Papers presented by the statistics department in national and international *fora*

Supplement to the Statistical Bulletin
July | 2017

BANCO DE PORTUGAL
EUROSYSTEM

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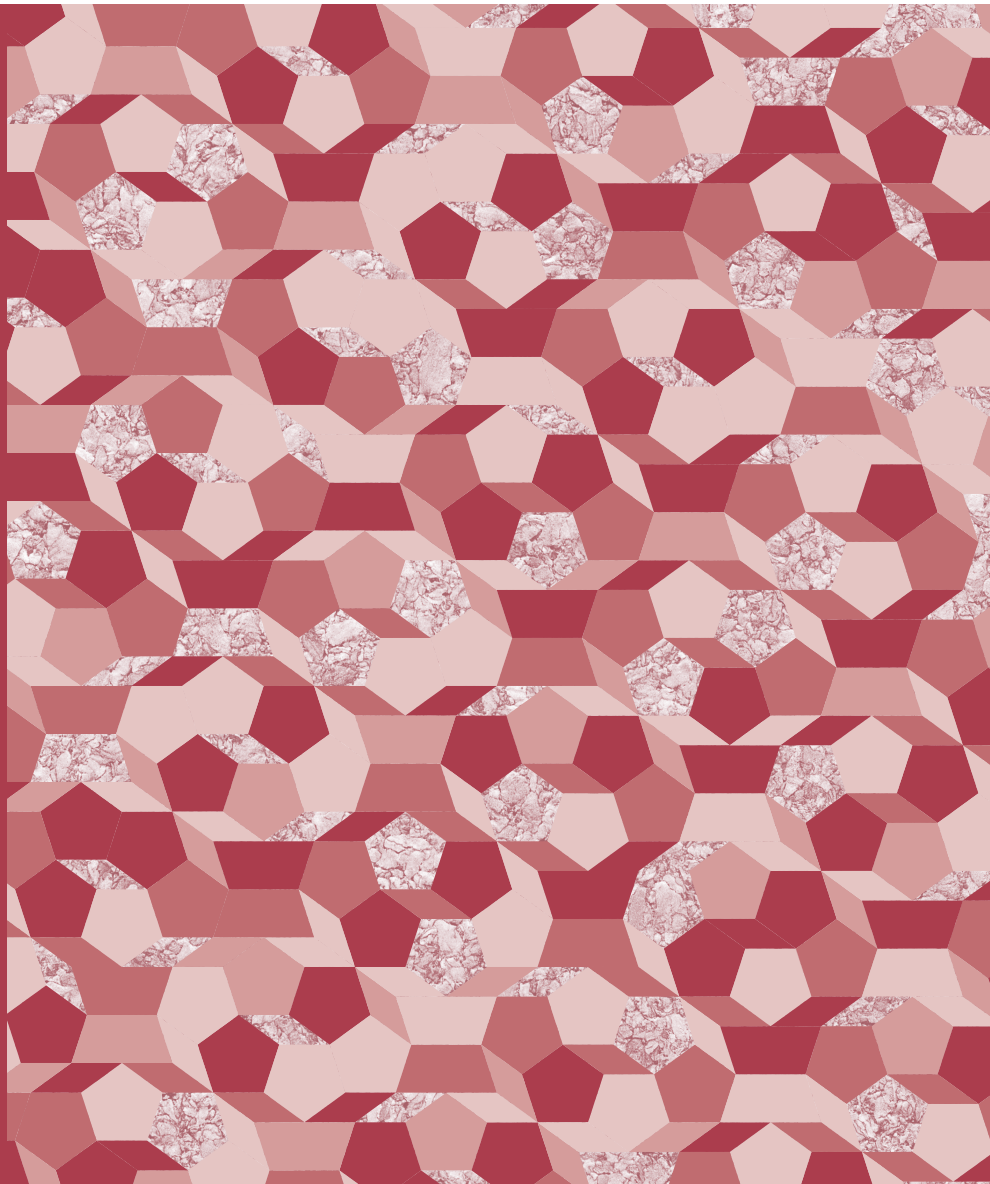

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PAPERS PRESENTED BY THE STATISTICS DEPARTMENT IN NATIONAL AND INTERNATIONAL FORA | Supplement to the Statistical Bulletin 1 | 2017 • Banco de Portugal Av. Almirante Reis, 71 | 1150-012 Lisboa • www.bportugal.pt • Edition Statistics Department • Design and printing Communication Directorate | Image and Graphic Design Unit • ISBN 978-989-678-512-3 *(online)* • ISSN 2182-1747 (online) • Legal Deposit no 320300/10

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Foreword

The current issue of the *Supplement to the Statistical Bulletin* compiles a number of articles and technical papers prepared by the staff of the Statistics Department of the *Banco de Portugal*, which were presented in 2016 at various national and international *fora* and reflect the diversity of the statistics under the Statistics Department's responsibility.

This issue of the Supplement comprises four sections: **I** Commitment to Quality; **II** Micro-databases – Potential for statistics; **III** Indicators of macroeconomic imbalances and **IV** Compiling statistics – Special case studies.

To guide the reader throughout the collection of papers, a brief summary is provided for each one.

I Commitment to Quality

Agostinho, António and Miguel, Alexandra, "*How to increase quality in the Central Banks statistical business process? The experience of Banco de Portugal*", European Conference on Quality in Official Statistics, Madrid, Spain, 1 June 2016

Over the last decade the statistical function of European Authorities, and Central Banks in particular, has been particularly challenged. During this period Banco de Portugal has been developing several initiatives to ensure a statistical production with high quality standards aiming at fully meeting users' needs. This paper provides an overview of the main initiatives currently being developed by the Statistics Department of Banco de Portugal to improve the statistics data quality and to provide a more efficient data quality management in statistical systems. These new developments comprise: i) reduction of reporting burden for economic agents; ii) implementation of solutions based on elementary data to allow an integrated exploration for different purposes; iii) implementation of systems based on Business Intelligence architecture; and, iv) development of solutions for more efficient statistical communication.

II Micro-databases – Potential for Statistics

Batista, Rodrigo and Alpiarça, Isabel, "*The usefulness of granular data - The new statistics based on Banco de Portugal's Central Credit Register*", JOCLAD XXIII, Évora, Portugal, 1 April 2016

The constant need for information represents a challenge both in terms of how and when to acquire it. The Portuguese Central Credit Register contains monthly granular information on credit on a borrower-by-borrower basis, allowing detailed analysis unachievable to other databases as well as interlinkages with other micro-databases. This granular information has been a key factor in meeting most of the data demands Banco de Portugal has been faced with in this domain.

Casimiro, Paula, Pinto, Ana Bárbara and Pereira, Tiago, "*Matching firm-level data sources at the Statistics Department of Banco de Portugal*", IFC / ECCBSO / CBRT Conference on "Uses of Central Balance Sheet Data Offices", Özdere-İzmir, Turkey, 26 September 2016

Matching data from the Central Balance Sheet Database (CBSD) with other firm-level data sources for quality control (QC) purposes has been a common practice at the Statistics Department of Banco de Portugal. Data from annual and quarterly surveys of non-financial corporations (NFC) available in CBSD were matched with internal and external firm-level data sources. As internal data sources we have used bank loans granted by resident financial institutions from Central Credit Register (CCR), securities issues from the Securities Statistics Integrated System (SSIS), Monetary

and Financial Institutions (MFIs) Interest Rates (MIR), and bank loans granted by non-resident financial institutions and group companies, exports and imports, and trade credits from Transactions and Positions with Non-Residents (COPE), database. As external data sources we have used exports and imports and information related with business demography from Tax Authority and number of employees and wages paid from Ministry of Social Security. Despite some methodological issues that avoid a full comparison between the different sources of information, all sources of information benefit from the cross checking of firm-level data sources. We concluded that matching data from firm-level data sources is of utmost importance to assure the accuracy and reach a high level of quality of the NFC information, which allows *Banco de Portugal* to publish useful information for firms' decision making such as the Enterprise and Sector Tables and the Central Balance Sheet Studies.

III Indicators of macroeconomic imbalances

Falcão Silva, João and Silveira, Vítor, "*Portuguese economy: Statistical analysis on the current account reversal´s sustainability*", 8th IFC Conference, Basel, Switzerland, 8 September 2016

In the past, Portugal exhibited persistent deficits on the current and capital account. In 2012, this situation reverted and a surplus in the current and capital account has been registered since 2012. The aim of this paper is to explore external statistics as a key source to evaluate country´s economic performance. External macroeconomic imbalances have to be analysed beyond traditional current and capital account. In particular, real economy cannot be disregarded from financial flows and positions. The richness of statistical data availability constitute a relevant tool to monitor economies performance and support economic decision makers.

