**Horizon 2020**  
**ICT - INFORMATION AND COMMUNICATION TECHNOLOGIES**

![Horizon 2020 Logo](image)

**PROmoting Financial Awareness and Stability**  
H2020 – 687895

### Analysis of the Best Current Practices

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<th>Work package No.</th>
<th>WP1</th>
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<tr>
<td>APR</td>
<td>Annual Percentage Rate</td>
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<tr>
<td>BoW</td>
<td>Bag-of-Words</td>
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<tr>
<td>CCI</td>
<td>Consumer Confidence Index</td>
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<tr>
<td>CEDEFOP</td>
<td>Centre for the Development of Vocational Training</td>
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<tr>
<td>D2D</td>
<td>Doorways 2 Dreams</td>
</tr>
<tr>
<td>DSGE</td>
<td>Dynamic Stochastic General Equilibrium</td>
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<tr>
<td>ECB</td>
<td>European Central Bank</td>
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<tr>
<td>ECM</td>
<td>Error Correction Models</td>
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<tr>
<td>ECO</td>
<td>E-learning Communication Open-Data</td>
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<td>EMMA</td>
<td>European Multiple MOOC Aggregator</td>
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<td>ESCO</td>
<td>European Skills, Competences, Qualifications and Occupations</td>
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<tr>
<td>ETF</td>
<td>Exchange-Traded Fund</td>
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<tr>
<td>FCI</td>
<td>Financial Conditions Index</td>
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<tr>
<td>FIBO</td>
<td>Financial Industry Business Ontology</td>
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<tr>
<td>FIOS</td>
<td>Financial Information Observation System</td>
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<td>FINRA</td>
<td>Financial Industry Regulatory Authority</td>
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<td>FLEC</td>
<td>Financial Literacy and Education Commission</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>HESC</td>
<td>Higher Education Services Corporation</td>
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<td>LOD</td>
<td>Linked Open Data</td>
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<td>MCI</td>
<td>Monetary Conditions Index</td>
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<td>MOOCS</td>
<td>Massive Open Online Courses</td>
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<td>NLP</td>
<td>Natural Language Processing</td>
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<td>OBI</td>
<td>Open Budget Index</td>
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<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
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<td>OER</td>
<td>European Open Educational Resources</td>
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<tr>
<td>OWL</td>
<td>Web Ontology Language</td>
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<tr>
<td>PCA</td>
<td>Principle Component Analysis</td>
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<td>POS</td>
<td>Part-Of-Speech</td>
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<td>Securities and Exchange Commission</td>
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<td>SIC</td>
<td>Standard Industrial Classification</td>
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<td>Simple Knowledge Organization System</td>
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<td>SVM</td>
<td>Support Vector Machines</td>
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<td>Vector Autoregression</td>
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<td>Workplace Financial Fitness Toolkit</td>
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Executive Summary

The needs for advancement of financial capability and enhancement of financial awareness among informed citizens and market participants have been identified as a major target for improved social performance, client protection and, ultimately, greater societal well-being. Acknowledging these needs, the PROFIT project and its platform are designed as a solution catering to the exact need of action enhancement for greater financial awareness and capability.

This deliverable describes the best current practices that are relevant to the PROFIT project. The main goal of this deliverable is twofold; (a) to report on the current advances in the area of financial literacy, financial and econometric forecasting and open linked data for supporting financial decision-making, and (b) to highlight the advances introduced by the PROFIT concepts.

The deliverable is divided into three main parts. The first part reviews the most popular financial awareness platforms that are available online and provides an overview of the services supported by them. The main purpose of the first part is to give the reader (incl. the PROFIT industrial partners) the understanding of what is the current state of the art (i.e., capabilities, limitations) related to the PROFIT platform technologies.

The second part of the document focuses on the two main scientific pillars of the PROFIT project, namely the financial literacy and financial forecasting components. Initially, the second part reviews the best current practices in the academic and professional agenda on financial literacy as well as the currently available financial literacy tools and toolkits. Subsequently, it describes the main market sentiment indicators used in the empirical research and how these indexes are extracted using sentiment analysis techniques. Finally, this part reviews the most prominent models used to forecast well-known econometric indicators. The main purpose of this part is to acquaint the reader with the current state of the art in financial literacy and financial forecasting and to present the novel insights of the methods and toolkits to be developed within PROFIT.

The final part of this deliverable presents technologies employed in the envisaged financial awareness platform, including the financial linked open data. Existing thesauri are presented, followed by a discussion on semantic resources and evolving ontologies. The main purpose of this part is to give the reader an idea of how the PROFIT ontology might look like at the end.
1 Introduction

The recent financial crisis has generated interest in better understanding how to promote more responsible and prudent individual saving and borrowing behaviour (Klaper, Lusardi, and Panos, 2013). The Eurozone debt crisis, with the resulting fiscal consequences throughout Europe, further stimulated the discussion on how to promote the efficient allocation of financial resources and greater financial stability (Lusardi and Mitchell, 2014), (Lusardi, Michaud and Mitchell, 2015). The ability of citizens to make informed financial decisions is critical to developing sound personal finance, which can contribute to increased saving rates, more efficient allocation of financial resources, and greater financial stability.

Technological developments have enabled and enhanced the availability of large volumes of information on themes relevant to financial decision-making. Their potential benefits, though, are hindered by the cognitive limitations by individuals when it comes to the processing of large volumes of information, as well as the documented widespread financial illiteracy even within developed economies, including those of the European Union.

Acknowledging such needs, the PROFIT (Promoting Financial Awareness and Stability) project brings together researchers and professionals with expertise across accounting and finance, economics, information technology, computer/software engineering and education, along with a range of private, third-sector and institutional partners, to develop a financial awareness and capability platform for improved social performance, client protection and, ultimately, greater financial stability and societal well-being.

PROFIT will develop a platform built on Open Source components with aforementioned functionalities that will be pilot-tested via the collaboration with the members of the European Federation of Ethical and Alternative Banks (FEBEA), an institution committed to the responsible banking and finance agenda. The outcomes of the project are expected to enable inferences and specific appropriate practices that can be made available to the wide public in the European Union.

1.1 Scope of the document

This deliverable provides the baseline definition for commencing the work of Work Package 1 (WP1 - Requirements and Functional Design). The overarching goal of WP1 is to study and specify the requirements of the targeted users with respect to the proposed financial awareness platform, analysing and turning them into specifications. Based on this analysis, it will define and deliver a number of representative use cases and user scenarios to exemplify the novelties of the PROFIT platform. Finally, this work package will set the framework for planning the assessment activities towards validating the PROFIT tools.

In particular, this deliverable will provide a state-of-the-art analysis on the best current practices that are relevant to the PROFIT project. The main goal is to report on the current advances in the area of financial literacy, financial and econometric forecasting and open linked data for supporting financial decision-making, and to highlight the advances introduced by the PROFIT concepts.
1.2 Structure

The deliverable is organized as follows:

- **Chapter 1** introduces the deliverable and defines its scope and structure.

- **Chapter 2** reviews the various types of financial awareness platforms that are available online and outlines their services.

- **Chapter 3** reviews the best current practices in the academic and professional agenda on financial literacy. It begins by providing a conceptual overview assessing the importance of financial literacy for economic behaviour of all sorts. It then reviews and compares the currently available financial literacy tools and toolkits. Finally, it presents the novel insights of the PROFIT financial education toolkit.

- **Chapter 4** describes the main market sentiment indicators used in the empirical research and how these indexes are extracted using sentiment analysis techniques. Then, it highlights the interlink between the financial sector and the real economy. Finally, it reviews the main forecasting models used in the empirical research and provides information about their predictive performance.

- **Chapter 5** introduces the emerging concept of linked open data and how this concept is applied in PROFIT.

- Finally, **Chapter 6** draws the main findings and conclusions of this deliverable.
2 Financial Platforms

There is a wide range of websites that aspire to the term financial awareness platform ranging from Yahoo personal finance to classical economic media (i.e., the Wall Street Journal, the CNBC, Forbes, etc.), general media (i.e., the New York Times, CNN, etc.), stock exchange and securities websites (i.e., The New York Stock Exchange, Börse Franfurkt, the London Stock Exchange, etc.) as well as encyclopedic websites (i.e., investopedia.com, mymoney.gov, about.com, e-axes, etc.) and specialized financial literacy education toolkits (i.e., the Workplace Financial Fitness Toolkit (WFFT), funded by NYSE and the Euronext Foundation). For better understanding how the unlimited number of these communication media works, we next provide an overview of the different types of platforms outlining the services supported by them.

2.1 Types of platforms

2.1.1 Classical economic media

This group of portals are similar to standard media formats. They share to high extend the structure related to home and world’s news. The site structure contains the usual “Home”, “World”, “U.S.”, and “Politics” items. On the other side, it is not unusual to find columns related to Life and Art, for example, Buddhist Treasures from Gobi Desert, or posts describing TV episode “Game of Thrones”. The main focus, however, remain to financial & economy events and analysis. Next, we take a brief look on selected sites, particularly Wall Street Journal, CNBC, and Forbes.

WSJ is focused to news from U.S. and World’s Entrepreneur environment and finance.

![The Wall Street Journal](image.png)

Its Policy contains Blog section, consisting from traditional Washington Wire feature, providing the look behind the stories and warnings of what to watch in the days ahead. The section contains also “Think Tank”, a home for outside analysis form political thinkers.

Apart of blogs, the video section offers clips of selected political moments, like highlights from president speech, political causes, election, etc. The last section in Politics is dedicated to News Polls about Election.

Similar section is covered by Economy. Again a blog, named “Real Time Economy”. It offers analysis and commentary on U.S. and global economy, central bank policy and economics. GDP growth, actual economic events like job reports, results of manufacturing sector, car sales, trade deficit is presented with accompanying numbers and graphs.
Interesting section in Economy is related to Forecasting survey, displaying the estimated GDP forecasts and actuals on 3, 5, and 7-year basis. The survey is performed by WSJ, in cooperation with more than 60 economists on more than 10 major economic indicators on a monthly basis. The indicator includes Oil prices, Unemployment, 10 Year Note, CPI index, Federal Fund Rate, and Recession Probability.

**GDP (quarterly)**

![GDP Forecasts Graph](image)

**Figure 2–2 Estimated GDP forecasts in WSJ**

And, similarly to Politics, there are also videos in Economy section. Short clips capture various news from stamp price, FED comments, to Vietnam Investing in Social Good Challenges. The core info channels are under site structure items “Business”, “Tech”, “Markets”, and “Opinion”. Rather than itemized view the purpose of service is provided in the next chapter, in conjunction with other group sites.

“Arts” and “Life” covers obligatory topics about books, films, health, food & drink, sports etc.

WSJ has close relationship to Barron’s web site, which is primarily dedicated to financial markets, representing investment ideas to various securities, and providing the advisors service, service for managing user’s portfolio, and notification of important economic events. The advisors and investing ideas are paid services.

**CNBC Channel** has its “sister” in WEB site. Similarly, the site is oriented primarily to world and U.S. markets. Besides obligatory News sections, the site refers to “Financial Markets”, “Investing”, and “Tech”, more elaborated in Services view.

Interesting section is “Make it”, a storytelling platform for those who wants more – starting own business, advance the career, looking for inspiration. The section brings small business news, headlines, information about startups, to inspire the readers to make their own way to make a business. The section is further divided into “Inspire”, “Guide”, and “In Depth”
chapters.

The “Inspire” contains examples of successful business, usually based on inspirational ideas. For example, making the fashion on selfies, clothes for outdoor exercises that can hide the sweat, standing desk for children to make homework fun, etc.

The “Guide” chapter focuses more on “how to” themes, like starting the business with less than $1000, tips for fresh graduates who are looking for new job, or, advices from legends, like Apple Inc. founder Steve Wozniak how to approach the study.

The “In Depth” contains articles grouped by themes like “How I made it”, “Better your business”, etc., which resembles a bit the “Inspire”.

The section also contains “Attend” chapter, with links to Conferences related to business, presenting founders, CEOs of successful companies, and other entrepreneurs that share their stories and advises.

Figure 2–3 The inspire section in CNBC

**Forbes** welcomes its readers with daily citations of famous people – Quote of the Day. After couple of seconds the main page will be shown and, according to Forbes motto “The Capitalist Tool”, the flying Billionaire Ticker in the top of the page shows actual earnings of richest people in the world. The main page is full of Top list, starting from Billionaires, Celebrities, Colleges, to Powerful women.

The “Entrepreneur” section is keeping the “Capitalist spirit” and provides the list of best small U.S. companies, best Cities to launch a business, best Franchises to buy, etc. More interesting articles are linked under chapters like “Exit Strategies” that explain why Startups usually fail, “Taxes and Law”, with articles related to regulation topics, or “Sales and
Marketing” and “Startup” with success stories similar to CNBS “Inspire”.

![Forbes website](image)

**Figure 2–4 The opinion channel in Forbes**

The “Opinion” represents the news grouped to various categories, similar to News in other sites. The “Leadership” (apart of commercial links) informs about career advices, corporate responsibility topic, leadership styles, and sales skills. The C-level leadership articles are grouped in the “Networks”, starting from Executive, through Financial to Marketing Officers.

The young businessmen are captured in the “Under 30” Section, and “Lists” contains the top lists typical for Forbes.

Forbes investment information services are hidden under “Newsletter”. The section contains recommendations for people who want to invest into securities. Articles are locked, could be accessed by subscribing the service.


### 2.1.2 General media

Finance and economy is common topic in general information media, often covered in the “Business” section. The selected elaborated here are The New York Times, CNN, and Bloomberg.

**The New York Times** Business starts with economy related news, e.g. U.S. job report, events about issuing or closing big funds, information about big I.P.O., strikes in world’s countries, etc. The news is grouped by usual categories – “International”, “Technology”, “Economy”, “Energy”, etc. The “Dealbook” is focused on news about mergers and acquisitions, and divestitures. “Your Money” section brings news and commentary about investments, loans, and retirement. However, these are not specialized services, but kind of views, or filter to articles, that you can approach also from other site places.
CNN economy section is “Money”. The initial page brings “Top Global News”, for example situation about Zimbabwe, Tech company product news, big stock moves, etc. The sub-sections provide detailed info about “Markets”. Namely “Pre-Market Trading” brings Agency news about pre-market movers, overview of the commodity, bonds, and interest rate.

“Market Movers” sub-section shows top gainers, losers, and most active stocks, the “World Markets” depicts the selected market data in America, Asia, and Europe.
“Investing guide” does not educate how to invest, as one should get impression from the name, but focuses on news related to investment. For example, silver and oil price commentary, Dow Jones trends, the oil producers’ contracts, etc.

Interesting feature is covered by “Fear and Greed” index, which reflects the current mood on the market. The index is tracking seven indicators of market sentiments, namely volatility index, following the upward and downward market trend, price momentum, the actual movement against 125-day average, price strength, price breath, put and call options, junk bond demand, and safe heaven demand.

2.1.3 Economy Environment

Sites in this category offer the readers the view based on economy context, understanding the general principles, and asking the questions, rather than classical consumer’s view.

e-axes is dedicated to providing analysis, research info, commentary, and book reviews. The “Home” section contains links to recent articles, the topics include Economy growth, Monetary policy, Eurozone debt crisis, Global inflation, etc. Every article is presented by brief commentary and the Title of research, under which the article is published.

“Member’s posting” refers to actual contribution of e-axes members, categorized to four main groups – Commentary, Working papers, Books, and Conferences. The themes are reflecting wide range of various topics, including corruption in development countries, urban problems in Asia, impact of water level in reservoir to Singapore import, etc.

The “Books” section provides reviews of economy books, including Academy sources like Princeton University Press, Oxford University Press, MIT Press, etc. The site provides also “Calendar of Conferences” with coordinates on date, place, organizer, and keynote speakers. Examples of upcoming events are “Impact of uncertainty shocks on the global economy”, “Annual conference on Macroeconomic Analysis”, and “EBES Journal Conference” scheduled for May 2016.
Apart of the site sections with members’ contribution, the site refers to three additional sections referring to International Blogs, Global Research, and 360° Economy View. The “Blogs” section contains selection of International articles. For readers wanted more info the original link is included at the end of article, so that all comments, authors’ credentials, related columns, etc., are easily accessed.

“Global research” archives the research results, usually in PDF form that could be downloaded by reader. Documents are introduced by short Abstract, and usual coordinates referring to Author, Date, and Affiliation. For example, a Deutsche Bank Affiliate Author describes the innovation in financial sector brought by digital currencies, elaborating the potential opportunities and risks arising from the global adoption of digital currencies.

“360° Economy View” is an interesting way to file the common articles. For example, the topic “New and noteworthy books” lists the selected reviews in one article, focusing on 6 titles. Other theme “On economy Rents and Inequality” appoints to 2 links, which are relevant to high industry concentration and the rise in inequality, two other links related to persistent economic rents, and at the end the link to statistic.

The selection is prepared by e-axes team and the focus is to choose the most relevant topics, instead of huge numbers of links, which saves the time of readers, which are looking for particular themes.

**Scientific and Academic Publishing** is the open access publisher covering the academic disciplines. Its chapter “Business and Management” contains economy related Journals “Journal of Economics”, “Finance and Accounting”, and “Microeconomics and Macroeconomic”.

![Scientific & Academic Publishing](image)

*Figure 2–9 The Scientific & Academic Publishing welcome screen*
The Journals contain articles in HTML and plain text format. It is possible to download the PDF. Older stuff is clearly filed in Archive section.

*The Journal of Economics* employs economics to analyze problems in business, consumer behavior, and public policy. It publishes theoretical and empirical papers in finance and related themes, for example consequences of adopting IFRS system, relation between financing the education and unemployment rate, role of Corporate Social Responsibility in Community development, policy instruments and growth sustainability, etc. Articles do not avoid development countries, like Ghana, Nigeria, Tanzania, or Congo.

*Journal of Finance and Accounting* is dedicated to publishing the empirical research in Finance and Account theory. Empirical approach includes quantitative, qualitative laboratory, and combination methods, applied in Auditing, Accounting, Banking, Financing, Investing, and Tax fields. Featured topics are, for example, Exploring Sustainable strategies for Banks, Assessment of Factors affecting Tax morale, Monetary policy and Inflation, Forecasting Stock Market Volatility, Empirical Investigation of the Debt Maturity, etc.

*Microeconomics and Macroeconomic Journal* introduces basic microeconomic concepts to analyze issues in business, and to disseminate papers of practical implication for public policy, business policy, and individual decision making.

Articles cover topics, like Impact on Inflation on Stock Prices by evaluating the positive vs. negative impact of inflation, Mutual Interdependence between Human Action and Social Structure in Economy, Effect of Supply and Demand in Controlling GDP, and so on.

FIRST Project Portal is a web site, which addresses challenges of growing amounts of heterogeneous data and information in financial markets. For that purpose, FIRST develops and provides an Information and Communication Technology (ICT) infrastructure to collect and process data to integrate it into a financial knowledge base for further analysis and developing online event detection and prediction models, visualization models, and decision-support models that will deliver pertinent information to the decision maker.

The main page of the site describes the FIRST objectives, and the Technical details. This includes the current state of technology, the Advancements, which describe in greater detail implementation of the technical realization, and Scaling strategy of development process. Other sections of main page covers:

*Project Results* refers to integrated financial market information system, and related deliverables including Ontology, Information Integration, and Data Acquisition Infrastructure, Semantic Extraction system, and Decision Support System;

*Case Studies* introduces complementary and visionary use cases of market surveillance, risk management, and online retail brokerage and investment management.
The Blog section contains articles about PROFIT – technology related news like spam detection, sentiment extraction from web documents, ontology learning, as well project achievements and usage. The section “News” refers to press releases, showcases, and actual project presentation; “Dissemination Material” contains deliverables like Financial Market Information Systems GUI, Visualization of Textual Streams, Large-scale ontology reuse, Qualitative models, etc. The “Partners” lists the list of parties involved in the project, and “Links” shows FIRST in social networks, publishing in other sites, and related project.

2.1.4 Stock exchange and securities WEB sites

In this section, we briefly overview sites with direct access to the securities market and they environment. The list of sites covers U.S. and European regions.

The New York Stock Exchange portal is a part of Intercontinental Exchange company web site. The first service in the list is “Designated Market Maker” for brokers, who represent the interest of financial institutions, pension funds, banks, etc. Other services for public companies includes Investor Relations programs, Corporate governance to manage risks and enhance performance, Marketing and public relations, and NYSE Network, an entry point to cross country diversified community.

NYSE further offers services for providing information about Stock Exchange Trades and Data (Real-Time, Historical, Summary data, Reference Data). The “Insight” Section contains economy related articles, for example growing demand for Green Energy, as a result of Paris Agreement Climate Change Conference, Briefings from Customer Conferences, the comments related to technology trends like network security, etc. The last section
“Regulation” provides the info about companies listed in Stock Exchange, and rules, which cover access and communication with Floor, Listing & Delisting rules, Arbitration rules, Conducts and Disciplinary rules, etc.

**Börse Franfurkt** focuses more on providing the online information about market. The sections are filled by types of securities, e.g. Equities, Bonds, ETF, Funds, Commodities, Currencies and Sustainable Securities.

![Figure 2–11 The Börse Franfurkt welcome screen](image)

Every securities section has subsections, which enable the user to get specific info about the securities, for example “Overview”, “Search” service to find specific security based on Country, type of securities (Equity, ETF, Fund, Commodities, …), “New issues” of securities (Initial Price Offering), “Indices”, if relevant for given security.

On top of securities sections, there are two other, “News”, and “Know how”. “News” refers to Dividend/Interest information, commentary about world’s Stock exchange, or technical info like new tools, apps, etc.

“Know how” section contains quite complex glossary of Stock Exchange and finance terms, starting from definition of AAA Rating, Market Value, Micro Cap, Sector Index, Securities, etc. etc.

**U.S. Securities and Exchange Commission** is the web site of U.S. regulator (SEC). Its mission is to protect investors and to act in conjunction with promoting the capital formation that is necessary to sustain economy growth. SEC is driven by the simple concept – all investors, large institutions or small private individuals should have access to important facts, before
they decide to buy the securities.

Figure 2–12 The U.S. Securities and Exchange Commission company filings

The site provides four main types of information:

• SEC organization; the section “About”, “What we do” describes the Mission, the Divisions are described under “Division” section, describing the Function, Structure, News, Regulatory actions, Laws and rules. The SEC has following divisions: Corporate Finance, Enforcement, Economic and Risk Analysis, Investment Management, and Trading and Markets. SEC also explains how its activities are undertaken, specifically how Investigations work, with list of most common violations.

• SEC Activities under “Enforcement” section, providing the info about
  o Litigation Releases, from actual date to year 1995. The Release contains the typically Frauds and other Act violations.
  o The notices and orders concerning the institutions and settlement of Administrative proceedings to view the significant pleadings and decisions.
  o Commission Opinions and Adjudicatory orders issued by SEC
  o Auditing Enforcement Releases
  o Trading suspensions based on U.S. Securities laws up to 10 working days if public interest or protection of investors’ interests has to be defended.

• Laws related to SEC
  o listing the Acts that govern the securities industry, starting from the first Act 1933 after the Great Depression, to recent Sarbanes-Oxley from 2002 and JOBS ACT from 2012,
  o Information about Rulemaking activities, proposed/interim/final rules,
  o Education material like fast answers, how to read financial statements, glossary of common Terms, recommendation how to check the Investment advisers and
Brokerage firms

- The Edgar Database of public trading companies, with regular financial statements, proxy statements, and other filling documents

2.1.5 Educational websites

The overview of financial sites will be enclosed by educational webs. Three representatives have different approach to education. Investopedia covers wide range of terms, up to very specific topics interesting also for financial professionals. About.com is a general education site. Its Money section is approaching the wide public. And, in the middle of this approach is MyMoney.org, supported by Federal Financial Literacy and Education Commission, and its mission is to strengthen financial capability and access to financial services for U.S. citizens.

Investopedia.com main page is similar to classic economy web sites, e.g. brings the news and comments related to U.S. and world economy, commenting the future FED decisions about interest rates, U.S. imports, special reports about various investment securities, etc. The Investopedia’s sections are more focused on various topics, mostly for potential or actual investors:

- Markets, brings the investment columns, with subsections
  - ETC Center is oriented topics like most traded funds, development of commodity ETF prices, best dividend-paying funds
  - Analysis and Opinions evaluates the situation in the financial market, bringing the news like shares buyback in certain company, opening new subsidiaries, Traders’ trends, stock analysis, similar to CNBC portal
  - Sectors brings the snapshot of actual best and worst performing economic sectors, with related articles
  - Chart Advisor brings various trends in the selected charts, which try to help predicting the future development of securities prices by the patterns.

![Investopedia Chart Advisor Articles](image-url)
The remaining sections are dedicated to explaining the meaning of various technical indicators, videos explaining the trading strategies, and software review for performing the Technical analysis.

- Retirement section brings articles in categories Investing, Living, Insurance and Health, and Retirement planning. The content is not too much different from investing topics, with added recommendation topics like “What countries makes you feel like millionaire on $3000/Month”, “Avoid Insurance Policy Pitfalls”, “How to prepare to handle Natural Disasters” etc.

- Investing section brings the Tutorial about investing, while the rest of the content is filled by investing news. Similar approach could be seen in the Sections “Managing Wealth”, “Financial Advisor”, “Personal Finance”, etc. The more interesting part is Filing Taxes Section, with tools for calculating the tax, tax tips, and news related to tax limits and deadlines.

The educational stuff is more covered in the Guides and Exam preparation, in Reference section. The Guides are categorized up to 20 divisions, including Industry handbook, the short describing the terms like Industry, Sections, Federal Reserve system description, Macro and Microeconomic topics, etc.

The Exam preparation contains list of guides to help passing the FINRA, CFA/CFP/CMT certifications, and Canadian professional exams. The guides are either self studies online textbooks, or references to books, which could be obtained from reseller.

Investopedia contains also simulator for stock and forex trader (topic is out of scope of this document). On the other hand, Advisor insight contains answers to questions issued by public citizens, many of them faces practical life situations about taxes and divorced pairs, contribution to pension funds, money withdrawals from funds, how to plan Retirement for 40-year-old individual, etc.

**Mymoney.gov** is chartered by U.S Federal Financial Literacy and Education Commission (FLEC). It educates the wide public by five principles - Earn, Save & Invest, Protect, Spend, Borrow. Every principle is explained, suggested actions to be taken, and provide Tips & Hints:

The educational web site is mapping the links within three streams for supporting the financial knowledge:

- Resources for Youth contains games, fun activities, and videos. For kids, there are links like The Collectors Club turns the collecting the pocket money and coins into hobby. The game where goal is to make the longest burning light bulb refers to commemorative silver dollar, dedicated to Thomas Alva Edison. The C.h.a.n.g.e. project tries to creating habits and financial awareness by advising on money spending and saving, introducing the compound interest concept, explaining how much costs the slice of pizza – if someone will pay $2 for pizza slice every week, the cost for it is $5 200 in 50 years, e.g. until retirement age. Saving the same amount at 8% if interest however brings $64 678, which is the real pizza cost.
- Resources for Teachers and Educators refers to federal guides and curricula for teaching the financial capability concepts. The Online Resource center contains videos covering topics like Savings goals and Accounts, Understanding the financial institutions, Shopping effectively, etc.
- Resource for Researches enables searching the Research Clearinghouse, which contains the FLEC Reports and Articles from federally supported research on financial capability topics. The resources are categorized around mentioned five principles.

![MYMONEY.GOV](image)

Figure 2–14 The mymoney.gov borrow section

**About.com** is general educational site, covering also the financial topic – About Money channel. It contains the articles categorized by topics like Insurance, Retirement, Small business, Savings, etc. For example, the Car Insurance contains report about insurance for Non-owners, which is suitable for persons borrowing or renting a car. Similarly, the reader can find Financial planning articles in the Retirement category, advising to avoid luxury cars, count the money, limit the moving and/or renovating the house, etc.

### 2.2 WEB Information Services

An overview about services the platforms provide. Instead of analysing view to the platforms one by one as provided in previous chapter, we will look on value the platforms provide in common.

#### 2.2.1 Education

The main criterion for considering the service as an Educational one is based either on curriculum based material, which gradually explains and teach the selected topics, or the glossary approach, when terms are grouped by predefined categories. This criterion stands by generic commentary articles or thematic guides, which surface the popular topics.
The common education approach is explaining the financial terms. The useful feature is the rich list of terms, which provide usually Stock Exchange platforms, or SEC portal. Somewhat drawback is mutual reference in explanation that lead to tree-like method of studying because one term can be explained by other terms, which would need also an explanation.

More visual method provides Investopedia that combines short article with video. The video is animated and very uses apparent steps – for example, the difference between common and preferred stock is highlighted by shareholders that own the common stock and can vote in annual meetings.

The similar approach like glossary is covered under “Know how” that can form a set of articles thematically similar to selected terms.

The training material is available in the form of online modules, with provided narrator speech, quiz, explanatory slides, tests, etc., usually for adult audience. Specialty guides are available as a support material for Trainers, which are focused on training the youth or children on Mymoney.gov, where fun, cartoon, and game materials could be found for leading the children to basic financial awareness.

