

## Data Science in Action: A Challenge

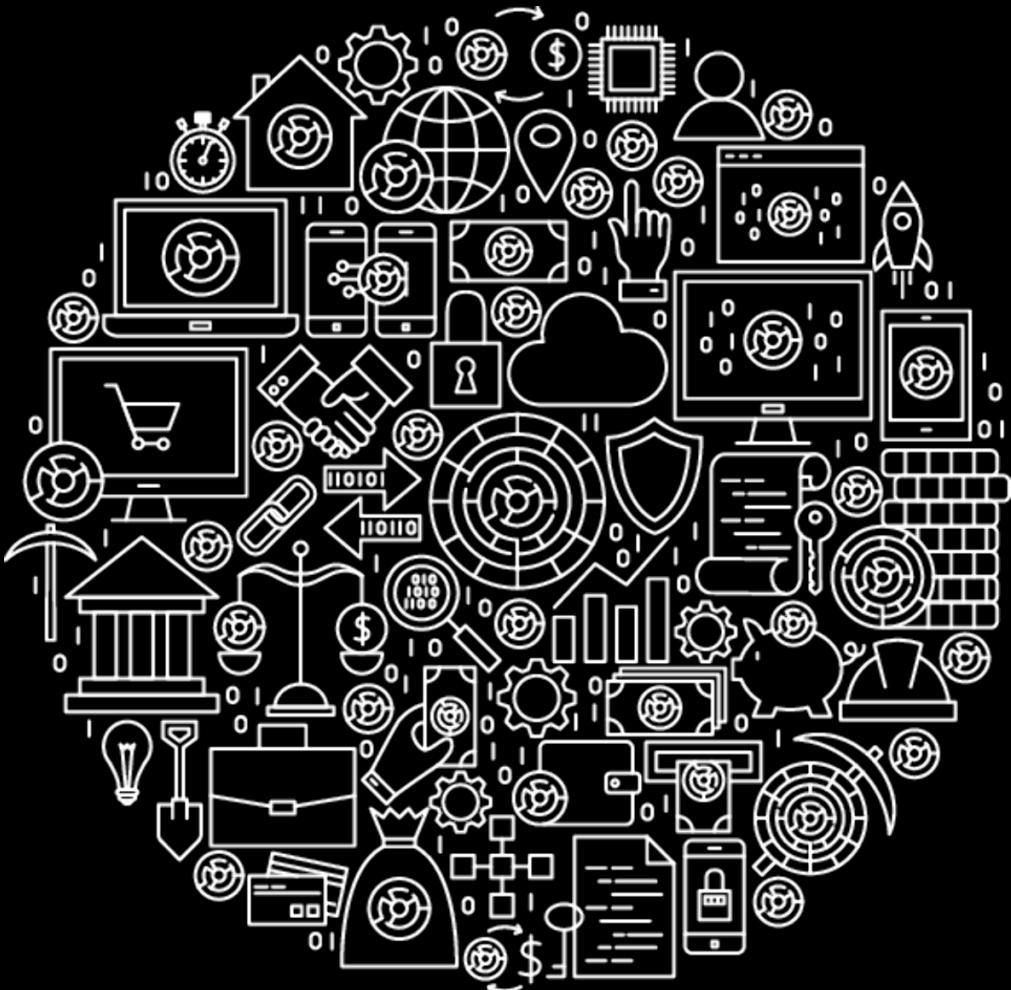
Marco Vulpiani

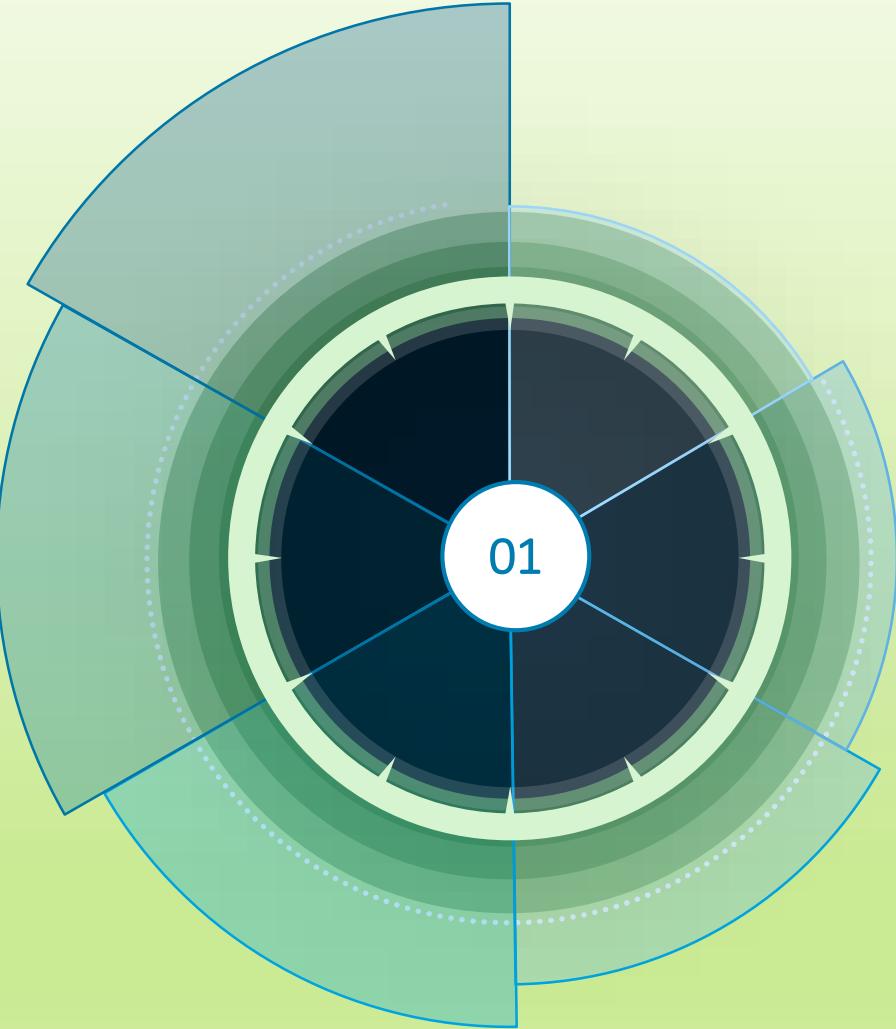
Head of Valuation, Business Modelling and Economic Services