IV Compiling statistics: Special case studies

Lima, Filipa and Mota, Sónia, "*Unconventional monetary policy – is there a call for unconventional statistics?"*, 8th IFC Conference, Basel, Switzerland, 8 September 2016

Central banks across the world have been progressively adopting "unconventional" monetary policy measures which include, among others, zero or negative reference rates and expanded assets purchase programmes, aimed at pursuing price stability, easing the funding conditions for households and firms and ultimately promoting economic growth. In order to monitor the impacts from these measures it is essential the provision of good quality and timely statistics. In light of the current international statistical data requirements, namely in terms of the banks' balance-sheets and interest rates, financial accounts and public debt data, we will assess if these "conventional" statistics are fit for that purpose.

Amador, João and Falcão Silva, João, "*Banks International Asset Portfolios: Optimality, Linkages and Resilience"*, 8th IFC Conference, Basel, Switzerland, 8 September 2016

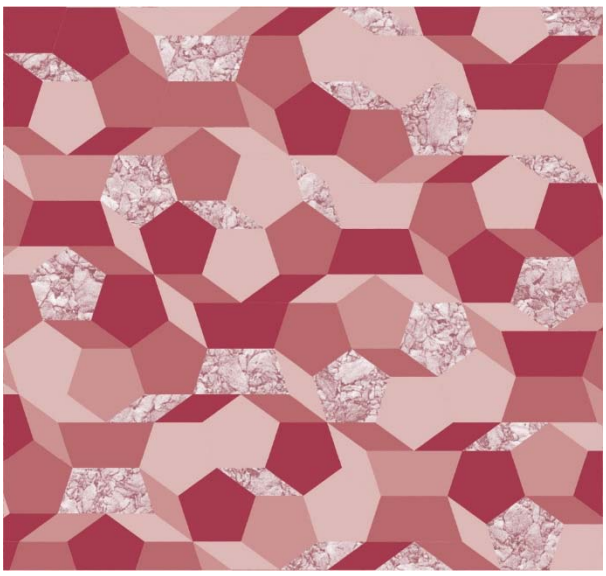
The world economy has been living under the shadow of the latest global financial crisis. The persistence of high indebtedness levels across the world maintains these concerns on the agenda of economic institutions. This paper tries to address two main questions. First, it examines the cross country asset portfolios and uses network theory to map linkages between banking systems and discuss its resilience to shocks. Second, it assesses how distant are portfolios from an optimal diversification strategy.

Carvalho, Ana Filipa, Perestrello, Manuel and Lourenço, Mário, "*The indebtedness of Portuguese SMEs and the impact of leverage on their performance",* 8th IFC Conference, Basel, Switzerland, 8 September 2016[1]

Small and medium-sized enterprises (SMEs) account for a relevant part of Portuguese companies' turnover and number of employees, standing for half the loans granted to non-financial corporations by resident financial institutions. Tracking their performance is one of the pillars of monitoring the country's financial stability. Focusing on these companies' performance, and using Banco de Portugal's Central Balance-Sheet Database and Central Credit Register data, stylised facts suggest that financial debt is not usually used to increase profitability. Instead, indebtedness seems to be increasingly linked to companies that eventually cease their activity. Implications regarding monetary policy, financial stability and risk assessment are also addressed.

Notes

1. In 2016 an additional paper covering the same subject was presented. For the sake of efficiency we opted to include in this Supplement only one of the two papers given their similitude. The other papers not included in this Supplement is: Ana Filipa Carvalho, Manuel Perestrello and Mário Lourenço (2016). The indebtedness of Portuguese SMEs and the impact of leverage on their performance, presented at the JOCLAD XXIII in Évora, Portugal on 1 June 2016



Commitment to quality

How to increase quality in the Central Banks statistical business process?
The experience of Banco de Portugal

How to increase quality in the Central Banks statistical business process? The experience of Banco de Portugal*[2]

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1. Introduction

One of the most significant features of our times is the constantly changing environment. The financial world is perhaps one of the most affected areas by the increased pace of innovations. This calls for central banks to be particularly attentive in the fields of regulation and financial supervision but also in the statistics' field as a mean to feed those two fields.

This document gives an overview of the main initiatives currently being developed by the Statistics Department of Banco de Portugal to improve the statistics data quality and to provide a more efficient data quality management in statistical systems. These new developments comprise: i) reduction of reporting burden for economic agents; ii) implementation of solutions based on elementary data to allow an integrated exploration for different purposes; iii) implementation of systems based on Business Intelligence architecture; and, iv) development of solutions for more efficient statistical communication.

2. Micro-databases in Banco de Portugal

The financial innovation and the globalization experience created new and more demanding challenges to the statistical function of central banks. On the other hand, we have learned with the global financial crisis that aggregate figures are not sufficient to fully grasp developments in the global economy and they must be complemented with micro-data, which enable to explore and drill down the heterogeneity hidden behind aggregate numbers. This new involvement leads to new requirements, such as, what kind of sources, collecting systems and statistical procedures could be particularly helpful to reduce the burden of data collection and speed up the relevant information without compromising the quality and the coverage of the statistical production.

Banco de Portugal has been confronted with the need to adapt to these new requirements and has developed a number of initiatives in order to increase the efficiency of its statistical systems management without compromising the quality and the coverage of the statistical production. The use of micro-data, i.e. individual data, and transaction-by-transaction reporting, covering different statistical areas, as well as the integration of different reporting systems, are approaches that have

generally been followed by Banco de Portugal aiming at improving the availability of timely information and leaving behind some of the shortcomings associated with the conventional data collecting systems.

The granular nature of such information, together with a good coverage of the relevant sources, offers increased flexibility as regards the compilation of new statistics and getting on-time responses to ad hoc data requirements and users' requests. This flexibility is manifold, both for respondents and compilers since it:

- Allows for a significant reduction of the reporting burden based on an integrated system for the collection of elementary information;
- Increases the ability of the system to deal with changes in the statistical requirements, especially in cases where further details in existing breakdowns are needed (in most cases these situations do not imply any intervention in the reporting system);
- Facilitates changes in the reporting scheme as they typically consist of additional granular items (new dimensions) that will not need to be transformed or aggregated by respondents;
- Prevents data redundancy, promoting in practice the principle that "data should be collected only once";
- Leads to the definition of more efficient mechanisms for exploring data and compile statistics;
- Enables a more efficient data quality management; and, above all,
- Improves dramatically the responsiveness to *ad hoc* requests.

There are several micro-databases available in the Statistics Department of Banco de Portugal, namely:

- the Securities Statistics Integrated System (SSIS) with security-by-security and investor by investor database of both securities holdings and issuances;
- the Central Credit Register (CCR) which contains granular information about credit on a borrower-by-borrower basis;
- the Central Balance Sheet Database (CBSD) which holds accounting and financial information covering the population of non-financial corporations;
- the database to collecting individual data about the new bank loans and respective interest rates to better assess current credit conditions of the sector and monetary policy transmission;
- the balance of payments system with a transaction-by-transaction database for the non-financial corporations with transactions with non-residents;
- the information reported for supervision purposes which contains elementary accounting data.

Beyond the statistical function, the micro-data can be used in many different fields of central banking like economic and financial research, financial stability and supervision activities, monetary policy and risk assessment.

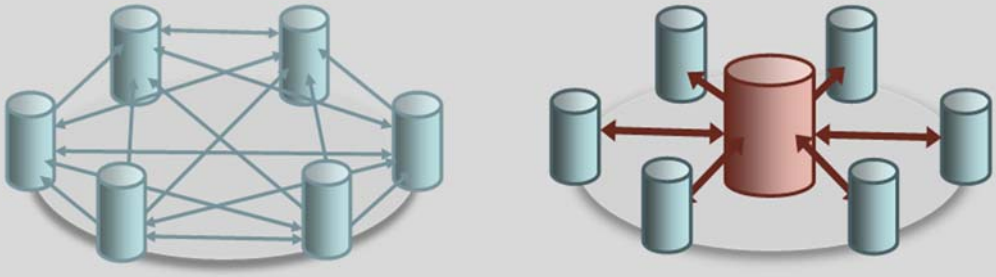
3. How to integrate micro-databases

The micro-databases provide very complete information concerning their respective domains and are extremely rich. However, to obtain the maximum potential of these databases, it is essential to take the additional step and, instead of viewing them as an isolated data repositories, linking them in a single fully integrated high granular data system. By joining the information contained in each individual database, this data system will increase the potential associated with each one,

enabling the crossing and combination of data, supported by the use of a common identifier for the economic agents.

In the context of the information systems developed in the framework of the statistical function, the Banco de Portugal has decided to implement an integrated information system, which helps to integrate data from various statistical fields, making it possible to cross-check and share data from different statistical sources and ensuring the linkage, coherence and quality of the compiled statistical results, as can be illustrated by the following diagram (Figure1) moving from multiple information links to a centralized data warehouse approach.

