BBVA Research

Investment in “Real Time” and “High Definition”: A Big Data Approach

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Creating Opportunities

The Covid-19 crisis has reinforced the potential of Big Data tools for Economic Analysis and Policymaking

The high uncertainty triggered by the Covid-19 crisis has stressed the need to monitor the evolution of the economy in “real time”. These efforts have been materialized in several ways:

- **Focusing on timely, alternative indicators:** soft data surveys (particularly the Purchasing Manager Indexes, PMIs) and other high frequency indicators like electricity production or chain store sales released on daily or weekly basis.

- **Developing higher frequency models:** Some CBs have relied on this High Frequency indicators to develop weekly activity tracker models such as the FED´WEI (Lewis, 2020) and the Bundesbank WAI (Eraslan, S. and T. Götz, 2020).

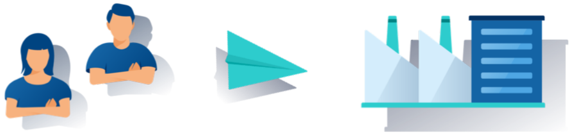
- **Developing New Big Data Indicators*:** Focusing on daily aggregate information of banking transactions to track consumption, employment , turnover, mobility (link to our BigData Project).

* Some of the Recent literature on Big Data analysis Andersen, Hansen, Johannesen, & Sheridan (2020a), Andersen, Hansen, Johannesen, & Sheridan (2020b), Alexander & Karger (2020), Baker, Farrokhnia, Meyer, Pagel, & Yannelis (2020a), Baker, Farrokhnia, Meyer, Pagel, & Yannelis (2020b), Bounie, Camara, & Galbraith (2020), Chetty, Friedman, Hendren, & Stepner (2020), Chronopoulos, Lukas, & Wilson (2020), Cox, Ganong, Noel, Vavra, Wong, Farrell, & Greig (2020), Surico, Kanzig, & Hacioglu (2020).

Through the analysis of the firm-to-firm transactions we extend our project of national accounts in real time & high definition to Investment

The investment spending is done mostly by companies and, to a lesser extent, by individuals

We track investment payments through



individual to firm transactions

firm to firm transactions

Firms are classified by their **NACE codes** to identify their **business activity** (in line with the European statistical classification of sectors)

We approximate investment demand in one type of asset taking into account the aggregate flows or transactions done from any firm or individual to the sector which produce the fixed assets

Total Investment **Machinery Investment*** **Construction Investment**

*Machinery & Equipment, Media & ICT, Agriculture & Animals, Forestry, Durable Goods, Retail Trade, Textile & Clothing, Transportation and Shipping.

The case of Turkey: Data and Representativeness

INVESTMEMT DATA 2019: BBVA vs COMPANY ACCOUNTS (CENTRAL BANK & TURKSTAT)

	BBVA Big Data			Turkey CBRT		
	Total	Machinery	Construction	Total	Machinery	Construction
Transactions (000s)	24.6	22.3	2.3			
Amount (US$ bn)	308	280	28	440	257	183
Firms (000s)	179.7	156.5	23.2	730.2	614.4	115.8
Firms (% CBRT)	24.6%	25.5%	19.8%			

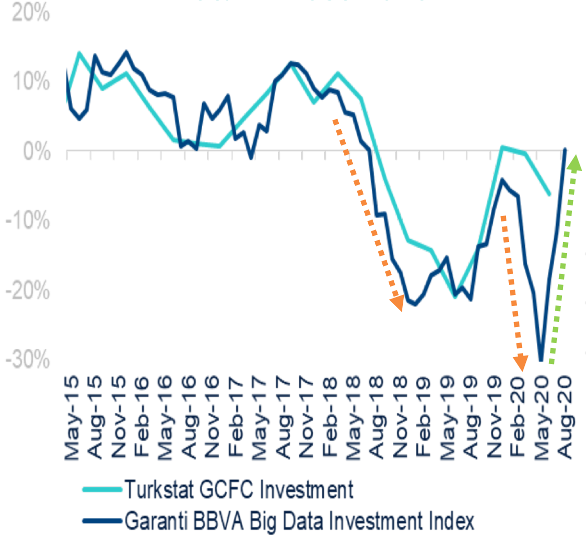
Source: cbrt & turkstat and own calculations

Validation I: The Big Data investment index shows a high correlation and co-movement with the oficial data

