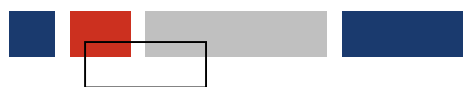Avanos, Nevsehir, Turkey, 8 May 2018

Rui Evangelista

»

Presentation outline

- Introduction

- Methodology

- Results

- Closing remarks and way forward

Introduction

- The 2008 financial crisis highlighted the key role of real estate markets in influencing the economy and unveiled the need for more and better price statistics (among other) to monitor these markets:

  - Progress in covering the residential property market segment; Despite some recent key developments (Eurostat, 2017), there is still the lack of commercial property market indicators.

- In particular, commercial property price indexes (CPPI) are of great importance for economic analysis, financial stability analysis, macroprudential policy and as an input for better official statistics (National Accounts).

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In Portugal:

- Quarterly House Price Index (HPI) : July 2014 (INE, 2014);

- CPPI project (Banco de Portugal & Statistics Portugal), 2015-2016:

  - One economist/econometrician from Banco de Portugal working at Statistics Portugal (around 70% of her time); supervision by Statistics Portugal;

  - Preliminary results: September 2016;

  - Presentation of methodology and more definitive results: May 2017 (Raposo e Evangelista, 2017);

  - Publication of an annual CPPI: June 2017 (INE, 2017).
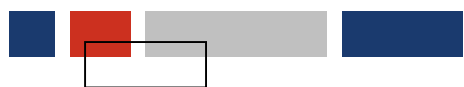
Methodology

Challenges:

- Lack of methodological guidelines:

    - Scope of the index: e.g., commercial property definition; how to define prime locations?

    - Type of properties covered: e.g., should we include buy-to-let properties?

- Need for more work on this area:

"…Several significant challenges were identified: for instance,… the need for further methodological work on the Commercial Property Price Indices…"

IMF (2017), in: Data Gaps Initiative Conference, Key messages, July 2017.

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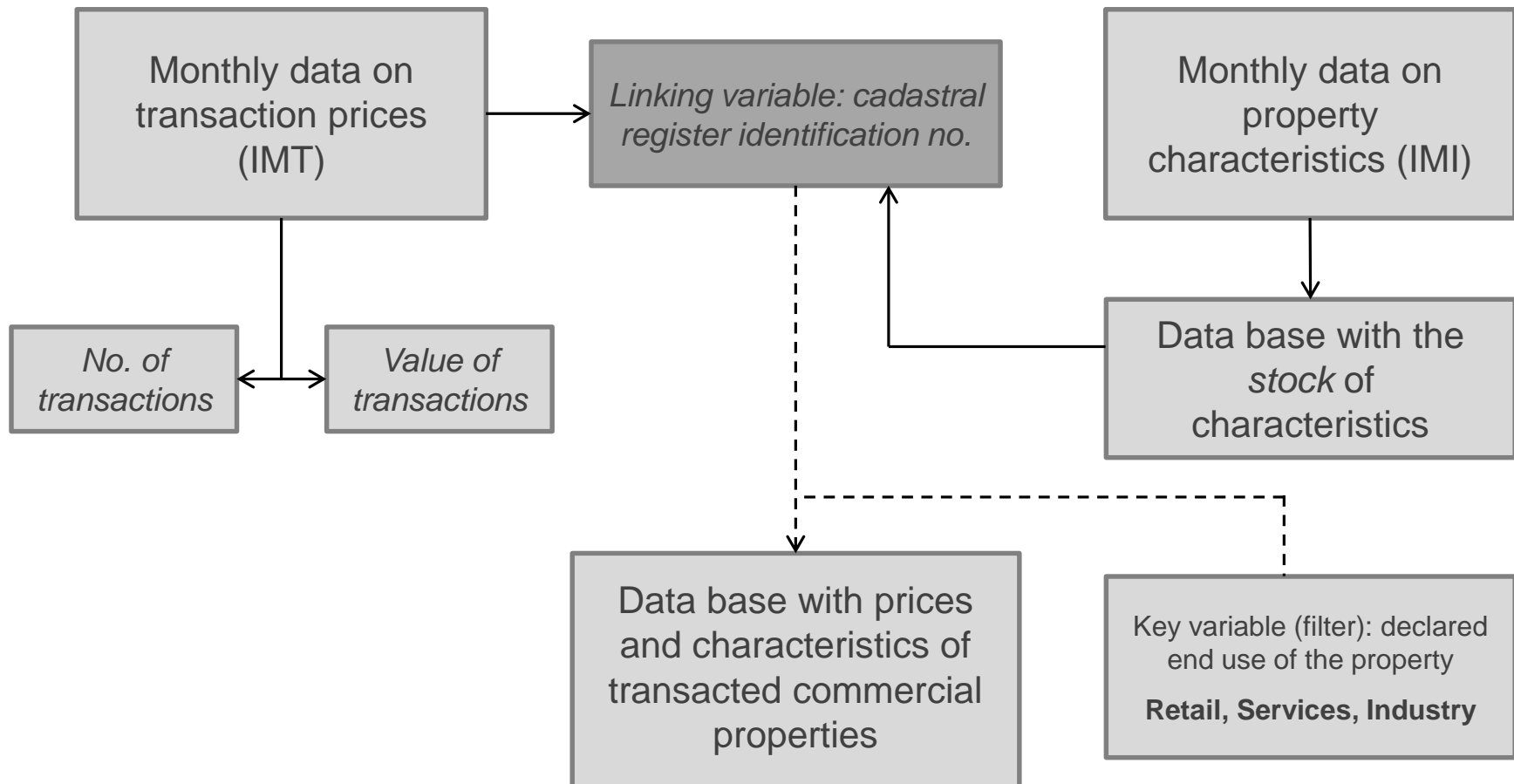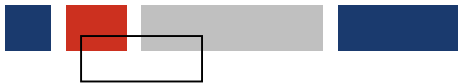STATISTICS PORTUGAL