Figure 1 • Data warehouse approach



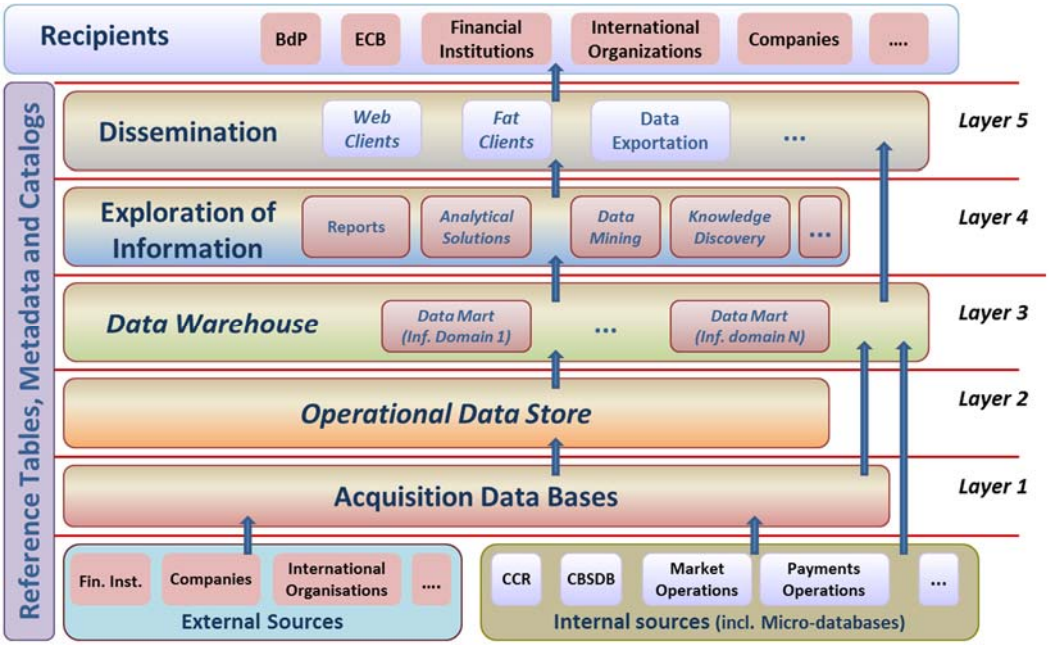
This integrated statistical information system is supported by a Business Intelligence (BI) architecture that covers the full statistics workflow since the collection of data till the exploration and the statistics dissemination.

The core issues of this system are the statistics data warehouse, where data is organized and stored following similar rules, the centralized reference tables (Reference Data Management System - SPAI) and a common IT platform where the systems for statistical production are developed.

This solution allows for greater integration and consistency between the statistical information from various sources (a central access point to every statistical data), common reference data and crosslinking information (reference tables and catalogues) and consistent IT solutions, enabling statistical production systems to be developed on a common technology infrastructure.

Given the crucial importance of the information for most of the activities of the Banco de Portugal, an information management model was developed to ensure the quality, auditability and manageability of the data. It establishes the levels of responsibility in the management of information, separating the activities related to the organization and processing of information from the analysis and exploration activities. The information architecture is based in five layers where the division between the information management and the exploration and analytic activities occurs from the 3rd to the 4th layer, as it can be seen in Figure 2.

Figure 2 • The information architecture



4. Exploring micro-databases and their integration to increase quality

The use of micro-database and transaction-by-transaction reporting enables a better data quality management. In the case of administrative sources, where the information is collected for other purposes than statistics, the nature of the information requires to be previously approved or certified, to guarantee a good approximation to statistics concepts and a minimum level of quality in the information since the beginning of the process, in line with principle 8 of the "Public commitment on European Statistics by the ESCB". One illustrative example where this kind of data prove to be useful is in the analysis of the information reported to the CBSD by companies within the scope of Simplified Corporate Information (in Portuguese IES) that gives a complete view on the non-financial sector assets and liabilities. The IES is a joint electronic submission of accounting, fiscal and statistical information by companies to the Ministry of Finance, the Ministry of Justice, the Statistics Portugal and the Banco de Portugal and allows companies to simultaneously fulfil four reporting obligations, in a single electronic form, removing the duplication of requests and minimising the reporting burden (under principle 9 of the public commitment). Another example concerns the information reported to prudential supervision data (accounting elementary data) reported to the Banco de Portugal and also explored for statistical purposes.

The fact that the information is reported on an individual basis enables an easier and a more efficient and effective exploration of the elementary data among different sources (within principle 10 of the public commitment). Thus, and considering that all these databases are managed in the Statistics Department of Banco de Portugal, it is quite evident the enormous potential for quality control through micro data cross-checking, of which we have been increasingly making use.

This cross-assessment can be performed either on elementary data, or on aggregated data. In this context, one should highlight the work that has been developed in terms of monitoring and controlling the overall consistency of the data reported to the Banco de Portugal within the scope of the different statistical production systems. These procedures have been set up with the purpose of promote more efficient global compilation processes and to control the overall quality of the individual statistics (enhancing principle 8 of the public commitment) and the cross-checking of the information reported to the Banco de Portugal on monetary and financial statistics, balance of payments statistics, securities statistics and central credit register. As a final level of quality control, the compilation of financial accounts, which is also under the responsibility of the Statistics Department of Banco de Portugal, may be considered as the overall cross-checking test on the consistency among the various statistics produced in the Statistics Department.

All these approaches have allowed:

- changes in the organization of the financial institutions themselves in order to cope with the high quality reporting requirements of the Banco de Portugal, which, subsequently, improve the quality of the statistical information submitted to the Bank;
- to minimize the reporting burden;
- a better data quality management;
- a greater efficiency to statistical exploration supported in more flexible tools;
- to enhance the overall consistency of the statistics produced in the various domains in the Statistics Department;
- to lead to higher quality standards and efficiency.

5. Statistical communication

One of the main purposes of the Statistics Department of the Banco de Portugal is to ensure the production of high quality statistics aiming at fully meeting users' needs. By providing more complete and detailed statistics and the necessary tools to answer to users' needs, the Banco de Portugal increases transparency and promotes statistical communication. However, the dissemination of statistics based on micro-database, requires that the Banco de Portugal ensures that statistical dissemination is in accordance with the confidentiality rules in order to preserve confidence in the statistical system by reporters of this elementary information (in line with principle 5 of the public commitment).

In this context, Banco de Portugal has started a new project to disseminate statistical information to allow an easy and quick access to a wide range of statistical series and indicators produced by the Bank and other national and international institutions. The Statistical Portal aims to disseminate statistical data and metadata based on the standardization of all the statistics domains around the same concepts and information structures, so that the statistical information disclosed should be clear and comprehensible, in charts, tables and info graphics that facilitate the analysis and allow a correct interpretation of the economic results (enhancing principle 15 of the public commitment). The new Statistical Portal is planned to be released towards the end of 2016 and will put together 32 statistics domains, 48 dimensions of analyse, over 4 thousand of classifications, disclosing more than 5 million of series.

6. Conclusions

The use of micro-databases and transaction-by-transaction reporting, covering different statistical domains, has entailed several and enormous advantages, in particular in terms of good population coverage, reduction of the reporting costs, more efficient data quality management, greater efficiency to statistical exploration, more complete and detailed statistics and faster response to ad hoc data requirements.

To properly manage this information a robust data information solution based on a data warehouse system supported by a BI architecture is essential to lead to higher quality standards and efficiency and respond to the challenges ahead.

Finally, another aspect that must be highlighted is that the shared use of these databases and more flexible exploring tools gave a strong impetus to deepen the coordination among all staff in charge of the statistical production in the Statistics Department, which was translated into an increasingly cooperative work, with positive impact on the quality and consistency among the various statistics produced in the Banco de Portugal.

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Notes

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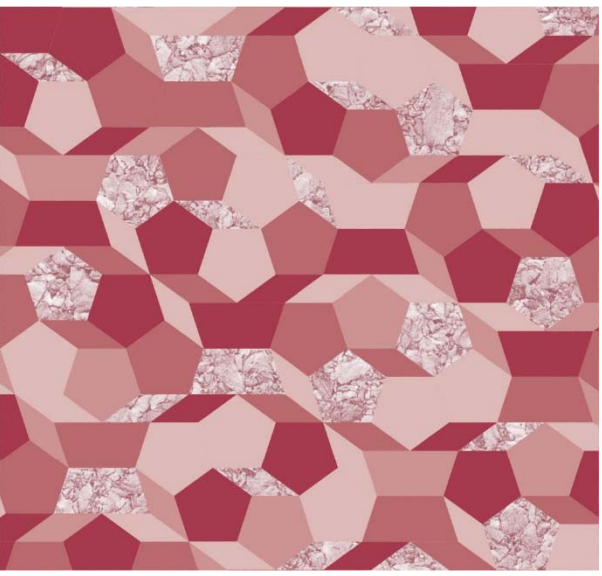
2. The opinions expressed in this paper reflect the personal views of each of the authors, which are not necessarily those of the Banco de Portugal or of the Eurosystem.