Rome, February 22<sup>nd</sup> 2022

# Contents

1	Introduction	3
2	The challenge	8
3	Speakers	20





01

# Introduction



# Introduction

## The challenge

Today we will present you a challenge, providing an **opportunity for you to prepare, complete and present a report about a real-life business case study.**

1

This case study will provide you with the opportunity to:

- Think about the complexities of real-life situations that you may face in the workplace;
- Make connections between the theory you have learned to real-life practice;
- Provide realistic, reasonable and practical solutions to real-life problems;
- Develop familiarity with how advisors and scientists work and report professionally on their work.

2

You are expected to demonstrate an ability to think critically and analytically. This includes:

- Methodically and systematically analyzing the situation;
- Identifying all of the issues;
- Exploring all aspects of the issues in depth;
- Analyzing potential implications, outcomes or relevant considerations;
- Making connections between the case and the theory.

# Introduction

How do you prepare and complete the case study?

## Analyze the case

To really examine in depth all of the possible issues included in the case, you need to read and think at the same time. Constructing a brainstorm of all possibilities at this stage may help you ensure who have not missed some important information. Some things you ought to consider when analyzing a case are:

- What are the definite facts? – list any definite information is a useful starting point;
- What is happening / has happened? – list any definite actions that have occurred.

## Explore in more detail

Refer to your specific task and be clear about what you are being asked to do. What is the purpose for analyzing the case? You may need to:

- make recommendations;
- identify solutions;
- consider potential actions required.

These will most likely be connected to real-life work situations. Exploring the case in more detail will help you to:

- find any details which may not be explicitly stated;
- identify what extra information possibly needed to complete the task.

# Introduction

How do you prepare and complete the case study?

## Make connections to theory

Understanding the links between the theoretical content in your course and the practical realities of the case is an essential element of any case study. Once you have a detailed analysis of the case, it will be important to:

- search for literature to support your actions, decisions or choices and justify your approach and solutions;
- demonstrate how you have developed your ideas by referring to reliable sources;
- Develop insights into the relationship between theory and practice.

## Apply technical skills in data science

Providing evidence of your skills in:

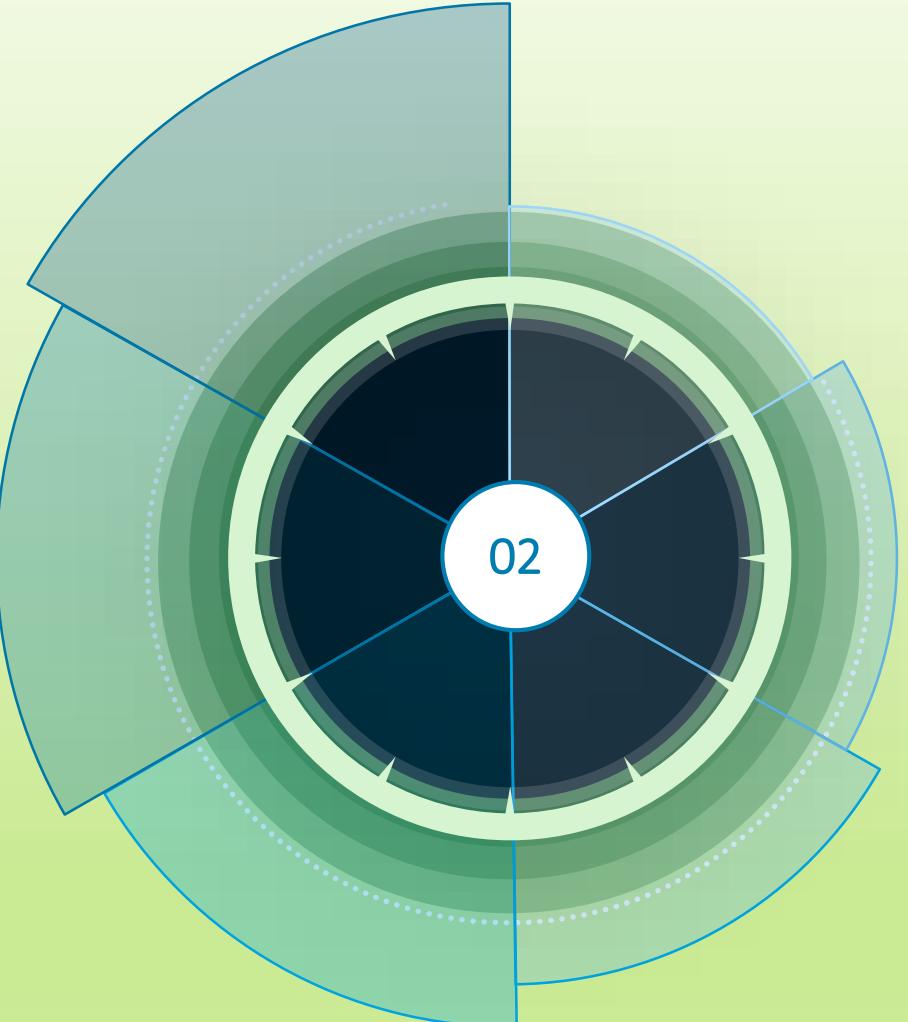
- Collecting, organizing, analyzing and reporting data;
- Using statistical packages;
- Judgement about the procedure and the results of an experiment;
- Statistical modeling.