Opportunity:

- Access to good-quality transaction (IMT) and property tax (IMI) data:

    - Coverage: population of transactions;

    - Timeliness: sent on a monthly basis;

    - Rich data sets: variables on the quality of the properties available. Possibilty of linking these data with other sources (e.g., energy efficiency certificates);

    - Already in use in current production (HPI, house sale statistics).

Summary of price and characteristics data flow:

Monthly data on transaction prices (IMT)	→	*Linking variable: cadastral register identification no.*

No. of transactions ←→ Value of transactions

Monthly data on property characteristics (IMI)

Data base with the *stock* of characteristics

Data base with prices and characteristics of transacted commercial properties

Key variable (filter): declared end use of the property

Retail, Services, Industry

But… practical problems :

- More infrequent transactions than its residential market counterpart.

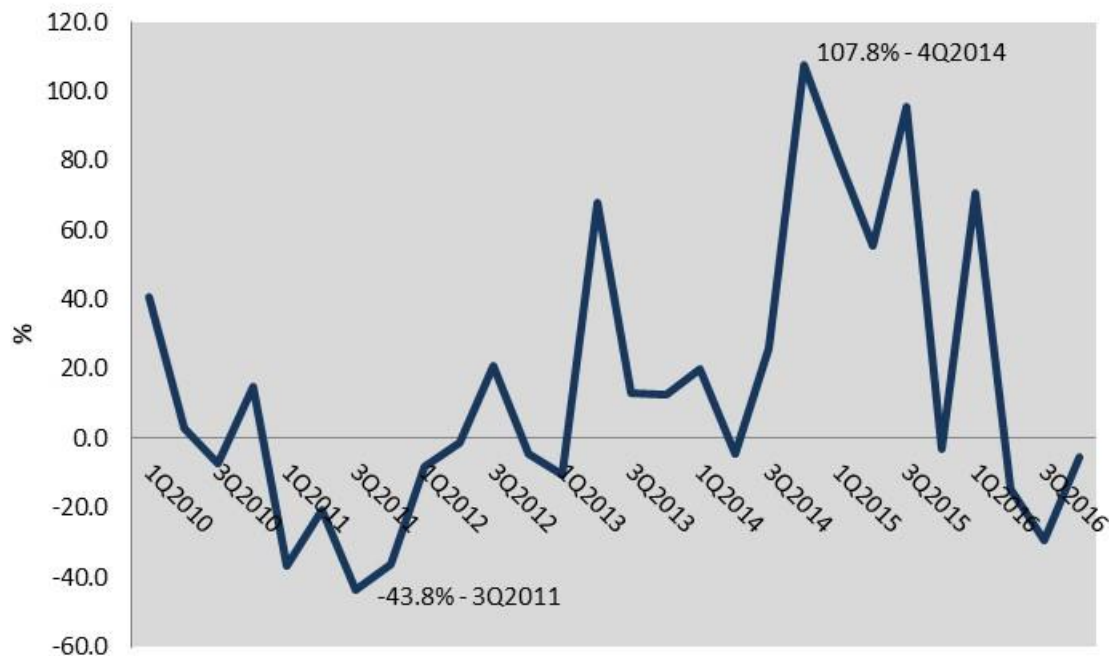**Residential and commercial property transactions**
Quarterly data; 2009 - 2016
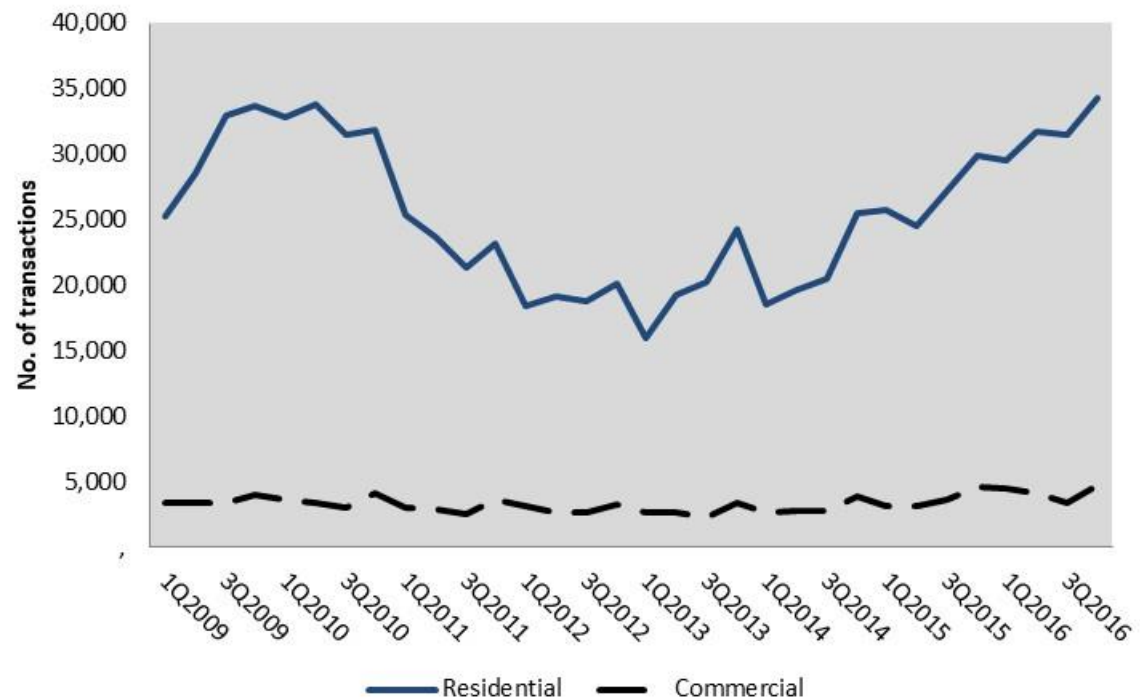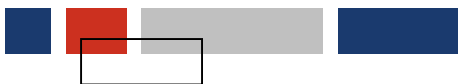
And…

- Properties are more heterogeneous than residential properties…

Year-on-year change in the value of transacted commercial properties

Followed approach:

- Hedonic price indexes, Time dummy hedonic regression method, adjacent period approach (Triplett, 2006: 54:5).

- Already used in the production of official statistics:

  - Same methodology that is used in the production of the HPI (INE, 2014); New Housing Price Index (INSEE, nd).

- A particular case of the Rolling window time dummy (Shimizu et al., 2010).