TURKEY: GBBBVA BIG DATA INVESTMENT INDICES

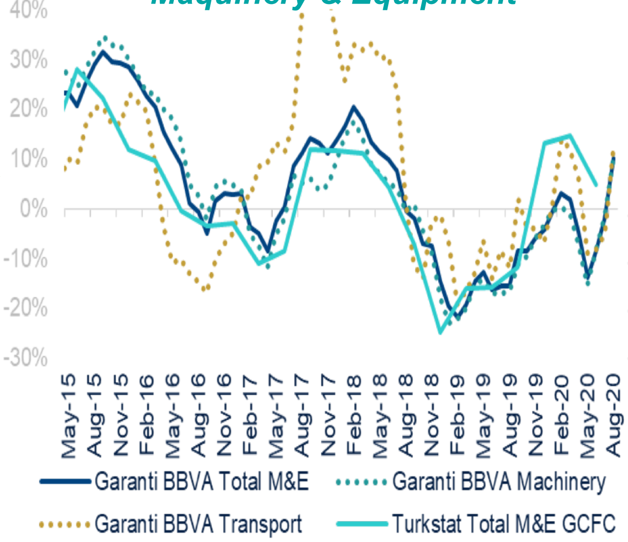
(28-day cum. YoY real)

Total Investment



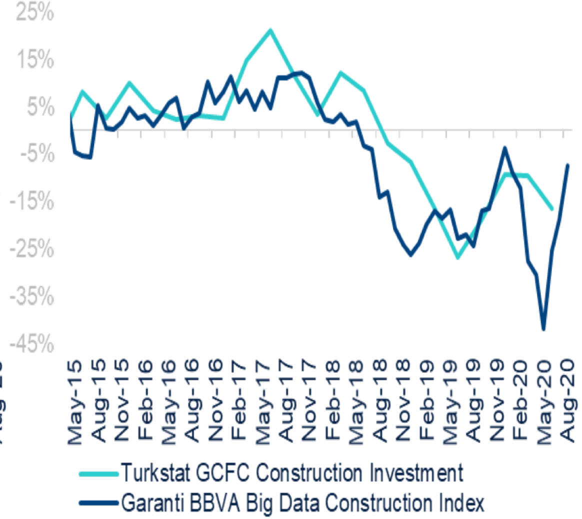
Correlation coefficient: 0.88

Maquinery & Equipment



Correlation coefficient: 0.84

Construction



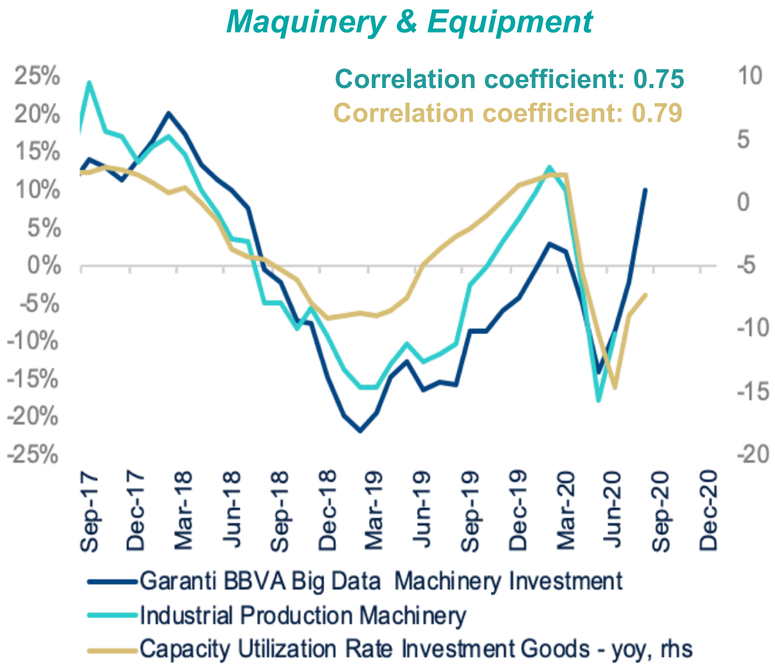
Correlation coefficient: 0.77

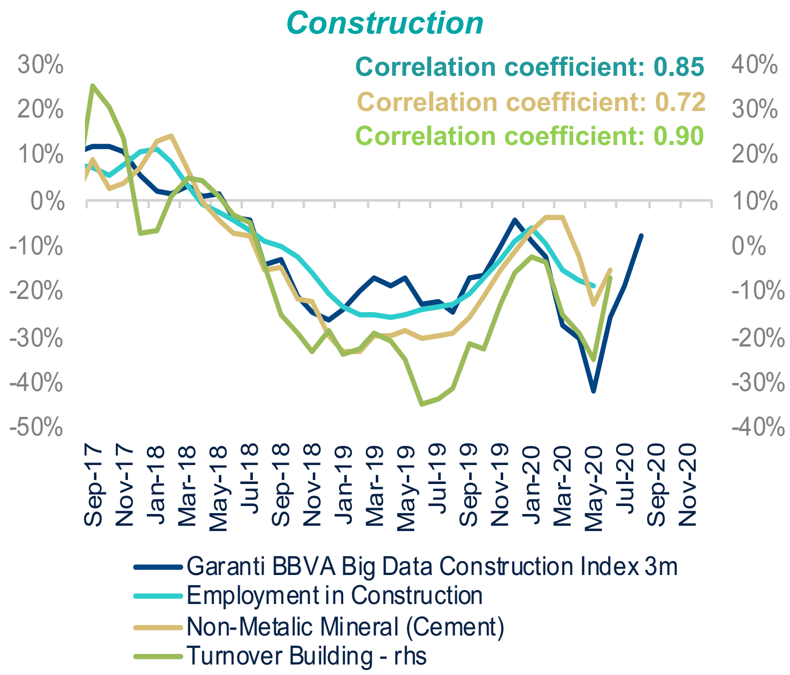
Source: Own Calculations

Validation II: The sincrony of BigData Investment with the Investment Cycle is validated by the high correlation coefficients with HF proxies

BBVA BIG DATA INVESTMENT & HIGH FREQUENCY PROXIES

(28-day cum. YoY real)





Source: Own Calculation

Investment Big Data in an Nowcasting Model (DFM): The framework

A Dynamic factor Model (DFM)

$$y_t = \Lambda f_t + \epsilon_t \,,$$

$$f_t = A_1 f_{t-1} + A_2 f_{t-2} + \cdots + A_p f_{t-p} + u_t \,,$$

$$u_t \sim \text{i.i.d. } \mathcal{N}(0, Q)$$

Expectation Maximization (EM) Algorithm

$$L(\theta, \theta(j)) = \mathbb{E}_{\theta(j)} \left[l(Y, F; \theta) | \Omega_T \right] ;$$

$$\theta(j+1) = \arg\max_{\theta} L(\theta, \theta(j)) \,.$$

the conditional moments of the latent factors,
$\mathbb{E}_{\theta(j)} \left[f_t | \Omega_T \right]$, $\mathbb{E}_{\theta(j)} \left[f_t f_t' | \Omega_T \right]$, $\mathbb{E}_{\theta(j)} \left[f_{t-1} f_{t-1}' | \Omega_T \right]$
and $\mathbb{E}_{\theta(j)} \left[f_t f_{t-1}' | \Omega_T \right]$

obtained through the Kalman smoother

for the state space representation:

$$y_t = \Lambda(j) f_t + \epsilon_t \,, \qquad \epsilon_t \sim \text{i.i.d. } \mathcal{N}(0, R(j))$$

$$f_t = A(j) f_{t-1} + u_t \,, \qquad u_t \sim \text{i.i.d. } \mathcal{N}(0, Q(j))$$