# Introduction

How do you prepare and complete the case study?

## Prepare a report

Providing your ability in producing and presenting a clear and effective report describing your work.



02

## The challenge



# The challenge

The business case: Evaluating the impact of an advertising campaign

**Company Alpha sells perfumes online.**

**The executives of the company wanted to determine the impact of an advertising campaign on sales.**

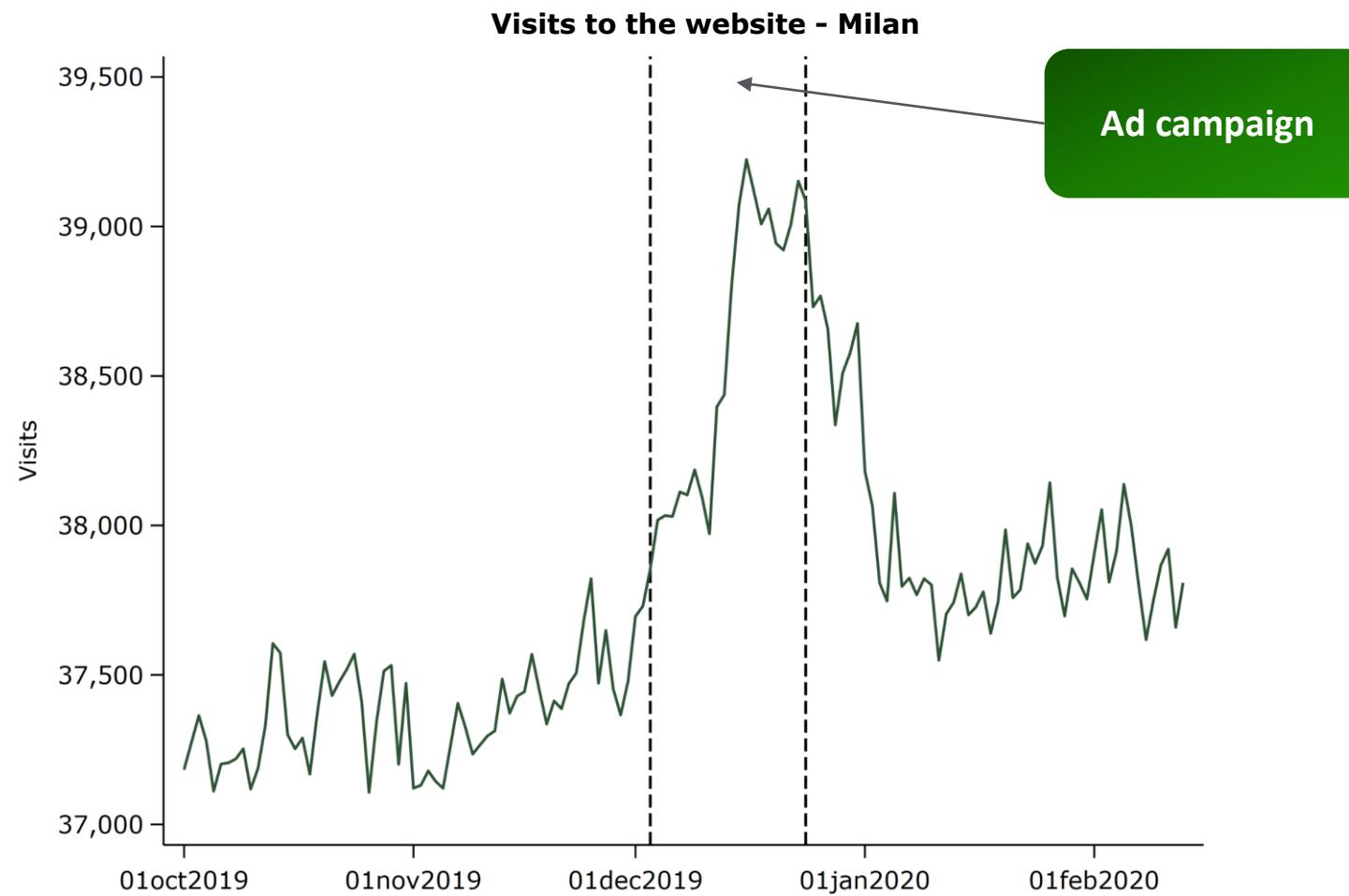
Thus, the company ran an ad campaign for a few weeks, with the possibility of launching a massive advertising campaign later on.

The advertising campaign started on 2019 December 3<sup>rd</sup> and ended on 2019 December 24<sup>th</sup>.