Time dummy hedonic regression method, adjacent period approach:

- **Regression analysis:** hedonic price function (Rosen, 1974); describes the equilibrium relationship (demand and supply) between characteristics of a product and its price. The coefficients of the price-determining characteristics are obtained through the use of the ordinary least squares estimator (OLS).

- **Time Dummy:** dichotomous (0,1) variable is used to signal the period of time in which the property is sold.

- **Adjacent periods:** pairs of contiguous quarters of data (Q-1,Q) are used as a basis to estimate the parameters of the hedonic function.

Hedonic regression:

For all pairs of contiguous quarters q=(Q-1,Q), the following regression is estimated:

$$\log(P) = \alpha + \sum_{k=1}^{K} \beta_k X_{i,q,k} + \theta D_{i,q} + \epsilon_{i,q}$$

where,

log(P), is logarithm of the price level;
$X_{i,q,k}$, is the value of the kth characteristic;
$\epsilon i, q$, is an error term ;and
$D_{i,q}$ is the time dummy defined as :
$$D_{i,q} = \begin{cases} 1, if\ q = Q \\ 0, otherwise \end{cases}$$

- The assumption is that the parameters associated with the characteristics are constant over adjacent quarters.

- θ is the parameter of the time dummy from which the quarterly evolution of prices between quarters Q-1 and Q is extracted:

$$I_{Q,Q-1} = \exp(\hat{\theta}_q) * 100$$

- Three strata (hedonic models) are considered:
  - Retail and wholesale;
  - Services; and
  - Industrial and warehouse.

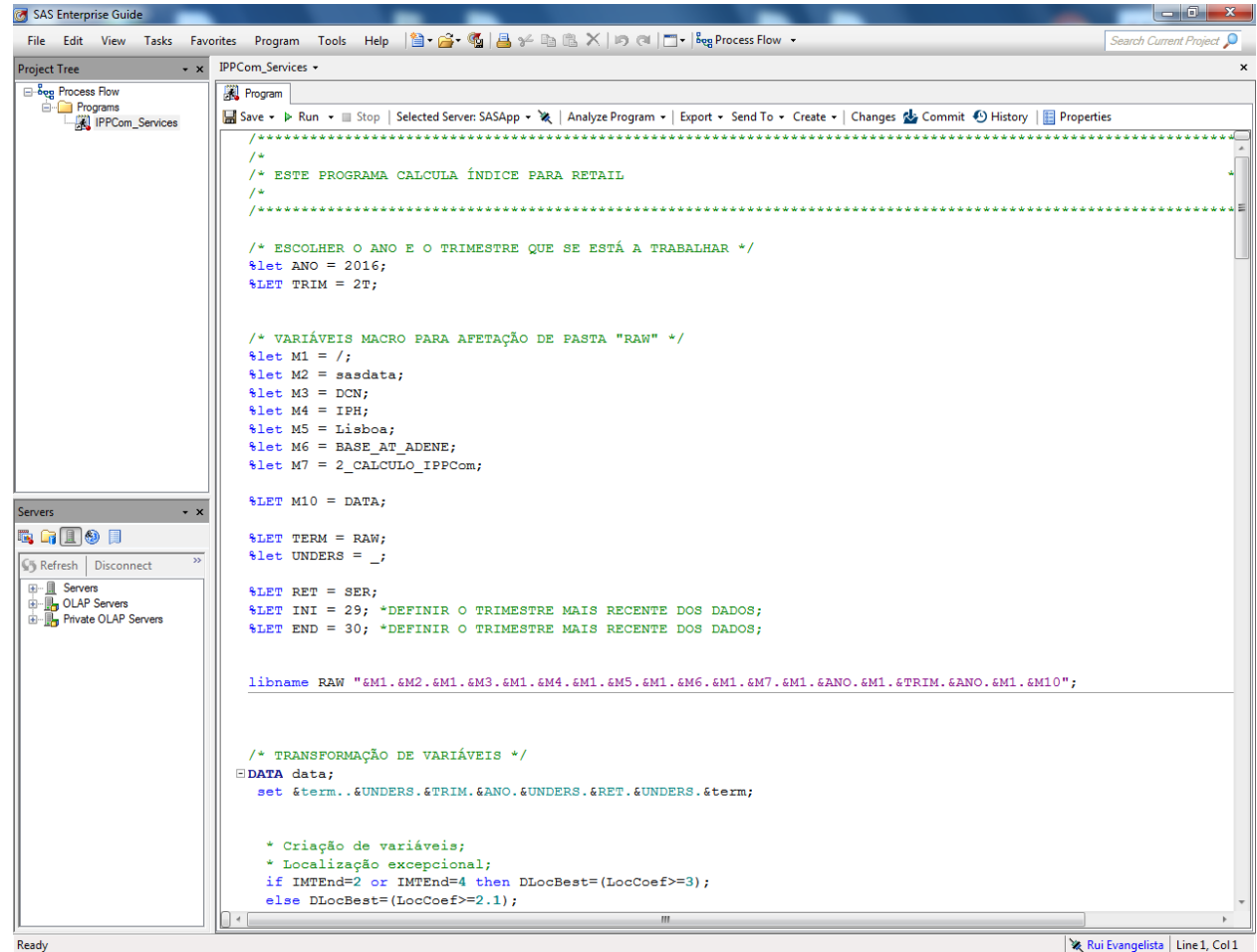 - Weights based on previous year's annual sales are used to aggregate the three stratum results into a national index.