Outcomes

Nowcasting Accuracy

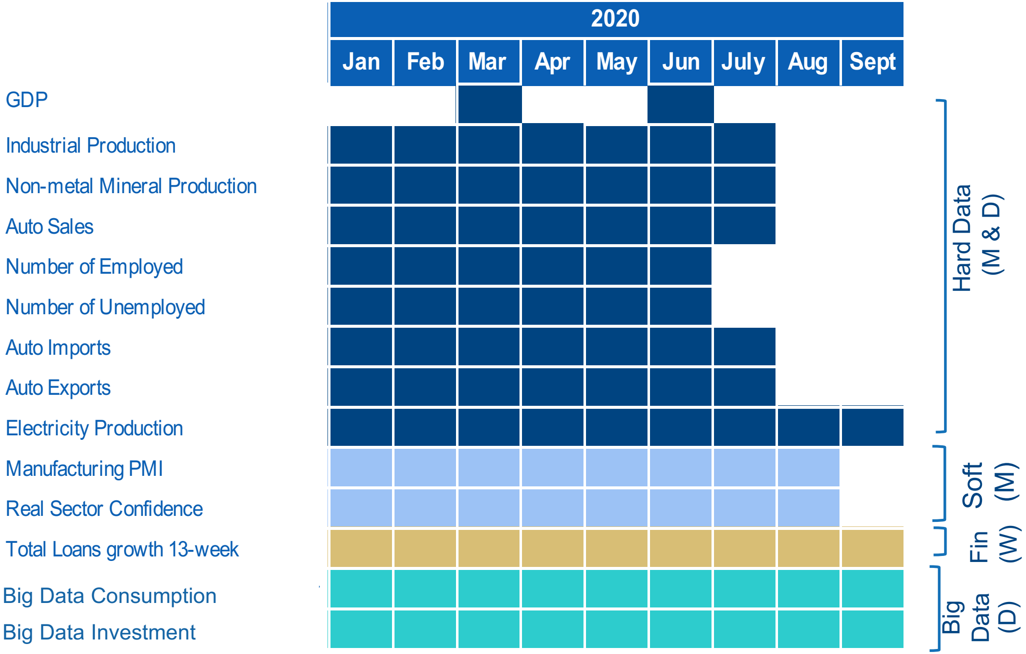
Nowcasting Anticipation

News Contribuion

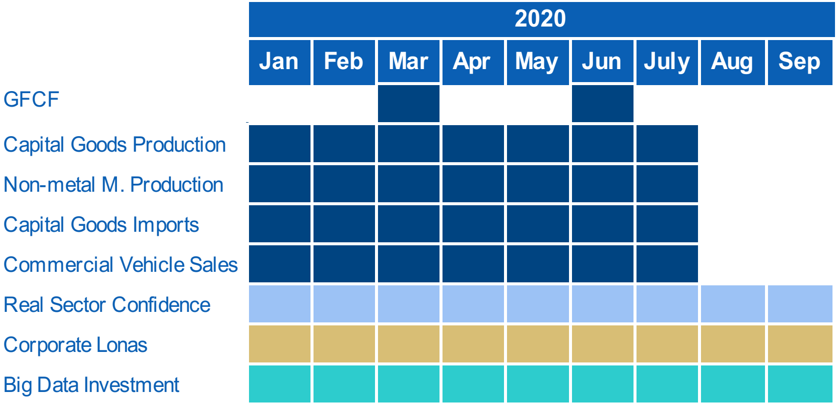
Source: Banbura M., and Modugno, M (2010)

Investment Big Data in a Nowcasting Model (DFM): Variables & Releases

TURKEY: VARIABLES IN MONTHLY GDP DFM



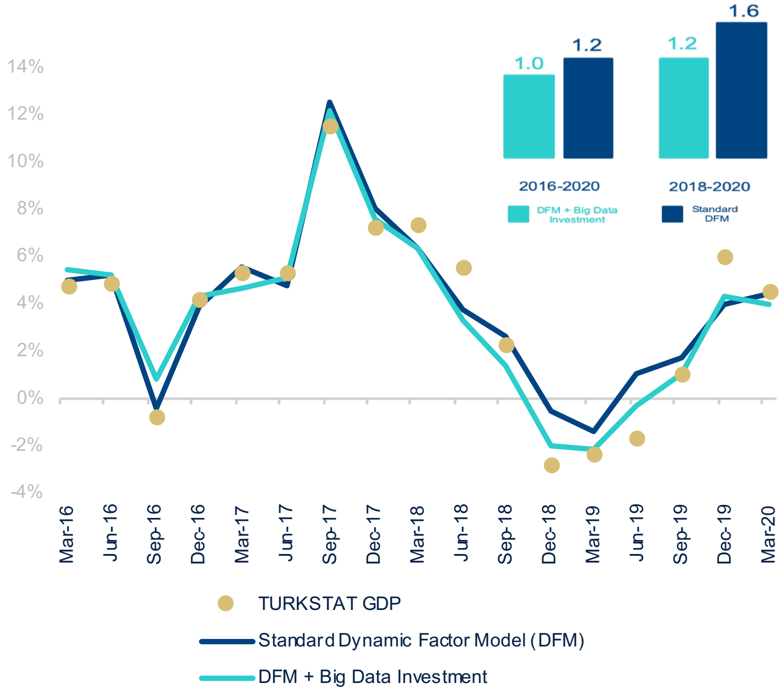
TURKEY: VARIABLES IN MONTHLY INVESTMENT DFM