# The challenge

## The ad campaign

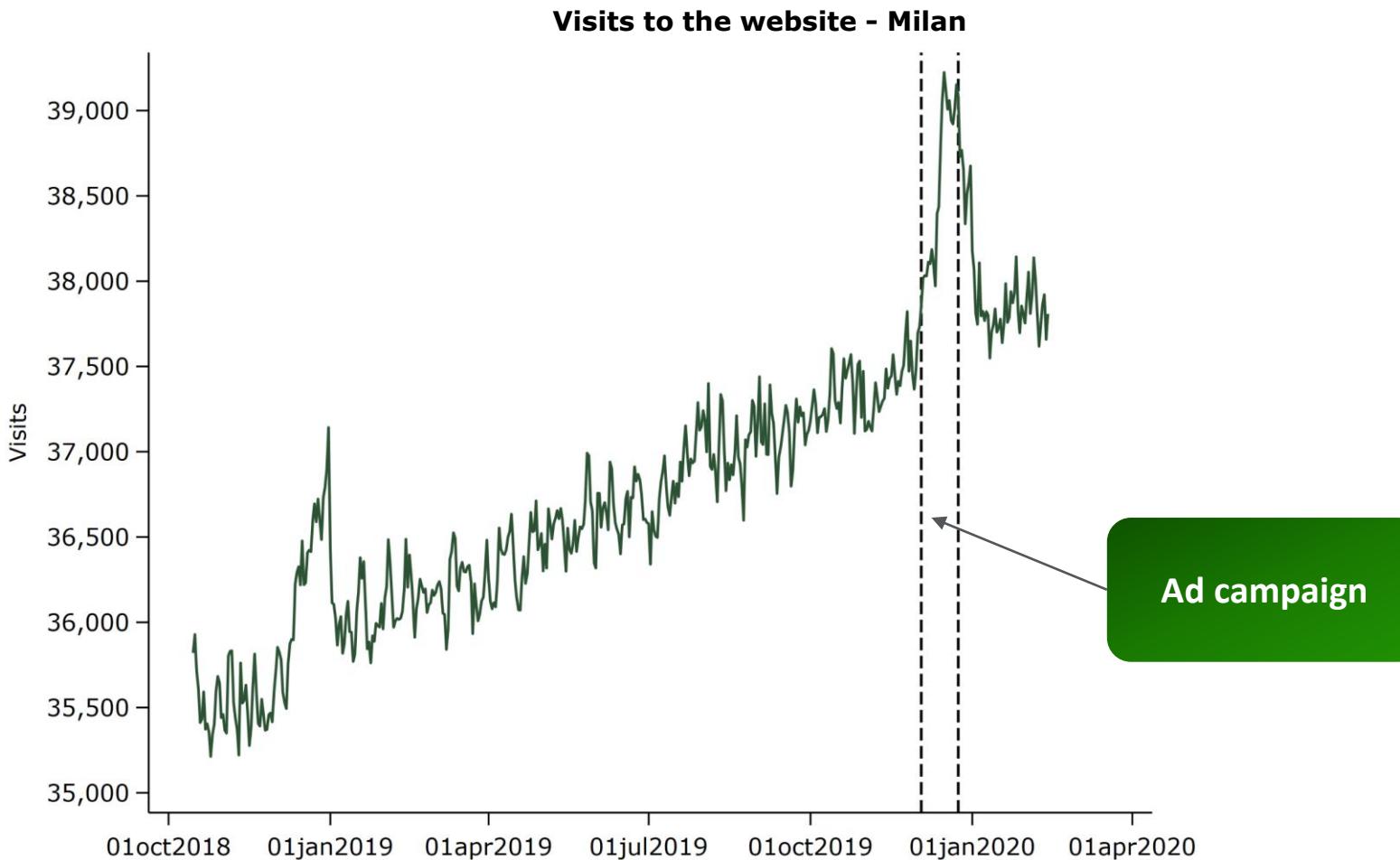
The advertising manager of company Alpha was asked by the executives why he thought his ads were effective. He showed the following chart and answered:



# The challenge

## The ad campaign

Going on through the discussion about historical trends, the following chart has been shown, and a question was raised to the advertising manager:



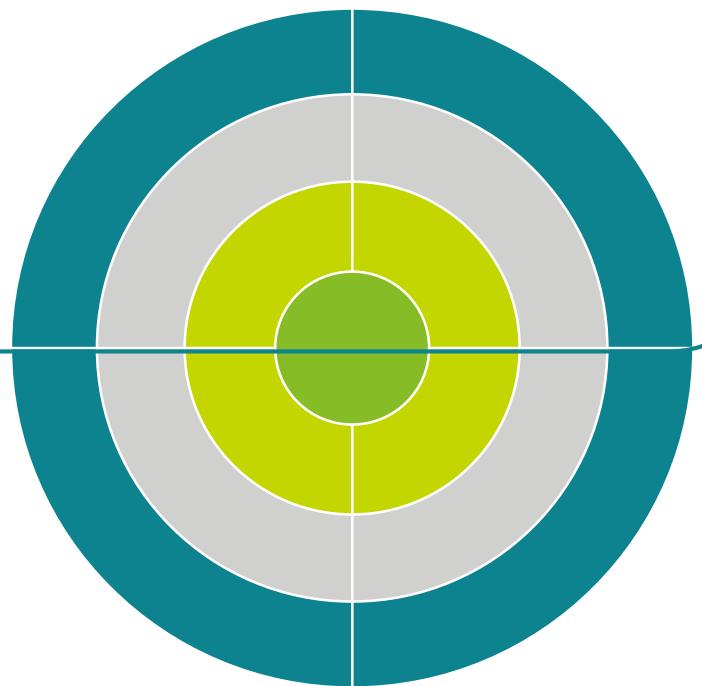
"Hey, wait a minute! Look at last December figures. There was no ad campaign last year. So, how can you be so sure our campaign was really effective?"

# The challenge

## The scope of work

Thus, in order to support the advertising manager that the ad was actually effective, the executives of Alpha Ltd asked you, as the consultant data scientist, to quantify the impact of the advertising campaign on sales, analyzing visits to its website and online purchases.

The results of this analysis will then be used to make a decision about the possibility of launching a massive advertising campaign later on.



# The challenge

Options to consider

## What is obvious?

Ceteris paribus, if the ad campaign has an effect on the outcome, we should observe a significant increase in the latter after the campaign is started.

## What is not obvious?

How can we determine what visits would have been in the absence of the ad campaign?

# The challenge

## Correlation and causation

Typically, Machine learning models are entirely about prediction.