II

Micro-Databases: Potential for statistics

The usefulness of granular data – The new statistics based on Banco de Portugal's Central Credit Register

Matching firm-level data sources at the Statistics Department of Banco de Portugal

The usefulness of granular data - The new statistics based on Banco de Portugal's Central Credit Register*

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Abstract

The constant need for information represents a challenge both in terms of how and when to acquire it. The Portuguese Central Credit Register contains monthly granular information on credit on a borrower-by-borrower basis, allowing detailed analysis unachievable to other databases as well as interlinkages with other micro-databases. This granular information has been a key factor in meeting most of the data demands Banco de Portugal has been faced with in this domain.

Keywords: Central bank statistics, Central credit register, Granular databases

The challenges posed to a national central bank represent a constant need for information. Predicting beforehand which information might be required and how to obtain it, so that users have it when needed, is the challenge laid to a statistics department. The Statistics Department of Banco de Portugal has the experience of managing several granular databases and of being able to surpass this challenge through their use.

One of this databases is the Central Credit Register (CCR), which contains granular data about all the loans above 50 euros granted by the financial sector. Besides statistical compilation, CCR's granular data is used for several purposes such as: reduction of the information gap between borrowers and lenders, supervision of financial entities, analysis of the stability of the financial system and conduction of monetary policy.

The CCR is able to fulfil all of its purposes due to the several variables that define each credit record but also due to an important advantage of granular data – the possibility of crossing its information with other internal granular databases. These interlinkages allow for the characterization of borrowers, in the case of non-financial corporations (NFC), by dimensions such as size, sector of economic activity or exporting company status, thus providing additional insights to the analysis of the loans' market in Portugal.

In February 2016, Banco de Portugal, using the potential of this granular data, published a new set of statistics based on the CCR. Charts 1 to 4, only achievable through the use of this potential, are examples of these statistics.

Chart 1 details the evolution of loans granted to NFC in default according to their sector of economic activity. The information regarding the sector of activity of the NFC is not directly available in the CCR, being acquired through a connection to the Central Balance-Sheet Database of Banco de Portugal (CBSD). The analysis of Chart 1 depicts an increase both in the overdue loans ratio and in the share of borrowers with overdue loans across all sectors between 2010 and 2015.

Chart 2 presents information which aggregates households according to their indebtedness levels *vis-à-vis* the resident financial sector. Observing Chart 2 it is noticeable that the overdue loans ratio registers its highest value in the smallest brackets of credit amount (less than 25 000 euros) while the highest share of borrowers with overdue loans is verified in the case of borrowers indebted in more than 250 000 euros.

Chart 1 · Evolution of the default indicators concerning loans granted to NFC by economic activity

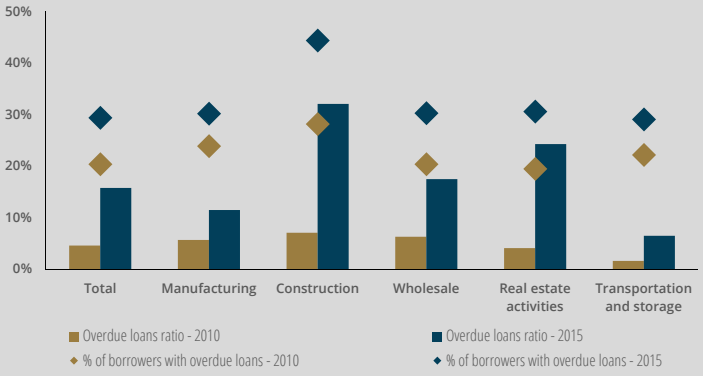
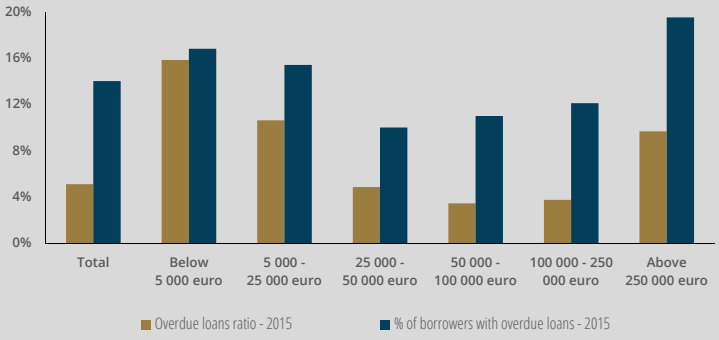


Chart 2 · Default indicators concerning loans granted to households by bracket of credit amount



Charts 3 and 4 present relationship indicators between NFC and financial entities. These charts represent two examples of the advantages of granular data: firstly the NFC are classified according to their size, also through a connection to the CBSD, and secondly each borrower has to be evaluated regarding its indebtedness to each individual financial institution. Analysing Chart 3, it is observed that the average number of financial entities with which each borrower has a credit relation

has decreased since 2010 while the analysis of Chart 4 shows that the concentration of loans in a single financial entity has increased.

Chart 3 · Average number of financial entities with which each borrower has a credit relation

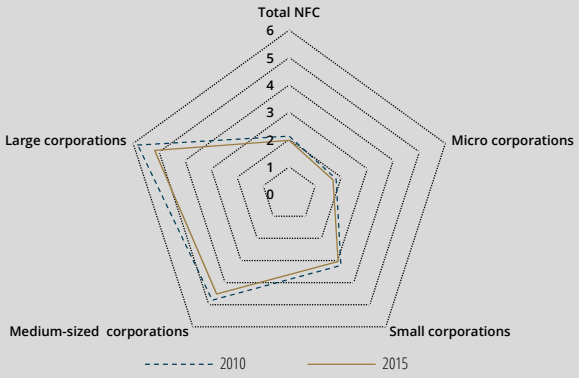
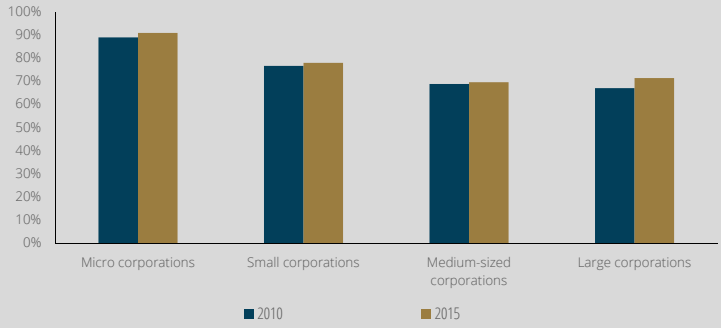


Chart 4 · Average percentage of loans granted by the entity with the largest share



Notes

* JOCLAD XXIII, Évora, Portugal, 1 April 2016.

3. The analyses, opinions and findings of this paper represent the views of the authors, which are not necessarily those of the Banco de Portugal or the Eurosystem. Any errors and omissions are the sole responsibility of the authors.

Matching firm-level data sources at the Statistics Department of Banco de Portugal*[4]

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Abstract

Matching data from the Central Balance Sheet Database (CBSD) with other firm-level data sources for quality control (QC) purposes has been a common practice at the Statistics Department of Banco de Portugal. Data from annual and quarterly surveys of non-financial corporations (NFC) available in CBSD were matched with internal and external firm-level data sources. As internal data sources we have used bank loans granted by resident financial institutions from Central Credit Register (CCR), securities issues from the Securities Statistics Integrated System (SSIS), Monetary and Financial Institutions (MFIs) Interest Rates (MIR), and bank loans granted by non-resident financial institutions and group companies, exports and imports, and trade credits from Transactions and Positions with Non-Residents (*COPE)*, database. As external data sources we have used exports and imports and information related with business demography from Tax Authority and number of employees and wages paid from Ministry of Social Security. Despite some methodological issues that avoid a full comparison between the different sources of information, all sources of information benefit from the cross checking of firm-level data sources. We concluded that matching data from firm-level data sources is of utmost importance to assure the accuracy and reach a high level of quality of the NFC information, which allows Banco de Portugal to publish useful information for firms' decision making such as the Enterprise and Sector Tables and the Central Balance Sheet Studies.

Keywords: firm-level databases, non-financial corporations, data matching

JEL classification: C81

1. Introduction

Matching data from the Central Balance Sheet Database (CBSD) with other firm-level data sources for quality control (QC) purposes is a common practice at the CBSD of Banco de Portugal.