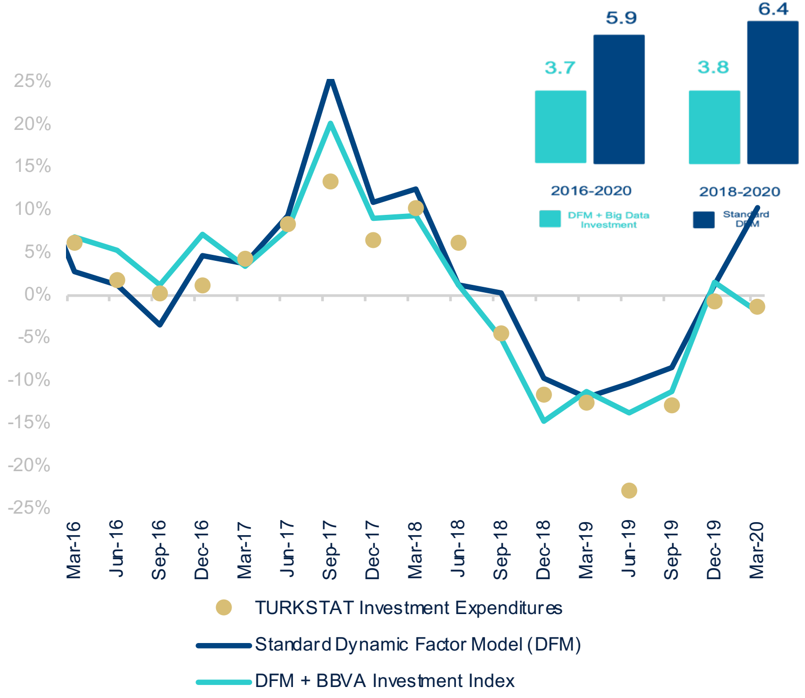
Source: Own elaboration

Investment Big Data in a Nowcasting Model (DFM): Forecasting Accuracy

TURKEY: OUT-OF-SAMPLE ERROR GDP MODEL



TURKEY: OUT-OF-SAMPLE ERROR INVESTMENT MODEL

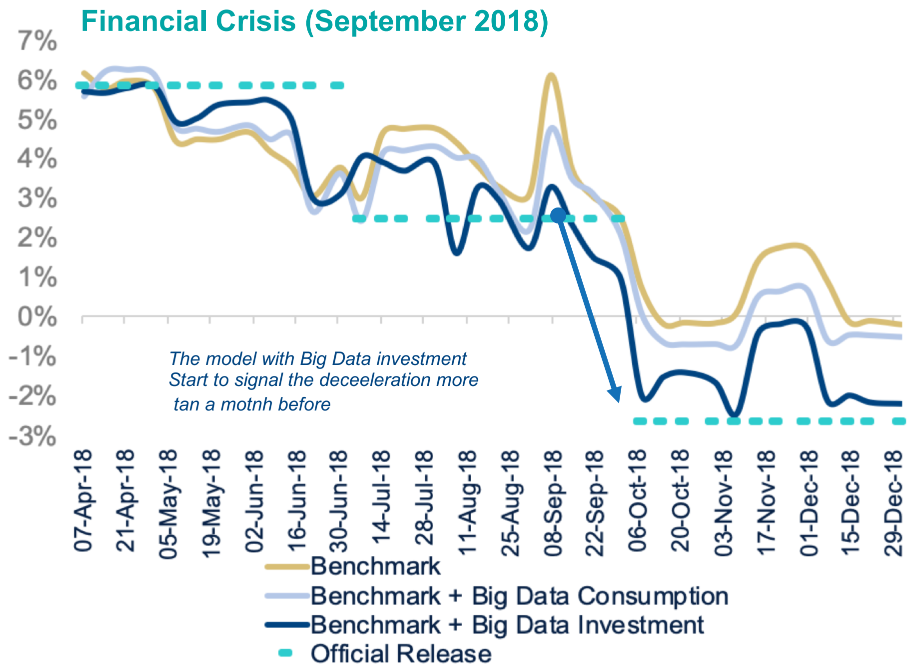


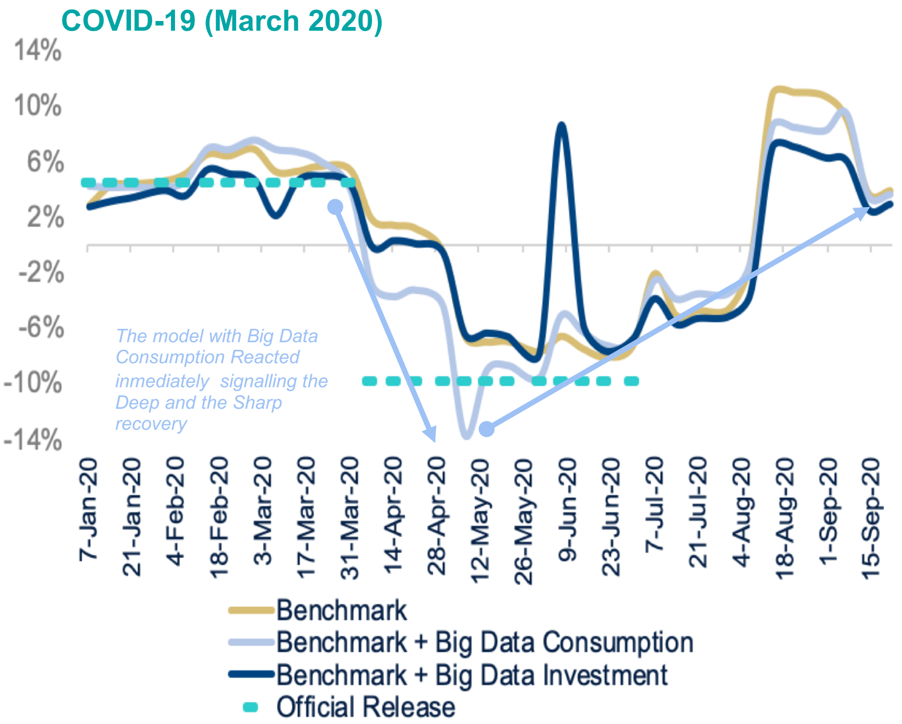
Source: Own Elaboration