Nonetheless, as economists know well, **there is a big difference between correlation and causality.**

If data at hand were in fact generated by ad managers who increase ad expenditure in periods of the year when the purchase probability is higher, then the observed relationship between ad campaigns and sales could be highly **predictive for the historical data but not useful in predicting the causal impact of explicitly assigning additional resources to an ad campaign.**

The ideal way to estimate advertising effectiveness is, of course, to get an **estimate of the counterfactual: what would have happened without ad exposures.**

More generally, **there is likely to be confounding factors that affect both exposure to ads and website visits (and the propensity of purchase), which make causal interpretations of observed relationships problematic.** Hence, these factors must be accounted for in order to reliably quantify the impact of the ad campaign and provide convincing results about its effectiveness.

# The challenge

## Collecting data

First of all, we collected **data on website traffic** before, during and after the ad campaign.

Specifically, data refers to three Italian cities, namely:

Milan,

Rome,

Naples,

considered as broadly representative of the Italian market in the three main geographical areas (respectively North, Center, South).

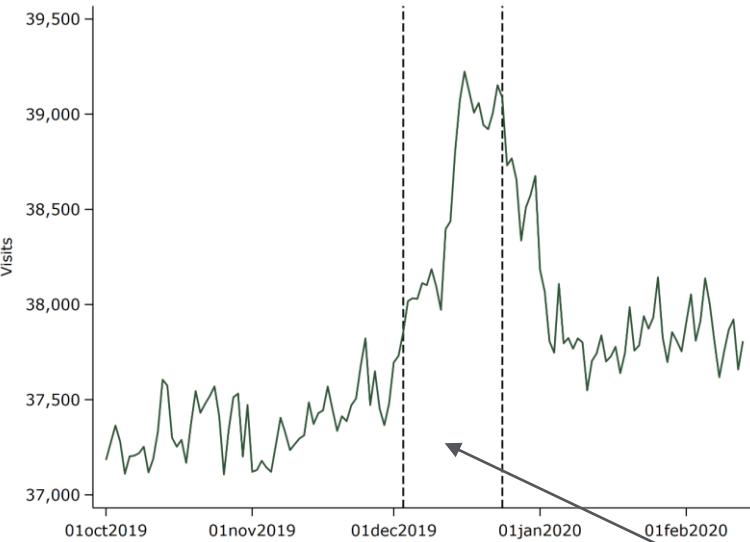
We downloaded the data as a comma-separated values (CSV) file, namely 'WebTraffic.csv'.

```
1 city,day,visits
2 "Milan",15oct2018,35820
3 "Rome",15oct2018,15451
4 "Naples",15oct2018,22622
5 "Milan",16oct2018,35929
6 "Rome",16oct2018,15298
7 "Naples",16oct2018,22744
8 "Milan",17oct2018,35713
9 "Rome",17oct2018,15318
10 "Naples",17oct2018,23006
11 "Milan",18oct2018,35612
12 "Rome",18oct2018,15291
13 "Naples",18oct2018,23075
14 "Milan",19oct2018,35412
15 "Rome",19oct2018,15480
16 "Naples",19oct2018,23080
17 "Milan",20oct2018,35432
18 "Rome",20oct2018,15793
19 "Naples",20oct2018,23171
20 "Milan",21oct2018,35592
21 "Rome",21oct2018,15808
22 "Naples",21oct2018,23510
```

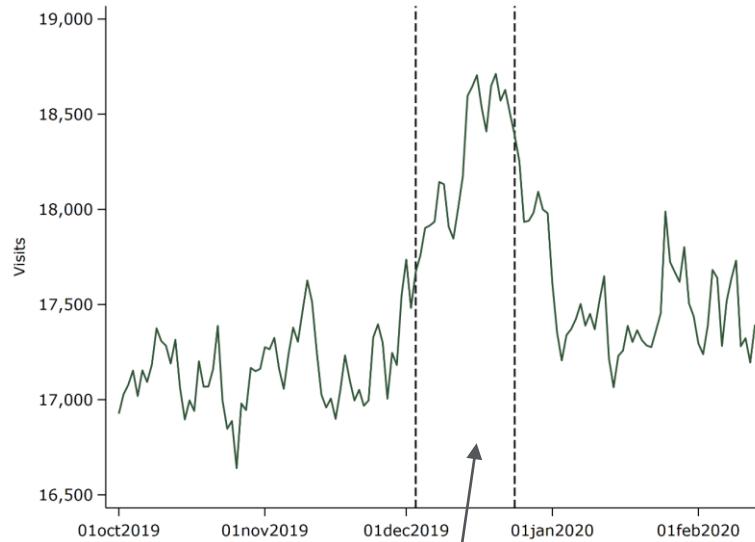
# The challenge

The data

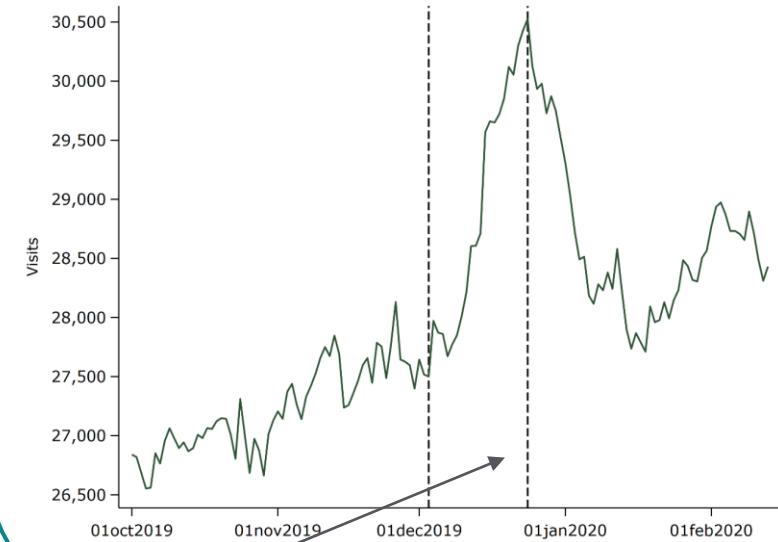
Visits to the website - Milan



Visits to the website - Rome



Visits to the website - Naples



Ad campaign

# The challenge

## The objective

### What is the objective of this challenge?

You are asked to:

- quantify the impact (causal effect) of the advertising campaign on sales, analyzing visits to its website and online purchases;
- prepare a brief report presenting your work.