Every year, data from both the annual and the quarterly survey of non-financial corporations (NFC) are matched with the Central Credit Register (CCR), the Securities Statistics Integrated System (SSIS), the data from Transactions and Positions with Non-Residents (*COPE*, *Comunicação de Operações e Posições com o Exterior*, in the Portuguese acronym) - and the Monetary and Financial Institutions (MFIs) Interest Rates (MIR) in order to assure the accuracy of the information reported by the NFC.

The CCR database contains information about all the loans above 50 Euros granted by resident financial institutions, while the SSIS database contains detailed data on issues and portfolios on a "security-by-security" and "entity-by-entity" basis. The COPE database contains information of flows and positions reported by resident legal entities with yearly transactions with the rest of the world above 100.000 Euros.

During the QC process of the annual and quarterly surveys of NFC, loans reported by firms in their balance-sheets are compared with the information available at the CCR, the SSIS and the COPE databases, while exports and imports of goods and services are compared with the COPE database. This comparison has been very useful for CBSD, although there are some methodological issues that do not allow for a complete matching of the data, especially in the case of the COPE database.

Regarding loans, benefits from the CCR and the SSIS database are twofold: on one hand, they allow the distinction between bank loans and bonds when firms do not specify the sources of their funding; on the other hand, in the case of bank loans, since the CCR only contains loans from resident financial institutions, it is possible to obtain, by a residual approach, the amount of loans granted by non-resident financial institutions to Portuguese NFC. The amount of loans granted by non-resident financial institutions can also be obtained directly from the COPE database. Usually, data on loans granted by non-resident financial institutions obtained by the residual approach matches the data obtained from the COPE database. It is also possible to obtain from the COPE database the intra-group loans from non-resident firms.

With respect to exports and imports of goods and services, the existence of data from COPE for a company that does not report exports and imports of goods and services in the CBSD surveys possibly allows to fill a gap in the CBSD database. However, there are several explanations for the absence of a complete matching between COPE and CBSD database, such as the existence of trade credits, business group relationships or cash pooling.

Monetary and Financial Institutions' (MFIs) statistics have detailed data on new, renegotiated and outstanding loans granted by monetary financial institutions on a "loan-by-loan" and "entity-by-entity" basis. Hence, it is possible to match this information with the implicit interest rates on the accounting information sent by NFC to the CBSD.

Data from Tax Authority includes information on intra-European Union (EU) and extra-EU exports and imports of goods and services, total sales and value added taxes (VAT), R&D tax incentives (deductions to R&D expenditures), business register for VAT purposes, income paid to or received from non-resident entities and interest paid or received by natural resident people.

Finally, data from the Ministry of Social Security contains the number of employees and the wages paid, by firm, on an annual basis.

Throughout the paper, we provide an integrated time series analysis of CBSD, CCR, SSIS, MIR and COPE databases from 2011 to 2015, as well as additional comments on matching databases.

2. Firm-level data sources

2.1. Internal data sources

Statistics based on the CBSD, CCR, SSIS, MIR and COPE databases are regularly published on the Statistical Bulletin and on the BP*stat* | Statistics Online, the interactive dissemination database available at Banco de Portugal website. In this section, we provide a brief description of each one.

- Central Balance Sheet Database (CBSD)

CBSD exists since 1983, based on accounting data of individual firms. From 2006 onwards, annual CBSD data has improved considerably and has been based on obligatory financial statements, which allowed the monitoring of almost all Portuguese NFC (about 370.000), instead of only a sample of them.

The major goal of the CBSD is to contribute to a better understanding of the operating and financial performance of NFC. CBSD data are useful to produce statistics about NFC, to derive the NFC sector for National Accounts, to estimate several items for Balance of Payments (BoP), to update business registers, and to produce sectoral benchmarks, namely Sector Tables and Enterprise and Sector Tables (Brites, 2013).

Yearly data of the CBSD database is obtained from Informação Empresarial Simplificada (IES). IES is a mandatory annual report through which NFC submit their annual accounts (balance-sheet, income statement, statement of changes in equity, cash flow statement and the annex to the financial statements) simultaneously to the Tax Authority, Ministry of Justice, Banco de Portugal and Statistics Portugal.

IES is reported within six and a half months of the economic year end, which, for most enterprises resident in Portugal, corresponds to 15 July of the year following the reference year.

Data reported by enterprises through IES is subject to QC by Banco de Portugal mainly to ensure that the accounting information for the economic year is coherent and complete and that the main aggregates are consistent throughout the years.

QC comprises the matching of data reported through IES with other internal data sources of Banco de Portugal, such as CCR, SSIS, MIR and COPE, as well as with external data sources, such as Tax Authority and Social Security.

- Central Credit Register (CCR)

Following Casimiro (2013), the Portuguese CCR database was launched in 1978, first including only the credit liabilities of NFC and, from 1993 onwards, also the credit liabilities of households.

Reporting institutions to the Portuguese CCR are banks, savings banks and mutual agricultural credit banks (MFIs), other non-monetary financial institutions and public agencies that grant credit, and NFC buying loans from the resident financial sector.

The main purpose of the CCR is to contribute for the financial stability by helping financial institutions in assessing the credit risk of their current or new credit clients, since they can access CCR data. Insurance companies undertaking credit and bond insurance can access CCR data, although they do not report it.

Data reported to Portuguese CCR include the borrowers ID (for residents, the tax identification number is used), the credit drawn (amounts outstanding at the end of the month), credit undrawn (irrevocable credit commitments), personal guarantees (potential credit liability), type or purpose of the loan, collateral (type and value), periodic repayments (for some types of loans granted to private individuals), original and residual maturities, credit defaults and write-offs, and specific flags for Banco de Portugal internal use of the data (e.g. securitized loans and loans used as collateral in Eurosystem financing operations).

- Securities Statistics Integrated System (SSIS)

The SSIS of Banco de Portugal was established in 1999. It was created to store, manage and explore data on securities issues and portfolios on a "security-by-security" and "investor-by-investor" basis, excluding investors in the households sector, whose data are aggregated by the investor's country. This database comprises securities other than shares and shares and other equity. The assembled data include, on a monthly basis, stocks and transactions, with the ISIN code being used for the identification of the securities (Dias, 2013).

Regarding issues, the SSIS collects data on securities issued by resident entities in Portugal, irrespectively of the fact that those issuances take place in the Portuguese market or in external markets. A multiplicity of sources are used such as the Lisbon Stock Exchange, the Portuguese Securities Market Commission, the Portuguese Treasury and Debt Management Agency and commercial databases.

In the case of portfolios, comprehensive information on holdings of domestic and foreign securities by resident investors and holdings of domestic securities by non-resident investors is collected. Data are reported mainly by custodians (e.g. banks, dealers and brokers). Direct reporting by resident investors with relevant portfolios deposited abroad is also applicable.

The leading aim of SSIS is the production of statistics on issues and portfolios of securities, the design of "from-whom-to-whom" tables crossing issuers and holders, and the supply of input data for MFIs, BoP and National Accounts statistics.

- Monetary and Financial Institutions (MFIs) Interest Rates (MIR)

Besides micro data regarding the end-of-month balance-sheet of MFIs (mainly deposits received and loans granted), these institutions also communicate individual information concerning banking interest rates on new and renegotiated loans to NFC.

According to Santos (2013), Banco de Portugal created this new requirement in June 2012 with the aim of obtaining representative data on new loan operations, in a context of financial stability assessment. This new requirement only applies to MFIs granting at least 50 Million Euros per month

in new loans to NFC. Furthermore, solely euro denominated operations and loans to euro area resident entities are taken into account.

Reported data includes the date of the operation, maturity of the loan, initial period of interest rate fixation, amount, annualized interest rate, the existence or not of collateral, the nature of the loan (new or renegotiated), borrower ID and residence.

Information on the interest rates of outstanding loans is also available.

- Transactions and Positions with Non-Residents (COPE)

According to Marques (2011), the collection and compilation of BoP data was set in 1993, based on monthly reports by resident banks, which communicated and classified transactions with non-residents on their own behalf and on behalf of their customers. Also, the report of transactions with non-residents settled without the intermediation of the resident banking system was mandatory and it was done by direct reporting to Banco de Portugal.

From 2013 onwards, the system of communication to Banco de Portugal changed, giving rise to direct reporting by economic agents on monthly transactions and positions with non-resident counterparts (so-called COPE, Comunicação de Operações e Posições com o Exterior, in the Portuguese acronym). Entities with transactions with non-residents above 100.000 Euros per year started to report and classify their transactions and positions with non-residents directly to Banco de Portugal, even if they have the intermediation of the resident banking system. Reports by resident banks without the classification of transactions are now only used to validate information submitted by entities.