2.2.2 User’s portfolio management

Tracking the user securities is popular service, often guarded by registration to protect the privacy of data. The portfolio service basically allows to
- search the securities based on identification, which can be a Ticker (in case of stock), or ISIN number
- register the securities in the portfolio database by entering the number of units, the price, date, and the buy or sell transaction. Deposits and withdrawals can be also supported in order to have the whole picture of invested money.
- Get the news related to securities, for example in case of stock it is often related to important earning events, shareholder meetings, new product or service introduction, big movement of price.
- Comparing tools that outline the difference between the own portfolio performance and the comparable securities, which can be selected from Indices, other Stocks, bonds, funds, ETFs, or other kind of securities

The various tracking tools differ in terms of usability, interfaces (import export of data), graphical features, and agency service provided.

2.2.3 Communities

The most supported community could be found on investing and security research firms. There are various opinions on how to invest the money or on the preferred investment strategies, usually accompanied with various views and ratings of users. For example, the myfool.com users assign the fool caps as ratings to topics if confirmed by other users’ experience.
However, the concept of Community of people with common interests, demand, or concerns receives rather lower attention in most of analyzed platforms. Stock Exchange portals and SEC does not even support blogs with comments, at least in actual versions.

Economy media supports Blogs with comments from usually registered users, similarly the FIRST project web site. The obvious features like Follow or Like on social networks are quite common. Active management of user groups, dedicated for certain community of people, moderating the topics, or active promoting of the certain aspect of financial awareness had rather limited support.

2.2.4 Economy Environment

In all reviewed platforms, the Economy environment is the most common topic apart from news. The service is provided in several ways:

- The commented articles related to world and regional economies. The nature of comments often expresses the sentiment of author, analysing impact of industry trends, technology innovations, regulation decisions, political events, and so on. This topic is commonly covered by traditional economic media, as well as general media with economy sections;
- Academy research, covered by deep analysis, often as a result of study, for example Effect of socio-economic factors on aggregate savings, the topics often covering the development countries;
- Tools for economy environment, like the FIRST portal, the “Fear and Greed” parameter for measuring the current mood of the market;
- Conferences for presenting the successful entrepreneurs or business trends from commercial sphere, or academic conferences, for example to analysing Macroeconomic data

2.3 The PROFIT approach

Despite the wide range of financial awareness platforms available today, PROFIT aims at introducing an entirely new approach to financial awareness by establishing a user-centred financial awareness platform that obtains finance-related crowdsourced data from the web and its users in order to create new knowledge towards offering financial information, education and advanced forecasting tools to help users understand financial data and trends and empower them in decision making, catering to user profiles and specifics. The platform will be freely available based on Open software components and licensed under suitable Open license to be available for the general use and re-usage. To the best of our knowledge, such a multi-functional platform for the user is not available in the European environment so far. Moreover, the PROFIT platform will be among the first Open Source paradigms to illustrate and analyse the possibilities of exploiting the semantic technology in the financial awareness domain showcasing the benefits therein as well as the problems and obstacles to overcome in the future.
3 Financial Literacy

This section reviews the best current practices in the academic and professional agenda on financial literacy. This agenda can be seen as having two distinct phases. Its first phase, which covers the period up to 2014, aimed at establishing financial literacy as an important and distinct field in the economics and finance literature. This phase was completed with the publication of the review paper by Lusardi and Mitchell (2014) in the Journal of Economic Literature. That publication set the benchmark for financial literacy as a distinct field. The second phase of the agenda aims at establishing methods for delivering financial literacy courses and training programmes, aiming at the maximum possible impact on increasing the financial literacy of the population and, in particular, the target groups of primary interest. The PROFIT project is among the primary innovators in this agenda aiming to set a benchmark for the delivery of financial literacy training in an open online platform mode for mass audiences.

It is worth noting that the extensive review of all resources is not the penultimate purpose of this work package, as a thorough review and unique synthesis will be conducted along the delivery of Work Package 3 (WP3 - Financial Literacy for Informed Decision-Making). The current review intends to motivate the relevant section of the project and highlight its importance, potential and novelty.

3.1 The assessment of financial literacy (ASSESS)

The recent financial crisis has generated interest in better understanding how to promote more responsible and prudent individual saving and borrowing behaviour. The Eurozone debt crisis, with the resulting fiscal consequences throughout Europe, further stimulated the discussion on how to promote the efficient allocation of financial resources and greater financial stability. In an era of ageing demographics and increased rates of internal and external migration in Europe, the challenges for government budgets are vast. The ability of consumers to make informed financial decisions is critical to developing sound personal finance, which can contribute to increased saving rates, more efficient allocation of financial resources, and greater financial stability. From an institutional perspective, increased financial capability can contribute to client protection and social performance target assessment by financial institutions. From the European Union’s viewpoint, it can also be conducive to the enhancement of the European identity, open democracy and active citizenship for informed political awareness. Ultimately, it can contribute to increased levels of overall well-being, along with higher levels of satisfaction relating to income, retirement, housing and financial situation.

Financial literacy is the ability to use knowledge and skills to effectively manage financial resources at a personal-level. It is more than numeracy—“being good with numbers”. It includes for example the understanding of how compound interest rates operate, the difference between real and nominal values and the role played by inflation, and principles of financial risk diversification, inter alia. The USA President’s Advisory Council on Financial Capability defines personal financial literacy as the: “...ability to use knowledge and skills to manage financial resources effectively for a lifetime of financial well-being” (PACFL, 2008). Lusardi and Mitchell (2014) define financial literacy as “...peoples’ ability to process
economic information and make informed decisions about financial planning, wealth accumulation, debt and pensions”.

The assessment of the levels of financial literacy in population samples in the academic literature has seen a number of approaches, with the dominant schools of thought being those of Mandell (2004; 2008) and Lusardi (2008). Both approaches were based on the specification of quiz-type questions, installed in custom-made - and later on mainstream - population surveys. The former approach is based on long test-type quizzes. As a result it was met with more criticism, due to people's dislike of feeling tested in surveys. Another important criticism stemmed from the long number of questions involved, which were often lacking conceptual clarity and were often inter-related with each other, resulting in conceptual and statistical caveats when it came to their utilisation. The approach by Lusardi dominated the field, due to its simplicity and conceptual clarity. It is based on sets of 3, 5, 7, and/or 17 questions. The question subset which stood the academic scrutiny of economic theorists was focused on the understanding of the three fundamental notions of finance, namely, interest, inflation and risk. From parity conditions in international finance, to corporate and public finance, the discussion is always founded around the clear understanding of these three notions. Lusardi and Mitchell (2011b) argue that it is important to think in terms of “basic” and “sophisticated” financial literacy questions. What distinguishes the two is their complexity. In other words, the sophisticated questions are more difficult to answer correctly. Accordingly, one would expect a large share of incorrect and don’t know answers for the sophisticated questions.

The three basic questions were initially included in an experimental financial literacy module for the 2004 US Health and Retirement Study (HRS) and since then they been added solely or along with other questions to many surveys, such as the National Longitudinal Survey of Youth (NLSY) for 2007-2008, the Rand American Life Panel (ALP) in 2008, the 2009 Financial Capability Study (FINRA, 2010), etc. The World Bank has introduced the questions in a number of its own custom-made surveys and Panos and Wreight (2016a; b; c) introduced the three questions in the British Elections Study 2014, a major UK survey. For each question a list of possible answers is specified (up to five). There is only one correct answer. On average, it takes a much shorter period of time to answer questions of this type, compared to open-ended question. Respondents are allowed to choose “Don’t know” (and should be encouraged to choose this option rather than guess). In addition they are allowed to choose the option “Refuse to answer”. It is important to include this option since it allows respondent to object to be tested or object if they believe the question is prying into their financial circumstances. More recently, Klapper, Lusardi and van Oudheusden (2015) have transformed the basic 3 financial questions into 4, distinguishing between mere numeracy and the understanding of interest rates. The 4 questions are presented in Table 3–1. In addition, Table 3–2 presents a set of 8 questions from a recent effort by the OECD (2015). The OECD negotiates the same 3-4 fundamental concepts, i.e. interest, inflation, risk, and numeracy; albeit, with a longer set of questions, in order to distinguish between different levels of understanding.

Table 3–3 presents an international comparison of financial literacy based on custom-made surveys in different countries, using the 3 basic questions of Panel A of Table 1.1. The figures
presented are adapted from Lusardi and Mitchell (2014) and Montagnoli, Moro, Panos and

Table 3–1 The main financial literacy questions and their extensions

<table>
<thead>
<tr>
<th>Panel A: The 3 basic questions (Lusardi and Mitchell, 2014)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Numeracy [Interest]</td>
<td>Suppose you had $100 in a savings account and the interest rate was 2 percent per year. After 5 years, how much do you think you would have in the account if you left the money to grow?</td>
</tr>
<tr>
<td>2. Inflation</td>
<td>Imagine that the interest rate on your savings account was 1 percent per year and inflation was 2 percent per year. After 1 year, how much would you be able to buy with the money in this account?</td>
</tr>
<tr>
<td>3. Risk</td>
<td>True or false? Buying a company stock usually provides a safer return than a stock mutual fund.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: The 5 updated questions (Klapper, Lusardi and van Oudheusden, 2015)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Numeracy [Interest]</td>
<td>Suppose you need to borrow 100 US dollars. Which is the lower amount to pay back: 105 US dollars or 100 US dollars plus three percent?</td>
</tr>
<tr>
<td>2. Inflation</td>
<td>Suppose over the next 10 years the prices of the things you buy double. If your income also doubles, will you be able to buy less than you can buy today, the same as you can buy today, or more than you can buy today?</td>
</tr>
<tr>
<td>3a. Compound interest 1</td>
<td>Suppose you had 100 US dollars in a savings account and the bank adds 10 percent per year to the account. How much money would you have in the account after five years if you did not remove any money from the account?</td>
</tr>
<tr>
<td>3b. Compound interest 2</td>
<td>Suppose you put money in the bank for two years and the bank agrees to add 15 percent per year to your account. Will the bank add more money to your account the second year than it did the first year, or will it add the same amount of money both years?</td>
</tr>
<tr>
<td>4. Risk diversification</td>
<td>Suppose you have some money. Is it safer to put your money into one business or investment, or to put your money into multiple businesses or investments?</td>
</tr>
</tbody>
</table>
Table 3–2 The OECD’s 8 financial literacy questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Record numerical response. Options of:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Imagine that five &lt;brothers&gt; are given a gift of $1,000. If the &lt;brothers&gt; have to share the money equally how much does each one get? &lt;brothers&gt; could be substituted.</td>
<td>Correct answer: None, nothing, zero etc Options of:</td>
</tr>
<tr>
<td>2. Now imagine that the &lt;brothers&gt; have to wait for one year to get their share of the $1,000 and inflation stays at X percent. In one year’s time they will be able to buy?</td>
<td>Options of:</td>
</tr>
<tr>
<td>3. You lend $25 to a friend one evening and he gives you $25 back the next day. How much interest has he paid on this loan?</td>
<td>Options of:</td>
</tr>
<tr>
<td>4. Suppose you put $100 into a &lt;no fee&gt; savings account with a guaranteed interest rate of 2% per year. You don’t make any further payments into this account and you don’t withdraw any money. How much would be in the account at the end of the first year, once the interest payment is made?</td>
<td>Options of:</td>
</tr>
<tr>
<td>5. and how much would be in the account at the end of five years [add if necessary: remembering there are no fees]? Would it be:</td>
<td>Options of:</td>
</tr>
<tr>
<td>6. An investment with a high return is likely to be high risk Alternative: If someone offers you the chance to make a lot of money there is also a chance that you will lose a lot of money.</td>
<td>Options of:</td>
</tr>
<tr>
<td>7. High inflation means that the cost of living is increasing rapidly</td>
<td>Options of:</td>
</tr>
<tr>
<td>8. It is usually possible to reduce the risk of investing in the stock market by buying a wide range of stocks and shares. Alternative: It is less likely that you will lose all of your money if you save it in more than one place.</td>
<td>Options of:</td>
</tr>
</tbody>
</table>
Wright (2016). The figure establishes low levels of financial literacy, with some 40% responding correctly to all three questions in Great Britain, 30% in the United States, 45% in the Netherlands, 53% in Germany, 42% in Australia and figures even lower in other countries, e.g. Japan (27%), New Zealand (24%). A stylized fact is that, in the majority of the countries, more than a third of the sample responds that they do not know the correct answer at least once.

Table 3–3 International comparison of financial literacy

<table>
<thead>
<tr>
<th>Country</th>
<th>Survey year</th>
<th>Interest rate</th>
<th>Inflation</th>
<th>Risk</th>
<th>All 3 correct</th>
<th>At least 1 “Don’t know”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Britain</td>
<td>2014</td>
<td>81.3%</td>
<td>69.1%</td>
<td>48.7%</td>
<td>40.2%</td>
<td>28.3%</td>
</tr>
<tr>
<td>USA</td>
<td>2009</td>
<td>64.9%</td>
<td>64.3%</td>
<td>51.8%</td>
<td>30.2%</td>
<td>42.4%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2010</td>
<td>84.8%</td>
<td>76.9%</td>
<td>51.9%</td>
<td>44.8%</td>
<td>37.6%</td>
</tr>
<tr>
<td>Germany</td>
<td>2009</td>
<td>82.4%</td>
<td>78.4%</td>
<td>61.8%</td>
<td>53.2%</td>
<td>37.0%</td>
</tr>
<tr>
<td>Japan</td>
<td>2010</td>
<td>70.5%</td>
<td>58.8%</td>
<td>39.5%</td>
<td>27.0%</td>
<td>61.5%</td>
</tr>
<tr>
<td>Australia</td>
<td>2012</td>
<td>83.1%</td>
<td>69.3%</td>
<td>54.7%</td>
<td>42.7%</td>
<td>41.3%</td>
</tr>
<tr>
<td>New Zealand</td>
<td>2009</td>
<td>86.0%</td>
<td>81.0%</td>
<td>49.0%</td>
<td>24.0%</td>
<td>7.0%</td>
</tr>
<tr>
<td>Switzerland</td>
<td>2011</td>
<td>79.3%</td>
<td>78.4%</td>
<td>73.5%</td>
<td>50.1%</td>
<td>16.9%</td>
</tr>
<tr>
<td>Italy</td>
<td>2007</td>
<td>40.0%*</td>
<td>59.3%*</td>
<td>52.2%</td>
<td>24.9%*</td>
<td>44.9%*</td>
</tr>
<tr>
<td>Sweden</td>
<td>2010</td>
<td>35.2%*</td>
<td>59.5%</td>
<td>68.4%</td>
<td>21.4%*</td>
<td>34.7%*</td>
</tr>
<tr>
<td>France</td>
<td>2011</td>
<td>48.0%*</td>
<td>61.2%</td>
<td>66.8%</td>
<td>30.9%*</td>
<td>33.4%*</td>
</tr>
<tr>
<td>Russia</td>
<td>2009</td>
<td>36.3%*</td>
<td>50.8%*</td>
<td>12.8%</td>
<td>3.7%*</td>
<td>53.7%*</td>
</tr>
<tr>
<td>Romania</td>
<td>2011</td>
<td>41.3%</td>
<td>31.8%*</td>
<td>14.7%</td>
<td>3.8%*</td>
<td>75.5%*</td>
</tr>
</tbody>
</table>

Notes: Figures for Great Britain and its countries are weighted averages from the British Election Study. The figures from the remaining countries are from Lusardi and Mitchell (2014). Asterisks denote differences in the wording or format of the questions in different surveys.

Figure 3–1 presents a global map of financial literacy for a more recent global survey funded by Standard & Poor’s (2014) and conducted by Klapper, Lusardi and van Oudheusden (2015). The countries with the highest financial literacy rates are Australia, Canada, Denmark, Finland, Germany, Israel, the Netherlands, Norway, Sweden, and the United Kingdom, where about 65% or more of adults are financially literate. On the other end of the spectrum, South Asia is home to countries with some of the lowest financial literacy scores, where only a quarter of adults – or fewer – are financially literate.

Figure 3–2 highlights the segment of the map for the 28 member countries of the European Union. Financial literacy rates vary widely across the European Union. On average, 52% of adults are financially literate, and the understanding of financial concepts is the highest in northern Europe. Denmark, Germany, the Netherlands, and Sweden have the highest literacy rates in the European Union: at least 65% of their adults are financially literate. Rates are much lower in southern Europe. For example, in Greece and Spain, literacy rates are 45% and 49%, respectively. Italy and Portugal have some of the lowest literacy rates in the south. Financial literacy rates are also low among the countries that joined the European Union after 2004. In Bulgaria and Cyprus, 35% of adults are financially literate. Romania, with 22% financial literacy, has the lowest rate in the European Union.
Figure 3–1 Financial literacy around the world


Figure 3–2 Financial literacy in the EU-28

It is evident that financial literacy rates differ enormously between the major advanced and emerging economies in the world. Klapper, Lusardi and van Oudheusden (2015) highlight that, on average, 55% of adults in the major advanced economies – Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States – are financially literate. But even across these countries, financial literacy rates range widely, from 37% in Italy to 68% in Canada. In contrast, in the BRICS economies (Brazil, the Russian Federation, India, China, and South Africa) – on average, 28% of adults are financially literate. Disparities exist among these countries, too, with rates ranging from 24% in India to 42% in South Africa.

One frequent claim is that differences in financial literacy around the world might be explained by income and the level of economic development. Figure 3–3 examines the relationship between financial literacy and GDP per capita (accounting for the cost of living, in terms of PPP $international). The figure indicates that wealthier countries, as proxied by GDP per capita, tend to exhibit higher rates of financial literacy. However, the relationship mostly holds when looking at the wealthiest 50% of economies. Klapper, Lusardi and van Oudheusden (2015) suggest that around 38% of the variation in financial literacy rates in these economies can be explained by differences in income across countries. For the poorer half of economies, with a GDP per capita of $12,000 or less, there is no evidence that income is associated with financial literacy. Our own computations also suggest that the relationship between financial literacy and PPP-divided GDP per capita is highly non-linear and mildly V-shaped. The evidence is interpreted as indicative that national-level policies, such as those related to education and consumer protection, shape financial literacy in these economies more than any other factor.

examines the relationship between financial literacy and PPP-divided GDP per capita in the 28 countries of the European Union. There the relationship seems to be closer to log-linear, with wealthier countries exhibiting higher levels of financial literacy. This observation is of great interest, as it adheres one novel policy element in the agenda of the European integration process; that of differences in financial knowledge and resulting differences in financial planning behaviour. Apart from heterogeneity across EU countries at the macroeconomic level, it is evident that there also exist microeconomic differences in terms of knowledge. Such differences are likely to exert significant impact on individual and country outcomes. Recent evidence shows that financial knowledge is a key determinant of wealth inequality. It is suggested that 30-40% percent of retirement wealth inequality in the US is accounted for by financial knowledge (Lusardi, Michaud and Mitchell, 2016). In a series of studies, reviewed in the next section, it has been suggested that individuals who are more financially literate make more economically rational decisions pertaining to real estate purchases, insurance purchases, investing, saving, tax planning, retirement planning, pension and insurance planning. More generally, people who are more financially literate make better financial decisions. Thus, it is evident that financial literacy is likely to exert a large indirect impact on financial stability. Given global economic challenges, which have recently tested the stability of the European Union, policy initiatives regarding the enhancement of financial knowledge at the microeconomic level are likely to entail significant positive macroeconomic implications, conducive to financial stability.
Figure 3–3 The relationship between financial literacy and GDP per capita

Source: UoGlasgow’s processing of the S&P financial literacy survey (2014) and World Development Indicators (2014)
Figure 3–4 The relationship between financial literacy and GDP per capita in the EU-28

Source: UoGlasgow’s processing of the S&P financial literacy survey (2014) and World Development Indicators (2014)
3.2 Financial literacy demographics (DESCRIBE)

The very recent booming literature on financial literacy has identified differences in knowledge across demographic groups which are of primary interest for informing policy initiatives aiming at the enhancement of financial capability. Klapper, Lusardi and Panos (2015) find that in the financially literate individuals in the US are more likely to start their own business, and also perform better while in business. This view on entrepreneurial financial knowledge matches the description of the entrepreneurial figure by Adam Smith (1876)\(^1\).

The review paper by Lusardi and Mitchell (2014) establishes that apart from the observed low levels of financial literacy; less developed countries have even lower rates. Importantly, financial illiteracy is more severe for some key demographic groups. These include the generation of baby boomers, which has neared or gone in retirement, minorities and migrants, the less educated, low income individuals, etc. A demographic group of particular interest involves the females, who have been consistently shown to exhibit lower levels of financial literacy. Significant gender differences have been documented for most Western countries. Figure 3.5 presents figures from the UK, the USA, Germany, Switzerland and the Netherlands (Panos and Wreight, 2016a). Males are significantly more likely to respond correctly to all three financial literacy questions in the British Election Study, with females significantly more likely to respond that they don’t know the response to at least one of the three questions. This pattern has been also shown in a number of studies for other countries. Lusardi and Mitchell (2014) suggest that the observed gender differences are likely to also reflect a greater lack of confidence in financial matters by females, apart from only knowledge differences. Using a Scottish sample of students aged between 11-17, Panos and Wright (2016b) find that the gender gap in financial literacy starts very early in the student life, and that economics/finance/business classes narrow the observed gender gap in financial literacy at school years.

Recognising the increasing need for financial education, both in the school curriculum and in lifelong learning among adults, there have been some studies that have aimed to assess the effectiveness of various financial education programmes, both among the young and adults. There has been some debate as to whether financial education in high schools has been successful at improving the financial knowledge of participants. Bernheim, Garrett, Maki (2001) find that middle-aged individuals who took a personal financial management course in high school were more likely to save a higher proportion of their incomes than individuals who did not. This emphasises the fact that financial education can help individuals make better financial decisions which would benefit them throughout life. However other studies have questioned the effectiveness of these financial education courses. Mandell and Klein (2009) examined the impact of a personal financial management course taken 1-4 years previously on 79 high school students in the U.S. They discovered that those who took the

\[\text{[The entrepreneur] must "...be able to read, write, and account, and must be tolerable judge too of, perhaps, fifty or sixty different sorts of goods, their prices, qualities, and the markets where they are to be had cheapest. He must have all the knowledge, in short, that is necessary for a great merchant, which nothing hinders him from becoming but the want of a sufficient capital."}\]

Adam Smith (1776: Book I, Ch. X: p.12)
course were not more financially literate and did not appear to have better financial behaviour than those who had not taken the course.

These are only two of many studies that have been carried out on the effectiveness of high school financial education programmes; a review of these studies indicates contradictory results. Walstad, Rebeck, and MacDonald (2010) undertook a study with 800 high school senior students across the United States to assess whether a personal finance programme would increase students’ knowledge of personal finance. The study had both a treatment and a control group and both groups showed similar levels of financial knowledge at the start of the programme. The programme was then delivered to the treatment group through five different video segments, which were spread over a two-to-four week period. At the end of the study the treated group showed a substantial increase (19.7%) in their financial knowledge whereas the control group only saw a very small increase (1%) in their financial knowledge, which led to the conclusion that a well-designed and properly implemented financial education programme could significantly improve the financial knowledge of high school students.

Luhrmann, Serra-Garcia and Winter (2015) carried out a study, which evaluated the impact of financial literacy training on teenagers between 14 and 16 years old in German high schools. Their study consisted of three short training modules, which typically took 90 minutes and were taught by finance professionals who volunteered to teach teenagers in high schools. The training modules focused on shopping, planning, and saving. The study used a treatment group of 558 students compared to 158 control students and they found that those in the treatment group showed an increase in financial knowledge and interest in financial matters. This again highlights that even a relatively short financial literacy programme can help to improve the financial knowledge of high school students.

Bruhn et al (2013) carried out a study into the impact of a comprehensive financial education programme in Brazil that spanned six states, 868 schools and approximately 20,000 high school students through a randomized control trial. The programme spanned 17 months and it was integrated into the classroom curricula of Mathematics, Science, History, and Portuguese, depending on the teacher teaching the course. This was in place of introducing a separate financial education course, as it was decided that this would have had too great an impact on teacher and student workloads. One big difference between this study and other studies was the length of time that the programme was delivered over, with the programme using textbooks with materials, which provided between 74 and 144 hours of teaching. These materials involved interactive case studies which aimed at placing students in financial situations that they were likely to face in the future, for example, family finances, entry into the labour market, and preparing for financial independence. The programme helped to improve the financial knowledge of students taking part and also increased the likelihood of financial planning and participation in household financial decisions by students. This study again highlighted that financial education programmes targeted at high school students can help to improve both the financial knowledge and behaviour of students taking part.
Panel A: All 3 correct

![Distribution of financial literacy in Great Britain and other countries, by gender](image)

Panel B: At least 1 "don’t know"

![Distribution of financial literacy in Great Britain and other countries, by gender](image)

Figure 3–5 Distribution of financial literacy in Great Britain and other countries, by gender

Notes: Figures for Great Britain, England, Scotland and Wales are weighted averages from the British Election Study, by Wreight and Panos (2016a). The figures from the remaining countries are from Lusardi and Mitchell (2014).

Another recent study that focuses on the effectiveness of financial education in high schools is by Hospido, Villanueva and Zamarro (2015). Their inquiry was completed in Madrid and the study comprised of 1,223 students in the 3rd year of mandatory secondary education from 22 schools. For the study there were 981 students in the treated group and 242 in the control group. The programme consisted of a 10-hour course in financial education with the
material for the course drawn from both a Student and Teacher’s Guide and a website which offered online support via practical exercises, activities, games, and additional resources. The programme aimed at increasing the financial knowledge of the participants and providing them with the tools to make better financial decisions later in life. The study found that students of the course performed better in both the arithmetic and non-arithmetic questions than students from the control group in a test of financial competence at the end of the course2.

These studies have primarily focused on the effectiveness of financial education as a whole, rather than focusing on the method of teaching that has been used during these courses and the different studies have provided mixed results as to the effectiveness of financial education courses in high school. Due to the increasing importance of developing financial literacy in the general population and the general belief that financial education will play a key role in improving the financial literacy of individuals, it has been argued by Lusardi et al (2015) that the research in financial education should move away from a discussion as to whether generic financial education works. Instead, the research should focus on trying to gain an understanding of how to make financial education work through better design and appropriate delivery methods. By focusing on how to make financial education work to deliver more effective courses and produce better informed individuals, it is important to look at the different ways that financial education can be taught and which method will result in the most informed participants.

Collins & Urban (2015) conduct a field study where individuals within 45 credit unions across Wisconsin had randomized access to a 10-hour online financial education programme on savings and debt management. Employees at the credit unions that offered the program in the 1st half of the study constitute the treatment group and employees at the those that offered it in the 2nd half constitute the 'control' group. All employees completed a 48-question survey concerning their self-assessed financial knowledge and behaviour at 3 points in time, i.e. before any education, after half of sites had access to the training, and after all sites had access. The results show an increase in knowledge regarding interest, loans, credit scores, stocks and bonds, and retirement investment. They also show that the education is associated with greater retirement plan participation, more frequent emergency savings, and more instances of creating a budget or financial plan. These findings are corroborated with actual retirement plan contribution accounts

2 While the above studies indicate the effectiveness of financial education, there have been some studies, which have contradicted this view. Becchetti, Caiazzo, and Coviello (2013) carried out a study with 944 high school students from 36 classes in their final year in Italy. The course lasted approximately 3 months and the participating students were required to complete a survey both before and after the completion of the course. As the course was being taught by different teachers in different classes, the teachers were provided with the same materials to teach the course. These materials included: (i) a set of slides; (ii) a short guide for the teacher, which illustrated the guidelines to be followed in their lessons and (iii) a more detailed guide to the available materials specifically designed for the students. The same survey was used for both the baseline and the follow-up survey and whilst the treated group did perform better in the follow up survey, the control group showed similar improvements, with little statistical difference between the two groups. It is therefore difficult to assess whether the course helped to improve the financial knowledge of the participants or if any improvement came from students learning the answers to the survey questions.
3.3 The importance of financial literacy (ATTRIBUTE)

The ability of individuals to make informed financial decisions is critical to developing sound personal finance, which can contribute to more efficient allocation of financial resources and to greater financial stability at both the micro and macro level (see, e.g., Lusardi, 2008; Lusardi and Tufano, 2009a, b). Recent studies have documented a strong relationship between financial literacy and a set of economic behaviours. Bernheim (1995, 1998) showed that most households lack basic financial knowledge and cannot perform very simple calculations, and that the saving behaviour of many households is dominated by crude rules of thumb. Hilgert, Hogarth, and Beverly (2003) find a strong link between financial literacy and day-to-day financial management. Financial literacy has also been linked to a set of behaviours related to saving, wealth, and portfolio choice. For example, several papers have shown that individuals with greater numeracy and financial literacy are more likely to participate in financial markets and to invest in stocks (Christelis, Jappelli, and Padula, 2010; Yoong, 2011; Almenberg and Dreber, 2011; Christiansen, Joensen, and Rangvid, 2008; Almenberg and Widmark, 2011; Van Rooij, Lusardi, and Alessie, 2011). Moreover, more literate individuals are more likely to choose mutual funds with lower fees (Hastings and Tejeda-Ashton, 2008; Hastings and Mitchell, 2011).

Klapper, Lusardi and Panos (2013) use unique Russian panel data from prior to and after the financial crisis, to examine financial literacy and its effects on behaviour. They find low levels of financial literacy in Russia and that financial literacy is positively related to participation in financial markets and negatively related to the use of informal sources of borrowing. Moreover, individuals with higher financial literacy are significantly more likely to report having greater availability of unspent income and higher spending capacity. In addition, Klapper and Panos (2011) find that in a country with widespread public pension provisions, financial literacy is significantly and positively related to retirement planning involving private pension funds.