Variables that are common to all three strata:

Area variables
* Log(Gross Floor Area)

Age variables
* Dwelling age at the moment of transaction
* Square of dwelling age at the moment of transaction

Location variables
* NUTS II Dummies
* Oporto Dummy

(Base location is Área Metropolitana de Lisboa)

Specific variables are added to tailor a specification to each of the strata:

Area variables
* Number of floors
* Number of divisions

Age Variables
Dummies signalling:
* New buildings
* Bad conservation state
* Improvements

Location Variables
* Location near the sea

Quality and Comfort Variables
Dummies signalling the existence of:
* Air conditioning
* Sewage

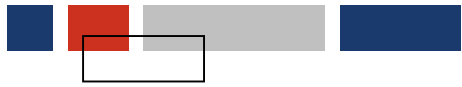*Example of calculation environment:*

Results

Some information on the regression outputs:

	Retail and wholesale	Services	Industrial and warehouse
Average no. of observations per quarter	≈ 2,500	≈ 1,200	≈ 900
Adjusted R^2 (average over the quarters)	≈ 0.67	≈ 0.82	≈ 0.82

Overall, the results are in line with our experience in the field and type of estimation context (pooled cross section data)…
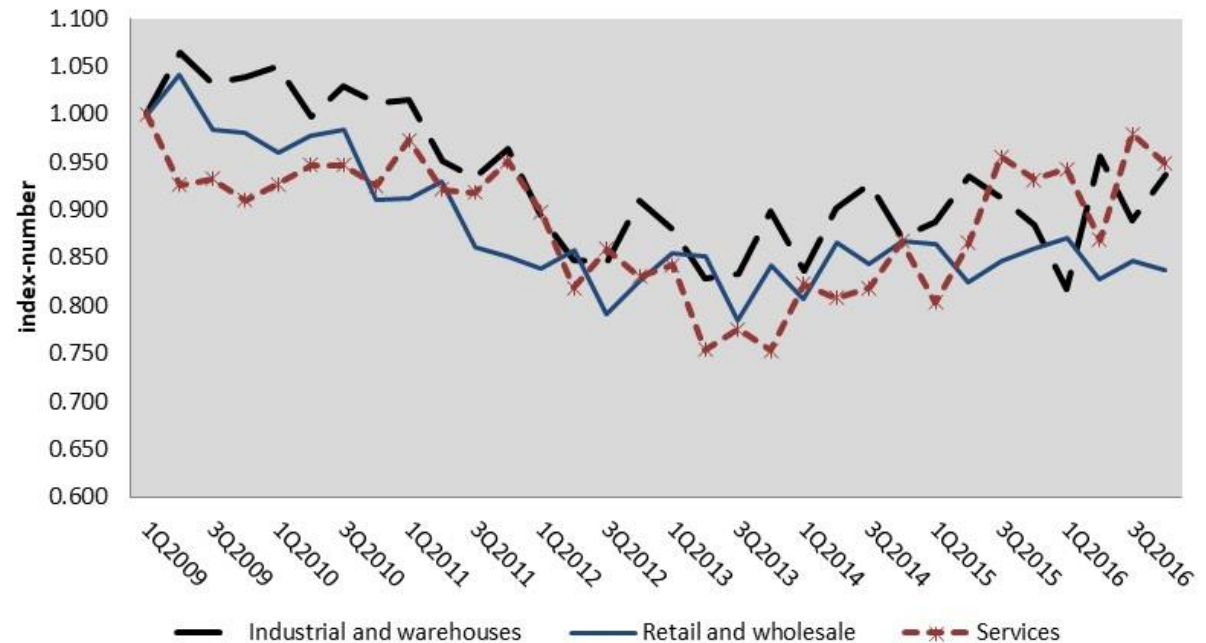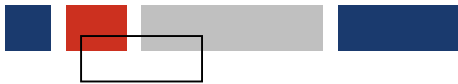
However:

- The method does not completely eliminate the heterogeneity associated with commercial properties.
- This situation is particularly evident when quarterly and/or regional indexes are derived.

Index-numbers of the three CPPI strata

2009 - 2016; 1 = 1Q2019

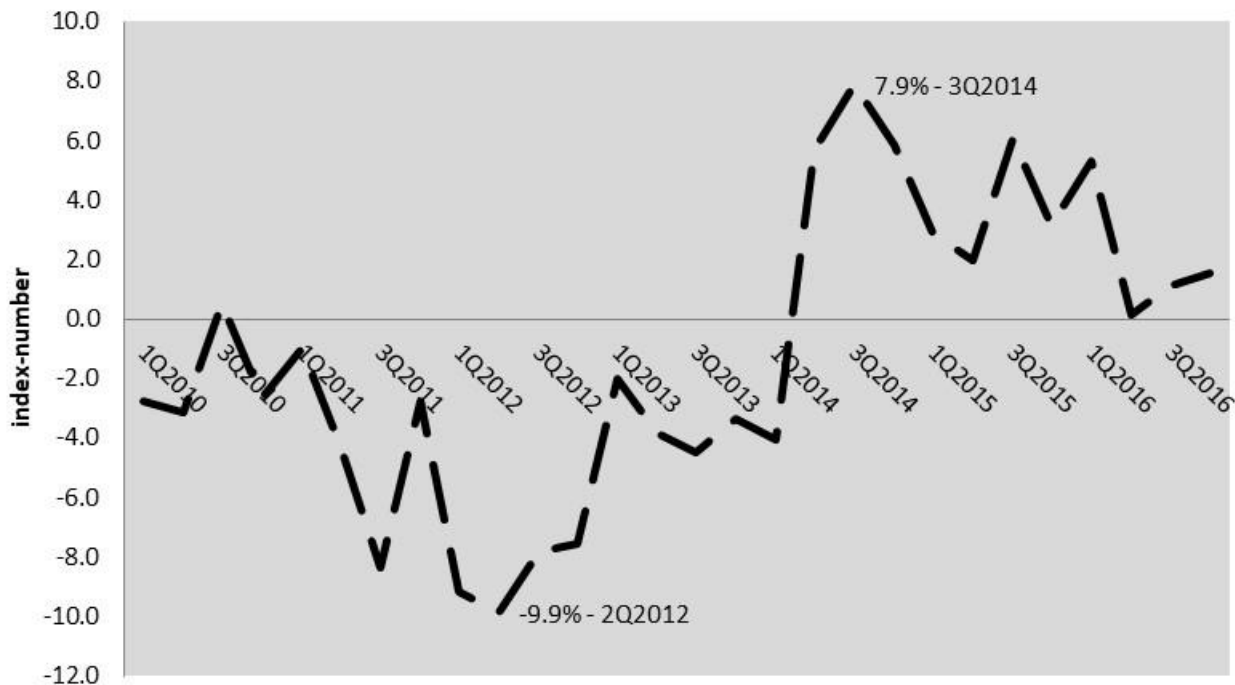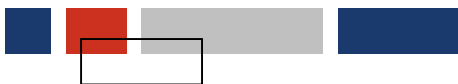Legend: Industrial and warehouses — Retail and wholesale — Services

And…

- Even when the strata are grouped together, this characteristic does not disappear…