Reported data is very granular and includes exports and imports of goods and services (including travel and tourism), rights and operations over tangible and intangible assets, unilateral transfers, real estate investment, shares, units of participation and other equity securities, debt securities, performing and non-performing loans, trade credits, bank deposits, margin accounts, financial derivatives and employee stock options and transfers between accounts breakdown by nature (asset or liability), maturity (short or long term), direct investment relationship (no relationship, voting rights lower than 10% or voting rights greater or equal than 10%), and transaction type (capital or income).

2.2. External data sources

- Tax Authority

Banco de Portugal has been receiving firm-level data from the Tax Authority since 2014, in the sequence of an information exchange agreement. Data is sent four-times a year and it is available from 2006 onwards.

This database includes the monthly amount of extra-EU exports and imports of goods and services, the quarterly amount of intra-EU exports and imports of goods and services, the fields of the VAT return (e.g. amount of sales, intra-EU imports of goods and services and other operations that originate VAT), the annual amount of tax incentives for R&D, the register of active companies for VAT purposes, with the date of beginning and end of activity, income paid to non-resident entities, interest on savings paid to resident natural persons, and income obtained from non-resident entities.

- Social Security

Data from Social Security was available until 2013 and comprised the annual number of employees and wages paid by firm.

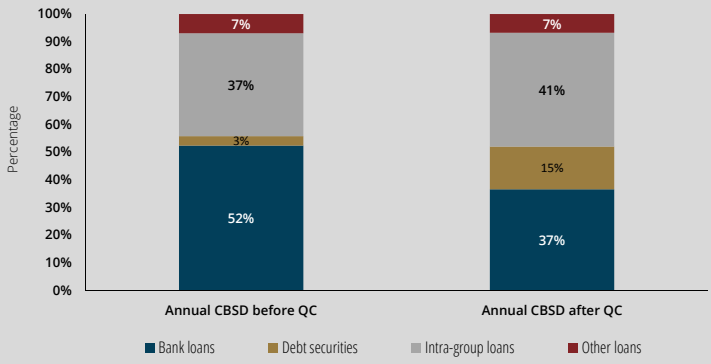
3. Results

In this section, we provide some examples of data matching and how it improves the quality of the databases. The QC process of the CBSD occurs every year and quarter according with the periodicity of the data sources. Annual QC is done after the submission of the IES and it involves not only human resources from Banco de Portugal but also a group of undergraduate students that manually validate the information sent by a sample of NFC[5].

3.1. Borrowings structure and their sources

Chart 1 below shows the total borrowings structure of the Portuguese NFC in 2015, breakdown by sources. For total borrowings we mean the sum of bank loans, debt securities issued, loans from group companies and other loans. During the QC process, data on bank loans, debt securities and intra-group loans is matched with the CCR, the SSIS and the COPE databases, which explains the differences between the initial and the present situations. The CCR database provides information on loans granted by resident financial institutions, while SSIS database provides data on debt securities issues and COPE database on non-resident banks and intra-group loans.

Chart 1 · Borrowings structure of NFC (2015)



3.2. CBSD vs. CCR database

Chart 2 shows the amount of loans granted by financial institutions in the CBSD before QC and in the CCR database, as well as loans granted by non-resident financial institutions[6] from the CBSD, which are not available at the CCR database. External loans usually account for 15% of the loans granted by financial institutions and for 5% of total borrowings.

As it can be observed, loans granted by financial institutions in the CBSD before QC are higher than in the CCR database. This happens because of the existence of external loans and because NFC usually do not detail their sources of financing and include all of them in a single item, which is loans from financial institutions. External loans can be obtained through the comparison with the

COPE database or the NFC' annual report, if available. Otherwise, NFC can also be contacted to clarify the data.

Chart 2 · Loans granted by financial institutions before QC

Chart 3 shows the situation after QC. As it can be seen, the amount of loans granted by financial institutions at the CBSD moves closer to the amount in the CCR database and, if we deduct to this amount the value of external loans we can observe an almost perfect matching between databases.

Chart 3 · Loans granted by financial institutions after QC

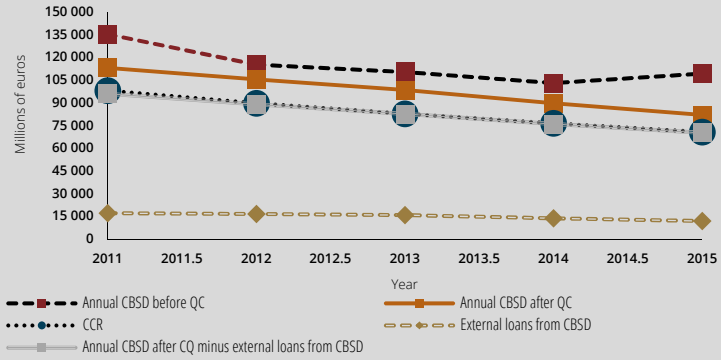


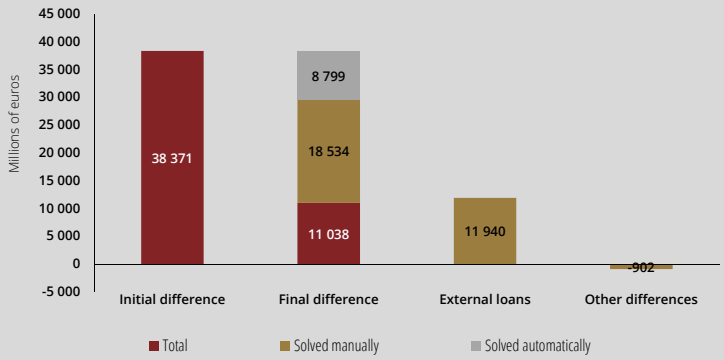
Chart 4 shows initial and final differences between the CBSD and the CCR database before and after QC.

In a first stage, NFC with large differences between the CBSD and the CCR databases and without external loans in the previous years in the CBSD[7], and for which the amount of loans outstanding in the CCR database is less or equal than the borrowings reported through IES are treated automatically, with the amount of loans outstanding in the CCR database being incorporated in the CBSD. According to Chart 4, this automatic procedure solved about 23% (corresponding to 8.799 Millions of Euros) of the initial difference between the databases.

In a second stage, NFC with large differences regarding CCR database which are not solved automatically are distributed for manual QC. Manual matching solved around 48% (corresponding to 18.534 Millions of Euros) of the initial difference between the databases. At the moment, the difference between the two databases remains at 11.038 Millions of Euros (29% of the initial difference), which corresponds approximately to the amount of external loans (11.940 Millions of Euros). As

pointed out before, these loans are not generally covered by the CCR and are manually inserted according to firms' annual reports, direct contact or matching with COPE database.

Chart 4 · Initial and final differences between CBSD and CCR databases (2015)

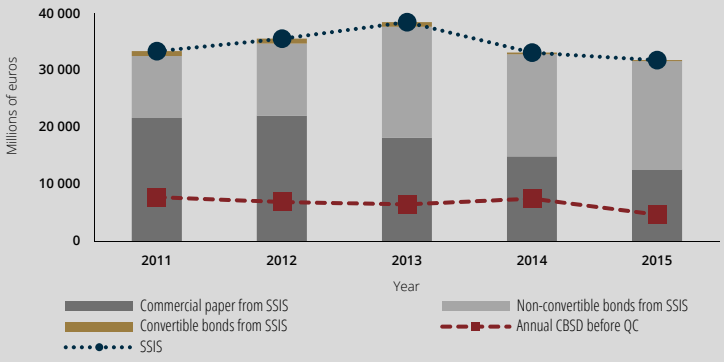


Besides external loans, there is a fraction of the final difference that is explained by specific circumstances such as time lags between the CBSD and the CCR databases, bankruptcy[8] or lawsuits against banks (Other differences, which represent 2% of the initial difference in absolute value). Also, there will always be a small difference between databases, even after QC, because only firms with material differences between CBSD and CCR database are distributed for manual QC.

3.3. CBSD vs. SSIS database

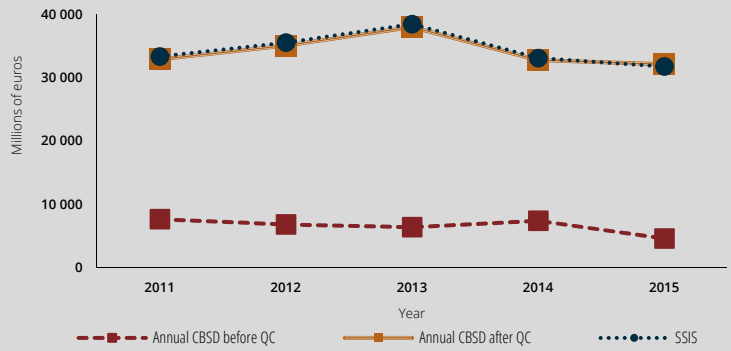
During the QC process, matching with SSIS database is also done. Chart 5 shows the comparison between the outstanding amount of debt securities in the CBSD and in SSIS database. The amount from SSIS is generally much greater given that NFC incorrectly recognize the majority of their funding as loans from banks. On one hand, NFC usually do not detail their sources of financing and include all of them in a single item, which is loans from financial institutions. On the other hand, there are cases in which firms contact a bank to contract a loan, the bank agrees, and then securitizes the loan due to tax advantages. This loan will be consider by the firm as bank loan but in fact in a debt security.