Similarly, Lusardi and Mitchell (2007) show that those who display high levels of literacy are more likely to plan for retirement and, as a result, accumulate much more wealth, a finding reproduced in many of the countries that are part of an international comparison of financial literacy (Lusardi and Mitchell, 2011b). Moore (2003) reported that respondents with lower levels of financial literacy are more likely to have costly mortgages. Gerardi, Goette, and Meier (2010) report that those with low literacy are more likely to default on sub-prime mortgages or to have problems with them. Stango and Zinman (2009) find that those who are not able to correctly calculate interest rates out of a stream of payments end up borrowing more and accumulating lower amounts of wealth. Campbell (2006) shows that individuals with lower incomes and lower education levels are less likely to refinance their mortgages during a period of falling interest rates. Lusardi and Tufano (2009a, b) report that individuals with lower levels of financial literacy tend to transact in high-cost manners. Similar findings are reported in the UK (Disney and Gathergood, 2013).

Correlation between financial literacy and behaviour does not mean causation, and it is important to establish a causal link. Interestingly, Agarwal et al. (2009) show that financial mistakes are prevalent among the young and the elderly, which are the groups that display the lowest levels of financial knowledge. Calvet, Campbell, and Sodini (2007, 2009) examine...
data from Sweden and look at actions of investors that can be classified as mistakes. They find that poorer, less educated, and immigrant households - demographic characteristics that are strongly associated with low financial literacy - are more likely to make financial mistakes. These findings have been supported in recent studies using randomised control trials to explore the causal impact of financial literacy on financial outcomes. For instance, in Indonesia, a randomly selected set of unbanked individuals were offered financial literacy training sessions, which were found to increase the demand for banking services among those with low initial levels of financial literacy and low levels of education (Cole et al., 2011).

Another strategy has been to rely on instrumental variable (IV) estimation. Several instruments have been used. For example, Lusardi and Mitchell (2009, 2011) follow Bernheim and Garrett (2001) in using high school financial literacy mandates in different states and time periods in the United States. Van Rooij, Lusardi, and Alessie (2011) have used the financial literacy of others, such as siblings and parents. Behrman et al. (2010) use data from the Chilean Social Protection Survey and a set of plausibly exogenous instrumental variables that satisfy critical diagnostic tests to isolate the causal effects of financial literacy on wealth.

Thus, individuals who are more financially literate have been shown to make more economically rational decisions pertaining to real estate purchases, insurance purchases, investing, saving, tax planning, retirement planning, pension and insurance planning. More generally, people who are more financial literate make better financial decisions (Lusardi and Mitchell, 2014). Thus, from an institutional perspective, increased financial capability can contribute to client protection and social performance target assessment by financial institutions.

Some very recent literature establishes some particularly novel stylized facts regarding the link between financial literacy and financial stability. In addition, very recent studies show a link between financial literacy and public attitudes which can be thought of as conducive to economic stability. Recent evidence shows that financially literate individuals in the US are more likely to start their own business, and also perform better while in business (Klapper, Lusardi and Panos, 2016a). In addition, Klapper, Lusardi and Panos (2016b) find a positive relationship between financial literacy and trust in institutions.

At the macro level, and in view of looming debt and retirement crises around the world, salient political choices – recently involving voting in referendums – are determined by attitudes towards redistribution, immigration, austerity, as well as the workings of economic partnerships in monetary and fiscal unions etc. Such attitudes are likely to depend upon the understanding of the basics of macroeconomic accounts and public finance. Recent evidence shows relationships between financial literacy in the UK and attitudes to the Scottish referendum, the EU referendum, and towards immigration (Panos and Wright, 2016a; 2016b; 2016c). Moreover, Montagnoli, Moro, Panos, and Wright (2016) find a significant negative relationship between financial literacy and attitudes favouring strong government income redistribution efforts.
Recent evidence shows that financial knowledge is a key determinant of wealth inequality. 30-40% percent of retirement wealth inequality in the US is accounted for by financial knowledge (Lusardi, Michaud and Mitchell, 2016).

Thus, recent literature starts to place financial literacy at the epicentre of policy discussions regarding financial and macroeconomic stability, going beyond emphasizing its apparent importance for microeconomic financial stability. Its relationship with the formation of public attitudes is also a dimension that is of primary interest to national and international policy agendas, with implications regarding the communication of public finance.

3.4 Financial literacy tools and toolkits (COMPARE)

Given the importance of financial literacy and the negative effects of illiteracy on financial behaviour as documented in extant academic research, there has been growing interest in addressing financial illiteracy across countries. In the European Union, the European Commission has been actively engaged in promoting financial education for its citizens (European Banking Federation, 2009).

This section reviews the currently available financial literacy tools and toolkits. It distinguishes between: (i) Financial institutions engaged in financial education; (ii) Newspapers with online personal finance sections; (iii) Open online courses (MOOCs); (iv) Books; (v) Financial games and gamification tools, and; (vi) European educational platforms.

The review was conducted using search engines and databases containing financial literacy initiatives such as the Canadian financial literacy database maintained by the Financial Consumer Agency of Canada and the global database on financial education maintained by the OECD. References were also made to prior reviews of current best practices such as the European Banking Federation’s (2009) report on financial literacy, the survey of financial literacy schemes in the EU-27 by Habschick et al. 2007, and the review financial education and awareness by the European insurance and reinsurance federation (Insurance Europe, 2011). Additional reviews of existing schemes across European countries were also conducted using the OECD’s global database on financial literacy.

3.4.1 Financial institutions engaged in financial education

This subsection discusses financial education initiatives by financial institutions, distinguishing between: (i) individual financial institutions; (ii) banking associations, central banks and ministries, and; (iii) financial institutions that are actively engaged in online financial education using publicly available resources; and (iv) interactive tools by institutions.

In the first category, twenty-one individual financial institutions are analysed. These are from Europe and North America and are presented in Table 3–4. This is not an exhaustive review, but aims to covering the major initiatives in this agenda by financial institutions. Moreover, the mix of organisations reviewed is quite diverse, including private banks, ethical banks, public sector and federations of financial organisations.
We start our analysis from the European Union level. The European Banking Federation (EBF) is the voice of Europe’s banking sector in all regulatory debates at European and global level. It represents 32 national banking Associations representing 4500 banks and 2.3 million employees. While not providing content on financial literacy, it is a “hub” where the general public can find third-party websites dealing with financial literacy. A similar “hub approach” is taken by another Europe-wide organisation, the European Banking and Financial Services Training Association.

Deutsche Bank AG is a German global banking and financial services company based in Frankfurt. The approach adopted by it is direct, with employees going to schools and holding financial literacy lectures in order to educate the young. The content of such lessons is quite standard and basic (in accordance to the target audience), including investment and retirement funds, global financial systems and financial crises.

In Denmark and Northern Europe, Danske Bank offers financial literacy materials that target the family ecosystem – from children to young people, parents and teachers. The goal of such a strategy is to prepare the next generation of banking customers to manage their financial affairs. The way in which they deliver the content is bespoke to the target audience: advisory services, educational materials, online games, events and presentation materials to stimulate financial skills and knowledge.

The Belgian Financial Sector Federation offers e-learning materials to everyone who needs a basic training and is intended for people who wish to acquire general knowledge of the activities, products and organization of a bank.

In Italy, the Foundation for Financial Education and Savings, a not-for-profit organisation founded by the Italian Banking Association, has the goal to promote financial education among citizens ranging from young people to retirees. They try to achieve this goal via educational workshops, theatrical shows, multimedia, videos, games, events and collaborations with various institutions of the territory.

It should be stressed that not only traditional banks, but also ethical banks (both examples below are FEBEA members) offer resources relevant to financial literacy. For example, Banca Etica has a programme which targets young people and features role-playing games to think about money, investments and interest and how to make the right decisions with respect to transparency and sustainability.

Cassa Padana Bcc is another ethical cooperative bank that offers guides to children and immigrants. Cassa Padana has a training programme dedicated to elementary school and high school students: through games, they understand the importance of properly spending their own money. They also deal with more advanced concepts such as saving food, resources, water and time. The financial inclusion of immigrants is an issue Cassa Padana has been dealing with for years. To improve the relationship between the bank and immigrants, financial education is a fundamental step. Thanks to the collaboration of several employees of foreign origin, Cassa Padana has produced guides to banking products, translated into Albanian, Arabic, Indian, English, French and Spanish.
In Malta, the Malta Financial Services Centre - a public body which is the regulator of financial services in Malta - is also engaged in financial literacy efforts. Its target audience is the general public and has a section, which is purely educational explaining issues related to banking, investments, insurance etc. Another public institution that deals with financial literacy is the Ministry for the Family and Social Solidarity. The highlight is the Draft National Strategy document on retirement income and financial literacy 2016-2018. It sets out a programme and a number of initiatives that the government will be taking to improve financial literacy in Malta. This document is currently available for public consultation and has examples of financial calculations and explanations.

In the UK, certain large banks, such as Barclays and RBS, offer specific financial education programmes targeted towards young people. The former even tailors content according to the continent (Africa, Asia-Pacific, Europe and so on) and both take advantage of online learning to make the content accessible. The goal is to help the next generation improve money-management skills, knowledge and confidence. Similarly, Lloyds targets youngsters and teachers in order to feed information to the education system. Standard Chartered offers two global financial education programmes: Financial Education for Youth, teaching young people about making a budget and managing their money; and Education for Entrepreneurs, which helps micro and small enterprises to master the basics of entrepreneurship. Others, like Halifax and HSBC offer websites with generalist content (explanation of jargon, insurance etc.) alongside personal budgeting tools and calculators that integrate with the client’s profile. In this case, the content is delivered via a wide spectrum of articles, videos, apps and social media.

In the United Kingdom, there are also non-bank institutions offering financial education tools. The Money Advice Service is a service provided by the Consumer Financial Education Body, which was established by the national financial regulator, i.e. the Financial Services Authority, that provides free-of-charge advice on money and financial decisions to people in the United Kingdom. It is an independent organisation, whose statutory objectives are: to enhance the understanding and knowledge of people about financial matters, including the UK financial system, and to enhance their ability to manage their own financial affairs. The main thematic areas of the educational material are: debt and borrowing, budgeting and managing your money, saving and investing, retirement, work and benefits, insurance and mortgages.

In the United States, the Federal Deposits Insurance Corporation (FDIC) provides financial literacy training targeted towards low- and moderate-income individuals outside the financial mainstream. Interestingly, it also provides materials for instructors. The content it offers, in line with its mission and its target users, includes bank services, credit, chequing accounts, financial recovery, savings, credit card, borrowing, credit and home ownership. The mode of delivery of the training involves slides, CDs and printed guides.
Table 3–4 List of individual financial institutions engaged in financial education

<table>
<thead>
<tr>
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<th>Country</th>
<th>Link</th>
<th>Emphasis/Target audience</th>
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<td>General Public</td>
</tr>
<tr>
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<td>Several countries</td>
<td><a href="http://www.citigroup.com/citi/citizen/community/curriculum/teens.htm">http://www.citigroup.com/citi/citizen/community/curriculum/teens.htm</a></td>
<td>Young People and General Public</td>
</tr>
<tr>
<td>Danske Bank</td>
<td>Denmark</td>
<td><a href="https://danskebank.com/en-uk/CSR/Financialliteracy/Pages/default.aspx">https://danskebank.com/en-uk/CSR/Financialliteracy/Pages/default.aspx</a></td>
<td>Children, Young People, Parents and Teachers</td>
</tr>
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<td>UK</td>
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<td>Clients</td>
</tr>
<tr>
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<td>UK</td>
<td><a href="http://financialplanning.hsbc.co.uk/#/all">http://financialplanning.hsbc.co.uk/#/all</a></td>
<td>General Public, Clients</td>
</tr>
<tr>
<td>Foundation for Financial Education and Savings</td>
<td>Italy</td>
<td><a href="http://www.feduf.it/chi-siamo/i-partecipanti">http://www.feduf.it/chi-siamo/i-partecipanti</a></td>
<td>General Public, Elderly and Entrepreneurs</td>
</tr>
<tr>
<td>Financial institution</td>
<td>Country</td>
<td>Link</td>
<td>Emphasis/Target audience</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-----------</td>
<td>----------------------------------------------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>Ministry for the Family and Social Solidarity</td>
<td>Malta</td>
<td><a href="https://0d2d5d19eb0c0d8cc8c6-a655c0f6dcd98e765a68760c407565ae.ssl.cf3.rackcdn.com/29aad6157295ca5fe74d885d8f69bfb3d3074cc.pdf">https://0d2d5d19eb0c0d8cc8c6-a655c0f6dcd98e765a68760c407565ae.ssl.cf3.rackcdn.com/29aad6157295ca5fe74d885d8f69bfb3d3074cc.pdf</a></td>
<td>General Public</td>
</tr>
<tr>
<td>Malta Financial Services Centre</td>
<td>Malta</td>
<td><a href="http://mymoneybox.mfsa.com.mt/info/consumer-advice">http://mymoneybox.mfsa.com.mt/info/consumer-advice</a></td>
<td>General Public</td>
</tr>
<tr>
<td>Banca Etica</td>
<td>Italy</td>
<td><a href="http://www.bancaetica.it/git/firenze/articolo/locandina-scuola-popolare-di-economia-2016">http://www.bancaetica.it/git/firenze/articolo/locandina-scuola-popolare-di-economia-2016</a></td>
<td>Young People and General Public</td>
</tr>
<tr>
<td>Cassa Padana Bcc</td>
<td>Italy</td>
<td><a href="http://www.popolis.it/linclusione-finanziaria-degli-stranieri/">http://www.popolis.it/linclusione-finanziaria-degli-stranieri/</a></td>
<td>Young People, Immigrants</td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="http://www.cassapadana.it/Dettaglio.asp?idPagina=1&amp;idNews=193&amp;id=">http://www.cassapadana.it/Dettaglio.asp?idPagina=1&amp;idNews=193&amp;id=</a></td>
<td></td>
</tr>
</tbody>
</table>

**Bank of America**, one of the largest bank holding companies in the United States in terms of assets offers financial education material, comprising mostly online articles on a diverse mix of topics, e.g. credit, saving and budgeting, debt, home buying, taxes, personal banking, paying for school, families and money, work and income, and retirement planning.

As a final case from the United States, **Citi Group**, an American multinational investment banking and financial services corporation with branches in 140 countries, offers an e-learning training programme targeting the general public, from children and teenagers to adults. The main areas covered by the materials are savings, investment planning and budgeting.

Outside North America and the EU, **Credit Suisse**, a globally active integrated universal bank providing solutions to its clients in private banking, investment banking and asset management, is a distinct case in terms of its provision of financial literacy training. The banking group’s initiative on financial literacy training involves more practical activities, with learning programmes in Brazil, China, India and Rwanda. Furthermore, the main targets are girls and young women. A highlight is the Financial Education for Girls programme, aiming to provide relevant and timely financial education to girls and young women at key points in their lives, as part of a programme to provide girls with the necessary knowledge, skills and attitudes to tackle decisions along their life’s journey, whether this is personal, professional or in continuing education.

In addition to the efforts by individual financial institutions for the enhancement of the financial skills of their clientele across the EU, there are a number of efforts initiated by banking associations and institutional players, such as central banks and ministries. While an extensive review of these efforts will be relevant to work package 3 and is beyond the scope of this section, these efforts are summarized in Table 3–5.

The existing internet-based schemes across European countries have been reviewed and are listed in Table 3–6. The focus here is identifying tools/channels used to deliver financial education. In general, there are multiple channels of delivery of financial literacy. For
### Table 3–5 List of financial associations engaged in financial education

<table>
<thead>
<tr>
<th>Country</th>
<th>Institution</th>
<th>Initiative</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>Austrian Bankers Association</td>
<td>Workshop entitled &quot;debt-free through life&quot;, which was aimed at providing basic financial education tailored to different age groups</td>
<td>-</td>
</tr>
<tr>
<td>Belgium</td>
<td>Belgian Financial Sector Federation</td>
<td>TV series on the financial world aimed at the public at large; creation of an interactive website aimed at providing financial education</td>
<td>-</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>Association of banks in Bulgaria</td>
<td>A number of activities aimed at enhancing financial literacy including: websites on financial education, publication of education materials, dictionaries with financial terms and periodicals. Also, in a dedicated section on its website aimed at informing the public about the financial products and services offered by financial institutions.</td>
<td>-</td>
</tr>
<tr>
<td>Cyprus</td>
<td>Association of Cyprus commercial banks</td>
<td>Ad hoc seminars</td>
<td>-</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Czech Banking Association</td>
<td>Creation of an educational website in partnership with other professional associations from the finance sector.</td>
<td><a href="http://www.financniivzdela-vani.cz/svet-financi">http://www.financniivzdela-vani.cz/svet-financi</a></td>
</tr>
<tr>
<td>Denmark</td>
<td>Danish Bankers Association</td>
<td>Money Guide: a website, which contains updated prices for financial products and services, aiming to enable users to compare these before making a selection. It also contains a dictionary of financial terms</td>
<td><a href="http://www.pengepriser.dk">http://www.pengepriser.dk</a></td>
</tr>
<tr>
<td>Denmark</td>
<td>Danish Bankers Association</td>
<td>Tool that aids in the estimation of the cost of borrowing.</td>
<td><a href="http://www.aaop.dk">http://www.aaop.dk</a></td>
</tr>
<tr>
<td>Denmark</td>
<td>Danish Bankers Association</td>
<td>Entrepreneurs' guide: a website which provides an entrepreneur with concrete information on the financial aspects of starting up a company Other initiatives include specialised seminars</td>
<td>Website was not available on the report.</td>
</tr>
<tr>
<td>Denmark</td>
<td>Danish Bankers Association</td>
<td>Websites for Children</td>
<td><a href="http://www.pengeby.dk/">http://www.pengeby.dk/</a></td>
</tr>
<tr>
<td>Estonia</td>
<td>Estonian Banking Association</td>
<td>Vikerraadio: A series of radio broadcast on personal finance topics such as savings and investing</td>
<td>-</td>
</tr>
<tr>
<td>Finland</td>
<td>Federation of Finnish financial services</td>
<td>Publication of booklets (e.g. &quot;You and Your bank&quot;); promotion of nationwide competitions about financial knowledge in schools and short TV - series</td>
<td>-</td>
</tr>
<tr>
<td>Germany</td>
<td>Association of German bankers</td>
<td>Financial literacy website</td>
<td><a href="http://verbraucher.bankenverband.de/">http://verbraucher.bankenverband.de/</a></td>
</tr>
<tr>
<td>Germany</td>
<td>Association of German bankers</td>
<td>Schul bank: an initiative aimed at promoting financial literacy in schools</td>
<td><a href="http://schulbank.bankenverband.de/">http://schulbank.bankenverband.de/</a></td>
</tr>
<tr>
<td>Country</td>
<td>Institution</td>
<td>Initiative</td>
<td>Link</td>
</tr>
<tr>
<td>------------</td>
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<td>-------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Germany</td>
<td>Association of German bankers</td>
<td>Schul banker competition: sponsoring financial literacy competition on finance and the wider economy</td>
<td><a href="http://schulbanker.de/">http://schulbanker.de/</a></td>
</tr>
<tr>
<td>Germany</td>
<td>Association of German bankers</td>
<td>Financial literacy teaching materials on money and consumption for schools</td>
<td><a href="http://www.unterrichtshilfe-finanzkomp.etenz.de/index.htm">http://www.unterrichtshilfe-finanzkomp.etenz.de/index.htm</a></td>
</tr>
<tr>
<td>Germany</td>
<td>Assoc.of German bankers</td>
<td>Publication of booklets and other initiatives</td>
<td>-</td>
</tr>
<tr>
<td>Greece</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Hungary</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Iceland</td>
<td>Icelandic financial services association</td>
<td>Provision of information sessions on finance in secondary schools and colleges</td>
<td>–</td>
</tr>
<tr>
<td>Ireland</td>
<td>Irish banking federation</td>
<td>Financial education for school aged children and adults in partnership with other stakeholders</td>
<td><a href="http://www.financialeducation.ie">www.financialeducation.ie</a></td>
</tr>
<tr>
<td>Italy</td>
<td>Italian Banking Association</td>
<td>PattiChiari Consortium</td>
<td><a href="http://www.pattichiariti">www.pattichiariti</a></td>
</tr>
<tr>
<td>Italy</td>
<td>Bank of Italy</td>
<td>Financial education web page and classroom-based financial education for school children</td>
<td><a href="http://www.bancaditalia.it">http://www.bancaditalia.it</a></td>
</tr>
<tr>
<td>Italy</td>
<td>CONSOB</td>
<td>Publication of documents aimed at educating the public about investments</td>
<td><a href="http://www.consob.it">http://www.consob.it</a></td>
</tr>
<tr>
<td>Italy</td>
<td>Italian Treasury</td>
<td>–</td>
<td><a href="http://www.dt.tesoro.it">http://www.dt.tesoro.it</a></td>
</tr>
<tr>
<td>Luxembourg</td>
<td>Luxembourg Bankers Association</td>
<td>Promotes financial education events and provides relevant information in dedicated section of their website</td>
<td><a href="http://www.abbl.lu/">http://www.abbl.lu/</a></td>
</tr>
<tr>
<td>Malta</td>
<td>Malter Bankers Association</td>
<td>Production and dissemination of information booklets/brochures on a wide range of personal finance topics. rganises seminars on financial topics of interest</td>
<td>–</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>Netherlands Bankers Association</td>
<td>Co-founder of CentiQ, a platform which has financial education among its aims. Co-organised a television programme aimed at educating young people</td>
<td>–</td>
</tr>
<tr>
<td>Norway</td>
<td>Norwegian Financial Services Organisation</td>
<td>Provision of financial education to schools</td>
<td>–</td>
</tr>
<tr>
<td>Poland</td>
<td>Polish Banking Association</td>
<td>Several initiatives, i.e.: Financial education forum, evaluation of financial education programmes, financial education section of website, supporting financial education programmes on radio and newspapers,</td>
<td>–</td>
</tr>
<tr>
<td>Portugal</td>
<td>Portuguese Bank Association</td>
<td>Publication of booklets on financial topics, creation of a banking game which simulates the management of a bank branch, provision of seminars and online courses on personal finance topics, e.g. an open course entitled &quot;What's a bank?&quot;</td>
<td>–</td>
</tr>
<tr>
<td>Country</td>
<td>Institution</td>
<td>Initiative</td>
<td>Link</td>
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<td>------</td>
</tr>
<tr>
<td>Sweden</td>
<td>Swedish Banking Association/Financial Supervisory Authority</td>
<td>Financial education programmes in schools, creation of a financial education website</td>
<td><a href="http://www.finanskunskap.se/">http://www.finanskunskap.se/</a></td>
</tr>
<tr>
<td>Switzerland</td>
<td>Swiss Bankers Association</td>
<td>–</td>
<td><a href="http://www.iconomix.ch/">http://www.iconomix.ch/</a></td>
</tr>
</tbody>
</table>

Source: 2009 European Banking Federation report on financial literacy programmes by its members across the EU. This was also supplemented by searching the OECD Database of programmes across the world: http://www.financial-education.org/program.php; http://www.financial-education.org/gdofe.html; http://www.consumerclassroom.eu/resources/theme/financial-literacy#.VxSaJUwrK71

instance, Habschick et al. (2007) reported that 48% of financial literacy schemes in Europe use four or more channels such as websites, leaflets and brochures, printed handbooks and training courses.

Habschick et al. (2007) provides a comprehensive review of financial literacy schemes across Europe up until 2007. The report’s findings suggest that there is a wide distribution of financial literacy schemes across Europe. However, only a few countries are actively engaged in the provision of financial education such as the UK, Germany and Austria, with Eastern European countries being less active in this area. Furthermore, they found that most schemes were targeted at children and young adults in classrooms or universities, with a focus predominantly on money management and financial planning. About 25% of schemes were targeted at low-income and low-education groups and were mostly offered by non-profit organisations and consumer-protection agencies. A significant number of financial literacy schemes are internet based and often include interactive elements such as games. All national authorities, non-for-profit organisations and private financial institutions are actively involved in the provision of financial education.

Additionally, Error! Reference source not found. reviews the more interactive websites, which provide free financial education resources to enhance financial literacy across countries. These are offered by non-for profit organisations, government authorities or professional bodies. For instance, in the US, the institute of certified public accountants provides a free website aimed at educating the general public on personal finance (http://www.360financialliteracy.org/); the Australian securities and investments commission also provides a similar website (https://www.moneysmart.gov.au/). In the UK, one of such websites is the “money advice service” (www.moneyadvice service.org.uk), created as part of the government’s initiative to improve financial literacy across the UK. Similar websites are also available across other EU³ countries. In general, these websites provide an interactive platform for educating the public on personal finance matters. Content varies across these sites but is mostly centred

³ Other reviews have mentioned European website which provides financial education (Dolceta.eu). However, it appears to no longer exist or was planned but not yet implemented.
## Table 3–6 List of online financial education initiatives in the European Union