### Which format for the report?

A pitch, a slide presentation deck to give a summary report of your work.

# The challenge

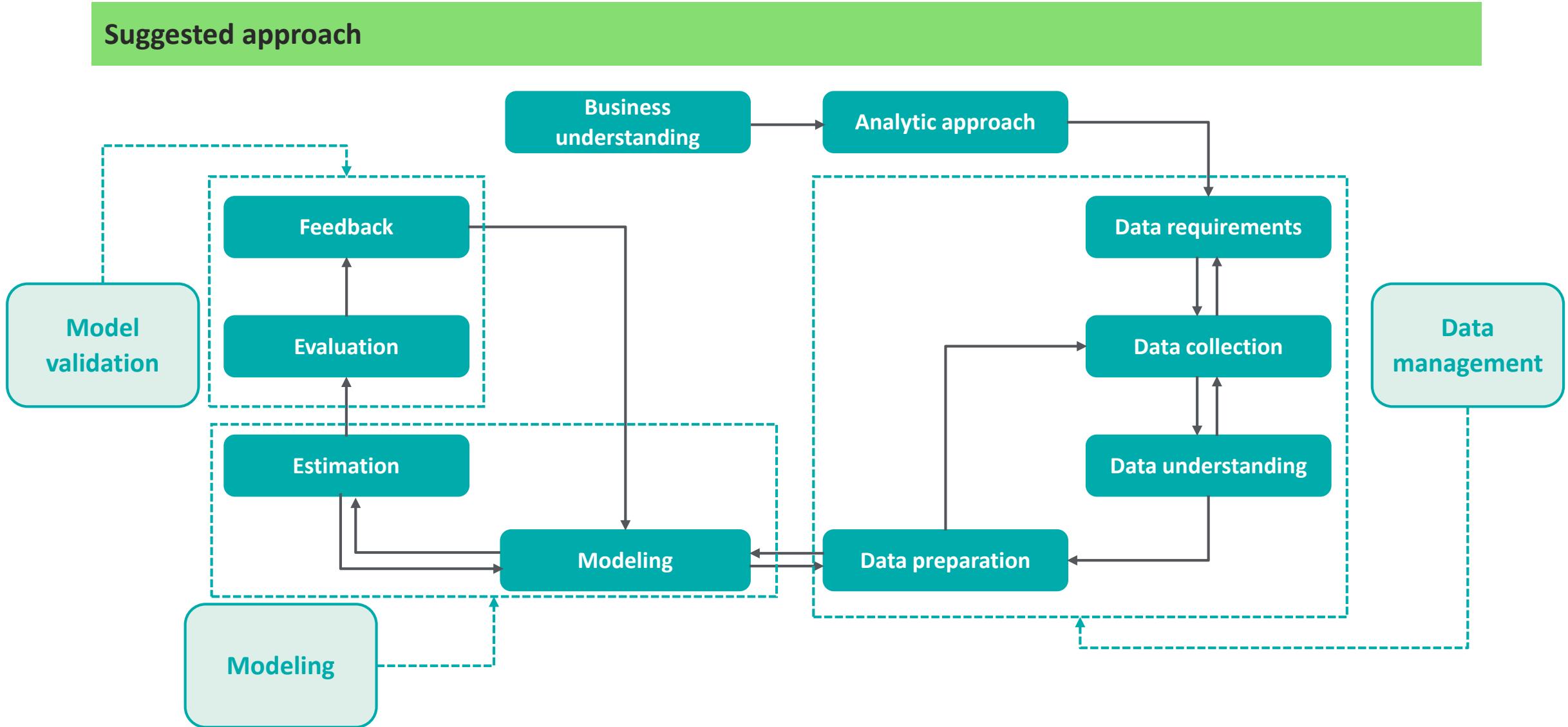
## The report

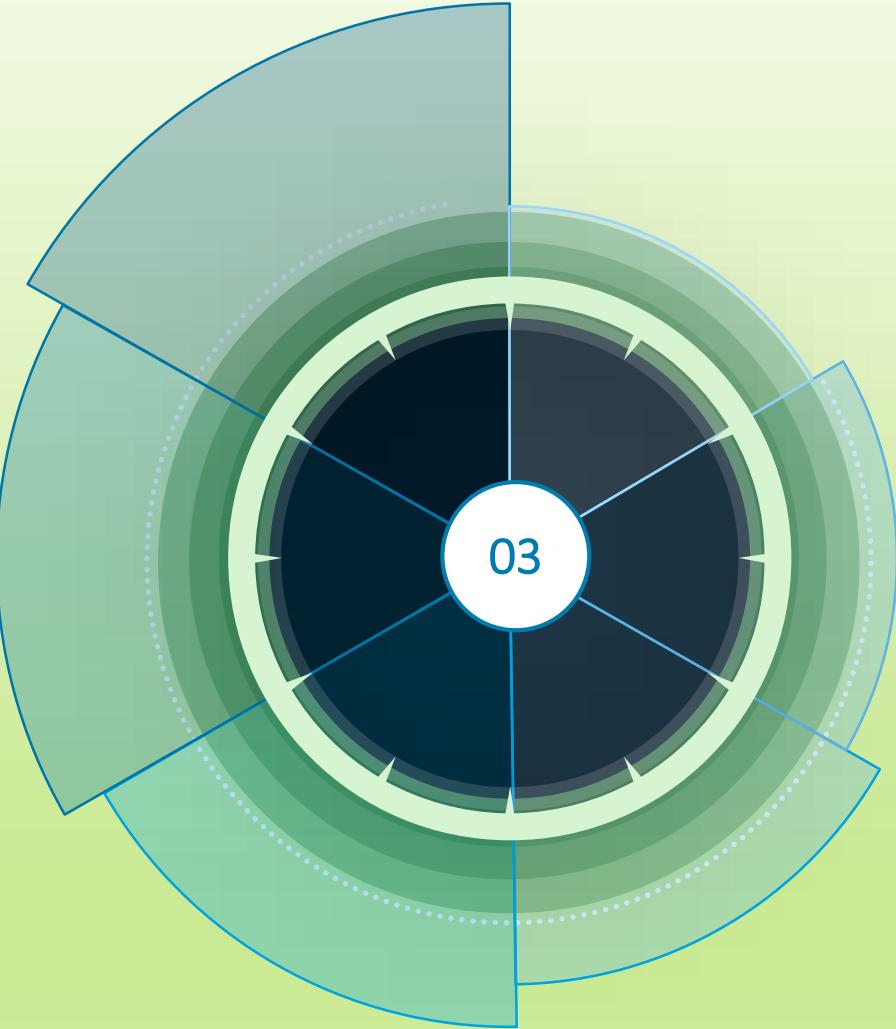
### Suggested structure of the presentation

- Cover page
- Introduction
- Data
- Methodology or modelling approach
- Results
- Discussion and/or Conclusions
- References
- Appendix (technical details and/or detailed information referred to in the report)

# The challenge

## The approach





03

## Speakers



# Speakers

## Curriculum Vitae – Marco Vulpiani, PhD - Senior Partner

### Marco Vulpiani, PhD

#### Equity Partner, PhD, Financial Advisory, Rome, Italy



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#### Career summary

Marco Vulpiani holds a Ph.D. in Business Administration from the University of Rome "Tor Vergata" a Master of Science in Business Administration from the University of Rome "Tor Vergata" and a Master's Degree in Aeronautical Engineering from the University of Rome "La Sapienza".

He has about 25 years of professional experience mainly in Business Valuation.

Before joining Deloitte, he began his professional activity in Fiat Avio S.p.A., as an aerospace designer. He then continued his experience in ENI Group, where he worked for about six years in the Strategic Planning department of the company Agip Petroli S.p.A.. As a Strategic Development Project Manager, in ENI Marco