Chart 5 · Financing through debt securities before QC



After QC, the amount of outstanding debt securities at the CBSD nearly overlaps the amount at the SSIS database (Chart 6). Here, the QC is also organized at two stages. First, for NFC with large differences between the CBSD and the SSIS database and for which the amount of outstanding debt securities in the SSIS database is less or equal than the borrowings reported through IES, automatic matching with the SSIS database is done. Then, the remaining situations are distributed for manual validation.

Chart 6 · Financing through debt securities before QC



It should be stressed that automatic matching of CCR and SSIS database is done simultaneously to prevent unbalanced balance-sheets. Every year and quarter there is automatic incorporation in the CBSD of data from other sources namely CCR and SSIS databases, as well as bank and group loans from COPE database. As a result of this incorporation, the new total borrowings of CBSD could go above or go below the original ones, generating unbalanced balance sheets.

If, after matching the data from other data sources with the CBSD, the new total borrowings of CBSD go above the original ones and this excess is due to the original Other loans item of total borrowings, then the Other loans are adjusted to make the new total borrowings equal to the initial ones. If adjusting the initial Other loans item of total borrowings does not solve the unbalance, empirical evidence tells us that firms recognize borrowings in other liabilities' items which not total borrowings. Hence, the automatic procedure will take values from these other liabilities' items to total borrowings in order to match the data available from the other sources and will solve the unbalance.

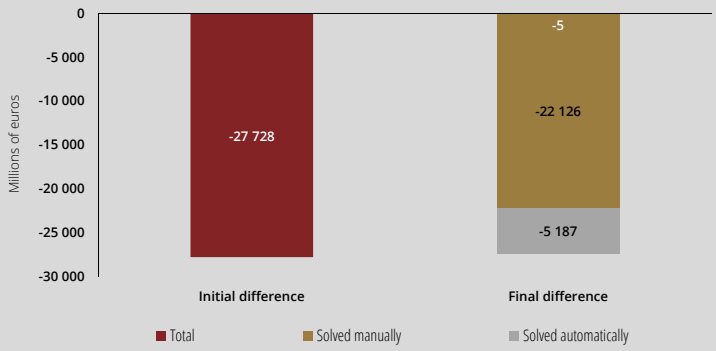
In the cases that unbalance could not be solved acting this way, data from other sources is only automatically matched until the amount that prevents unbalanced balance-sheets and that respects the maximum difference allowed between CBSD and the other sources. The firms which are not solved automatically are distributed for manual validation.

If the new total borrowings go below the original ones, original total borrowings are kept equal, with the bank loans being matched with the CCR and the COPE databases, intra-group loans with the COPE database, and the loans through debt securities matched with the SSIS database. The excess in the original total borrowings is distributed for intra-group loans and other borrowings, according to the borrowings structure of the previous year.

Chart 7 shows initial and final differences between the CBSD and the SSIS database before and after QC. From the initial difference of -27.728 Millions of euros (SSIS greater than CBSD), almost 80% (corresponding to 22.126 Millions of Euros) were manually inserted and 19% (corresponding

to 5.187 Millions of Euros) were automatically inserted into CBSD after consultation of the SSIS database. In the end of the QC, the two databases are almost fully matched, with the amount of outstanding debt securities in CBSD being slightly greater than in SSIS database (which means a final difference of -5 Millions of Euros, 0,02% of the initial difference in absolute value).

Chart 7 · Initial and final differences between CBSD and SSIS databases (2015)



As in the case of comparisons with the CCR database, a complete matching is not possible mainly because some firms report liquid (deducted of fees) or mark-to-market values to the CBSD database while in the SSIS database figures appear at their gross or nominal value.

On the other way around, SSIS database also benefits from inputs of the CBSD. For example, in the case of debt issuance by companies belonging to the same business group, the consultation of the annual reports of companies during the QC of the CBSD annual data allows the identification of the correct issuer, which sometimes is incorrectly identified at the SSIS database. If non-resident companies are, indeed, those which issue the securities, the issue should not be considered at the SSIS, since they are non-resident. However, during the QC process of the CBSD, if the consolidated annual report indicates that securities are, actually, issued by a domestic firm of the group, contacts between the two areas are made and SSIS database is updated if necessary.

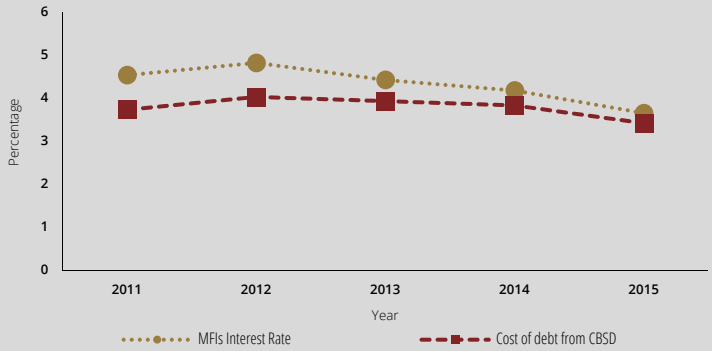
3.4. CBSD vs. MIR database

MIR database is used in the QC process of CBSD to detect eventual cases of a wrong report by firms. Chart 8 illustrates the interest rate of outstanding loans granted by MFIs to NFC, as well as the cost of debt from CBSD, defined as the interest paid divided by total borrowings.

Although this cost of debt contains other sources of financing besides loans from banks (and eventually with lower interest rates) it is a proxy for the interest rates that are actually paid by firms and, thus, it can be compared with MFIs' interest rates.

As it can be observed, in recent years, the overall cost of debt of NFC is not too far from the interest rates that are actually paid by NFC to MFIs.

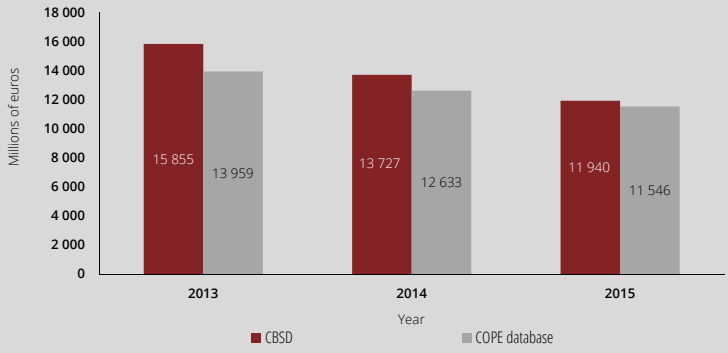
Chart 8 · Cost of debt of NFC



3.5. CBSD vs. COPE database

Chart 9 shows the amount of external loans in the CBSD and COPE database. As it can be seen, external loans in the two databases are almost completely matched, which is not a surprise given that, on the one hand, COPE database is one of the sources used to fill the gaps regarding external loans in the CBSD, and, on the other hand, information from the CBSD is also used by BoP for QC purposes.

Chart 9 · External loans in the CBSD and COPE database



On the other hand, comparisons between the amount of exports and imports of goods and services from the CBSD and the COPE and the Tax Authority databases are also made during the QC of the CBSD annual data. Contrarily to what happens with the CCR and SSIS databases, an almost complete matching is not possible because there are several methodological differences between the databases. However, information is used in the CBSD whenever it is needed to fill in missing values or confirm non-expected values according to the historical data for a given firm.

First, not all of the amounts recognized in the income statement correspond to effective financial flows. There are fractions of exports and imports that are not immediately paid. CBSD works according to an accounting perspective, while COPE database only recognizes exports or imports when there are financial flows. Hence, one of the sources of differences between the two databases is the existence of trade credits. Indeed, if we subtract the amount of trade credits to the exports and imports of the CBSD, there is an approximation to the COPE figures (Charts 10 and 11).

Besides trade credits, causes for an incomplete matching between CBSD and COPE database include the existence of transactions with resident branches of non-resident firms and with non-resident branches of resident firms[9], intra-group cash pooling, misclassification of transactions, time lags between the two databases, same operations reported in different companies of the same business group in each of the two systems, and the utilization of non-resident bank accounts owned by resident firms.