<table>
<thead>
<tr>
<th>Country</th>
<th>Organisation</th>
<th>Website</th>
<th>Content</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe-wide</td>
<td>–</td>
<td><a href="http://www.consumerclassroom.eu/resources/theme/financial-literacy#VxSaJUwrK71">http://www.consumerclassroom.eu/resources/theme/financial-literacy#VxSaJUwrK71</a></td>
<td>-</td>
<td>Public</td>
</tr>
<tr>
<td>Europe-wide</td>
<td>–</td>
<td><a href="http://threecoins.org">http://threecoins.org</a></td>
<td>Aims to develop financial literacy among young adults</td>
<td>Public</td>
</tr>
<tr>
<td>Austria</td>
<td>Austrian National Bank</td>
<td><a href="https://www.oenb.at/Ueber-Uns/finanzbildung.html">https://www.oenb.at/Ueber-Uns/finanzbildung.html</a> and <a href="https://www.eurologisch.at/">https://www.eurologisch.at/</a></td>
<td>Financial education materials including information on monetary policy. Content is a rather limited as several key personal finance topics are not included, e.g. insurance</td>
<td>Public</td>
</tr>
<tr>
<td>Austria</td>
<td>Austrian National Bank</td>
<td><a href="http://www.schuldner-hilfe.at">www.schuldner-hilfe.at</a></td>
<td>Financial Divers License - A programme which is aimed at delivering financial education to young people.</td>
<td>Public - Non-web based - Young people</td>
</tr>
<tr>
<td>Austria</td>
<td>Civil Society - Klartext</td>
<td><a href="http://www.schuldenkoffer.at">www.schuldenkoffer.at</a></td>
<td>A financial education programme aimed at teaching young adults about money management</td>
<td>Public - Non-web based - Young people</td>
</tr>
<tr>
<td>Belgium</td>
<td>Belgian financial sector federation</td>
<td><a href="http://www.monargentetmoi.be/fr">http://www.monargentetmoi.be/fr</a></td>
<td>Payments, loans, savings, investment and banking</td>
<td>Public</td>
</tr>
<tr>
<td>Croatia</td>
<td>Charity - Personal Finance Counselling Association</td>
<td><a href="http://www.zivotuplusu.info/">http://www.zivotuplusu.info/</a></td>
<td>Insurance, banking, leasing, savings and pension funds</td>
<td>Public</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Czech Banking Association</td>
<td><a href="http://www.financnivzdelavaeni.cz/">http://www.financnivzdelavaeni.cz/</a></td>
<td>Banking, financial intermediation, investing, financial markets, leasing, payments, insurance and pensions</td>
<td>Public</td>
</tr>
<tr>
<td>Denmark</td>
<td>Danish Shareholders Association</td>
<td><a href="http://www.shareholders.dk/investorskolen">http://www.shareholders.dk/investorskolen</a></td>
<td>Bonds, mutual fund, stock investment and analysis, pensions</td>
<td>Non-web based and targeted at investors</td>
</tr>
<tr>
<td>Denmark</td>
<td>Ministry of Economic and Business Affairs</td>
<td><a href="http://www.pengeogpensionspanel.et.dk">www.pengeogpensionspanel.et.dk</a></td>
<td>Financial education</td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td>Danske Bank Group</td>
<td><a href="http://www.controllyourmoney.dk/">http://www.controllyourmoney.dk/</a></td>
<td>Financial literacy</td>
<td>Public - children up to 12 years old</td>
</tr>
<tr>
<td>Estonia</td>
<td>Estonian Financial Supervision Authority</td>
<td><a href="http://kool.minuraha.ee/">http://kool.minuraha.ee/</a></td>
<td>Financial literacy</td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td>Bank of Finland</td>
<td><a href="http://www.euro.fi/">http://www.euro.fi/</a></td>
<td>Financial literacy</td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td>Organisation</td>
<td>Website</td>
<td>Content</td>
<td>Availability</td>
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<tr>
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<td>--------------</td>
</tr>
<tr>
<td>France</td>
<td>Societe Generale</td>
<td><a href="https://www.abcbanque.fr/#Games-">https://www.abcbanque.fr/#Games-</a></td>
<td>Cost of goods and managing pocket money</td>
<td>Public - children 6-10</td>
</tr>
<tr>
<td>France</td>
<td>Bank of France</td>
<td><a href="http://www.citedeleconomie.fr/-Games-">www.citedeleconomie.fr/-Games-</a></td>
<td>Financial literacy games</td>
<td>Public</td>
</tr>
<tr>
<td>Germany</td>
<td>Association of German Bankers</td>
<td><a href="http://verbraucher.bankenverbund.de/">http://verbraucher.bankenverbund.de/</a></td>
<td>Financial literacy</td>
<td>Public</td>
</tr>
<tr>
<td>Germany</td>
<td>Association of German Bankers</td>
<td><a href="http://schulbank.bankenverbund.de/">http://schulbank.bankenverbund.de/</a></td>
<td>Financial literacy</td>
<td>Public - youth</td>
</tr>
<tr>
<td>Germany</td>
<td>Association of German Bankers</td>
<td><a href="http://www.unterrichtshilfe-finanzkompetenz.de/index.htm">http://www.unterrichtshilfe-finanzkompetenz.de/index.htm</a></td>
<td>Financial literacy resource for teachers</td>
<td>Public</td>
</tr>
<tr>
<td>Greece</td>
<td>Civil society - International and regional initiatives</td>
<td><a href="http://www.interfima.org/project-dignity/">http://www.interfima.org/project-dignity/</a></td>
<td>A variety of personal finance topics such as banking, insurance, savings etc</td>
<td>Non-web based</td>
</tr>
<tr>
<td>Iceland</td>
<td>Institute for financial literacy - Reykjavik University</td>
<td><a href="http://www.fe.is/">http://www.fe.is/</a></td>
<td>Financial education</td>
<td></td>
</tr>
<tr>
<td>Ireland</td>
<td>Competition and Consumer Protection Commission</td>
<td><a href="http://www.consumerhelp.ie/">http://www.consumerhelp.ie/</a></td>
<td>Budgeting, banking, savings and investments, insurance, mortgage, loans and credit, pensions, life stages and financial fraud</td>
<td>Public</td>
</tr>
<tr>
<td>Ireland</td>
<td>Money management and budgeting service</td>
<td><a href="http://www.yo-yos.ie/">http://www.yo-yos.ie/</a></td>
<td>A limited range of financial education topics suited for young people</td>
<td>Public - youth</td>
</tr>
<tr>
<td>Ireland</td>
<td>Money management and budgeting service</td>
<td><a href="http://www.moneycounts.ie/">http://www.moneycounts.ie/</a></td>
<td>Earning and spending money, budgeting, banking, saving, borrowing, inheritance</td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>Italian Banking Association</td>
<td><a href="http://www.pattichiari.it">www.pattichiari.it</a></td>
<td>Offering financial education to high schools and the wider public in city squares,</td>
<td>Public - youth</td>
</tr>
<tr>
<td>Italy</td>
<td>Bank of Italy</td>
<td><a href="http://www.bancaditalia.it">http://www.bancaditalia.it</a></td>
<td>Financial education web page and classroom-based financial education for school children</td>
<td>Public - youth</td>
</tr>
<tr>
<td>Italy</td>
<td>CONSOB</td>
<td><a href="http://www.consob.it">http://www.consob.it</a></td>
<td>Financial planning, rights and duties of investors, bonds, shares, derivatives</td>
<td>Investors</td>
</tr>
<tr>
<td>Italy</td>
<td>Italian Treasury Insurance regulator (IVASS)</td>
<td><a href="http://www.dt.tesoro.it">http://www.dt.tesoro.it</a></td>
<td>Insurance</td>
<td>Public</td>
</tr>
<tr>
<td></td>
<td>IT</td>
<td><a href="http://www.educazioneassurativa.it/guide-pratiche/">http://www.educazioneassurativa.it/guide-pratiche/</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td>Organisation</td>
<td>Website</td>
<td>Content</td>
<td>Availability</td>
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<tr>
<td>---------</td>
<td>---------------</td>
<td>---------</td>
<td>---------</td>
<td>--------------</td>
</tr>
<tr>
<td>Italy</td>
<td>Consumer credit research centre - University of Rome - &quot;Tor Vergata&quot;</td>
<td><a href="http://www.monitorata.it">www.monitorata.it</a></td>
<td>Consumer credit</td>
<td>Public</td>
</tr>
<tr>
<td>Lithuania</td>
<td>Economic Education Development Centre</td>
<td><a href="http://www.essc.lt/">http://www.essc.lt/</a></td>
<td>Financial education</td>
<td>Public - Children up to grade 12</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Ministry of finance</td>
<td><a href="http://www.wijzeringeldzaken.nl/">http://www.wijzeringeldzaken.nl/</a></td>
<td>Personal finance topics including savings, mortgages, pension etc.</td>
<td>Public</td>
</tr>
<tr>
<td>Norway</td>
<td>Norwegian Consumer Council</td>
<td><a href="http://www.finansportalen.no">www.finansportalen.no</a></td>
<td>Enables comparison of different financial products</td>
<td>Public</td>
</tr>
<tr>
<td>Portugal</td>
<td>Banco de Portugal</td>
<td><a href="http://cliente.bancario.bportugal.pt/pt-PT/DireitosdosClientes/Paginas/default.aspx">http://cliente.bancario.bportugal.pt/pt-PT/DireitosdosClientes/Paginas/default.aspx</a></td>
<td>Personal finance topics focused mostly on banking products</td>
<td>Public</td>
</tr>
<tr>
<td>Slovakia</td>
<td>Ministry of finance</td>
<td><a href="http://www.fininfo.sk/sk/yaa-financie/planovanie-osobnych-a-rodninnych-financi">http://www.fininfo.sk/sk/yaa-financie/planovanie-osobnych-a-rodninnych-financi</a></td>
<td>A wide range of personal finance topics including banking, savings, investments, loan, leasing, insurance etc.</td>
<td>Public</td>
</tr>
<tr>
<td>Slovakia</td>
<td>Children of Slovakia Foundation</td>
<td><a href="http://www.poznaj.sk/index.html">http://www.poznaj.sk/index.html</a></td>
<td>Personal finance for children</td>
<td>Public</td>
</tr>
<tr>
<td>Slovenia</td>
<td>Securities Market Agency</td>
<td><a href="http://vlagatelj.atvp.si/ENG/">http://vlagatelj.atvp.si/ENG/</a></td>
<td>Personal finance topics focused mostly on investments</td>
<td>Public</td>
</tr>
<tr>
<td>Spain</td>
<td>Ministry of education</td>
<td><a href="http://www.finanzasparatodos.es/">http://www.finanzasparatodos.es/</a></td>
<td>Wide range of personal finance topics</td>
<td>Public</td>
</tr>
<tr>
<td>Spain</td>
<td>Financial studies institute</td>
<td><a href="http://edufinanciera.com/es/">http://edufinanciera.com/es/</a></td>
<td>Wide range of personal finance topics</td>
<td>Public</td>
</tr>
<tr>
<td>Spain</td>
<td>Private Sector Organisation</td>
<td><a href="http://www.jubilaciondefuturo.es/es/">http://www.jubilaciondefuturo.es/es/</a></td>
<td>Website dedicated to creating social awareness about the pensions system situation</td>
<td>Public - Adult</td>
</tr>
<tr>
<td>Sweden</td>
<td>Swedish banking association</td>
<td><a href="http://www.finanskunskap.se/">http://www.finanskunskap.se/</a></td>
<td>A wide range of personal finance topics</td>
<td>Public</td>
</tr>
<tr>
<td>Sweden</td>
<td>Public authorities in association with civil society and private sector</td>
<td><a href="http://gilladinekonomi.se/">http://gilladinekonomi.se/</a></td>
<td>A wide range of personal finance topics</td>
<td>Public</td>
</tr>
</tbody>
</table>
Table 3–7 List of other online resources

<table>
<thead>
<tr>
<th>Source</th>
<th>Website</th>
<th>Content</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visa</td>
<td><a href="http://www.practicalmoneyeskills.com/">http://www.practicalmoneyeskills.com/</a></td>
<td>A website which provides free educational resources including personal finance articles, games and lesson plans</td>
<td>Public</td>
</tr>
<tr>
<td>Jumpstart/Doughmain</td>
<td><a href="http://www.irulemoney.com/">http://www.irulemoney.com/</a></td>
<td>A website dedicated to teenagers where experts answer their questions about money and money management</td>
<td>Public</td>
</tr>
<tr>
<td>Northwestern Mutual</td>
<td><a href="http://www.themint.org/index.html">http://www.themint.org/index.html</a></td>
<td>A website which provides tools and resources to teach children and teens to manage money wisely and develop good financial habits</td>
<td>Public</td>
</tr>
<tr>
<td>AICPA</td>
<td><a href="http://www.360financialliteracy.org/">http://www.360financialliteracy.org/</a></td>
<td>A website which offers general information for managing personal finances. The website is structured to provide tailored information for different categories of users.</td>
<td>Public</td>
</tr>
<tr>
<td>Australian Securities and Investments Commission</td>
<td><a href="https://www.moneysmart.gov.au/">https://www.moneysmart.gov.au/</a></td>
<td>A website which provides financial education and guidance to the public. Content includes: managing money, borrowing and credit, insurance, retirement, investing and financial scams</td>
<td>Public</td>
</tr>
<tr>
<td>Mutual Fund Dealers Association of Canada</td>
<td><a href="http://www.mfda.ca/investors/Quiz/Quiz-r-01.html">http://www.mfda.ca/investors/Quiz/Quiz-r-01.html</a></td>
<td>Fraud awareness quiz</td>
<td>Public</td>
</tr>
<tr>
<td>Money Advice Service (UK Government's initiative on addressing financial illiteracy)</td>
<td><a href="https://www.moneyadvice-service.org.uk/en">https://www.moneyadvice-service.org.uk/en</a></td>
<td>Content is structured into sections as follows: Debt and Borrowing/ Pensions and retirement/ Births, deaths and family/Budgeting and managing money/ Work and redundancy/ Insurance/ Saving and Investments/ Benefits/ Homes and Mortgages etc.</td>
<td>Public</td>
</tr>
<tr>
<td>Federal Financial Literacy and Education Commission (USA)</td>
<td><a href="http://www.mymoney.gov/Pages/default.aspx">http://www.mymoney.gov/Pages/default.aspx</a></td>
<td>The website is organised around five principles: Earn/Save and Invest/ Protect/ Spend/ Borrow. It also contains a section for entrepreneurs with links to relevant information such as links to sources of finance.</td>
<td>Public</td>
</tr>
<tr>
<td>European Commission</td>
<td><a href="http://www.consumerclassroom.eu/">http://www.consumerclassroom.eu/</a></td>
<td>A Europe-based education website</td>
<td>Public</td>
</tr>
<tr>
<td>Personal Finance Education Group</td>
<td><a href="http://www.pfeg.org/">http://www.pfeg.org/</a></td>
<td>A website aimed at teaching financial and business skills to children and young adults</td>
<td>Public</td>
</tr>
</tbody>
</table>

on personal finance topics including debt and borrowing, pensions and retirement, budgeting, insurance, savings and investment, benefits and taxes, mortgages etc. Content may be structured by user groups defined by age, profession, marital status or life stages. There is generally a high level of interaction with the users as most websites feature interactive elements such as financial calculators, webchats, forums, newsletters, links to related blogs or other resources, videos, games, quizzes etc. These features enhance learning and users’ engagement.
3.4.2 Newspapers with online personal finance sections

Information about personal finance is provided by several broadsheet newspapers. In general, this is contained in a “personal finance” or “money” section of their websites (e.g., “La Repubblica” in Italy; “The Guardian” in the UK; “Die Welt” in Germany). Some news channels such as the BBC (British Broadcasting Corporation) and CNN (Cable News Network) also provide similar information on their websites.

The content of these webpages, reviewed in Table 3–8, comprises mostly news articles, analysis and reports on a variety of personal finance topics. In some cases, the content is classified into separate headings relating to an area of personal finance. For instance, the Telegraph newspaper in the UK classifies its personal finance-related content into separate pages as follows: investment, property, bills, insurance, pensions, banking, tax and financial services. Content and categories vary greatly across newspapers, with some being much more comprehensive than others.

The focus on news reports about personal finance provides a useful means for updating knowledge and raising awareness of changes to existing legislation and their impact on financial decisions. However, it may be argued that such benefit is limited by the extent of knowledge one already possesses about these topics. For instance, news reports on pension reforms may have little value for someone with little or no prior understanding of the pension system and the importance of retirement planning.

Furthermore, access to the content of these websites may be restricted to registered users with payment required, e.g. the Financial Times in the United Kingdom. The target audience is generally not specified but could be regarded as not suited for children, very young people and people with low levels of literacy who may struggle to understand the content.

Finally, newspapers’ personal finance sections also feature interactive tools to engage users and enhance financial knowledge, though this varies significantly across newspapers. Examples of such features include: an “Ask the expert” section where users can interact with financial experts by emailing personal finance-related questions, which are answered and commented on by other users; interactive tools to aid financial decision-making such as mortgage repayment, savings, debt and stamp duty calculators; stock and fund screener tools; glossary of financial terms; newsletters to which users can subscribe to; tools to compare accounts, credit cards and mortgages across different financial services firms; and short videos and podcasts on personal finance.

Overall, personal finance information offered by newspapers on their websites provide practical and interactive means for individuals to enhance their financial knowledge. However, users may require prior financial knowledge to maximise such benefit.
Table 3–8 List of newspapers with personal finance sections

<table>
<thead>
<tr>
<th>Newspaper</th>
<th>Link</th>
<th>Content</th>
<th>Public/Licensed</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Guardian</td>
<td><a href="http://www.theguardian.com/uk/money">http://www.theguardian.com/uk/money</a></td>
<td>Content is classified into sections as follows: Money/Property/Savings/Pensions/Borrowing/Careers</td>
<td>Registration not required</td>
</tr>
<tr>
<td>Financial Times</td>
<td><a href="http://www.ft.com/personal-finance">http://www.ft.com/personal-finance</a></td>
<td>Content is classified into sections as follows: Property and Mortgages/Investments/Trading/Pensions/Tax/Banking and Savings</td>
<td>Registration required</td>
</tr>
<tr>
<td>Daily express</td>
<td><a href="http://www.express.co.uk/finance/personalfinance">http://www.express.co.uk/finance/personalfinance</a></td>
<td>Content is not classified into sections. Mostly a list of brief news reports and analysis on a variety of personal finance-related topics.</td>
<td>Registration not required</td>
</tr>
<tr>
<td>Telegraph</td>
<td><a href="http://www.telegraph.co.uk/money/">http://www.telegraph.co.uk/money/</a></td>
<td>Content is classified into sections as follows: Investing/Property/Bills/Insurance/Pensions/Banking/Tax/Financial services</td>
<td>Registration not required</td>
</tr>
<tr>
<td>USA today</td>
<td><a href="http://www.usatoday.com/money/personal-finance/">http://www.usatoday.com/money/personal-finance/</a></td>
<td>Content is not classified into sections. Mostly a list of news reports and analysis on a variety of personal finance-related topics.</td>
<td>Registration not required</td>
</tr>
<tr>
<td>Wall Street Journal</td>
<td><a href="http://www.wsj.com/public/page/newspersonal-finance.html">http://www.wsj.com/public/page/newspersonal-finance.html</a></td>
<td>Content is classified into sections as follows: Family finance/Wealth adviser/Taxes/Retirement planning/Real estate</td>
<td>Registration required</td>
</tr>
<tr>
<td>Forbes</td>
<td><a href="http://www.forbes.com/finance/#36a00ad31f3a">http://www.forbes.com/finance/#36a00ad31f3a</a></td>
<td>Content is not classified into sections. Mostly a list of brief news reports and analysis on a variety of personal finance-related topics.</td>
<td>Registration not required</td>
</tr>
<tr>
<td>Bloomberg</td>
<td><a href="http://www.bloomberg.com/personal-finance">http://www.bloomberg.com/personal-finance</a></td>
<td>Content is not classified into sections. Mostly a list of brief news reports and analysis on a variety of personal finance-related topics.</td>
<td>Registration not required</td>
</tr>
<tr>
<td>The Independent</td>
<td><a href="http://www.independent.co.uk/money">http://www.independent.co.uk/money</a></td>
<td>Content is not classified into categories. Mostly a list of brief news reports and analysis on a variety of personal finance-related topics.</td>
<td>Registration not required</td>
</tr>
<tr>
<td>CNN</td>
<td><a href="http://money.cnn.com/pf/">http://money.cnn.com/pf/</a></td>
<td>Content is not classified into categories. Mostly a list of brief news reports and analysis on a variety of personal finance-related topics.</td>
<td>Registration not required</td>
</tr>
<tr>
<td>This is Money</td>
<td><a href="http://www.thisismoney.co.uk/money/index.html">http://www.thisismoney.co.uk/money/index.html</a></td>
<td>Content is classified into sections as follows: Markets/Saving and Banking/Investing/Bills/Cars/Holidays/Cards and loans/Pensions/Mortgages and home</td>
<td>Registration required only for specific sections and financial tools</td>
</tr>
<tr>
<td>New York Times</td>
<td><a href="http://www.nytimes.com/pages/your-money/index.html?8qa">http://www.nytimes.com/pages/your-money/index.html?8qa</a></td>
<td>Content is classified into sections as follows: Investments/loans/planning/retirement/credit/insurance</td>
<td>Registration not required</td>
</tr>
<tr>
<td>Washington Post</td>
<td><a href="https://www.washingtonpost.com/business/get-there/?nid=menu_nav_business-personalfinance">https://www.washingtonpost.com/business/get-there/?nid=menu_nav_business-personalfinance</a></td>
<td>Content is classified as follows: Build it (Earning and Investing)/Finance it (Borrowing)/Protect it (Insurance and financial fraud)/Save it (Savings and retirement)/Spend it.</td>
<td>Registration not required</td>
</tr>
<tr>
<td>BBC</td>
<td><a href="http://www.bbc.co.uk/news/business/your_money">http://www.bbc.co.uk/news/business/your_money</a></td>
<td>Content is not classified into categories. Mostly a list of brief news reports and analysis on a variety of personal finance-related topics.</td>
<td>Registration not required</td>
</tr>
</tbody>
</table>
3.4.3 Open online courses (MOOCs)

The number of financial literacy/personal finance courses provided by online educational platforms free of charge and with material available at all times (that is, regardless of whether the course is currently running), is quite limited. The courses are presented in Table 3–9 and a short summary follows:

The Open University offers three courses that could be classified as financial literacy/personal finance courses. The main Open University course is “Managing my Money”; the other two, namely “Managing my investments” and “Estimating the cost of equity”, are extensions to the former one, focusing primarily on the field of investments and presenting more complex and sophisticated concepts. However, the courses often overlap; sometimes even presenting the exact same material in the exact same way. Since the Open University is a UK institution, a quite large portion of the material is primarily focused in information and concepts that are more country-specific rather than universally applied or relevant (most sections of the "Pensions" chapter being an example).

The material is mostly presented in a form akin to a book, as text is the main element of the Open University courses. This is not an ideal form of presentation for an online course, as it makes it rather unattractive. Many of the sections also include video and/or audio segments in certain sections, as well as graphs, charts and tables to help explain some concepts or give historical data/information, which occasionally improve the presentation of the material. The content of the video and audio segments mainly includes: talks or lectures, interviews with experts, news segments, street interviews and animated explanations of financial concepts. Several of these segments are interesting and useful additions, but other are too long or lack in relevance or specificity. It is suggested that 3 hours per week be devoted when taking this course, which might be a large amount of time for certain groups of people (e.g. employees and students). There are few interactive elements in this course; specifically, in some of the sections there are some activities requiring the course taker to give a response or choose an answer from a list, generating an automatic response with the correct answer and an explanation.

“Personal and Family Financial Planning” by the University of Florida is similar to “Managing my Money” in that they are both built around a model on how to build a personal or and household financial plan. In addition, this course is also focused in a specific country, namely the US, meaning that at least a part of it is not universally relevant. Moreover, they cover approximately the same economic and financial concepts.
The material is presented in a form that resembles a University lecture. Prof. Gutter, the course’s creator, presents the material in videos, using slides, which are also available for download. This method of presentation might be tiring for some people and make the course more difficult to follow. This might be exacerbated by the lack in structure of the slides. Moreover, the video presentations are often very long, with their duration ranging from 16 to 32 minutes. Another problem might be the time that is suggested to be devoted to this course: 5-7 hours for each module, meaning 40-56 hours in total. This course does not feature any interactive elements.

In the “Financial Awareness and Consumer Training for Students – FACTS” programme by the Higher Education Services Corporation (HESC) of New York State, the material is primarily focused on US high school and college students. Because of that, it covers much fewer financial and economic concepts and subjects than the other courses. This programme could be interesting with regard to the way the material is differentiated according to the targeted age group. However, it seems that the last module, which is supposed to be targeted towards high school students, is mostly a summary of the previous three, with slight additions or omissions so as to make it more relevant to high school students. The material is also presented in slides. In addition, although it is targeted at high school and college students, it does not use any of the features that would make it more attractive to young people (e.g. videos, graphs, infographics, etc.).

“Financial Literacy” by Advance Learning is a course offered in the platform ALISON, in partnership with Three Rivers Workforce Investment Board. Like all the aforementioned courses, this one is also primarily focused on the context of the United States. This course has several interesting features, including the use of animation for the presentation of the material (although the quality of the animation is quite unimpressive), the recommendation on which topics to pay more attention to when studying the following module base on the performance in the pre-assessment quizzes before each module, the embedded glossary. It also features some interactive elements, including the pre-assessment quizzes before each module, short assessments within some of the sections, a savings bar and the right-hand side of the screen, which increases or decreases depending on the answers to the course’s quizzes and assessments.

Regarding content, several subjects (such as is inflation) are not analysed very thoroughly and the level of details provided is quite low. Hence, the amount of time for the completion of this course is shorter in comparison to the other courses, estimated to be 45-90 minutes for each of the 7 modules, or 6-10 hours in total.

“Financial Literacy”, offered in Allversity, is a course is built for the country of Uganda. Hence, a big portion of the material is not relevant for more developed western countries. Since the Allversity website was shut down, the material of the course is only available in Word format, and there is no information regarding how the material used to be presented in the platform.
### Table 3–9 List of financial literacy/personal finance open online courses

<table>
<thead>
<tr>
<th>rse</th>
<th>Institution</th>
<th>Platform</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal and Family Financial Planning</td>
<td>University of Florida</td>
<td>Coursera</td>
<td><a href="https://www.coursera.org/course/uffinancialplanning">https://www.coursera.org/course/uffinancialplanning</a></td>
</tr>
</tbody>
</table>

3.4.4 **Financial games and gamified tools**

Videogames are fast becoming a popular tool for enhancing financial capability. Videogames on personal finance are provided by a variety of organisations, including non-profit organisations (e.g. D2D fund), government agencies and authorities (e.g. FINRA – Financial Industry Regulatory Authority in the US and the ECB – European Central Bank in Europe) and private financial institutions (such as Visa and Danske bank).

The content of video games varies significantly: some are aimed at assessing users' financial literacy through tests and quizzes which are presented using a game’s settings rather than the traditional quiz format; others require users to make a series of financial decisions (usually simulating real-life situations) in a virtual setting. In the process, users are exposed to personal finance concepts and are able to comprehend how current financial decisions impact on future outcomes.

Videogames provide an interactive tools that enable users to enhance their financial capabilities through real life simulations of personal financial decision-making. However, many games are designed for children and teens and are mostly focused on limited financial topics such as money basics, savings, budgeting and credit.

While technology-based financial education continues to evolve, the following internet-based video games are presented as currently available free resources. It should be noted, however, that this list is in no way exhaustive. The relevant video games are reviewed in Table 3–10.

*Bite Club, Farm Blitz, Celebrity Calamity,* and *Groove Nation* are financial literacy games developed by the Doorways 2 Dreams Fund (D2D), part of RAND’s Financial Literacy Centre. These games are targeted towards low-income, minority adults with a limited
understanding of the English language. These games “have great potential because they facilitate repetitive engagement with lessons and create a ‘performative’ learning environment” (Tufano, Flacke, & Maynard, 2012).

Bite Club (http://financialentertainment.org/play/biteclub.html) is set within the context of a club for vampires and is accompanied by a dance beat. Players are required to face the dialectics of personal finance: meeting current consumption needs, eliminating debt, and saving for retirement. By playing the game, a greater understanding of annual percentage rate (APR) and its impact on debt repayment is developed.

Farm Blitz (http://financialentertainment.org/play/farmblitz.html) is set ‘down on the farm’ and is complete with music. It is reminiscent of the popular game Farmville available on Facebook. On this farm, however, debt exponentially multiplies like bunnies. Players manage debt and savings but will also need to prepare for financial emergencies, due to, for example, catastrophic weather conditions. By playing the game, a greater understanding of high-interest, short-term debt, compound interest, and net worth is developed.

Celebrity Calamity (http://financialentertainment.org/play/celebritycalamity.html) is marketed towards women ages 18-35. Players take on the role of financial manager for a celebrity who has difficulty keeping her finances in order. The celebrity asks the financial manager to make specific purchases for upcoming trips, to share with her friends, or for entertainment purposes. The player chooses whether to pay with a credit card or debit card and as a result gains greater insight into finance charges, credit limits, fees and annual percentage rates (APR). Beyond managing finances, players must work to ensure the celebrity’s happiness. The addition of this psychological element is interesting as research demonstrates that income can have an impact on happiness (Kahneman & Deaton, 2010).

Also marketed towards women ages 18-35, Groove Nation is about “dancing] your way to a healthy budget” (http://financialentertainment.org/play/groovenation.html). Similar to Celebrity Calamity, players serve as financial managers. Income, fixed and variable costs, debt, short- and long-term savings, as well as upgrades for dance performances are managed. The financial manager learns to set aside earnings from the dancer’s job and performances in order to make it from town to town. As the location changes, so do fixed costs, such as rent. Groove Nation teaches players how to manage current consumption and save for future goals.

Visa has developed the Financial Football for football enthusiasts. The game simulates a soccer game in which users assume the position of a player of a football team. When in possession of the ball, users are required to answer a question on a variety of personal finance topics. If the answer is correct, the ball is passed forward towards the goal; if the answer is wrong the ball is stolen by the opposing team. Users can choose the level of difficulty based on their age group: Rookie (ages 11-14), Pro (ages 14-18) and Hall of Fame (18+). As part of the game, resources are also provided on financial topics assessed in the game. Educators may use such teaching resources to educate students prior to the game (http://www.practicalmoneyskills.com/games/trainingcamp/ff/play/).
Table 3–10 List of financial literacy games

<table>
<thead>
<tr>
<th>Source</th>
<th>Link</th>
<th>Title of Game</th>
<th>Aim of game</th>
<th>Target Audience</th>
</tr>
</thead>
<tbody>
<tr>
<td>D2D Fund</td>
<td><a href="http://financialentertainment.org/">http://financialentertainment.org/</a></td>
<td>Bite Club</td>
<td>Save for retirement while running a vampire nightclub</td>
<td>General Public but aimed at low income and minority adults</td>
</tr>
<tr>
<td>D2D Fund</td>
<td><a href="http://financialentertainment.org/">http://financialentertainment.org/</a></td>
<td>Celebrity calamity</td>
<td>Manage celebrity credit card and spending</td>
<td>General Public but aimed at low income and minority adults</td>
</tr>
<tr>
<td>D2D Fund</td>
<td><a href="http://financialentertainment.org/">http://financialentertainment.org/</a></td>
<td>Farm Blitz</td>
<td>Manage farm resources to build savings and survive financial emergencies</td>
<td>General Public but aimed at low income and minority adults</td>
</tr>
<tr>
<td>D2D Fund</td>
<td><a href="http://financialentertainment.org/">http://financialentertainment.org/</a></td>
<td>Groove Nation</td>
<td>Dance and budget on the road to LA</td>
<td>General Public but aimed at low income and minority adults</td>
</tr>
<tr>
<td>D2D Fund</td>
<td><a href="http://financialentertainment.org/">http://financialentertainment.org/</a></td>
<td>Refund Rush</td>
<td>Help clients split tax refunds and save during tax time.</td>
<td>General Public but aimed at low income and minority adults</td>
</tr>
<tr>
<td>VISA</td>
<td><a href="http://www.financialsoccer.com/play/">http://www.financialsoccer.com/play/</a></td>
<td>Financial Soccer</td>
<td>A basic game to assess the level of financial literacy using a soccer theme</td>
<td>Public with different level of difficulty based on players' age</td>
</tr>
<tr>
<td>VISA</td>
<td><a href="http://www.practicalmoneyskills.com/games/trainingcamp/ft/">http://www.practicalmoneyskills.com/games/trainingcamp/ft/</a></td>
<td>Financial Football</td>
<td>A basic game to assess the level of financial literacy using a (American) football theme</td>
<td>Public with different level of difficulty based on players' age</td>
</tr>
<tr>
<td>VISA</td>
<td><a href="http://www.practicalmoneyskills.com/games/">http://www.practicalmoneyskills.com/games/</a></td>
<td>Countdown to retirement</td>
<td>A game that enables users to make financial decisions, incl. saving for retirement. A meter gauges how well they are prepared for retirement as they progress</td>
<td>Public but mostly relevant for adults rather than young children</td>
</tr>
<tr>
<td>VISA</td>
<td><a href="http://www.practicalmoneyskills.com/games/">http://www.practicalmoneyskills.com/games/</a></td>
<td>Ed’s bank</td>
<td>A game that teaches players to save for an item in a piggy bank</td>
<td>Young children</td>
</tr>
<tr>
<td>VISA</td>
<td><a href="http://www.practicalmoneyskills.com/games/moneymetropolis/">http://www.practicalmoneyskills.com/games/moneymetropolis/</a></td>
<td>Money Metropolis</td>
<td>A game that teaches players to set a savings goal, earn money and save towards that goal.</td>
<td>Youth/Children</td>
</tr>
<tr>
<td>VISA</td>
<td><a href="http://www.practicalmoneyskills.com/games/">http://www.practicalmoneyskills.com/games/</a></td>
<td>Roadtrip to savings</td>
<td>A game that teaches players to earn and save money</td>
<td>Public</td>
</tr>
<tr>
<td>SIFMA Foundation</td>
<td><a href="http://www.stockmarketgame.org/expstudent.html">http://www.stockmarketgame.org/expstudent.html</a></td>
<td>Stock market game</td>
<td>A game that teaches players about investing</td>
<td>Young students</td>
</tr>
<tr>
<td>MTV</td>
<td><a href="http://www.indebted.com/the-game/debtski/">http://www.indebted.com/the-game/debtski/</a></td>
<td>Debtski</td>
<td>Teaches players to limit excessive debts and maximise savings</td>
<td>Youth</td>
</tr>
<tr>
<td>Freedom Institution</td>
<td><a href="https://demo.moneyisland.com/">https://demo.moneyisland.com/</a></td>
<td>MoneyIsland</td>
<td>Teaches financial responsibility through the virtual world.</td>
<td>Children</td>
</tr>
<tr>
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<tr>
<td>Council for Economic Education</td>
<td><a href="http://www.genirevolution.org/">http://www.genirevolution.org/</a></td>
<td>Gen I Revolution</td>
<td>Teaches students a variety of financial concepts through sixteen interactive missions</td>
<td>Middle and High-school</td>
</tr>
<tr>
<td>Callystro</td>
<td><a href="http://www.finlitgame.com/">http://www.finlitgame.com/</a></td>
<td>Journey towards financial literacy</td>
<td>Financial education</td>
<td>Children</td>
</tr>
<tr>
<td>iGrad</td>
<td><a href="http://www.igrad.com/moneysmarts-game">http://www.igrad.com/moneysmarts-game</a></td>
<td>Money smarts game</td>
<td>Financial education</td>
<td>Young adults</td>
</tr>
<tr>
<td>Jumpstart/Doughmain</td>
<td><a href="http://www.sanddollarcity.com/">http://www.sanddollarcity.com/</a></td>
<td>Sanddollarcity</td>
<td>Financial education</td>
<td>8-12 year olds</td>
</tr>
<tr>
<td>Danske Bank</td>
<td><a href="http://moneyville.ie/">http://moneyville.ie/</a> For Danish: <a href="http://www.pengeby.dk/">http://www.pengeby.dk/</a></td>
<td>Moneyville</td>
<td>Financial literacy</td>
<td>Children 5-9</td>
</tr>
<tr>
<td>Danske Bank</td>
<td><a href="http://www.dreamonthegame.dk/">http://www.dreamonthegame.dk/</a></td>
<td>Dream on</td>
<td>Financial literacy</td>
<td>15-17 year olds</td>
</tr>
</tbody>
</table>

Age-appropriate lessons on credit, debt, savings, spending, and financial planning are also provided. For those individuals who prefer a different type of football, Financial Soccer is also available (http://www.financialsoccer.com/).