was responsible for the valuation of several strategic projects and for M&A projects as well. In addition, Marco took part in the IPO process of ENI Group, as a member of the workgroup responsible during every steps of the privatization process.

In 1999 he joined Deloitte, as a manager in the Corporate Finance area. As a Director and then Partner, he has been responsible for numerous advisory projects, including Economic Impact Assessment in the tobacco industry. As a Senior Equity Partner of Deloitte, he is the Firm's Head of the "Valuation, Modelling and Economic Advisory" service line in Italy and he serves on the Deloitte Global Valuation Executive Committee.

He is a member of the Management Board of the Italian valuation standard setter "Organismo Italiano di Valutazione" (OIV). In this role he participated in the OIV working group that contributed to drafting the Italian Valuation Principles ("PIV") and to the guidelines for the Impairment Test of Goodwill in contexts of financial and real crisis: "Impairment Test dell'avviamento in contesti di crisi finanziaria e reale – Linee Guida". Lastly, he is a Registered Engineer, a Chartered Accountant and a Registered Auditor.



#### Selected Publications

##### Monographs

- M. Vulpiani, "Special Cases of Business Valuation", McGraw Hill, 2014.
- M. Vulpiani, E. Croci, M. Caiffa, E. Lanzillo, "L'evoluzione del concetto di benessere individuale e aziendale", McGraw Hill, 2021