Investment Big Data in a Nowcasting Model (DFM): Anticipation

TURKEY: NOWCASTING FINANCIAL CRISIS (SEPT 2018) & COVID CRISIS (MAR 2020)

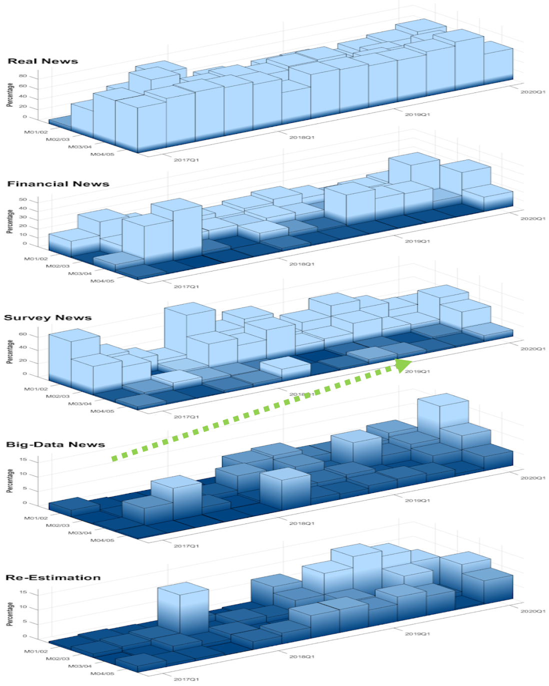
(quasi real time nowcasting with and without Big Data Indexes vs Benchmark)**





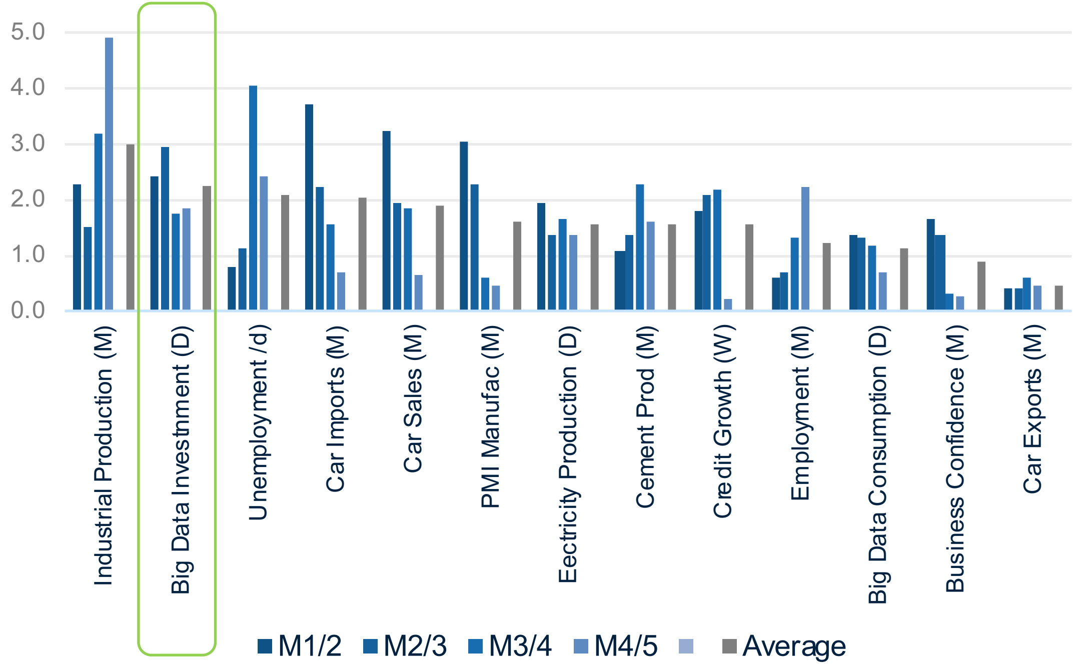
Investment Big Data in a Nowcasting Model (DFM): News & Prevalence Bias