Debt Ski (http://www.indebted.com/the-game/debtski/) is a fairly simple financial literacy game developed by mtvU, MTV’s college network, and the Peter G. Peterson Foundation. A piggy bank drives a jet ski through rough waters, collecting coins, wanted items, and basic necessities. If sufficient funds are not saved, a financial tsunami could set the player back. This game drives home a prudent message: in order to financially succeed, you must live within your means. This includes maximizing saving and minimizing debt. A happiness score
is also included in this game. It is impacted by debt, savings, and the provision of life necessities.

Moneyville is a game developed as part of Danske’s Bank’s financial literacy programme. It was launched in 2008 and targeted to children aged 5-9 years old. The aim of the game is to give children an understanding of money and teach them about income and expenditure. Children are introduced to a virtual town where they can earn money doing different tasks such as sorting parcels at the post office. They are also required to save up in order to purchase items they would like. This enables children to understand the principle of budgeting and prioritising when spending.

3.4.5 Books

There is a vast range of books on personal finance. A Google Books search of the keyword “personal finance” returned over one million hits. “Financial literacy” returned over 200,000 hits. These are in various formats, such as course textbooks with end-of-chapter exercises, guides or self-help books for personal improvement. For instance, there are a number of personal finance titles in the popular “for dummies” book series. Titles vary, but generally include “personal finance”, “personal financial literacy” or “personal financial management”, but may also be focused on a single personal finance topic such as investing. Their content (as can be deduced from the tables of contents) includes a wide range of personal finance topics, such as savings, investments, credit, insurance, banking and related concepts, with some books being more comprehensive than others. A number of books also include topics on public finance such as monetary and fiscal policies. Authors range from educators and academics to experienced financial planners and journalists, etc.

While most books are targeted at the general public, a number of books are specifically directed towards certain groups. Groups may be age specific (such as individuals in the 20s, 30s or post-50 years of age) or by country (some books specifically mention the target country such as Canada or Australia) or by marital status (such as singles, divorcees, newlyweds/young couples) or by occupation (some books are directed to individuals in the armed forces or entrepreneurs) etc. These are reviewed in Table 3–11.

3.4.6 European educational platforms

This section is dedicated to a short review of the online educational platforms in Europe, including whether they provide any courses on financial education. These can be divided in two groups: the ones financed by the European Union and the ones, which are independent.

OpenupEd (http://www.openuped.eu/) is essentially a website providing links and short descriptions to the MOOCs that its partners provide in their own platforms or websites. These partners include Universities, Open Universities and Technical Universities from several mainly European countries (as well as Turkey and Israel). Courses are offered in the local language in many cases. The personal finance courses that are provided are the ones from the UK Open University (see section 3.4.3).
<table>
<thead>
<tr>
<th>Book Title</th>
<th>Year</th>
<th>Author</th>
<th>Publisher</th>
<th>Content</th>
</tr>
</thead>
</table>
| Personal financial literacy                               | 2012 | Joan Ryan                  | Cengage                        | • How choices affect income  
• Income, benefits and taxes  
• Your purchasing power  
• Financial decisions and planning  
• Banking system  
• Personal risk management  
• Buying decisions  
• Preserving your credit  
• Credit problems and laws  
• Basic of saving and investment  
• Saving and investing options  
• Buying and selling investments |
| Financial literacy for managers: Finance and Accounting for better decision-making | 2012 | Richard Lambert            | Wharton digital press          | Table of content not included in the preview, but essentially about Accounting and Financial Management for Managers |
| The Student's Guide to Financial Literacy                  | 2012 | Robert Lawless             | ABC-Clio                       | • The value of an education  
• The importance of savings  
• Investments  
• Principals of investing  
• Debt  
• Tax considerations  
• Insurance  
• The Entrepreneur  
• Economics  
• The 10 most common mistakes to avoid |
| Teaching Financial Literacy Through Play                   | 2015 | Christopher Harris, Patricia Harris | Rosen Classroom                | Table of contents not accessible online                                                      |
| The Complete Personal Finance Handbook                     | 2007 | Teri Clark                 | Atlantic publishing company    | Table of content not accessible online                                                      |
| The Everything Personal Finance in Your 20s and 30s Book    | 2012 | Howard Davidoff            | Adams media                    | A wide range of personal finance topics suited for those in their 20s and 30s               |
| Ultimate Guide to Personal Finance for Entrepreneurs       | 2007 | Peter Sander and Jeffrey Lambert | McGraw-Hill Companies          | Table of content not accessible online but the book addresses personal finance from the view point of an entrepreneur |

Open Education Europa ([http://www.openeducationeuropa.eu/en](http://www.openeducationeuropa.eu/en)) is a European Commission Initiative “to provide a single gateway to European Open Educational Resources (OER)” with the main goal “to offer access to all existing European OER in different languages in order to be able to present them to learners, teachers and researchers”. For this purpose, among other things, links to MOOCs from European Institutions are provided in the website, similarly to the OpenupEd project above. Another similarity to OpenupEd is that
the only available financial literacy courses are the ones provided by the UK Open University (see section 3.4.3). As of 17/12/2015, the platform is “in hibernation”, as it is undergoing redesign and no new material is uploaded; however, the existing material is available.

**ECO (E-learning Communication Open-Data)** ([http://project.ecolearning.eu/](http://project.ecolearning.eu/)) aims to “extend to a pan-European scale the most successful MOOC experiences in Europe” by implementing “a merged MOOC platform integrating different modules provided by some ECO partners”. Courses are offered in multiple European platforms, but currently there are no financial literacy courses.

**EMMA (European Multiple MOOC Aggregator)** ([http://platform.europeanmoocs.eu/](http://platform.europeanmoocs.eu/)) is a multilingual platform still in its beta phase, which aims to operate in two ways: as a host to the MOOCs of its partners, that is several European Universities, and also as “a system that enables learners to construct their own courses using units from MOOCs as building blocks”. As of now, no financial literacy courses are offered.

As a conclusion, the EU-financed platforms seem to have the same main goal (or at least one of their main goals): to create a single hub for the MOOCs offered by European institutions. All of them offer courses in multiple European languages, but financial literacy/personal finance is a subject that is addressed only by the Open University among the European institutions involved in the projects (at least in the English language).

Most of the independent European platforms offering MOOCs are initiatives either by individual Universities or private companies. Many of them offer courses only in the local language. Only two of them offer financial literacy courses: the Irish ALISON and the German Allversity (for a short review, see section 3.4.3).

### 3.5 A synthesis of best practices and the space for PROFIT novelty (SYNTHESIS/NOVEL)

The provision of financial literacy has become a major policy target. As discussed above there is a large gap in the literature on financial education as to what is the best method of delivering financial education courses. It has been argued by Lusardi et al. (2015) that the research in financial education should move away from a discussion as to whether generic financial education works. Instead, the research should focus on trying to gain an understanding of how to make financial education work through better design and appropriate delivery methods. By focusing on how to make financial education work to deliver more effective courses and produce better informed individuals, it is important to look at the different ways that financial education can be taught and which method will result in the most informed participants.

One study that has looked at this issue is Lusardi et al (2014), which developed four new educational programmes focusing on risk diversification. The four programmes were delivered online and comprised of: an informational brochure, a visual interactive tool, a written narrative, and a video narrative. The study was delivered to 892 participants from the American Life Panel (ALP), which is a representative panel composed of 6,000 US households, and the participants were each allocated to one of the four programmes or to a
control group. The study found improvements in the financial knowledge of individuals in each of the four different treatment groups, which helped to show that even short duration interventions can help to improve financial literacy. The improvements in financial knowledge was greatest in the visual tool and video groups which led the authors to suggest that educational programmes that engage the user emotionally or physically (such as watching a video or using a visual tool) can be particularly effective compared to text-based or passive and educational programmes (such as reading a narrative) in improving individuals knowledge of complex financial matters like risk diversification. This is an important result as it encourages the use of interactive tools when designing financial education courses as using these tools provides the greatest improvement in knowledge amongst participants.

Heinberg et al (2014) is another study that aimed to assess which method of teaching is most effective when delivering a financial education course. For this study they designed and tested a financial education course called ‘Five Steps’, which focused on five basic financial planning concepts that relate to retirement. The five financial concepts were delivered to participants either through a video or written narrative, with five simple short stories describing the financial concepts verbally and the benefits of taking the appropriate action. The study was delivered through the ALP with participants either being exposed to the written narratives, videos, both methods, or placed in the control group. The results showed that despite only being exposed to the treatment for a short period of time (each of the videos or written narratives only took about 3 minutes), individuals showed a substantial increase in their financial knowledge. The two above studies are both very important as they indicate that even a short duration course can improve the financial literacy of individuals. This has potential benefits to educators when looking at how to implement financial literacy courses into the school curriculum as these short duration courses should be able to be easily implemented into the school curriculum whilst still helping to improve the financial literacy levels of the participants.

Thus, the PROFIT project comes at a very timely fashion in the policy agenda for the advancement of financial awareness in the population. Its contribution towards the financial-literacy enhancement goal is intended via the generation of an all-inclusive toolkit. This will be based on the generation of novel training material from experts in financial education. Moreover, it will be complemented by a rich collection of readily available material that is scattered in different locations. Such material involves videos, narratives with historical examples, games and interactive content such as quizzes.

The generation of the material is intended to be user-centred and interactive. Within these aims, Task 1.2 (Use Requirements and Application Scenarios) of Work Package 1 (WP1 - Requirements and Functional Design) aims to elicit the views of user groups of primary interest, along with bank managers and financial advisors. Based on the review in the previous sections, the user groups that have been identified as of the highest relevance are shown in Table 3–12. The outcome of this exercise will be discussed in detail in the next task of this workpackage. It aims to elicit responses regarding the users’ needs in terms of financial training, based on (a) a large sample of user-group respondents in a questionnaire survey (some 300 respondents), and (b) interviews with 18 cooperative bank executives and financial advisors.
Table 3–12 PROFIT user-groups

<table>
<thead>
<tr>
<th></th>
<th>PROFIT user-groups</th>
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<tbody>
<tr>
<td>1</td>
<td>Entrepreneurs/latent entrepreneurs/social entrepreneurs/self-employed</td>
</tr>
<tr>
<td>2</td>
<td>Elderly/retirees/pre-retirees</td>
</tr>
<tr>
<td>3</td>
<td>Migrants/Members of an ethnic minority</td>
</tr>
<tr>
<td>4</td>
<td>Children/Parents of young children</td>
</tr>
<tr>
<td>5</td>
<td>Customers: Indebted/Overindebted households</td>
</tr>
<tr>
<td>6</td>
<td>Customers: Investors/Potential investors/Depositors</td>
</tr>
<tr>
<td>7</td>
<td>Unemployed/trainees</td>
</tr>
<tr>
<td>8</td>
<td>Active citizens/taxpayers</td>
</tr>
<tr>
<td>9</td>
<td>Mortgage owners/home owners/first-time buyers</td>
</tr>
<tr>
<td>10</td>
<td>Professionals in financial services/financial experts</td>
</tr>
<tr>
<td>11</td>
<td>Government executives and political-party members/local authorities</td>
</tr>
<tr>
<td>12</td>
<td>Collective investors/borrowers/third sector organisations</td>
</tr>
</tbody>
</table>

Source: PROFIT partners’ compilation of user groups for task 1-2

The design of the material in Work Package 3 (WP3 - Financial Literacy for Informed Decision-Making) will be based on the following three principles: (1) generation of primary training material, incorporating novel elements such as notions of public finance and entrepreneurial finance. The aims of the training are to provide users with an enhanced understanding of the pivotal features of personal financial planning, e.g. (i) interest rates; (ii) the time value of money; (iii) consumer borrowing; (iv) residential mortgages; (v) savings and investment products; (vi) short and medium-term saving; (vii) saving for retirement I: planning; (viii) inflation and the erosion of purchasing power; (ix) personal taxes; (x) basic probability; (xi) risk versus return; (xii) risk diversification; (xiii) saving for retirement II: risk and retirement planning; (xiv) entrepreneurial finance and planning; (xv) mistakes people make: behavioural and other biases in personal finance; (xvi) public finance for active citizenship; (b) the critical analysis of existing practices and resources, aiming at a selection of the best available existing resources; (c) the incorporation of novel techniques aiming at interactive content and incentive-compatible user participation.

The assessment of financial literacy will be based on the following four key principles (Lusardi and Mitchell, 2014): (1) Simplicity: The measurement of the understanding of basic financial concepts, is founded on the notions of the very basics of finance; (2) Relevance: Questions must relate to concepts pertinent to people’s day-to-day financial decisions over the life cycle. Moreover, they must capture general rather than context-specific ideas. (3) Brevity: Due to time and space limitations in most surveys, the number of questions must be kept to a minimum in order to secure widespread adoption. (4) Capacity to differentiate: Questions must differentiate between financial knowledge levels, so as to compare people in terms of their scores on a common set of questions.

Finally, the design of the material will adapt to the insights from the literature on information technology and online education. Insights there suggest that the new generation of learners is cradled in technologies, communication, and an abundance of information. As a result, the design of learning technologies needs to focus on supporting social learning in context. Along with delivering content that aims to “teach” the learner the basic principles and their extensions, it is well within PROFIT’s targets to also (a) support the learner in finding the right content (right for the context, the user, the purpose, and
pedagogically); (b) support learners to connect with the right sources of information provision, and (c) motivate/incentivize users to learn.

The sets of principles above, along with the best practices followed in the resources of the previous sub-sections will shape the generation of a very novel and ambitious financial literacy training toolkit at Work Package 3 (WP3 - Financial Literacy for Informed Decision-Making) of the PROFIT project.
4 Financial and Econometric Forecasting

4.1 Market Sentiment Indicators

In this section it is analysed the importance of sentiment proxies in forecasting the future innovations of the real economy. In economics, it has been for some decades recognised that business cycle fluctuations are an outcome of less traditional sources such as sentiment shocks. A long strand of the theoretical literature aims at uncovering the transmission mechanisms of causality between uncertainty shocks and economic growth. Their empirical counterparts face a lot of difficulties in estimating this causality. The difficulties stem from the fact that existing measures of sentiment are far from perfect and in fact are best described as proxies rather than real measures. There is also a need for development of new proxies of sentiment that take into account the time horizon of sentiment, the type of sentiment (demand versus supply, policy, etc.) and finally the nature of uncertainty.

Under this vein, in the subsections that follow we try to set the ground for the next developments need to take place in the field of sentiment analysis in the financial sector. For that reason, we analytically expose how sentiment is treated in theoretical models in economics, how it is being estimated and finally what is its overall contribution to the forecast of subsequent economic growth. The best practices described below will be the gauges for the development of new sentiment proxies and forecasting models for analysing the core segments of the financial sector.

4.1.1 Theoretical justifications of sentiment affecting the economy

"Even apart from the instability due to speculation, there is the instability due to the characteristic of human nature that a large proportion of our positive activities depend on spontaneous optimism rather than mathematical expectations, whether moral or hedonistic or economic. Most, probably, of our decisions to do something positive, the full consequences of which will be drawn out over many days to come, can only be taken as the result of animal spirits—a spontaneous urge to action rather than inaction, and not as the outcome of a weighted average of quantitative benefits multiplied by quantitative probabilities."


The recent global financial crisis in between 2007 and 2009 was indeed spermatic and lead economists, policy makers and investors to realize that the financial sector plays a central role in the modern economy. Up to today economies still face the deep macroeconomic impact of the recent financial crisis and as De Grauwe and Macchiarelli (2015) state, DSGE modellers as a recognition of the nexus of the financial sector and the real economy, attempt to introduce financial intermediaries and the banking sector formally in their models, to describe understand and hopefully predict in a positive manner economic downturns and booms. Scholars, policy makers and investors regard as the origins of the 2007-2009 financial crisis the persistent lack of consumer confidence in the 2008 U.S. subprime crisis. Indeed, Akerlof and Shiller (2009) argued for the necessity of an active macroeconomic policy to restore the confidence of consumers and businesses and enhance economic activity as a path out of recession. Most governments and central banks did
undertake measures to restore confidence and economic activities following policies stemming from different schools of economic thought. Many central banks as the FED and ECB for example undertook measures, both conventional and unconventional, toward monetary easing. On the other hand governments under tide financial conditions attempted to reduce deficits of even balance their budget to restore market, consumer and businesses confidence, under the IMF supporting notion of contractionary expansion and others followed Keynesian expansionary policies.

As scholars and policymakers converge towards a consensus over the nexus and impact of the financial cycle to the real business cycle and vice versa "investor sentiment can have a profound impact on the economy, fuelling booms and exacerbating busts" Lutz (2015). While Lutz (2015) brings to our attention a large and growing literature on the effects of sentiment on financial markets and the economy, for example, Shiller (2000), Brown and Cliff (2004), Tetlock (2007), Kling and Gao (2008), Kurov (2008), Brunnermeier (2009), Schmeling (2009), Fung et al. (2010), Gençay et al. (2010), Chen (2011), Lux (2011), Singer et al. (2011), Chung et al. (2012), Garcia (2013), and Lutz (2015), the story goes back as early as Keynes (1936). Inspired from Keynes, researchers attempted to show whether investor sentiment can affect asset prices as people with high or low sentiment tend to form optimistic or pessimistic judgments and choices. Keynes (1936) argued that markets can exhibit fluctuations, that cannot be attributed to commonly modelled exogenous stochastic processes, stemming from the influence of investors “animal spirits”, which tent to move prices in a way not consistent to fundamentals features of the economy and firm-consumer behaviour.

Indeed, as Baker and Wurgler (2007) state, there are several stock market events that had a "dramatic" level or change in stock prices that seems to defy explanation. Some of these incidents Baker and Wurgler (2007) refer to as more characteristic are, the Great Crash of 1929, the 'Tronics Boom of the early 1960s, the Go-Go Years of the late 1960s, the Nifty Fifty bubble of the early 1970s, and the Black Monday crash of October 1987. As Baker and Wurgler (2007) argue the standard finance model, where unemotional investors always force capital market prices to equal to the rational present value of expected future cash flows, has considerably difficulty fitting these patterns. A promising attempt in explaining unconventional innovations in prices is developing by an approach of behavioural finance, where the standard model financial model is augmented to incorporate the assumption that investors are subject to sentiment. “Animal spirits” was introduced as a notion to describe the instincts and emotions that influence human behaviour and thus could be proxied by investor sentiment, and as Baker and Wurgler (2007) state can be defined broadly, as a belief about future cash flows and investment risks that is not justified by the facts at hand.

In a seminal paper by Azariadis (1981), argue that purely subjective agents can set in motion business cycles, observing shifts in any factor and then animal spirits or consumer sentiment affecting price innovations, simply because they are expecting them to change, and price signals convey no structural information. Azariadis (1981), show that "even perfectly well behaved economies will typically admit rational expectations equilibria in which the expectations themselves spark fluctuations in the level of business activity. If many individuals naively believe that sunspots or some index of confidence are good predictors of future prices, then they may take actions which tend to bear out their beliefs."
De Long, Shleifer, Summers, and Waldmann (1990) in a simple overlapping generations model of an asset market in which irrational noise traders with erroneous stochastic beliefs both affect prices and earn higher expected returns, make the role of investor sentiment in financial markets formal. They demonstrate that if uninformed noise traders base their trading decisions on sentiment and risk-averse arbitrageurs encounter limits to arbitrage, sentiment changes will lead to more noise trading, prices can diverge significantly from fundamental values even in the absence of fundamental risk, and lead to excess volatility.

Zhang (2008) attempts to summarize how economists have traditionally viewed sentiment. The first strand are asset-pricing theories of classical finance approach asset prices as rational equilibrium of expected future payoffs, reflecting that changes in prices are affected by external news about future cash flows and the movement of interest rates, and do not take into account investor sentiment. The behavioural finance approach assumes that investor sentiment may significantly distort market outcomes thereby affecting asset prices in equilibrium. In the spirit of De Long, Shleifer, Summers, and Waldmann (1990), Zhang (2008) points out that the noise trader model posits that if there are limits to arbitrage and investor beliefs are correlated, then noise unrelated to fundamentals, such as sentiment, may lead asset prices to deviate from what is expected from the benchmark of market efficiency.

In a more recent paper Angeletos and La’O (2013) attempt to address the question “Are business cycles and fluctuations in asset markets driven by changes in preferences and technologies? Or are the driven by animal spirits, market psychology and self reinforcing waves of optimism and pessimism?”. To answer this question they attempt to develop a new theory of fluctuations, one that helps accommodate the notions of “animal spirits” and “market sentiment” in unique-equilibrium, rational-expectations, macroeconomic models, developing a neoclassical model economy by allowing trading to be random and decentralized. The key feature of their model is the development of a novel formalization of extrinsic movements in market expectations, one that requires neither a departure from rationality nor the introduction of multiple equilibria. Their main finding is that economic outcomes and market expectations may co-move in response to a certain type of extrinsic shocks namely “sentiments”. In this manner, they manage to rationalize random and seemingly inexplicable shifts in the optimism or pessimism that economic agents may hold about one another’s choices and thereby future market conditions.

While Angeletos and La’O (2013) proposing the inclusion of their notion of shocks in DSGE models to estimate their contribution to observed business cycles, and study policy implications in a context of asset markets, De Grauwe and Macchiarelli (2015) highlighting that the last financial crisis was made possible by the fact that agents do not understand the complexity of the world in which they live, and their cognitive abilities are very limited, argue the need to introduce a banking sector in models that recognize the cognitive limitations of agents. In that spirit they extend the behavioural macroeconomic model of De Grauwe (2012) to include a banking sector and produces endogenous and self-fulfilling movements of optimism and pessimism (animal spirits). Their main result is that the existence of banks intensifies these movements, creating a greater scope for booms and busts. Thus, banks do not create but amplify animal spirits. De Grauwe and Macchiarelli (2015) show that an increase in the equity ratios of banks tend to reduce the importance of
animal spirits over the business cycle, highlighting also the role of the central bank to “tame the animal spirits”, by stabilising output.

4.1.2 The main and most current sentiment indexes used so far in the literature

"Investor sentiment is not straightforward to measure, but there is no fundamental reason why one cannot find imperfect proxies that remain useful over time"

Baker and Wurgler (2007)

As there is an on growing body of literature attempting to shed light on unconventional asset price movements, not related to fundamentals, and economic performance, many attempt to found agent "adverse" selection or "irrational" behaviour on the grounds of behavioural finance and economics. What is indisputably challenging in this strata, is how to extract from real economic and social activity the necessary and sufficient information, to construct proxies that can be closely related to micro level and macro level economic behavior and explain or forecast patterns that where insufficiently been explained. To this direction there are two main distinct paths to extract sentiment, the more traditional which is based on structured data, and the a more innovative and gaining momentum based on unstructured data. Sentiment index proxies based on structured data result in the utilization of existing data bases and use directly as proxies, quantitative data, or more sophisticated indexes constructed on these data. On the other hand, unstructured data, which is qualitative data, as can be derived by means of textual analysis or survey methods, have to properly analysed and handled in order to be quantified and uses as sentiment proxies. In this section we will attempt to present and categorize the main proxy indexes of sentiment in its broad sense using the distinction of structured - unstructured base indexes.

4.1.2.1 Structured sentiment indexes

In this subsection we present some commonly used structured sentiment indexes, indirect structured sentiment indexes and newly proposed.

Baker and Wurgler (2007) present and comment on some of the most typical Potential Sentiment Proxies used in the literature, which can be regarded in the classification we use as structured sentiment indexes: 1) retail investor trades; 2) mutual fund flows; 3) trading volume; 4) premia on dividend-paying stocks; 5) closed-end fund discounts; 6) option implied volatility; 7) first-day returns on initial public offerings (IPOs); 8) volume of initial public offerings; 9) new equity issues; 10) and insider trading.

As it is seen in Baker and Wurgler (2007); Greenwood and Nagel (2006); Barber, Odean, and Zhu (2006), the inexperienced retail or individual investor is more likely than the professional to be subject to sentiment. In this perspective Kumar and Lee (2006) suggest that sentiment measures for retail investors based on whether such investors are buying or selling, since this is consistent with systemic sentiment.

Another sentiment proxy can be easily derived by Mutual Fund Flows, since data on the allocation across fund categories by fund investors are widely available. For example Baker and Wurgler (2007) refer to Brown, Goetzmann, Hiraki, Shiraishi, and Watanabe (2002)
where they propose an overall market sentiment measure based on how fund investors are moving into and out of, for example, “safe” government bond funds and “risky” growth stock funds.

Regarding Trading volume, or more generally liquidity, is regarded by Baker and Wurgler (2007) as an investor sentiment index based on the argument made by Baker and Stein (2004). The later argue that irrational investors adds to liquidity when they are optimistic and betting on rising stocks rather than when they are pessimistic and betting on falling stocks.

Another way to reveal sentiment is to extract information based on Dividend Premium. As argued by Baker and Wurgler (2007) and Baker and Wurgler (2004a, b), dividend-paying stocks may be inversely related to sentiment. As stated in by Fama and French (2001) when dividends are at a premium, firms are more likely to pay them, and are less so when they are discounted. As Baker and Wurgler (2007) explain, firms appear to cater to prevailing sentiment for or against “safety” when deciding whether to pay dividends.

Towards a different approach it is argued that if closed-end funds are disproportionately held by retail investors, the average discount on closed-end equity funds may be a sentiment index, with the discount increasing when retail investors are bearish (see Zweig (1973), Lee, Shleifer, and Thaler (1991), and Neal and Wheatley (1998). A commonly used sentiment proxy is the Market Volatility Index (VIX), which measures the implied volatility of options on the Standard and Poor’s 100 stock index, is often called the “investor fear gauge” by practitioners. As Baker and Wurgler (2007) explain, Option Implied Volatility can be derived by options pricing models as a function of options prices. The implied causality is when an asset has greater expected volatility options prices rise, and thus capturing the investor fear as it is expressed through expected volatility.