##### Articles

- M. Vulpiani, E. Croci, M. Caiffa, "Economic and sociological determinants of well-being in Italy: A regional perspective. Journal of Governance & Regulation, 9(2), 112-122, 2020 <http://doi.org/10.22495/jgrv9i2art9>
- M. Vulpiani, "Le regole per creare partenariati", Le Formiche, Edizione N. 154, 2020
- M. Vulpiani, Overview of business valuation parameters in the energy industry. Edition no.3 – 2017;
- M. Vulpiani, Overview of business valuation parameters in the energy industry. Edition no.2 – 2015;
- G. Tardivo, M. Viassone, M. Vulpiani, "Rethinking target's private equity process in turnaround situations", Journal of Investment and Management; Vol. 3, No. 3, pag. 42-50; 2015;
- M. Vulpiani, Cost of Capital in the M&A Context: Methods for its Computation in Leveraged Buyout Transactions, Chap.7, The economics of leveraged buyouts, Edited by F. Baldi, 2014;
- M. Vulpiani, Overview of business valuation parameters in the energy industry. Edition no.1 – 2013;
- M. Vulpiani, A. Cattaneo, "L'evoluzione della Public-Private Partnership nelle infrastrutture: il contesto italiano comparato con alcune esperienze internazionali", "Laboratorio Brianza" a cura di Massimo Ghiloni, ed. Il Sole24 Ore, Cap. 7 2011;
- M. Vulpiani, "Purchase Price Allocation and Choice of the Valuation Methods", Business Valuation Review, Summer, Vol. 27, no. 2, 2008;
- M. Vulpiani, "Cost of Capital Estimation for Intangibles Valuation in Purchase Price Allocation", Business Valuation Review, Spring, Vol. 27, no. 1, 2008;
- M. Vulpiani, "Cost of Capital and Valuation of Merging and Acquisition Operations", Business Valuation Digest, Vol.12 issue II June (reprint) 2006;
- M. Vulpiani, "Cost of Capital and Valuation of Merging and Acquisition Operations", Business Valuation Review, Winter, Vol. 24, no. 4 2005;
- M. Vulpiani, "Elementi di Considerazione sul Processo di Valutazione delle Operazioni di M&A", Analisi Finanziaria, N. 54, 2004;
- "Considerazioni sul Metodo di Valutazione Adjusted Present Value", Revisione Contabile, N. 46, 2002;
- M. Vulpiani, "La Quantificazione del Rischio Sistematico nei Processi Valutativi", Analisi Finanziaria, N. 43, 2001;
- M. Vulpiani, "Sviluppo di Business Plan in termini di Valore", Analisi Finanziaria, N. 33, 1999;
- Deininger, W. D.; Attili, M.; Vulpiani, M.; Detoma, E. "Low Power Arcjet System Requirements Definition for North-South Station Keeping", AIAA, SAE, ASME, and ASEE, Joint Propulsion Conference and Exhibit, 29th, Monterey, CA, June 28-30, 19 p. 1993;
- Deininger, W. D.; Attili, M.; Vulpiani, M.; Detoma, E. "Low Power Arcjet System Requirements Description For North-South Station Keeping", IEPC 93-012, 23th international electric propulsion conference, Seattle, WA, 13 September 1993.
- I. Peroni, A. Paolozzi, A. Bramante, M. Vulpiani, "A Study of the Shock at the End of the Deployment of Folded Structures", Aerotecnica Missili e Spazio, vol.70, num.3/4, 1991;
- M. Vulpiani, "Analysis of Value Creation in M&A Operations", accepted workpaper in SSRN, [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=56081](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=56081).

# Speakers

## Curriculum Vitae – Claudio Rossetti, PhD - Senior Manager

### Claudio Rossetti, PhD

#### Senior Manager, PhD, Financial Advisory, Rome, Italy



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##### Career summary

###### Profile

Claudio Rossetti holds a Ph.D. in Econometrics and Empirical Economics, a Master of Science in Economics and Institutions, and a Master's Degree in Economics from the University of Rome "Tor Vergata". Claudio also completed an International Ph.D. Programme in Health Economics and Policy at the University of Lausanne.

Claudio has about 15 years of professional experience in Economic Consulting and about 10 years of Academic experience.

Before joining Deloitte, he was Professor of Econometrics at the University of Naples "Federico II" and Economic Consultant. As an advisor, Claudio developed a strong professional experience in economic modelling and data analytics focusing on statistical and econometric methods for causal modeling and impact evaluation for both business decisions and government policy. He was responsible for many economic advisory projects, both for national and international, private and public clients, developing a long experience in Life Science, Health Care and Transportation industries. His specific expertise also includes behavioral micro-simulation dynamic models, quantitative marketing, models for observed and unobserved heterogeneity in consumer preferences, socio-economic impact analysis, predictive analytics, and machine learning, among others.

In 2019 he joined Deloitte. As a senior manager in the Economic Advisory Services, he is responsible for economic advisory projects, both for national and international clients. Claudio has matured significant experience in the consumer goods, pharmaceutical and transportation industries.

###### Academic experience

Claudio was Professor of Econometrics at the University of Naples "Federico II", and he was Assistant Professor of "Statistics" and "Econometrics for Finance" at Luiss Guido Carli University . His teaching experience is both at graduate and undergraduate level, including Advanced Econometrics, Statistics, Web Analytics and Marketing, Quantitative Methods for Consumer Analysis, Data Analysis and Quantitative Methods, Unobserved Heterogeneity in Structural Models, and Quantitative Methods for Behavioral and Experimental Economics. He is author of several publications on top grade international scientific journals, and he has been a speaker at many national and international conferences and seminars.



##### Selected Publications

###### Articles

- "A Nonlinear Dynamic Factor Model of Health and Medical Treatment", with F. Peracchi, *Health Economics* (revise and resubmit).
- "Teacher motivation and student learning", with G. Barbieri and P. Sestito, *Journal of Economic Policy*, 33:1 (2017), 59–72.
- "In-Work Benefits for Married Couples: An Ex-Ante Evaluation of EITC and WTC Policies in Italy", with G. De Luca and D. Vuri, *IZA Journal of Labor Policy*, 3:23 (2014).
- "The heterogeneous thresholds ordered response model: Identification and inference", with F. Peracchi, *Journal of the Royal Statistical Society: Series A*, 176:3 (2013), 703–722.
- "Heterogeneity in health responses and anchoring vignettes", with F. Peracchi, *Empirical Economics*, 42:2 (2012), 513–538.
- "The determinants of teacher mobility: Evidence using Italian teachers' transfer applications", with G. Barbieri and P. Sestito, *Economics of Education Review*, 30:6 (2011), 1430–1444.
- "Drug compliance, co-payment and health outcomes: Evidence from a panel of Italian patients", with V. Atella, F. Peracchi, and D. Depalo, *Health Economics*, 15:9 (2006), 875–892.

###### Book chapters and edited volumes

- "Sample design and weighting strategies in SHARE Wave 5", with G. De Luca and F. Malter, in F. Malter and A. Börsch-Supan (eds.), *SHARE Wave 5: Innovations & Methodology*, Munich: MEA, Max Planck Institute for Social Law and Social Policy, 2015, 75–84.
- "Professional and geographic mobility of Italian teachers", with G. Barbieri and P. Esposito, in G. De Simone et al. (eds.), *Rapporto sulla scuola in Italia 2009*, Editori Laterza, Rome, 2009, 117–125.