DFM News Contributions
(Unbalanced Sample)



Source: Own Estimations

DFM News Contributions correcting Prevalece Bias
(Maintaining individually all the variables for the sample of Big data information)



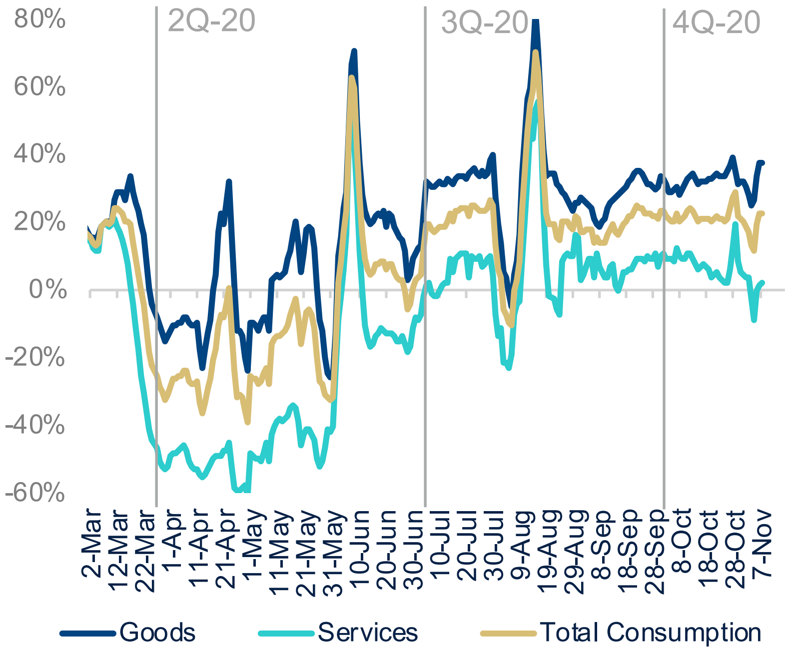
Source: Own Elaboration

Results: Investment in Real Time will help policy makers to react faster

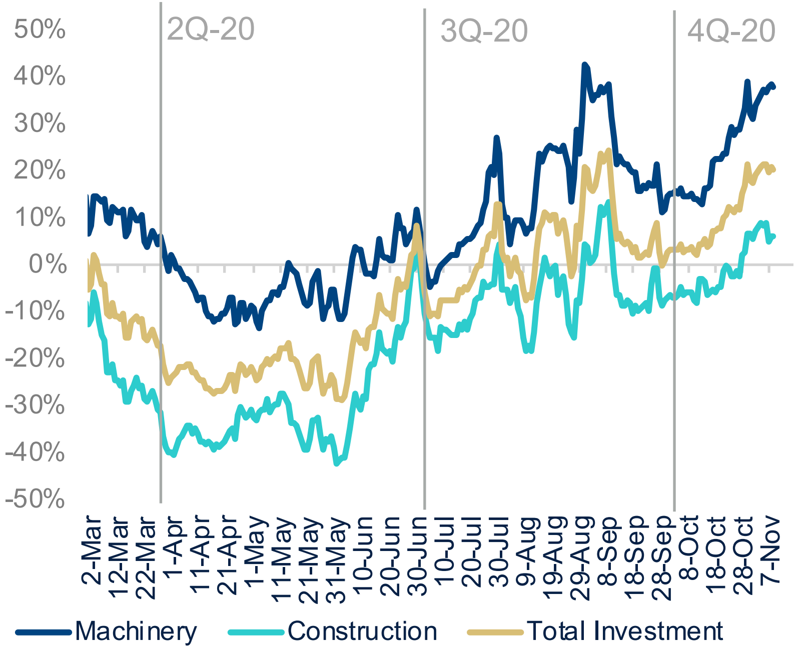
TURKEY: BIG DATA CONSUMPTION & INVESTMENT

(7-day cum. YoY nominal in Cons., 28-day cum. YoY nominal in Invest.)