Baker and Wurgler (2007) argues that the enthusiasm of investors may cause in some cases remarkable returns on first trading day of Initial public offerings, yielding IPO First-Day Returns proxy. At the same time IPO volume displays wild fluctuations, due to the fact that the underlying demand for initial public offerings may be extremely sensitive to investor sentiment.

A broader measure of equity financing activity which can be regarded as Another potential proxy of investor sentiment that usually draws investor’s attention is the equity share of total equity and debt issues by all corporations, which measures all equity offerings, and not just IPOs. In an earlier study Baker and Wurgler (2000), show that high values of the equity share portend low stock market returns that may improve forecasts on market returns.

Regarding Insider Trading Baker and Wurgler (2007) argue that if sentiment leads to correlated mispricings across firms, insider trading patterns may contain a systematic sentiment component, captured by the insiders decisions to form their portfolios with respect to outside investors.

4.1.2.1.1 Indirect structured sentiment indexes measures
Brown and Cliff (2005) find that many commonly cited indirect measures of sentiment are related to direct measures (surveys) of investor sentiment. In their study they utilize financial variables considered by practitioners as market weather vanes and also construct indirect sentiment index measures from structured data. The main consider market performance, type of trading activity and derivative variables.

Regarding market performance Brown and Cliff (2005) utilize data for NYSE issues to calculate a modification of the ratio of the number of advancing issues to declining issues (ADV/DEC), that can incorporate their respective volumes, presenting the ARMS index.

In order to capture the type of trading activity Brown and Cliff (2005) use the percentage change in margin borrowing (DMARGIN) as reported by the Federal Reserve which is regarded as a bullish indicator; the percentage change in short interest (DSHORTIR) which is garaged as a bearish indicator; the ratio of short sales to total sales (SHORTSLS); the ratio of specialists’ short sales to total short sales (SPECIAL) (when short-selling becomes relatively large, the market is likely to decline); and the ratio of odd-lot sales to purchases (ODDLOT) as bearish measure.

Brown and Cliff (2005) to capture sentiment indirectly by derivatives trading activity the use the following variables: the ratio of CBOE equity put to call (PUT/CALL) trading volume(a bearish indicator); the change in the net position in SPX futures by trader type reported by the Commodities Futures Trading Commission (CFTC); the forecasts of commodity market returns collected by Market Vane (MKTVANE) (bullish predictor). They also construct a measure of expected volatility relative to current volatility using VIX (the S&P 100 Index option volatility) and SIG is the realized volatility calculated from Open-High-Low-Close data on the S&P 100 Index.

4.1.2.1.2 Proposed new Indirect structured sentiment indexes / measures

Taking stock of the innovations on the contraction of new indirect structured sentiment indexes and measures we refer to Brown and Cliff (2004) and (2005) as discussed previously, where they propose a sentiment index, by employing PCA (Principle Component Analysis) to combine several sentiment proxies commonly used in the literature. Also, following Brown and Cliff (2004), Baker and Wurgler (2006) construct a sentiment index by using a PCA to combine six typical proxies for sentiment. In a more recent study Baker, Wurgler and Yuan (2011) construct sentiment indices for six major stock markets expanding the approach of Baker and Wurgler's (2006), and decompose them into one global and six local indexes.

Baker and Wurgler (2007) expand their previous work and construct an index based on the six proxies they use in Baker and Wurgler (2006): trading volume; the dividend premium; the closed-end fund discount; the number and first-day returns on IPOs; and the equity share in new issues, also taking into account for macroeconomic indicators and their impact on the sentiment proxies, as growth in industrial production; real growth in durable; nondurable; and services consumption; growth in employment, and an NBER recession indicator. The innovation is that they use the residuals from the regressions of the six basic proxies on macroeconomic variables the new sentiment proxies.

4.1.2.1.3 Other Proxies of Indirect structured sentiment indexes / measures used
While the vast majority of studies are consistent with USA cases, it is worth noting a study of Jansen and Nahuis (2003) where they use the European Commission’s consumer confidence index (CCI) as a proxy for sentiment and find stock returns and changes in sentiment are positively correlated for nine countries, with Germany as the main exception.

4.1.2.2 Unstructured sentiment indexes

Unstructured sentiment indexes can mainly occur by two types of unstructured data collection. The survey method as well as the textual analysis or content analysis or the bag-of-words (BoW) method.

4.1.2.2.1 Unstructured sentiment indexes: surveys

In a previous section we disused on the indirect structured sentiment measures commonly used in the literature. An approach to extract sentiment simply by asking investors how they feel about the market, as argued by Baker and Wurgler (2007) can proxy the marginal irrational investor. This path goes back to Robert Shiller who has conducted investor attitude surveys since 1989. In a similar approach UBS and the Gallup Organization have conducted random interviews of US investors households starting from 1996 to 2007, to construct the Index of Investor Optimism. In 2002, UBS extended the Index to France, Germany, Italy, Spain, and the United Kingdom. Qiu and Welch (2006) show that changes in the University of Michigan Consumer Confidence Index correlate highly with changes in the UBS/Gallup index. The Investors Intelligence (II) index is a weekly bull-bear spread by categorizing approximately 150 market newsletters used by Brown and Cliff (2005) to forecast market returns. Brown and Cliff (2005) also utilized in their study a measure broadly understood as of individual investor sentiment, obtained from Surveys conducted by the American Association of Individual Investors (AAII). To construct the index, the association asks on a random sample of its members where they think the stock market will be in 6 months: up, down, or the same and then labels these responses as bullish, bearish, or neutral, respectively

4.1.2.2.2 Unstructured sentiment indexes: textual analysis

As textual analysis gains momentum since the important work of Tetlock (2007), Loughran and McDonald (2011), Apel and Grimald (2012) or Baker et al. (2012), the main focus is not to create different quantitative proxies based on textual analysis, but rather than improve the methods and techniques towards improved quality of this proxy by finding the appropriate conversion strategy from qualitative data to quantitative, taking into account information sources, and methods of contend analysis. For example in a representative case, Tetlock (2007) utilizes the media content of the Wall Street Journal column to measure investor sentiment. His main finding is that high media pessimism, which implies low investor sentiment, predicts downward pressure on stock prices followed by a reversion to fundamentals. He also relates high market trading volume with an extreme value of pessimism, considering the latter as a good predictor.

To this direction Colm and Liu (2014), in a survey of methods in textual sentiment analysis, locate three main information sources, corporation disclosures, sentiment that can be extracted by media as in news stories, in-depth commentaries or analyst reports, and
sentiment as it can be extracted by the internet in the forms of posts. In they survey they restrict their analysis with respect to finance, but the main information sources can be used for extracting sentiment for more general use.

As Colm and Liu (2014) argue, the most common content analysis methods in the textual sentiment literature are the dictionary-based approach and machine learning. The general idea of the dictionary-based approach as Colm and Liu (2014) present it, is that it uses a mapping algorithm in which a computer program reads text and classifies the words, phrases or sentences into groups based on pre-defined dictionary categories, which is referred to as the ‘bag-of-words’.

In the dictionary-based approach there are two main issues, which words should be taken into account into the dictionary and what is their relative weight. For example in earlier studies the main word lists comes from social psychology and where developed by (Stone et al., 1966), that is the General Inquirer (GI) built-in dictionary, which used the Harvard IV-4 dictionaries. The GI / Harvard word lists where used for example by Tetlock (2007), Engelberg (2008), Tetlock et al. (2008), Doran et al. (2010), Loughran and McDonald (2011), Ferris et al. (2013) and more.

Following Stone's approach Hart (2000) developed DICTION 5.0, which counts words based on 33 separate dictionaries. This dictionary was used for example in the studies of Henry and Leone (2009), Demers and Vega (2011), and Ferris et al. (2013).

However this approach of sentiment extraction was criticized and as Li (2010) argues that the classification of tone based on the GI/Harvard does not provide sufficient accuracy. To overcome this drawback dictionaries or word lists more closely related to finance have been built by researchers so that more accurate and efficient sentiment scores can be generated, such as word list developed by Henry (2006, 2008).

In more recent studies, as Liu and McConnell (2013), and Loughran and Mcdonald (2013), the word list developed by Loughran and McDonald (2011) seems to gain ground. They use GI/Harvard negative words, which have been expanded by inflecting each word to forms that retain the original meaning of the root word.

Regarding the relative importance of each word found in a text, in the earlier studies there where an equal treatment of words, while Loughran and McDonald (2011a) use two weighting schemes, a simple proportional weighting and one that weights each word inversely proportional to its frequency found in the text. In more recent studies as Jegadeesh and Wu (2012), they assign weights for each word based on how the market has reacted to them in the past.

On the other hand machine learning relies on statistical techniques to infer the content of documents and to classify them based on statistical inference (Li, 2010). The key difference is that while machine learning is also regarded as a tool for textual analysis, a subset of the text is used as a training set for the algorithm and manually each word in this set is classified.
4.1.2.3 Latest innovations in sentiment analysis

Kontopoulos et al. (2013) argued that sentiment analysis constitutes a rapidly evolving research area, especially since the emergence of Web 2.0 and its related technologies (social networks, blogs, wikis etc.). They highlight that the recent increased use of internet-based communication via micro-blogging and Twitter grasped the attention of sentiment analysis as a prominent raw data source that can potentially uncover sentiment. Kontopoulos et al. (2013) criticize machine learning-based approaches that perform sentiment analysis on tweets, and respond to their drawbacks by proposing ontology-based techniques for determining the subjects discussed in tweets and breaking down each tweet into a set of aspects relevant to the subject, avoiding uniform scores of a post, increasing the relevant validity of the posts.

Also Kearney and Liu (2014) summarize the important and influential findings in the related literature about how textual sentiment impacts on individual, firm-level and market-level behaviour and performance, and vice versa.

Nassirtoussi et al. (2014, 2015) provide an extensive summary on techniques, such as machine learning on online sentiment analysis, social media text mining, news sentiment analysis, FOREX market prediction and stock prediction based on news, highlighting the new trend of forecasting economic and financial variables based on the notion of behavioural finance and the importance of sentiments and market perception. Nassirtoussi et al. (2015) also develop a technique to predict intraday directional-movements of a currency-pair in the foreign exchange market based on the text of breaking financial news-headlines.

Summing up, recent work have shown the importance of the effects or sentiment or the proxy of sentiments using 1) social media text mining, 2) news, 3) search engine data, 4) tweets.

4.1.3 The relative importance of sentiment indexes in predicting the financial economy

Since the recent financial crisis and the economic crisis succeeded, the theoretical and empirical models seemed inadequate in forecasting the downturn. This fact renewed the attention on the behavioural nature of economics and finance, producing a growing body of literature incorporating traditional sentiment indexes and more modern approaches that captures agents’ sentiment and market perception. The empirical literature suggests that the use of sentiment may have an important role in predicting real economy variables and financial variables.

Carroll et al. (1994) presented evidence that the lagged consumer sentiment has some explanatory power for current changes in household spending. Mclean and Zhao (2014) test whether recessions and low investor sentiment create financial constraints that limit real investment and employment.

Chen and Chou (2015) show that recession fear does lead to a higher probability of economic downturns; they also provide strong evidence that an increase in market pessimism may push the economy from an expansion state to a recession state. Chen and
Chou (2015) also found some weaker evidence suggesting that a lack of consumer confidence may trap the economy in a depressed regime longer. They conclude that a greater lack of confidence indeed pushes the economy into a downturn.

Hüfner and Schröder (2002) have analysed the forecasting qualities of German leading indicators by focusing on the ifo business expectations, the Economic Sentiment Indicator for Germany of the European Commission, the Purchasing Managers’ Index and the ZEW Indicator of Economic Sentiment. Hüfner and Schröder (2002) provide evidence that, except for the ESIN, all other indicators used in their study are leading the year-on-year growth rate of industrial production.

Matsusaka and Sbordone (1995) using vector autoregressions, investigate the link of consumer confidence and economic fluctuations. When controlling for fundamental economic variables their models fail to reject the hypothesis that consumer sentiment does not cause GNP, highlighting the role of consumer sentiment as an important information criterion that can improve GNP forecasting.

Batchelor and Dua (1998) also use consumer confidence and they show that the inclusion of this variable would have been helpful in predicting the 1991 US recession. However they also show that this is not a result that can be generalized in other years, and as they argue this is due to the nature of the recession rather than a persistent weakness in the forecasting technique in use.

In a similar strand regarding the usefulness of the consumer sentiment indicator Carroll et al. (1994), Bram and Ludvigson (1998), Howrey (2001), and Ludvigson (2004), argue that consumer sentiment can provide important information in explaining consumer spending innovations.

Howrey (2001) also considers the relationship between consumer confidence and the business cycle, showing that the use of the consumer confidence index increases the accuracy of one- to four-quarter-ahead forecasts of the probability of recession.

Leaving of the consumer confidence index aside and using the Purchasing Manager’s Index (PMI), Dasgupta and Lahiri (1993) show that the index provides additional explanatory power in the prediction of business cycles turning points.

Furthermore the related literature has shown that business sentiment is useful not only for forecasting GDP and the business cycle but is also important for GDP nowcasting (see for example Kauffman 1999; Klein and Moore 1991; Lindsey and Pavur 2005; Banerjee and Marcellino 2006; and Lahiri and Monokroussos 2013).

As sentiment indices seem to have increased significance for forecasting, this may be due to two characteristics that they have in comparison to traditional leading indicator variables. First, they are available in higher frequencies and in some cases they are available in real time and second, by their statistical nature are not subject to revisions (see for example Koenig 2002). And as Lahiri and Monokroussos (2013) note there are no economic variables of similar importance that are available with the same timeliness. On the other hand,
Macroeconomic variables and leading indicators are announced with a lag (a month or a quarter most of the cases) and in most cases are revised considerable. A recent example is the adoption of ESA 2010 instead ESA 1995 by Eurostat and member states.

Christiansen et al. (2014) in an empirical paper for the case of US recessions, provide evidence that sentiment variables play an important role enhancing the predictive power of recessions, outperforming classical recession predictors and in excess of common factors estimated based on large panel of economic data. Christiansen et al. (2014) argue that the best predictions for future recessions are obtained by the combination of sentiment variables with the classical recession predictors, or by combining sentiment variables with the common factors, both in-sample and out-of-sample. Christiansen et al. (2014) separate their approach from the related literature by using sentiment variables to forecast a binary recession indicator using profit models rather than forecasting continuous variables such as GDP growth. With this approach they show that the term spread, the short rate, and the stock market return carry important information about future recessions.

Schmeling (2009) using a sample of 18 advanced countries show that sentiment negatively forecasts aggregate stock market returns on average across countries. Schmeling (2009) argues that when sentiment is high, future stock returns tend to be lower and vice versa. An interesting finding in this paper is that the predictive power of sentiment is stronger for short and medium-term horizons. Oh and Sheng (2011) on the other hand, show that stock micro blog sentiments do have predictive power for simple and market adjusted returns respectively. They also relate this predictive accuracy with the under reaction hypothesis observed in behavioural finance.

Huang et al. (2014), following Baker, and Wurgler’s (2006) propose a new investor sentiment index and show that has much greater predictive power than existing sentiment indices have both in and out of sample, and the predictability becomes both statistically and economically significant. In addition, their findings suggest that it outperforms macroeconomic variables and can also predict cross-sectional stock returns sorted by industry, size, value, and momentum. The driving force of the predictive power in their models appears to stem from investors’ biased beliefs about future cash flows.

Nardo et al. (2015) in an extensive survey of the relative literature investigate the influence of online news on the financial market and the magnitude of this impact. In this effort Nardo et al. (2015) claim that the sequence economic event, investment decisions, stock price jumps, is far from being a stylised fact. They pinpoint from the literature that majority of the largest movements in the S&P500 and the CRSP Total Market Index cannot be tied to fundamental economic news sufficient to rationalize the size of the observed price movements. From the revision of the literature they are trying to uncover the potential link of online information with the aforementioned sequence. Nardo et al. (2015) also studies the literature linking changes in stock returns and trade volumes to measures of web buzz. They observe that although the web can to some extent anticipate financial movements, the gain seldom exceeds 5%. In addition, they investigate machine learning and sentiment detection to verify that more sophisticated models do not necessarily produce better results. Still, given the amount of money moved daily by the stock markets, even small gains could
be worth exploiting, they also argue that the use of the Internet to predict financial movements is a permanent development.

Furthermore the importance of sentiment in commodity markets is also highlighted by Borovkova and Mahakena (2015) who find significant relationships between news sentiment and the dynamic characteristics of natural gas futures returns. Aslo, Feuerriegel and Neumann (2013) provide empirical evidence that abnormal returns in commodity markets can be explained, up to a large extent, by news sentiment.

4.1.4 Concluding remarks

As scholars and policymakers are moving towards a common understanding of the relation of the financial cycle and the economic business cycle, new evidence, both theoretical and empirical, support the importance of sentiment in both real economic activity and financial activity, mainly through the connecting path of asset and commodity price movements. The importance of sentiment places the behavioural approach of finance and economics in a prominent position in the future of economic research. On the other hand as argued in Baker and Wurgler (2007) "Investor sentiment is not straightforward to measure", so it natural to observe a vast and on growing literature on methods and proxies proposed to capture sentiment. To this strand new information technology as machine learning, text mining, and neural networks make a promising contribution toward new up to date and more sophisticated proxies of sentiment that exhibit improved predicative power of forecasting and now casting of fundamental economic indicators, stock market prices, financial indicators and commodities.

4.2 Market Sentiment Analysis

The recent years, there has been a significant amount of work on using sources of text data from the Web (such as online newspapers, blogs or Twitter feeds) to predict financial and economic variables of interest. Much of this work has relied on some form of sentiment analysis to represent the text. Sentiment analysis targets open issues in various fields (including politics, psychology, finance, and society), because sentiments’ understanding can largely impact interactions, policies, and decision-making. Due to its importance, this form of textual information processing has become a growing part of the empirical finance research.

Essentially, the overarching goal in sentiment analysis is to turn text into data for analysis via application of natural language processing (NLP) and analytical methods. There is a wide variety of vocabulary used in the literature about sentiment analysis. The same task is often referred to as sentiment extraction, sentiment mining, opinion mining, subjectivity analysis, emotional polarity computation as well as other terms. The same applies for the task of classification, i.e., the identification of the polarity of an opinion. Commonly used terms are sentiment orientation, semantic orientation, opinion polarity, etc. We follow Tetlock (2007) with regard to these terms.

Tetlock’s pioneering study (Tetlock, 2007) demonstrated that news stories contain information relevant to predicting both earnings and stock returns. Within PROFIT, we restrict our focus on how to apply similar techniques, but on a wider variety of dictionaries, datasets, news sources, and methodologies, in order to extract investor sentiment indexes.
4.2.1 The Sentiment Analysis Workflow

An effective sentiment analysis consists of the following steps (see Figure 4-1: (1) information retrieval of textual-news data with respect to a specific financial instrument, (2) natural language processing, (3) extraction of the market sentiment on the sentence level, (4) aggregation of the sentiment to the document level.

*Information retrieval* is the activity of obtaining information resources relevant to a financial instrument from a collection of information sources. Searches can be based on parts of the original texts represented in databases or on full-text (or other content-based) indexing and can be restricted to specific websites, blogs or social media resources. Each document is stripped off from non-text elements, links, tags, comments, and emoticons. Moreover, the tf–idf scheme (a numerical statistic that is intended to reflect how important a word is to a document in a collection or corpus) may be used as a weighting factor.

In the next step, by using *Natural language processing* (NLP), we pre-process the text to identify the various parts of speech, phrases and named entities. NLP of document texts includes among others part-of-speech (POS) tagging, chunking and named entity recognition. We can also apply tokenisation, sentence splitting, and morphological analysis in order to further clean the text (Cunningham, Maynard, Bontcheva, and Tablan, 2002).

After that, we take the pre-processed clean text and extract the market sentiment with respect to a specific financial instrument or indicator. The *extraction of the market sentiment on the sentence level* is a knowledge-based approach, which takes into account domain expertise as modelled, for example, in a lexicon or in an ontology (see section 4.2.2.2 for details). After classifying the identified sentences into positive and negative sentences, the *aggregation of the sentiment to the document level* is done by aggregating the overall sentiment of the individual sentences that were tagged positive and negative in the previous step.

Apart from these processes, there is a variety of other sub-problems in the area of sentiment analysis, including subjectivity classification, opinion spam detection, topic relevance and topic shift, which will be detailed within the deliverable D4.1 (Market Sentiment Models and Indicators) that comes as part of the Work Package 4 (WP4 - Market Sentiment-based Financial Forecasting).

4.2.2 State-of-the-Art in Sentiment Analysis

In this section, we perform a literature review of the state-of-the-art with regard to the area of sentiment analysis and classification. First, we review the three main approaches to textual content modelling for sentiment analysis, and then we elaborate on the most popular sentiment detection approaches that are employed to extract the concealed sentiments of a textual resource.

4.2.2.1 The sentiment analysis model

In general, sentiment classification can be done at several levels: words, phrases, sentences, paragraphs, documents or even multiple documents. On each level, the classification can be done either directly or it can be built on the results of previous levels by aggregating them.
**Sentence-based analysis**: Typically, a textual resource is modelled using the baseline bag-of-words (BoW) model (Salton and McGill, 1986). The BoW model can be easily applied on sentences, with each sentence being considered to contain a set of words. A major feature of this model is that the order and co-occurrence of words are completely ignored. Another popular approach is a technique called n-grams, where an n-gram represents a sequence of n words. Accordingly, each sentence is modelled with a set of (overlapping) n-grams (N-grams splitting). In its simplest form, the so-called unigrams, the n-gram model is the same as the BoW model. In general, n-grams (apart from the unigrams) consider the ordering of the words in a sentence. By preserving the word ordering, this model enables the better understanding of the inter-word sentimental influences and interactions. To filter out words that probably do not express sentiment, one can use part-of-speech tagging (N-grams tagging) so that only words with specific tags (for example, adverbs, adjectives, noun, and verbs) are retained for further processing (N-grams filtering). Farah Benamara et al. (2007) suggest that adjectives and adverbs are good indicators regarding the semantic orientation of a sentence.

Various features can then be utilised to represent the filtered sentences (model representation), such as the set of observed n-grams weighted by their frequency of appearance. As textual resources are quite often characterized by contradictions or different levels of semantic orientation, we may also use additional features, such as intensifiers and negation words. The intensifiers affect a sentiment either by increasing its intensity (like the word “very” or “much”) or by decreasing its intensity (like the word “hardly” or “scarcely”). Negation words also affect the semantic orientation of a word or phrase; for example, in the sentence “this is good”, the polarity of the expressed sentiment is inverted by adding the word “not”. Accordingly, the sentence “this is not good”, has a negative polarity. In the sentence-based analysis, the final issue to be addressed is how to extract the concealed
sentiments \((sentiment\ detection)\). We discuss the most popular approaches in section 4.2.2.2.  

**Document-based analysis:** In case the textual resource we aim analysing is a document, we can decompose it into a set of sentences or paragraphs \((sentence\ splitting)\). Then, we may use a filtering approach \((sentence\ filtering)\) to retain only those sentences that might better convey information relevant to the document’s sentiment. Such filtering could be based on different features, such as position, length, and subjectivity. In general, the first and last sentences of a document are quite often indicative about its semantic orientation. Because a document is a set of sentences, its representation relies on the model used to represent each individual sentence \((sentence-based\ analysis)\). In order to capture the sentiment of the document as a whole, the sentiments expressed in each individual sentence are typically aggregated using appropriate measures, such as an averaging operator \((Branavan\ et.\ al., 2008)\).

**Topic-based analysis:** Sentiment analysis is without doubt highly topic dependent. This means that usually, we need to identify sentiments expressed by a textual resource with respect to a specific topic or a specific financial instrument, instead of the overall sentiment expressed in the text. The topic is the sentence’s actual subject for which the sentiment is expressed. In this case, a topic-based sentiment detection approach should be able to identify the topic, and then, capture the sentiments expressed with respect to it. Typically, a two-steps approach is followed in order to proceed: first, the sentences relevant to the considered topic are identified; and then, the sentence-filtering process is applied. Finally, a model representation approach is used to capture the sentiment of the on-topic sentences \((Lin\ and\ He, 2009)\).

### 4.2.2.2 Sentiment detection approaches

Typically, we capture the sentiment of a textual resource by using lexicon-based or machine learning approaches. Limited work has also been conducted on hybrid methodologies as well as on ontology-supported approaches.

**Lexicon-Based Approaches:** The lexicon-based approach is an unsupervised technique that extracts the sentiment of a text using lexicons \((dictionaries)\) that may be either domain-specific \((such\ as\ finance,\ politics,\ psychology,\ etc.)\) or domain-independent \((Turney\ 2002)\). Such dictionaries consist of words that are annotated with their semantic orientation value \((polarity\ and\ strength);\) usually a positive or negative value is assigned to each word \((for\ example,\ the\ score\ for\ the\ word\ “good”\ is\ 0.65\ and\ the\ score\ for\ the\ word\ “disgust”\ is\ \(-0.85)\).

Dictionaries for lexicon-based approaches can be created either manually \((Stone^4, 1966;\ Tong, 2001;\ Loughran\ and\ McDonald^5, 2010)\), or automatically, using seed words to expand the list of words \((Hatzivassiloglou\ and\ McKeown\ 1997;\ Turney\ 2002;\ Turney\ and\ Littman\ 2003)\). Much of the lexicon-based research has focused on using adjectives as indicators regarding the semantic orientation of the text \((Hatzivassiloglou\ and\ McKeown, 1997;\ Wilson,\ Wiebe\ and\ Hoffmann, 2005;\ Hu\ and\ Liu, 2004;\ Taboada,\ Anthony,\ and\ Voll\ 2006)\). According to this, a list of adjectives and corresponding semantic orientation values is compiled into a

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4 Available from http://www.wjh.harvard.edu/~inquirer/
5 Available at http://www.nd.edu/~mcdonald/Word_Lists.html
dictionary. Then, for any given text, all adjectives are extracted and annotated according to their semantic orientation value using the dictionary scores. The semantic orientation scores are in turn aggregated into a single score for the text.

**Machine Learning Approaches:** The text classification approach is essentially a supervised classification task, which involves building classifiers from labelled instances of texts or sentences. The introduction of the machine learning approach in sentiment analysis originates from Bo Pang et al. (Pang, Lee and Vaithyanathan, 2002). This approach is also referred to as a statistical or machine learning approach. The majority of the statistical text classification research relies on Support Vector Machine (SVM) classifiers, Naïve Bayes and Max entropy classifiers trained on a particular data set using features such as unigrams or bigrams, and with or without part-of-speech (POS) labels (Pang, Lee, and Vaithyanathan, 2002; Salvetti, Reichenbach, and Lewis, 2006).

Classifiers built using the supervised methods may achieve high accuracy when detecting the polarity of a text (Kennedy and Inkpen, 2006; Boiy et al., 2007; Bartlett and Albright, 2008). However, although such classifiers perform very well in the domain that they are trained on, their performance degrades when the same classifier is used in a different domain (Aue and Gamon, 2005). Moreover, utilizing an individual classifier might result in poor sentiment detection, since the performance of each classifier varies significantly, when for instance someone is using different features or weight measures. Therefore, for overcoming the deficiencies of each classifier and to proceed with a more robust and successful sentiment detection process, within PROFIT and similar to Rui Xia et al. (Xia, Zong, and Li, 2011), we will create ensemble classifiers; that is, a combination of multiple classifiers.

**Hybrid Approaches:** It became apparent that the lexicon-based approaches suffer from their absolute dependence on lexicons, which are often characterized by word shortage or inappropriate assignment of semantic orientation values. While, machine-learning approaches overcome these limitations, their need for a large volume of training data also lessens their advantage (Goncalves, Araújo, Benevenuto, and Cha, 2013).

Accordingly, the hybrid approach targets at solving these limitations by combining the aforementioned approaches. An exemplar use case scenario for a hybrid approach is to follow a two-step process; i.e., to initially generate a set of training data by automatically identifying the texts’ semantic orientation score (using a lexicon-based approach), and then to proceed with the classification (using a machine learning approach) that is independent from the lexicons’ limitations (Ghiassi, Skinner, and Zimbra, 2013). As Prabowo and Thelwall (2009) point out, hybrid approaches enhance the stability and accuracy of existing methodologies while exploring the strong characteristics of each of them.

**Ontology-based approaches:** Recently, semantic web-based sentiment analysis that relies on the usage of ontologies has started to attract attention. Ontologies are not a classification method in itself, but they can be used to enhance existing classification methods. Zhou and Chaovilat (2008) were among the first to use ontologies for this purpose. They incorporated an ontology to a supervised machine learning technique and a basic term counting method. In their work, as in most other works, the ontology contained semantic features and was used only to identify these features inside the text. Cadilhac et al. (Cadilhac, Benamara and
Aussenac-Gilles, 2010) on the other hand, they did not use the ontology only as a taxonomy by taking into account the “is a relation” between concepts. Instead, they presented an approach that uses other relations between concepts for creating summaries of opinions and computing the SO scores. Though an infancy stage, within PROFIT, we will explore the possibilities provided by this class of sentiment analysis techniques.

Table 4–1 summarises the sentiment analysis approaches used in the relevant literature. It is worth noting that the extensive review in sentiment analysis is not the penultimate purpose of this work package, as a thorough review and unique analysis will be conducted along the delivery of the deliverable D4.1 (Market Sentiment Models and Indicators).