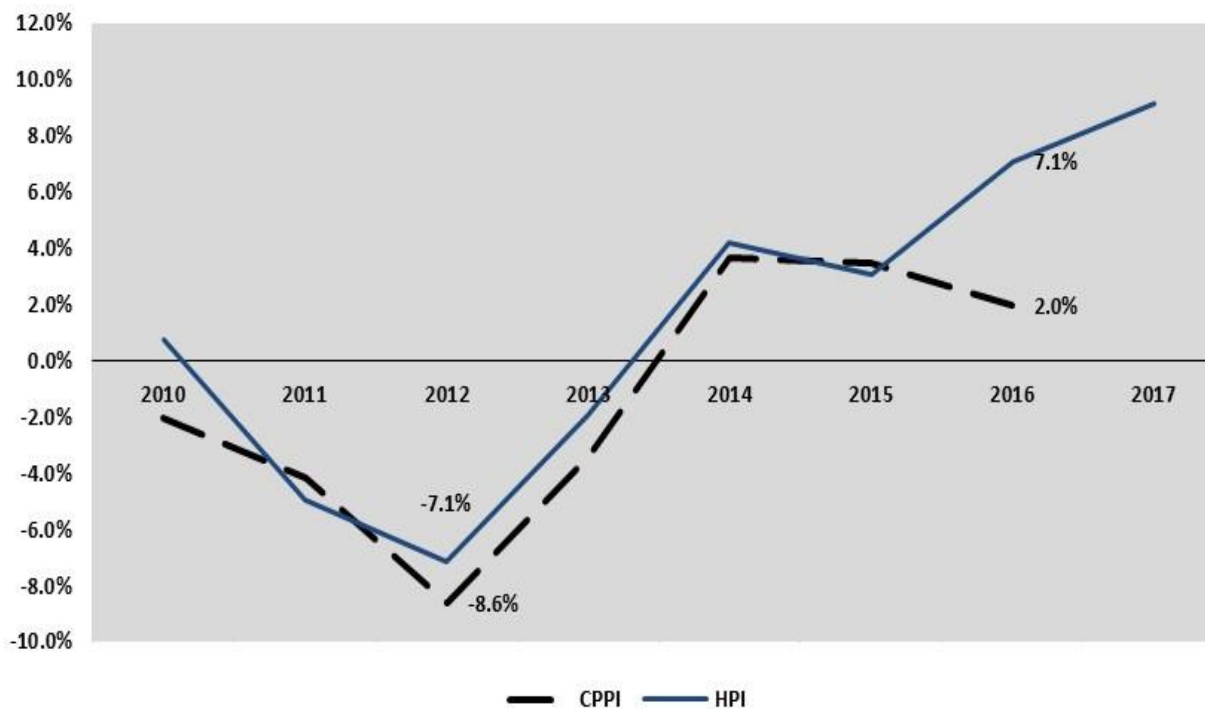## Quarterly year-on-year exchange rate of the CPPI

Final decision:

- Release of overall annual indexes only.

Quarterly year-on-year exchange rate of the CPPı

The results shown that the evolution of prices in the real estate market can be grouped into two periods:

- 2010 - 2012: characterized by a continuous drop in commercial and residential property prices:
  - Both commercial and residential property prices hit their lowest in 2012;
  - Commercial properties were hit more severely than residential properties (e.g., while the former observed a price change of -8.6%, the latter observed a variation of -7.1% in 2012).

- From 2013 onwards: more pronounced increase in prices for residential properties.

Closing remarks and way forward

- The coordination between the *Banco de Portugal* and Statistics Portugal has made it possible the development, production and release of a new price index on the commercial property market.

- Although there has not been a lot of feedback on the CPPI, its release provided a more complete picture of the evolution of real estate prices in Portugal (and a starting point from which it can be further developed).

- Resources permitting, some possible future improvements of the indicator and in this area are the following:

    - Increase the dissemination frequency of the CPPI (e.g., half-yearly);

    - Explore new administrative data flows (e.g., on electronic rent receipts for the compilation of a commercial property rents index).
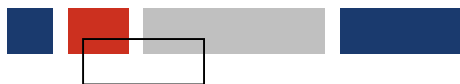
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Thank you for your attention!