BIG DATA CONSUMPTION



BIG DATA INVESTMENT

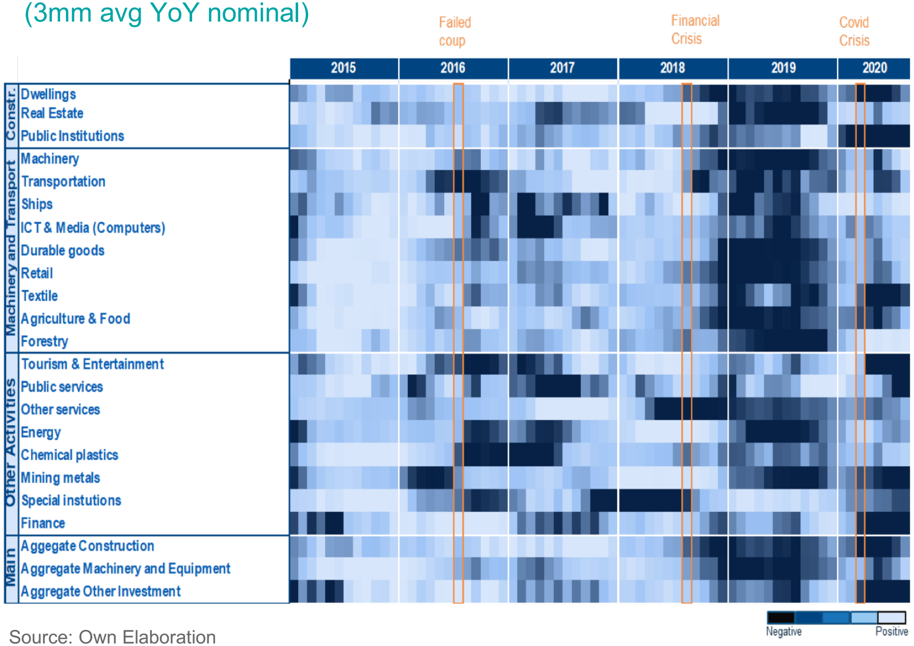


Source: Own Elaboration

Results: The "High Definition" dimension will allow policymakers to differentiate shocks and design more targeted policies

TURKEY:GB-BBVA BIG DATA INVESTMENT HEAT MAP

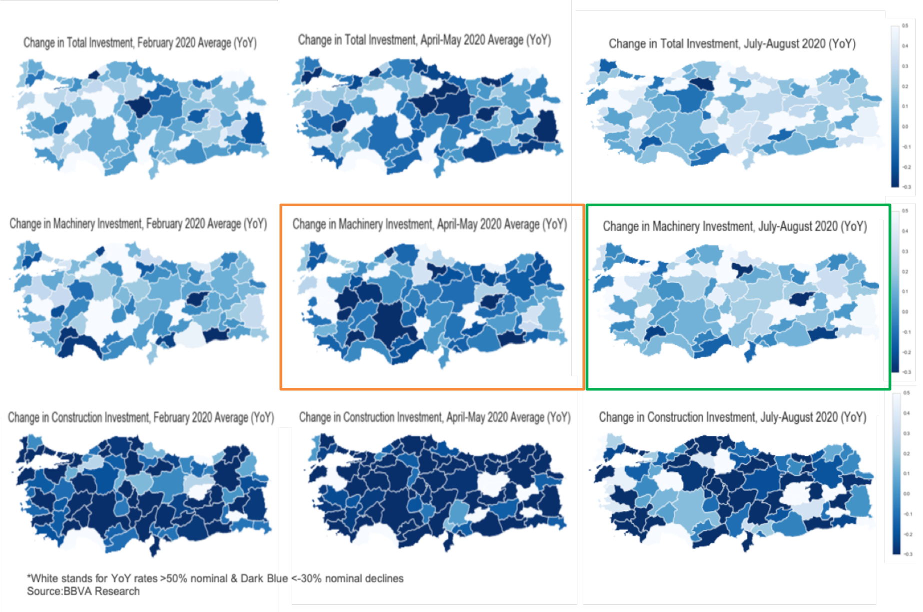
(3mm avg YoY nominal)



Source: Own Elaboration

TURKEY:GB-BBVA BiG DATA INVESTMENTS GEO-MAPS RECOV

(Change in YoY investment before, during and after the lockdowns by Covid)



*White stands for YoY rates >50% nominal & Dark Blue <-30% nominal declines
Source:BBVA Research

20 Activities & **81** Province in Real Time & High Definition

Conclusions & further Research

- We present a **novel approach to estimate Investment in “Real Time & High Definition”** from the analysis of a Bank´s Big Data (BBVA)

- **We cross validate the results** through the high correlations **with national accounts and high frequency proxies** for Turkey and other countries.

- **The Investment index improves the properties of a Standard Nowcasting Model** in terms of forecasting accuracy, anticipation and news.

- **The “High Definition” dimension can help to design targeted policies**

- The **characteristics of Big data** Information (detailed but short history) advocates for the **use of non linear and/or regularization techniques (Further Research)**

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