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<th>Approach</th>
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<td>Lexicon-based</td>
<td>General Inquirer’s Harvard IV-4 psychosocial dictionary</td>
<td>Positive, negative, neutral</td>
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<td></td>
<td>Loughran and McDonald financial dictionary</td>
<td>Positive and negative together with strength</td>
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<tr>
<td></td>
<td>Linguistic Inquiry and Word Count (LIWC)</td>
<td>Affect-related sentiments (such as angry, sad, joyful, fearful, proud, elated, cheerful, gloomy, irritable, listless, depressed, friendly, distant, liking, loving, hating, nervous, anxious, reckless, hostile, jealous, etc.)</td>
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<td>AFINN dictionary</td>
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<td>Lexicoder sentiment dictionary</td>
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<td>WordStat sentiment dictionary</td>
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<td>WordNet and WordNet-Affect</td>
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<td>SentiWordNet</td>
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<td>SentiStrength</td>
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<td>Machine learning</td>
<td>Support Vector Machines (SVM)</td>
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<td>Decision Trees</td>
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<td>Multinomial Naive Bayes</td>
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<td>Maximum entropy classifier</td>
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<td>Rule-based classifier (RBC)</td>
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<td></td>
<td>General Inquirer Based Classifier (GIBC)</td>
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<td></td>
<td>Ensemble classifiers</td>
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<tr>
<td>Hybrid</td>
<td>Hybrid classification means applying different approaches and classifiers on a sequence (i.e., GIBC -&gt; SVM, RBC -&gt; GIBC, RBC -&gt; GIBC -&gt; SVM)</td>
<td></td>
</tr>
<tr>
<td>Ontology-based</td>
<td>An ontology-based classification uses the ontology as part of the feature extraction process and takes the relations between concepts into account</td>
<td></td>
</tr>
</tbody>
</table>

4.2.3 Sentiment analysis in PROFIT

The approach of research that we aim addressing at PROFIT can be specified as follows (see Figure 4–2). A leading characteristic of the object of research is the focus on text, so we are only interested in text classification. The source of these texts is limited to the World Wide Web (including among others financial newspapers, online reviews, blogs, social media, etc.). Throughout a text there can be subjective or objective statements. We are only concerned with the former. The application domain of sentiment analysis is finance meaning

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that sentiments about persons or products, for example, are excluded. The problem that is tackled is the extraction, classification and aggregation of these sentiments for the creation of a sentiment index time series that reflects the sentiment of the market on a given day. The approach to be followed is automated information extraction. As identified in Section 4.2.2.2, various approaches can be used to capture the sentiment of a textual resource. Within PROFIT, we will consider all the available options before making any final decision.

![Figure 4–2 Sentiment analysis in PROFIT](image)

### 4.3 Forecasting Models

Accurate forecasting exercises regarding real economic activity, financial markets and commodities are the Holy Grail of the theoretical and empirical economic analysis. Both public and private sector rely on short or longer horizon forecasts in order to take various economic decisions spanning a wide range of everyday aspects. From the Central Bank’s decision of setting the effective interest rates, to the decision of a private investor to hold or not stocks and even to a bet against the realization of a football game. In the US, for example, prior to each Federal Open Market Committee meeting, the Federal Reserve staff produces forecasts of several macroeconomic aggregates at horizons up to two years as a basis for their discussions. The variables forecasted by the staff include exchange rates, which influence current account projections as well as US real GDP growth, eventually.

The importance of forecasting could be further assessed using some more indicative examples. In pursuing fiscal sustainability, fiscal authorities and central banks it is crucial to have good forecasts of the future path of national output. The same holds true for the
effective conduct of monetary policy in promoting financial stability. Furthermore, long-term labor contracts or mortgages or fixed deposit accounts are a common feature in modern economies. In such framework it is very important good forecasts of a country’s general price index (inflation rate) evolvement for efficient decision-making. Another example is whether a financial market is in a bear or in a bull sate, which implies very different investment opportunities. For example, during a bear market, stock prices are generally falling making more attractive risk free assets (i.e., sovereign bonds). Thus, the prediction of the future state of the market can help an investor to perform better by shifting to the most appropriate state market based investment portfolio. When it comes to the commodity prices, the importance of forecasting tools are even more crystal clear. It is common notion that changes in the cost of crude oil affect economic activity exerting a countercyclical effect on the growth rate of a national economy. This can take place for example through the investment channel, if the private sector is reluctant to proceed to investments because of their irreversible nature and of high oil prices or even because of expected high oil prices. For that reason, Central banks and international organizations (International Monetary Fund, World Bank inter alia) worldwide routinely use short-horizon forecasts of the quarterly price of oil. In the same vein, exchange rates are of great importance regarding private investment decisions, economic policy at national level (especially for countries that are heavy importers and exporters of commodities), as well as risk management. Taking into account all the above arguments, forecasting remains a fundamental concept of our understanding of economic decisions made by policymakers, firms, investors, and households spanning a voluminous literature.

It is important to note that empirical evidence point to the interconnection between financial markets, commodities and macroeconomic indicators (Gross Domestic Product, GDP, employment, current account, inflation, etc.). This means for example that oil prices may convey some information as predictive variables for the forecasting of exchange rates (this of course may hold under very specific assumptions). Macroeconomic variables could also predict future movements in stock returns or stock market indexes (Dow Jones, Eurostoxx 50 etc.). Finally, many papers find that some financial series have significant predictive power for future economic activity (GDP). Some of these series are interest rates and spreads, stock prices, monetary aggregates, survey forecasts leading financial indicators among others. At the centre of forecasting lies the prediction for the phase of the business cycle. As Siegel (2014) notes, “If one could predict in advance when recessions will occur, the gains would be substantial. That is perhaps why billions of dollars are spent trying to forecast the business cycle. But the record of predicting business cycle turning points is extremely poor”. The literature has considered a wide variety of econometric estimation methods, variable selection and model specification. Despite this chaotic effort, forecasting is still an ongoing effort.

4.3.1 The interlink between financial sector and the real economy

The severe US subprime crisis of 2007 that originated from the financial sector has brought under scrutiny the interplay of financial conditions and macroeconomic environment. Financial conditions can be thought of the current state of financial variables that influence economic behaviour and (thereby) the future state of the economy. Generally speaking, the universe of financial variables spans the supply or demand of financial instruments that are related to broader economic activity. This list might comprise a wide array of asset prices
and quantities (both stocks and flows), as well as indicators of potential asset supply and demand. The latter may range from surveys of credit availability to the capital adequacy of financial intermediaries.

A Financial Conditions Index (FCI) attempts to extract information about the future state of the economy conveyed by these current financial variables. Ideally, an FCI should measure financial shocks – exogenous shifts in financial conditions that influence or otherwise predict future economic activity. True financial shocks should be distinguished from the endogenous reflection or embodiment in financial variables of past economic activity that itself predicts future activity. If the only information contained in financial variables about future economic activity were of this endogenous variety, there would be no reason to construct an FCI: Past economic activity itself would contain all the relevant predictive information.

The growing literature on the monetary transmission mechanism could host our analysis for understanding FCIs. Searching in these studies we come up with a very influential finding: monetary policy affects the economy by shifting the financial conditions that change economic behaviour. The structure of the financial system plays a pivotal role in the various channels of transmission. For example, the large corporate bond market in the United States and its broadening over time suggest that market prices for credit are more powerful influences on U.S. economic activity than would be the case in Japan or Germany today, or in the United States decades ago. The state of the economy also matters: For example, financial conditions that influence investment may be less important in periods of large excess capacity.

The recent analysis of the monetary transmission mechanism by classifies these channels as neoclassical and non-neoclassical. The first category is comprised of traditional investment-, consumption- and trade-based channels of transmission. The investment channel contains both the impact of long-term interest rates on the user cost of capital and the impact of asset prices on the demand for new physical capital (Tobin’s q). The consumption channel contains both wealth and intertemporal substitution effects. Both the investment- and consumption-based channels may be influenced by shifts in risk perceptions and risk tolerance that in turn affect market risk premia. Finally, the trade channel captures the impact of the real exchange rate on net exports.

According to the ICAPM if investment opportunities change over time, then assets’ exposures to these changes are important determinants of average returns in addition to the market beta. The ICAPM dictates that the yield curve is an important part of the investment opportunity set. Two other variables proposed as candidates for state variables within the ICAPM are the returns on the HML and SMB portfolios. These factors capture common variation in portfolio returns that is independent of the market and that carries a different risk premium. Petkova (2006) in a seminal study provides a rationale through the Intertemporal Capital Asset Pricing Model of Merton (1973) for understanding the predictive ability of FF factors for stock returns. She concluded that Fama and French factors are associated with shocks in variables that predict investment opportunity set.

Under an asset pricing model context the expected returns of securities are related to their sensitivity to changes in the state of economy. Studies on this field have revealed that some
state variables carry a significant risk premium that might change through time. In this vein, Ferson and Harvey (1991) found that the time varying nature of expected risk premiums accounts for a large part of stock returns predictability.

The second category – or non-neoclassical set – of transmission channels includes virtually everything else. Prominent among this category are imperfections in credit supply arising from government intervention, from institutional constraints on intermediaries and from balance sheet constraints of borrowers.

Naturally, the importance of these different transmission categories may change over time. For example, a “credit view” – which emphasizes some of the non-neoclassical factors – might highlight the impact of the depletion of bank capital and the decline in borrower net worth in explaining the weak response of the U.S. economy to low policy rates in the early 1990s. A neoclassical assessment of the 1998-2002 period might highlight the role of stock prices in driving investment and, to a lesser extent, consumption. Note that both categories of transmission channels allow for a loose link (or even for the loss of a link) between the setting of the policy tool – typically, the rate on interbank lending – and the behaviour of the economy. The financial conditions that matter for future economic activity are subject to shocks from sources other than policy, in addition to policy influences. In the two examples in the previous paragraph, these shocks would include changes in the net worth of lenders and borrowers, or in the relationship between asset prices and economic fundamentals.

The slope of the yield curve dominated early research on financial conditions indexes. Studies that appeared in the late 1980s and early 1990s proved that the yield curve carries predictive power over future economic activity (Estrella and Hardouvelis, 1991). Another important financial variable is the spread between the fed funds rate and 10-year Treasury yield that participates in Conference Board’s index of leading indicators since 1996. Among the leading indicators of output we can find credit risk, which is proxied by the commercial paper-Treasury bill spread. In a related study Gilchrist, Yankov, and Zakrajšek (2009) proposed improved credit risk spreads with good forecasting performance over the past decade. The superiority of yield curve over other financial variables as recession predictor is beyond any doubt, though stock market performance has been found by some to be a useful recession predictor as well (Estrella and Mishkin, 1996). Stock market variables have been included in indexes of leading indicators since the 1950s.

The Bank of Canada (BOC) pioneered work on broader financial condition measures in the mid-1990s, when it introduced its monetary conditions index (MCI). For the BOC, the exchange rate was the most important additional variable. Its MCI, therefore, consisted of a weighted average of its refinancing rate and the exchange rate.

Over the course of the late 1990s, MCIs along the lines constructed by BOC became a widely used tool to assess the stance of monetary policy in many countries. Moreover, the scope of variables augmenting the effects of policy rates was broadened to include long-term interest rates, equity prices, and even house prices (on the grounds that rising house prices increased the borrowing capacity of households). These broader measures became known as financial condition indexes (FCIs) in order to distinguish them from MCIs.
A variety of methodologies for constructing FCIs have been developed over time, and tend to fall into two broad categories: a weighted-sum approach and a principal-components approach. In the weighted-sum approach, the weights on each financial variable are generally assigned based on estimates of the relative impacts of changes in the variables on real GDP. These estimates or weights have been generated in a variety of ways, including simulations with large-scale macroeconomic models, vector autoregression (VAR) models, or reduced-form demand equations. The second broad approach is a principal components methodology, which extracts a common factor from a group of several financial variables. This common factor captures the greatest common variation in the variables and is either used as the FCI or is added to the central bank policy rate to make up the FCI (this latter method is a combination of the weighted-sum approach and the principal-components approach).

4.3.2 Forecasting models. What have we learned?

As stated above the core objective of Central Banks, international organizations and private investors is the forecast of Gross Domestic Product. Although, GDP (or the Business Cycle analysis) attracts the most of the interest in the forecasting exercises stock prices and indexes, interest and exchange rates and commodities are also in the centre. The proposed estimation methods for forecasting are in many cases the same regardless the subject to be forecasted, with the most of the differences to concentrate in the selection of the predictive variables and in the model specification. However, since the predictive performance of the models varies according to the series to be forecasted we will present the most prominent models for each case along with their predictive performance. Our main scope in this subsection is to expose the evolution of forecasting methods, abstracting from any unnecessary technicalities. Of course the list is not exhaustive; however we can grasp some ideas of where empirical research stands and how we can cope with it.

**Gross Domestic Product (GDP):** Many different types of multivariate models have been used in the literature, typically generalizations of the single-equation models. Large scale macroeconometric models that was introduced in ’70’s performed rather poorly and not better than single equation autoregressive models. In the ’80’s Vector Autoregressive models (VAR) were introduced that required only weak identifying assumptions relative to the large scale models previously used. At the same time, increased popularity gained the Dynamic Stochastic General Equilibrium (DSGE) models, which are based on the interaction of microfounded decisions. This lead to the use of new hybrid models that incorporate both DSGE and VAR models.

The general finding from the literature, as it is described in Chauvet and Potter (2012) is that the DSGE forecasts are slightly superior especially in the medium term (three and four quarters ahead) to the ones obtained from VARs and BVARs, but still not significantly different from simple benchmarks such as univariate autoregressive processes.

Another strand of models includes dynamic factor models, mixed frequency models, non-linear models and forecast combinations. Dynamic factor models provide the advantage of extracting large scale information in a parsimonious framework. Many studies reveal that dynamic factor models beat univariate and multivariate autoregressive models. Mixed frequency models explore information in more timely indicators that are available at a
higher frequency. Combined with dynamic factor models outperform relative to previous models. Forecast combinations (Timmerman, 2006) infer about forecasting predictions by estimating the correlation between forecast errors and the relative size of the forecast error variances of single models. Results show that best results can be obtained from combining a simple equal-weighted average of survey and model based forecast.

On the other hand, empirical research has shown than possible non-linearities in the dynamics of the economy could be quite important for forecasting. The class of non-linear models include an endless variety of models such that dynamic Probit models, Markov switching models, and threshold multivariate models. Non-linear models may reveal additional information and improve forecasts compared to frameworks that take into account only the average linear effect of one series on another. Combination of the above stated non-linear models show that the recession probabilities perform quite well in estimation with real-time databases and are successful tool in monitoring the business cycle. Finally, as it was analysed in the previous subsection the forecasting performance of the models can be further enhanced with the use of financial series. This result is confirmed across a number of countries (Stock and Watson, 2003).

**Exchange rates:** Exchange rate dynamics are very difficult to predict using economic models and a random walk with a drift model can provide in many cases the best available forecast. Reviewing the literature it seems that there is almost a consensus among researchers that linear specifications based on Taylor rule and net foreign assets fundamentals may provide more explanatory power than models that rely on traditional fundamentals such as interest rate, inflation, output, etc.

Rossi (2013), finds that, although some predictors (Taylor-rule fundamentals and net foreign assets) do exhibit some predictive power at short horizons, and others (monetary fundamentals, especially in panel models) reveal some predictive ability at long horizons, none of the predictors, models, or tests systematically find empirical support for superior exchange rate forecasting ability of a predictor for all models, countries and time periods: typically, when predictability appears, it does so occasionally for some countries and for short periods of time.

Regarding the model specification, in contrast to the Gross Domestic Product case, non-linear models seem to have the least successful predictive power. Among the linear models, the single-equation Error Correction Models (ECM) and the panel ECM models are the most successful at long horizons, although there is disagreement among researchers about the degree of robustness of the results. Typically, but not always, for single-equation linear models the predictor choice matters more than whether the researcher uses contemporaneous, realized or lagged fundamentals; the linear monetary model does not perform well at any horizons, whereas Taylor-rule fundamentals and net foreign assets are successful predictors at short-horizons. Models with time-varying parameters show some degree of success, although most of the favourable empirical evidence is based on studies in the late 1980s-early 1990s, and the most recent analyses report less success (although with slightly different specifications). Among the multivariate models, the most successful specification is the panel ECM, although there is some evidence in favour of BVARs, BMA and factor ECM models.
In later years it has been proposed an estimation method that is a combination of all available macroeconomic variables named “Kitchen sink”. This statistical analysis uses a number of suggested predictors using penalized least squares. Under this framework the estimated variance is lower than under OLS estimation method, delivering a higher degree of predictive accuracy (Li et al., 2015). Finally, a new class of predictive variables is combined by unstructured information from mined news articles. This new dataset increases the predictive power of existing models, providing correct insights about upcoming reversals of the currency movements.

Stock Market Indexes: Literature on stock market predictability is voluminous but still inconclusive. Once again it is highlighted that since the core objective of the Profit project is to strengthen financial awareness of the users and financial stability, we approach the forecasting exercise of the stock market index from the scope of economic analysis rather than from the viewpoint of a trader. Under this regard, the objective of the forecast model will be the prediction of the direction of excess stock returns.

Studies for the predictability of stock market returns couch their analysis on the so-called predictive linear regressions. In the context of predictive linear regressions stock market returns are usually regressed against the lagged values of a stochastic explanatory variable, for example, the lagged log dividend yield, the default spread, the term spread, the short term interest rate assuming constant coefficients.

However, predictive linear regressions have been in the epicentre of criticism that rests mainly on their poor performance in out-of-sample exercises. The comparison between predictive regressions with historical average returns and shows that historical average returns almost always outperform predictive regressions in terms of predictive power. In a related study, Campbell et al. (2008) concluded that the out of sample forecasting ability of predictive regressions can be substantially improved once we pose restrictions such as sign or quantitative on the coefficients and return forecasts of any theoretically motivated forecasting regression.

Models of stock market predictability have also received intense criticism that stems from the question of whether stock market investors could have exploited predictability to earn abnormal returns in real time. Studies attempted to provide an answer to this with the majority reaching evidence against profitability of trading rules built on stock market predictability. Generally speaking, studies (see inter alia Marquering and Verbeek, 2004) detected strong in-sample stock return predictability that is substantially weaker when out-of-sample predictability is under scrutiny. A significant number of studies point to model parameter instability or structural breaks which in turn might affect the validity of the forecasting (see inter alia Paye and Timmermann, 2006). Other studies (Henkel et al., 2011) reach the conclusion that predictability is a phenomenon whose strength is distinctively time-dependent.

A rather prolific strand of literature proposes alternative econometric methods for alleviating the bias and performing reliable inference. Parallel to the standard stock return predictability literature and its related econometric issues various studies have attempted to
offer a different avenue of research. To this end, an alternative method of forecasting stock market returns – the sum-of-the-parts method was proposed by Fereirra and Santa-Clara (2011). They decomposed the stock market return into three components – the dividend yield, the earnings growth rate, and the growth rate in the price-earnings ratio – and forecast each of these components separately. Their results pointed to the existence of significant predictability in equity returns. Forecasting the future direction of the market whether is a bull or bear has attracted the interest of academic research. For example, Chen (2009) found that the yield curve spreads and inflation were the most useful predictors of recessions in the US stock market in terms of both in-sample and out-of-sample forecasting performance. In a related study, Nyberg (2013) by employing a U.S. dataset, they concluded that bear and bull markets are predictable in and out of sample. More recently, Chava et al., (2015) analysed stock market predictability in US employing a novel economically-motivated measure of credit standards. Their results revealed that their survey-based measure was able to predict aggregate stock market returns especially in the post-1990 data period and at a business cycle frequency. Çakmakli, and van Dijk (2016) employing Factor-augmented predictive regression models detected significant stock market predictability for US. Another noteworthy finding of this study is the collapse of benchmark forecasting models during the 1990s.

An interesting approach was proposed by Hong et al. (2007) who examined the predictability of US stock market returns employing predictive regressions and various industry portfolio returns and standard predictive variables as regressors. Their analysis rests on two assumptions: information travel across asset markets slowly and many investors are not able to gather the information from the asset prices of markets that they are not familiar with. These two combined together might lead to cross-asset return predictability. Their results revealed significant forecasting ability of several industry portfolios by up to two months. Their analysis was extended to other eight international markets (United Kingdom, Australia, Canada, France, Germany, Japan, Netherlands and Switzerland) and their results were qualitatively the same as in the US.

4.3.3 A Brief Description of the Forecasting Estimation Methods in PROFIT

In this subsection we briefly present the methodology that we are going to use in order to forecast, the phase of the business cycle for the GDP in the Eurozone, the Eurostoxx 50 which is Europe’s leading Blue Chip Index for the Eurozone, the Eurodollar exchange rate and the oil price. This selection of predictions corresponds to the most widely used by Central Banks, International organizations and private funds. Of course the pallet of possible useful series to be forecasted converges to infinity, but conditional on the extreme amount of effort required for each forecast exercise we confine ourselves to the abovementioned series.

Regarding the proposed methodology for the forecasting of GDP and the Eurostoxx 50, we will employ a set of dynamic models following. More specifically, responding to the criticism and accounting for the non-linear nature of stock market returns most likely induced by the interplay amongst market participants, managers, and central banks, we opt for a novel, semi-parametric estimation method which helps deal more effectively with non-linearities or structural breaks in the data (Florackis et al., 2015). In the case of oil prices and exchange rate we will follow recent empirical literature using linear models.
As shown before existing studies in the literature differ considerably depending on the characteristics of their data. The selection of predictors can crucially affect the forecasting power of the model in use. Thus, in order to avoid any inconsistencies and biases stemming from the selection of the predictor series we will employ new methods in feature selection and component analysis. Doing so, we will be able to use the most of the information available by the data avoiding any problems from overestimating the model. Furthermore, following recent literature we will use additional information from unstructured text data, enhancing the predictive power of our forecasting models. More technical analysis and intuition for the data and methodology selection process will be provided within the deliverables D4.1 (Market Sentiment Models and Indicators) and D4.2 (Advanced Econometric and Machine Learning Forecasting) of Work Package 4 (WP4 - Market Sentiment-based Financial Forecasting).

### 4.3.4 Forecasting Estimates

In this subsection we present sources of economic forecasts for the member countries of European Union provided by the European Commission, the International Monetary Fund, the European Central Bank and the Organization of Economic Cooperation and Development.

AMECO (European Commission - Economic and Financial Affairs: DG ECFIN's economic forecasts concentrate on the EU, its individual member states, and the euro area but also include outlooks for some of the world's other major economies, and countries that are candidates for EU membership. The forecasts extend over a time horizon of at least two years and cover about 180 variables. The forecasts are not based on a centralised econometric model, but are analyses made by DG ECFIN country desks, using models and expert knowledge. Consistency is ensured by a number of cross-country and cross-variable checks. Forecasts for the EU and the euro area are created by aggregating the data of the individual member states.

DG ECFIN's forecasts are published three times a year in sync with the EU's annual cycle of economic surveillance procedures, known as the European Semester. Prior to the adoption of these procedures in the autumn of 2012, two fully-fledged forecasts and two interim forecasts were published each year.

IMF (World Economic Outlook Database): The World Economic Outlook (WEO) database contains selected macroeconomic data series from the statistical appendix of the World Economic Outlook report, which presents the IMF staff's analysis and projections of economic developments at the global level, in major country groups and in many individual countries. The WEO is released in April and September/October each year.

OECD (Economic outlook, Analysis and Forecasts): The OECD's forecasts combine expert judgement with a variety of existing and new information relevant to current and prospective developments. These include revised policy settings, recent statistical outturns and conjunctural indicators, combined with analyses based on specific economic and statistical models and analytical techniques, as outlined below.
OECD (Composite Leading Indicator): Leading indicators comprise the composite leading indicator (CLI) and standardised business and consumer confidence indicators. They provide qualitative information useful for monitoring the current economic situation and advance warning of turning points in economic activity.

European Central Bank (Macroeconomic Projections): The macroeconomic projections cover the outlook for the euro area, in particular with regard to GDP and inflation. The projections are published four times a year: in March and September, when they are produced by ECB staff members; in June and December, when they are produced jointly by euro area national central banks and ECB staff members.

4.4 Financial and econometric forecasting in PROFIT

Prediction of economic and financial variables is a very difficult course as it includes various complications. The researcher needs to answer to many questions regarding the predictors that should use, the forecast horizon, the model to be employed, the data frequency and so forth. Many authors conjectured that sampling error, model misspecification and instabilities could potentially explain the poor forecasting performance of the economic models.

Thus, the core objective of this deliverable and mostly of Work Package 4 (WP4 - WP4 - Market Sentiment-based Financial Forecasting) is to provide a reliable overview of established findings that can be helpful to build models with the best available forecasting ability. It seems from the discussion in the previous sections that recent development in the way that we analyse bid data sets can provide an advantage of the forecasting performance of newly constructed models relative to the recent past.

To this end, within PROFIT we aim at extracting information first by new unstructured data sets and secondly by employing a larger set of predictive variables. By these means, we will be able to solve problems of selection bias. On top of that, we will make use of new methods in non-parametric analysis in order to avoid to the extent that it is feasible any problems arising from specification errors.

The new captured information will refer to the prevailing sentiment on the financial market. It is well understood by now that the predictive power of sentiment is pronounced in forecasting economic and financial variables. However as sentiment is still regarded as an amorphous concept without a reliable measure of it there is plenty of room in developing new proxies. In this vein, during the project we will develop new measures of sentiment analysis both in terms of concept and also in terms of methodology. The first refers to the development of a new composite index of sentiment analysis combining information from various financial markets. All this information is valuable to the investors, households, and policymakers in forming expectations for upcoming realizations, and subsequently make the more appropriate economic decisions.
5 Financial Linked Open Data

5.1 Linked Open Data (LOD)

Linked (Open) Data (Auer et. al, 2013), (Heath and Bizer, 2011), (Borrower and Kaltenböck, 2011) is an emerging concept for publishing structured data on the Web as interlinked RDF graphs. It is based on basic principles such as: (i) use HTTP URIs to name things, (ii) return RDF about those things when their URIs are looked up, and (iii) include links to related RDF documents elsewhere on the Web. The differences between Open Data and Linked Open Data are best described by 5 Stars Model introduced by Sir Tim Berners-Lee in 2010\(^7\) where LOD comes into play for 4 and 5 stars of the model:

<table>
<thead>
<tr>
<th>Star</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 star</td>
<td>Information is available on the Web (any format) under an open license</td>
</tr>
<tr>
<td>2 stars</td>
<td>Information is available as structured data (e.g. Excel instead of an image scan of a table)</td>
</tr>
<tr>
<td>3 stars</td>
<td>Non-proprietary formats are used (e.g. CSV instead of Excel)</td>
</tr>
<tr>
<td>4 stars</td>
<td>URI identification is used so that people can point at individual data</td>
</tr>
<tr>
<td>5 stars</td>
<td>Data is linked to other data to provide context</td>
</tr>
</tbody>
</table>

One can benefit from Linked Data technology as a publisher of data and as a consumer. For example, as a consumer of 5 stars open data one would be able to link and bookmark particular pieces of data as well as discover new data of interest while consuming other information. As a publisher with 5 stars data one increases the visibility and the value of the data and at the same time enables fine-granular control over the data\(^8\).

In addition to providing guidelines for publishing and consuming data on the Web and interlinking data just like Web pages, Linked Data is also emerging as a promising Data Integration and Data Interchange paradigm as well as this Semantic Web provides comprehensive mechanisms for complex querying and reasoning.

The growing adoption of these principles, as well as the increasingly common practice of embedding metadata into HTML pages (such as promoted by schema.org), have led to a vast volume of RDF data being made openly available online, contributing to what is often called the “LOD Cloud”\(^9\). Huge amounts of data containing millions of individual instances and relations between them are now openly available on the web. The English version of DBpédia\(^10\), which is the machine-readable semantic web version of Wikipedia, contains over 4.5 million of different things.

\(^7\) dwcs.w3.org/hg/gld/raw-file/default/glossary/index.html#linked-open-data  
\(^8\) 5stardata.info/en/  
\(^9\) lod-cloud.net  
\(^10\) wiki.dbpedia.org
5.2 Available Vocabularies

Controlled vocabularies offer a way to standardize the data representation and, therefore, easy the consumption of the data. In the controlled vocabularies main classes and predicates are defined. Among the most widely known and used controlled vocabularies are Simple Knowledge Organization System (SKOS)\textsuperscript{11} and Web Ontology Language (OWL)\textsuperscript{12}. The SKOS describes the constructs to constitute thesauri and OWL is the semantic web language for describing ontologies. Besides such general controlled vocabularies, domain specific vocabularies are often developed. In this chapter some thesauri and ontologies related to financial LOD are listed.

First it is necessary to understand how complex the needed ontologies (the complexity of thesauri is fixed) could be. The experts from Tecnología, Información y Finanzas (TIF) (Castells et al., 2004) have identified that the Resource Description Framework / RDF (with its model of representing data as triples) should be enough. The transitive closure of subPropertyOf and subClassOf relations from OWL, the domain and range entailments of properties, and the implications of subPropertyOf and subClassOf, were the only inference mechanisms used by TIF. The project team has created an ontology, however, all the elements of the ontology are described in Spanish. No multilingualism support has been considered, as the business activities of TIF are mainly focused on the Spanish market.

5.2.1 Abbreviations

FIBO\textsuperscript{13} is a modularized formal model of the concepts represented by finance industry terms as used in official financial organization documents such as contracts, product/service specifications and governance and regulatory compliance documents. This is referred to as a Business Conceptual Model as distinct from models or descriptions of data or IT implementations. The scope of finance industry encompasses a broad range of organizations that manage money, including credit unions, banks, credit card companies, insurance companies, consumer finance companies, stock brokerages, investment funds and some government sponsored enterprises. This particular specification defines the Foundations module of FIBO: a set of business concepts which are intended to support the financial industry terms semantics presented in other FIBO specifications. Foundations is itself segmented into a number of models or ontologies. The FIBO Foundations models define general concepts that are not unique to the financial industry, but needed to help define the financial concepts. FIBO Foundations therefore includes a number of basic legal, contractual and organizational concepts, among others. Concepts which are available in other industry standards are not included, but in some cases a “Proxy” concept is included for reference, for example for address and country concepts. The rationale for including these is two-fold:

- Concepts in the financial industry are generally specializations of more general, non-financial concepts such as contracts, commitments, transactions, organizations and so on, These are included in FIBO Foundations so that specializations of them may be defined in other FIBO specifications;

\textsuperscript{11}https://en.wikipedia.org/wiki/Simple_Knowledge_Organization_System
\textsuperscript{12}https://en.wikipedia.org/wiki/Web_Ontology_Language
\textsuperscript{13}edmcountry.org/financialbusiness
● Properties of financial industry concepts frequently need to be framed in terms of relationships to non-financial concepts such as countries, jurisdictions, addresses and the like. These are included in FIBO Foundations so that properties in other FIBO specifications may make reference to them.

One of the key benefits of FIBO with respect to data, message or reasoning meta-models is that it can provide a semantic anchor firmly rooted in the concepts as understood and used by people in the finance industry. FIBO enables the creation of logical data models such that those logical models derive their formal semantics from FIBO. FIBO supports the derivation of ontologies to support semantic reasoning and querying applications. Since FIBO itself is framed using the formal constructs of the OWL language, such operational ontologies may be derived directly from the FIBO conceptual ontologies, with adaptation as necessary to support any application specific constraints. FIBO allows disambiguation of new and existing regulation. To the extent that regulatory requirements reference the formal concepts in FIBO, terms referred to in these regulatory requirements, or in reports that are mandated, would be semantically unambiguous.

One important goal of FIBO is for the formal business definitions to be used in legal documents such as contracts, terms and conditions of sales and payment, IP protection, compliance reports; and to underpin less formal language used in advertising and customer-facing websites. The business terms and definitions in this specification may be used as a reference model to which firms would tie their own proprietary models (semantic models or ontologies); and also as a catalogue for all of the relevant data models.

FIBO is managed as a collaborative effort among financial institutions and vendors to precisely define the terms and characteristics of financial instruments, business entities, pricing and financial processes. FIBO is managed by the members of the EDM Council via the FIBO Content team (FCT) process. Content teams are formed to perform an in-depth evaluation of a FIBO domain. FCTs are operational for Equities, Loans, Indices/Indicators, FIBO-Foundations, Business Entities, FIBO processes and vendor testing.

5.2.2 STW Thesaurus for Economics

STW Thesaurus\textsuperscript{14} for Economics is a controlled, structured vocabulary for subject indexing and retrieval of economics literature. The vocabulary covers all economics-related subject areas and, on a broader level, the most important related subjects (e.g. social sciences). In total, STW contains about 6,000 descriptors (keywords) and about 20,000 non-descriptors (search terms). All descriptors are bi-lingual, German and English. STW helps users to search the ZBW catalogue ECONIS with the most suitable terms, because the holdings are indexed with its descriptors. Having been developed as a general indexing and retrieval tool for economics publications, STW can be used by other organisations for indexing their own materials. Details for use are given on the STW online homepage.

The STW thesaurus consists of seven main subject groups:

A  General Descriptors
B  Business Economics

\textsuperscript{14}zbw.eu/stw/version/latest/about
[A] contains a list of general terms. These terms do not belong to any special subject areas and therefore possess only little information value when used alone. The subject groupings of parts [B] und [V] follow the usual subject fields in national and international research. The descriptor groupings of parts [P] und [W] are mostly taken from the current commodity and sector classifications of Statistisches Bundesamt. The geographic sections of part [G] reflect the continental subdivisions, starting with Europe.

Exclusive responsibility for the continuous maintenance of the STW lies with ZBW. A regular editorial team verifies and decides on changes and updates concerning vocabulary and thesaurus structure. Proposals by indexers and the current professional discussion are taken as sources for changes to be made. The STW master file has been implemented into a thesaurus maintenance tool based on an in-house development. The consistent maintenance and revision is assured by carrying out plausibility checks and removing duplicate terms. Each descriptor is given an ID-number, which serves as a unique and inalterable key.

5.2.3 European Skills, Competences, Qualifications and Occupations (ESCO)

ESCO\(^{15}\) is the multilingual classification of European Skills, Competences, Qualifications and Occupations. ESCO is part of the Europe 2020 strategy. The Commission services launched the project in 2010 with an open stakeholder consultation. DG Employment, Social Affairs and Inclusion – supported by the European Centre for the Development of Vocational Training Cedefop – coordinate the development of ESCO. Stakeholders are closely involved in the development and dissemination of ESCO.

The ESCO classification identifies and categorises skills, competences, qualifications and occupations relevant for the EU labour market and education and training. It systematically shows the relationships between the different concepts. ESCO has been developed in an open IT format, is available for use free of charge by everyone and can be accessed via the ESCO portal.

The first version of ESCO was published on 23 October 2013. This release marks the beginning of the pilot and testing phase, including the ESCO mapping pilot. Until end of 2016 the classification will be completely revised. The final product will be launched as ESCO v1.

ESCO is structured in three pillars: occupations; skills and competences; qualifications. All three pillars are structured hierarchically and interrelated with each other. The ESCO occupations pillar contains occupation groups and occupations. The skills and competences pillar contains skills, competences, knowledge as well as skills and competence group concepts. The qualifications pillar contains qualification groups and qualifications. The

\(^{15}\) ec.europa.eu/esco/portal/escopedia
hierarchically structured qualification groups are based on the ISCED Fields of Education and Training 2013\textsuperscript{16}.

DG Employment, Social Affairs and Inclusion – supported by the European Centre for the Development of Vocational Training (Cedefop) and by external stakeholders – coordinates the development of ESCO. Shaping ESCO into an up-to-date, practical tool can only be done from the bottom up, through the active involvement of people from the education and training sector as well as from the labour market. Stakeholders contributing to the development of the classification include:

- employers' organisations
- trade unions
- employment services
- education institutions
- training organisations
- statistical organisations
- European and national sector skills councils and networks

5.2.4  EuroVoc

EuroVoc\textsuperscript{17} is a multilingual thesaurus, which was originally built up specifically for processing the documentary information of the EU institutions. It is a multi-disciplinary thesaurus covering fields, which are sufficiently wide-ranging to encompass both Community and national points of view, with a certain emphasis on parliamentary activities. EuroVoc is a controlled set of vocabulary, which can be used outside the EU institutions, particularly by parliaments.

The aim of the thesaurus is to provide the information management and dissemination services with a coherent indexing tool for the effective management of their documentary resources and to enable users to carry out documentary searches using controlled vocabulary.

The EuroVoc thesaurus covers all the activity fields of the European Union institutions:

- Politics
- International relations
- European communities
- Law
- Economics
- Trade
- Finance
- Social questions
- Education and communications
- Science


\textsuperscript{17} http://eurovoc.europa.eu/drupal/?q=abouteurovoc&cl=en
Some fields are more highly developed than others because they are more closely related to the EU’s centres of interest. Thus, for example, the names of the regions of each EU Member State are in EuroVoc but not those of third countries. The grouping of descriptors into fields is to a certain extent arbitrary. One of EuroVoc’s distinctive features is the limitation of polyhierarchy. Descriptors which could fit into two or more subject fields are thus generally assigned only to the field which seems the most natural for users, in order to facilitate the management of the thesaurus and limit its volume.

The EuroVoc thesaurus is adapted continually to take account of developments in the fields in which the European Union institutions are active and of changes in its language arrangements. The maintenance team at the Publications Office collects and examines the proposals, put forward by the national parliaments, the European institutions or agencies and the private users. A maintenance system has been established to deal with the administration and maintenance of the thesaurus. The maintenance team coordinates the work of the Maintenance Committee and is responsible for IT and technical developments and for monitoring translations; The Maintenance Committee made up of representatives of the various EU institutions, votes on the various proposals and decides on the amendments to be made to the thesaurus; The Steering Committee supervises the project and officially adopts each new version.

5.3 Available Financial Linked Open Data Resources

There is a high public demand to increase transparency in government spending. Open spending data has the power to reduce corruption by increasing accountability and strengthens democracy because voters can make better informed decisions. An informed and trusting public also strengthens the government itself because it is more likely to commit to large projects (Höffner, Martin and Lehmann, 2015). Following these ideas the initiatives of European Commission\(^\text{18}\) have encouraged the emergence of large amounts of public sector data to become freely available for use and redistribution without restriction. The EU has also mandated that collected financial, economic and legal data sets be made available as Open Data for integration and innovative reuse within new products and services\(^\text{19}\).

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The open financial data, like the data published by Eurostat\(^{20}\) (EU), the World Bank\(^{21}\), and International Monetary Fund\(^{22}\), could potentially be exploited in order to build advanced information portals for the financial sector (O’Riain, Curry and Harth, 2012). Further examples include, for example, OpenTED\(^{23}\), an initiative that provides data dumps of tenders from the joint European procurement system more easily accessible to journalists and researchers. However, since the beginnings, nearly all of the open data initiatives around the globe suffer from relatively low usage of their produced data. Existing projects are basically act as e-catalogs of data that are fragmented in topic, place and time since they do not share common standards and methodologies. In cases where open data exist, the basic obstacle is the fact that there are not even common practices for representing the main actors (e.g. payers and payees) and the type of payments. Therefore, it is impossible to interlink the available data in meaningful ways and support services and decision-making (Vafopoulos et al., 2016)

Financial data is hardly valuable in pieces, without having clear relations to the overall picture. As Hatsu Kim, VP Global Fundamentals Thomson Reuters, noted “when it comes to valuing companies, quarterly and yearly filings are insufficient in information terms and have to be considered together with information on markets and exchange rates”\(^{24}\). When it comes to corporate data, analysts and investors constructing detailed insight into an organisation develop their understanding through examination of a diverse range of business and financial information. Performing an analysis can require information varying from operational figures, new product announcements, risk exposure, sector spend, independent analysis and customer sentiment. The source of this information includes internal reports, social platforms, marketing briefs, regulatory filings, analyst reports, press releases, government statistics and third party information providers. Information professionals face the difficulty of how to achieve faster and more accurate analysis across these disparate financial information sources that present and behave as islands of information. It is clearly necessary to have a more holistic view on the financial data. However, low quality and multilevel data fragmentation raise barriers in interconnecting, analysing and inferencing from multiple data sources. For instance, budget and spending classifications are incompatible even within a single organization or country and there is not a standard method for representing company names and activities (Vafopoulos et al., 2016).

5.3.1 Budgets and Spending Data

Several countries publish their financial data, budget documents, and reports in open access. Notable examples include USA\(^{25}\), Brazil\(^{26}\), Korea\(^{27}\), France\(^{28}\). Clearspending\(^{29}\) is a Sunlight

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\(^{20}\) http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/
\(^{21}\) http://data.worldbank.org/data-catalog
\(^{23}\) http://ted.openspending.org/
\(^{25}\) usaspending.gov
\(^{26}\) portaldatransparencia.gov.br
\(^{27}\) eng.openfiscaldata.go.kr
Foundation’s project that analyses the spending data uploaded in the official portal of US government. In some countries there are civil initiatives that serve the purpose of collecting spending data, e.g. in Russia. In the field of open budgets, the International Budget Partnership (IBP) advocates for public access to accountable budget systems. One of its projects, the Open Budget Survey Tracker (OBS Tracker) allows citizens to monitor whether central governments are releasing the requisite information on how the government is managing public finances. Although the information about reports is linked to country’s profiles and can be tracked over different years, the OBS Tracker only monitors the fact of publishing the reports, not the information contained in the reports. Complemented by the Open Budget Index (OBI) issued every two years, and the Open Budget Survey the partnership offer a comprehensive stack of tools and reports to monitor the openness of state budgets. Moreover, IBP offer an interactive inflation guide. The guide may be used to explain the basics of inflation, different types of inflation, price levels, nominal versus real prices, and how to do various calculations using inflation. However, the data about spending even if provided by the government is usually not linked.

Starting from 2015, EU funds the OpenBudgets project to provide a scalable platform for public administrations to publish open budget data that is easy-to-use, flexible, and attractive for all. The goal of OpenBudgets is to provide its users with easy to use tools for comparative analysis and data mining. Different tools will be built to perform temporal, spatial, and administrative comparative analysis and data mining operations. The visualisation service contributes to the analysis and presentation of the data by providing off the shelf visualization tools on the platform. The intention of the project is to collect the “flat” Open Data for the governmental portals and to link it using LOD cloud. These new semantic resources are then processed further. Cleaning up of data in resources is required since the uploaded budget data usually contains inconsistencies and/or non-optimal states (e.g. duplications and contradictions). Moreover, the data will be enriched by linking them to other related semantic resources (in the created knowledge base and LOD Cloud). As of now (April 2016) no results from OpenBudgets are available yet. No reports are available in Work Package 2 (WP2 - Linked Data Life Cycle) that deals with data linking. Only some results on the linking of the vocabularies are reported.

OpenSpending website offers an easy system to upload, explore and share public finance data (e.g. budgets or expenditure databases). It aims to track and analyse public spending worldwide and, at April 2016, contains more than 28 million financial entries in more than 1100 datasets. Datasets can be submitted and modified by anyone but they have to pass a sanity check from the OpenSpending Data Team, which also cleans the data before publishing. OpenSpending hosts transactional as well as budgetary data with a focus on government finance. It contains this data in structured form stored in database tables and

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28 data.gouv.fr
29 sunlightfoundation.com/clearspending/
30 clearspending.ru
31 obstracker.org
33 openbudgets.eu
34 openbudgets.eu/about/technical-structure
35 openbudgets.eu/assets/deliverables/D1.8.pdf
36 openspending.org
provides searching and filtering as well as visualizations and a JSON REST interface. The data sets differ in granularity and type of accompanying information, but they share the same meta model. The system offers functionality for explorative analysis as well as for visualization of the data. The data is open for use for any purposes (non-profit and for-profit)\(^{37}\). New datasets are frequently added. There are properties with the same name in different data sets where it is unknown if they specify the same property (Höffner, Martin and Lehmann, 2015).

In order to correlate the new datasets and the properties LinkedSpending\(^{38}\) link the data from OpenSpending using semantic web principles. LinkedSpending follows the RDF Data Cube\(^{39}\) recommendation to make heavy use of the SDMX model for measures, attributes and dimensions. The data sets are very heterogeneous but there are some properties, which are commonly specified and thus modelled with established vocabularies. The year and date, a data set and an observation refers to, respectively, is expressed by sdmx-dimension:refPeriod and XSD. Currencies are taken from DBpedia and countries are represented using the vocabulary of LinkedGeoData\(^{40}\), a hub for spatial linked data. Some amount of data is imported from LinkedGeoData countries and DBpedia currencies. Because of the limited number of countries and currencies, and properties values imported per country and currency, the amount of data is too small to consider federated querying. As most countries and currencies are stable in the medium term, this data needs to be updated only infrequently.

The linking of entities, properties, and attributes is done mostly automatically based on the string comparison, i.e. if the names of two entities are the same and it is not explicitly stated that the entities are different then it is assumed that they are the same. In other words, properties with the same name in different data sets not having a mapping entry that states otherwise are assumed to represent the same concept and thus given the same URL. As noted in the paper, there is a possibility of mismatch, however, such a mismatch has not been spotted yet. If necessary, improving the automatic matching is part of future work (Höffner, Martin and Lehmann, 2015) Interlinking of entities is basically done using the same entity and not using owl:sameAs. The data conversion process is controlled by a web application, which constantly checks for added and modified data sets from OpenSpending, which are automatically queued for conversion but can also be manually managed. Updates don’t interrupt the accessibility of the SPARQL endpoint and the services building on it.

The PublicSpending\(^{41}\) project was the first attempt to harvest, align, interlink, analyze and distribute as Linked Open Data massive amounts of public spending data from seven (local and national) governments. In the project consortium proceeded as follows. Each dataset is subject to preprocessing and data preparation. Even though the data is open, there is no homogeneity in the information the datasets carry, not only across domains (e.g. Greece vs. Australia), but also within the same domain (e.g. data published by different departments in the UK). Because of the heterogeneity of the descriptions across datasets, minimum sets of

\(^{37}\) community.openspending.org/about/

\(^{38}\) linkedspending.aksw.org

\(^{39}\) https://www.w3.org/TR/vocab-data-cube/

\(^{40}\) linkedgeodata.org

\(^{41}\) www.publicspending.net
characteristics have been identified and universally applied in order to provide a common denomination of the data model.

The basic concepts in the public spending domain are the payment and its participants along with their metadata. Payments are given URIs based on their unique identifiers, but the URIs themselves indicate the domain of origin. The European Union has established the use of the Common Procurement Vocabulary 2008 (CPV) as mandatory for all public procurement notices according to the Regulation (EC) Nº 2195/2002 of the European Parliament. In order to create a comparison of the contracts object published by different public administrations a hub classification must be used to unify those descriptions. The CPV has been selected as a hub classification. Some links from international product mappings to CPV were available as LOD, the rest of them have been created applying custom NLP techniques to link a description of a product/service to a CPV concept.

Payers and payees are described using some form of unique identification in order to generate URIs, depending on the data origin, as well as their names. A variety of errors can be found such as misspelling errors, same company under different names, use of different kind of acronyms, etc. For example a company such as “Oracle”, “Accenture” or “Capgemini” can be found under different name conventions: “Oracle Aust.”, “Oracle University”, “Oracle Corporatio (Aust) Pty Ltd”, “Oracle Corp Aust P/L”, “Accenture”, “Accenture Australia” and “CAP Gemini” among others. In the Semantic Web area and more specifically in the LOD initiative one of the principles lies in providing a real unique identification of resources through URIs. Thus reconciliation techniques coming from the ontology mapping and alignment areas or algorithms based on Natural Language Processing have been designed to link similar resources already available in different vocabularies, datasets or databases. A context-aware method based on NLP techniques has been designed, customized and implemented trying to exploit the naming convention of the dataset. The technique to generate a unique name before performing the reconciliation process is a stepwise method, in which each step performs a filter over the string literal trying to remove all unnecessary words in the name to finally use an iterative process of string comparison and grouping to generate a unique and relevant name for the input dataset.

After preparing the data, RDF models were created using the publicspending.gr ontology as well as other widely used vocabularies such as Dublin Core and FOAF. The resulting RDF models were then serialized in RDF/XML form and uploaded to the Virtuoso Quad Store held in publicspending.gr. For each domain of interest the data is stored in a dedicated named graph. This procedure created seven named graphs that cover spending data for Greece, the US, the UK, Australia, the city of Chicago and the states of Alaska and Massachusetts. In total there were identified 87,629,622 triples and 1,466,520,742,920 Euros of payments. The different named graphs are interlinked in two different levels: (i) on the conceptual model level they use the same vocabularies, and (ii) on the data model through the use of CPV codes and aggregations of companies from different datasets. This makes the superset open to comparisons and analysis across domains.

5.3.2 Corporate Reports

So far most of the financial open data is related to companies’ reports. The eXtensible Business Reporting Language (XBRL) standardises financial reporting with a machine-
interpretable format that makes corporate reports easier to consume and integrate. The XBRL standard is an XML format and is therefore more amenable to automatic processing than traditional financial information representations such as PDF, HTML and text documents. However, XBRL-based information sources only provide part of the picture, and many other data sources are used in conjunction with XBRL. Within the wider global financial and business information ecosystem of corporate press releases, government statistics, market press coverage and third party information providers, XBRL data repositories represents yet another data silo in a global landscape of disconnected silos. In order to consume the data the users could find useful several analyses:

- Background information analysis, e.g., looking at company information from different sources such as the address, the founding date and the industry.
- Multi-company KPI analysis, e.g., comparing KPIs over time for several companies such as the stock market price for companies from the same industry.
- Cross-data-sources KPI analysis, e.g., comparing values from heterogeneous datasets such as the Earnings per Share from yearly balance sheets with prices per share from electronic stock quotes as well as Total Assets published using the US-GAAP version 2009 and version 2011.

Combining XBRL with the plethora of non-XBRL financial information remains at an early stage of realisation. Significant efforts are required on the part of financial information consumers to integrate XBRL data with other data expressed in a wide variety of data formats.

- Automatically deriving information from XBRL is difficult since formal semantics are limited (M. Spies, 2010). Relationships between financial concepts, such as “SalesRevenueNet” and “Revenues” in the U.S. Generally Accepted Accounting Principles (US-GAAP), are only textually described.
- Financial information from different XBRL documents often cannot be compared since accounting and regulatory organisations do not align their taxonomies of financial concepts; new versions, e.g., of US-GAAP, lack backward compatibility; and XBRL allows publishers to define their own concepts.
- Gathering information about a company is difficult since there are no unique company identifiers across different reporting sources and relationships between companies are obscure.
- Other finance-related Open Data such as stock quotes and background information are published using different data models (Kämpgen et al., 2014).

Next, we review several projects that tackle some of the abovementioned issues.

In FLORA project (Razmiski et al., 2012) authors consider the problem of fostering the transparent access to financial data through its dataset developed from extraction and triplification of the data contained in the financial statements of companies registered on U.S. Securities and Exchange Commission (SEC)42 through filings and forms stored on sec.gov
EDGAR\textsuperscript{43} System and furthermore allowing an easy combination of many information sources. Moreover authors aim at increasing the FLORA functionality through the use of frameworks for discovering relationships between companies contained on FLORA dataset and data items within different Linked Data sources, i.e. linking of entities. Hence, in the project a complex, unified process of transforming unstructured financial data into an interlinked, navigable knowledge base for financial information management and information discovery within the Web of data was designed and implemented.

The transformation and generation process of FLORA dataset consists in investigating appropriate data sources that are rich in financial information: balance sheets, cash flows, and income statements from companies. As of 2012 authors have generated a dataset that stores RDF triples generated from the extraction of 409.374 financial statements, which have been published in XBRL format by different U.S. companies through the EDGAR system fillings.

As external dataset authors have chosen DBpedia. Authors approached the task of linking 8915 companies to their DBpedia entries with different linguistic techniques. The task was approached using the techniques of string comparison. The best results were achieved after eliminating stopwords and allowing Levenshtein distance to vary between 0 and 1. With these settings it was possible to discover 3652 links.

The experiment, however, shows that the coverage of the financial domain is rather small. The lack of data that could be used to univocally identify company concepts (such as CIK or ticker symbol) makes dataset interlinking still a difficult task requiring various techniques for disambiguation and manual verification.

In the Financial Information Observation System (FIOS) (Kämpgen et al., 2014) authors model the XBRL data using the RDF Data Cube Vocabulary. This is done in order to achieve the requirement identified in the paper, namely, to enable the user to browse the data ("overview first, zoom-in, details on demand") and create his own analyses if possible with Excel-like functionality. Moreover, the system should be able to easy process and store new data.

The data was taken from different sources such as DBpedia, EDGAR, and Yahoo! Finance\textsuperscript{44}. All pieces of data was uniquely identified. Every XBRL instance and taxonomy was modelled as a multidimensional dataset, i.e., collection of facts with independent dimension variables and dependent measure variables, using a well-adopted Linked Data vocabulary, the RDF Data Cube Vocabulary. Similarly, stock quotes from Yahoo! Finance can be modelled using Data Cube Vocabulary: every daily collection of values is a dataset, every stock quote contains as dimensions the company, the date the value is valid and the stock quote type such as price at stock market opening (Open).

On the next step it is necessary to link the different entities. Whereas time periods can easily be matched by comparing canonical representations of time, for linking between different

\textsuperscript{43} sec.gov/edgar/searchedgar/companysearch.html
\textsuperscript{44} finance.yahoo.com
URI for companies and financial concepts across data sources mappings need to be available. Entities or properties in RDF can explicitly be stated as equivalent via relationships between their URIs.

To model finance related metadata, e.g., about companies and industries, we use widely-adopted Linked Data vocabularies, e.g., FOAF and the DBpedia ontology. The industry of a company can be represented using SKOS classification in FIOS hierarchies, e.g., the SEC provides for companies the Standard Industrial Classification (SIC) hierarchy, e.g., SIC concept “SERVICES-BUSINESS SERVICES, NEC” skos:narrower “MASTERCARD INC”.

The Semantic XBRL project\(^{45}\) aims at triplification of the XBRL data. Semantic XBRL is a repository that contains semantic data generated from the data submitted by participants in the XBRL Program EDGAR promoted by the U.S Securities and Exchange Commission (SEC). Semantic data is generated by translating XBRL XML to RDF following the XML Semantics Reuse Methodology, which is implemented by the ReDeFer tools. First, there is the XSD2OWL translation, which generates XBRL OWL ontologies from the XBRL XML Schemas. Then XML2RDF, which translate XBRL XML instances to RDF taking into account the XBRL OWL ontologies. The difference between FIOS and the Semantic XBRL is that the latter ties RDF representations of XBRL close to the original XML data which make mixing with other data sources difficult.

In the field of company data, OpenCorporates\(^{46}\) aggregates company information from different countries and jurisdictions. The opencorporates.com team is working on creating Linked Data representations out of their databases, by mapping company metadata to certified ontologies such as the Core Business Vocabulary and linking them to other data hubs, such as DBpedia.org and Geonames. Financial statements and accounting reports that are published by companies contain important data.

In the area of products, Open Product Data\(^{47}\) has been initiated by Philippe Plagnol (now is hosted by OKF as a community project) as a public database of product data connected to barcodes in order to empower consumers with useful and machine-readable product information (e.g. price).

The Thomson Reuters Permanent Identifier or PermiD\(^{48}\) is a machine readable, 64 bit number used to create a unique reference - which will never change over time - to a piece of information. Thomson Reuters has been using the PermiD company-wide to improve internal data federation. A subset of PermiIDs is available through an open license on the permid site. This provides significant and no-cost access to available Thomson Reuters-linked data. Thomson Reuters promise to continue to update, build and administer our PermiIDs.

\(^{45}\) rhizomik.net/semanticxbrl/html/
\(^{46}\) opencorporates.com
\(^{47}\) product.okfn.org
\(^{48}\) permid.org
5.4 Financial-specific LOD and the PROFIT advances

In this section, we have analysed the advantages of linked (open) data over the data that is not linked. Besides general advantages such as extensibility and reusability there are some features that are specific to the financial field, the main being that the financial and economic data only makes sense when put into the global context.

Several available controlled vocabularies were identified and described during this study whereby some of them are also available as Linked Open Data and can be used. They cover pretty large variety of different topics and constitute a solid baseline for further development. On the next phases of the project the described vocabularies may be complemented by further ontologies and thesauri that cover other areas related to the project (for example, description of educational materials). The already identified controlled vocabularies will be extended themselves if the need for this will be identified. The controlled vocabularies lay a grounding for linking and integrating the data into the data cloud of the project. Moreover, they add a semantic layer for the data facilitating the better understanding of the data and matching the data with the user profiles.

An overview of the existing approaches to linking the financial data reveals that the main obstacle to the consumption of the published financial data is the linking of the entities. Within PROFIT, we will address this obstacle by performing the higher level linking together with the analysis of the trends and the market sentiment in the financial field.
6 Conclusions

This deliverable is regarded as an initial sketch for the roadmap to be followed by PROFIT. Overall, it discussed the current advances in the area of financial literacy, financial and econometric forecasting and open linked data for supporting financial decision-making, and attempted to shed light to the advances to be introduced by the PROFIT platform in the area of financial decision making and awareness, namely

a) Novel financial education toolkits;
b) Novel financial forecasting models incorporating notions of market sentiment to identify market trends and threats;
c) Advanced crowd-sourcing tools based on semantic technologies to process financial data, extract and present collective knowledge;
d) Incorporation of linked data principles towards developing and establishing a methodology for a data lifecycle.

The state-of-the-art sections of this report included overviews of methods, tools and fields of science relevant to the PROFIT project. More, elaborative reviews and analyses will be performed in the respective deliverables of each unique research and development pillar of PROFIT.

Regarding the structure, this deliverable was divided into three main parts. The first part reviewed the most popular financial awareness platforms that are available online and provided an overview of the services supported by them.

The second part of the document focused on the two main scientific pillars of the PROFIT project, namely the financial literacy and financial forecasting components. Initially, the second part reviewed the best current practices in the academic and professional agenda on financial literacy as well as the currently available financial literacy tools and toolkits. Subsequently, it described the main market sentiment indicators used in the empirical research and how these indexes are extracted using sentiment analysis techniques. Finally, it reviewed the most prominent models used to forecast well-known economic indicators.

The final part of the deliverable presented technologies employed in the envisaged financial awareness platform, including the financial linked open data. Existing thesauri are presented, followed by a discussion on semantic resources and evolving ontologies.
7 References


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