Regarding Tax Authority data, information sent to Banco de Portugal is divided by intra-EU and extra-EU trade. However, it was detected for some companies a duplication of values, given that transactions for which the goods are sent to an extra-EU location, but the counterpart is an intra-EU company were considered in both extra-EU and intra-EU systems by the Tax Authority. Also, non-resident branches of resident firms are treated by the Tax Authority as non-resident entities, while in accounting they are included in the report of resident firms. Anyway, this information is used in certain situations as a reference for CBSD QC.

Chart 10 · Exports of goods and services from CBSD and COPE database

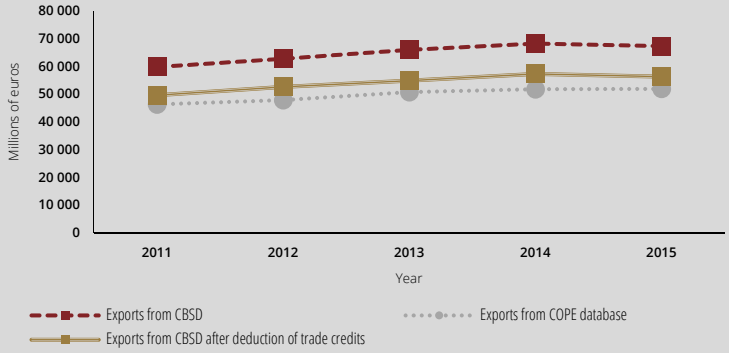
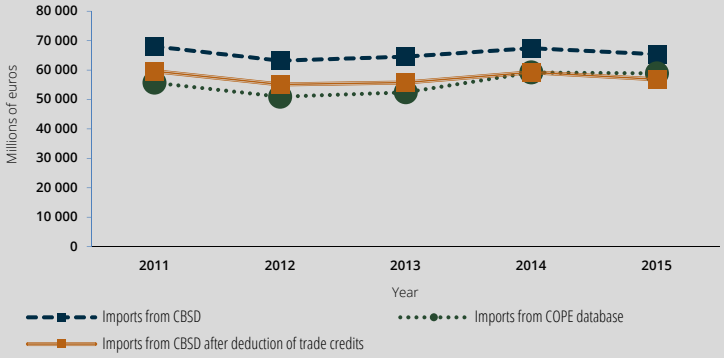


Chart 11 · Imports of goods and services from CBSD and COPE database



3.6. CBSD vs. Social Security data

Social Security data used at the CBSD were a result of a pre-processed query to the original Social Security data. From this query, only a file with the total number of employees and their wages by firm and year was made available to the CBSD. As a result, some differences arouse, especially regarding the number of employees, given that, through IES, firms report their average number of employees during the year and not the total one, as in the pre-processed file from the Social Security data.

Consequently, the number of employees from the Social Security data is greater than the CBSD. However, the trend is very similar as it can be seen in Chart 12. Wages from the CBSD and the Social Security are presented in Chart 13.

Chart 12 · Number of employees from the CBSD and the Social Security databases

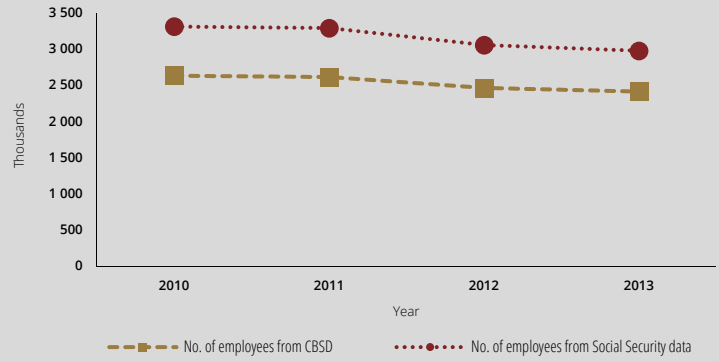
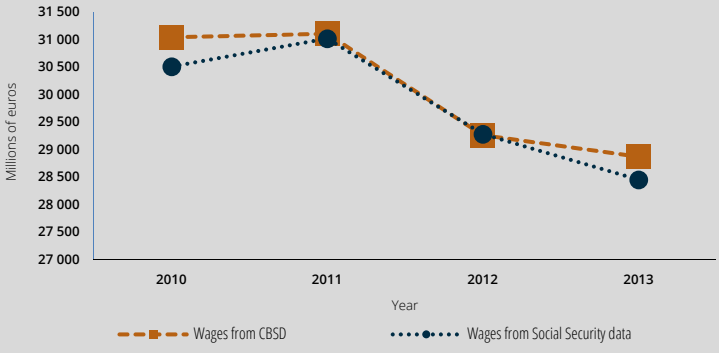


Chart 13 · Wages from the CBSD and the Social Security databases



4. Conclusions

Matching firm-level databases is essential to ensure the quality of statistics. This paper presents the specific case of the CBSD of Banco de Portugal, which benefits from the existence of both internal and external databases that allow filling the gaps of the information submitted by NFC.

The Statistics Department of Banco de Portugal manages several databases, namely the CBSD, the CCR, the SSIS, the MIR and the COPE databases. Besides internal databases, the CBSD also has or had access to external data sources such as the exports and imports from the Tax Authority and the number of employees from Ministry of Social Security. Every year, during the QC process of data sent by NFC, the Central Balance-Sheet Office uses information of these sources to improve the quality of its data.

It is important to stress that not only the Central Balance-Sheet Office, but also all the other divisions benefit from the integration and interchangeability of the databases managed by the Statistics Department of Banco de Portugal. Frequently, inputs from one division are used for other divisions to improve their data, by matching or by validation of their own reports.

Data from the CCR and the COPE databases on loans granted by financial institutions and group companies, and from the SSIS on debt securities issued by NFC are automatically and manually matched with the CBSD, overcoming misclassifications in the reported data that otherwise would only be solved by direct contact to firms, which would be a very slow process.

Sometimes, it is not possible to fully match the databases. If, in the case of CCR, nearly all the amount that is not matched derives from external loans, which are usually available from the COPE database, in the case of exports and imports the sources of differences between CBSD and COPE database is broader. Trade credits are the main justification, but there are many others such as transactions with resident branches of non-resident firms or between non-resident accounts, intra-group cash pooling and equal operations reported in different companies of the same business group.

It was also illustrated that independently of the database used, the trends are fairly the same, which is important in the sense that, even in the absence of some source, the other sources available allow the characterization of a given phenomenon.

To sum up, manage and match several databases contributes to improve the quality of statistics. In the particular case of the CBSD, it was demonstrated that matching databases allows filling the gaps of NFC reports, although there are some methodological differences, whose knowledge also contributes to better understand the boundaries of each data source.

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Notes

* IFC / ECCBSO / CBRT Conference on "Uses of Central Balance Sheet Data Offices' information", Özdere-İzmir, Turkey, 26 September 2016.

4. The analyses, opinions and findings of this paper represent the views of the authors, which are not necessarily those of the Banco de Portugal or the Eurosystem. Any errors and omissions are the sole responsibility of the authors.

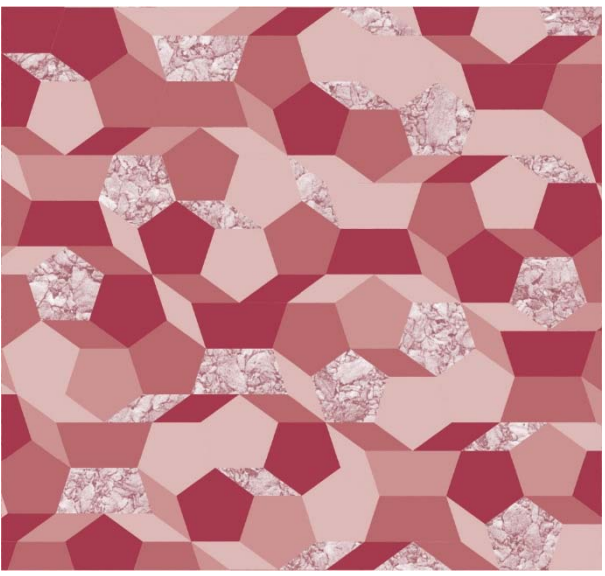
5. This sample is generated from the universe of more than 370.000 companies, according to some criteria. Usually, the final sample of validated companies represents more than 1% of the universe and more than 50% of the turnover of Portuguese NFC.

6. Also denoted as "external loans" throughout this paper.

7. NFC with external loans in the previous years are distributed for manual QC.

8. Bankrupt firms usually submit their IES with many figures equal to zero, namely loans granted by financial institutions, while in the CCR database these loans remain. This happens because banks that report to the CCR continue to recognize these loans in their balance-sheets.

9. Non-resident branches of resident firms are considered by COPE database as non-resident entities, while in IES an accounting perspective prevails and they are considered as part of the resident firm.



III

Indicators of macroeconomic imbalances

Portuguese economy: Statistical analysis
on the current account reversal´s sustainability

Portuguese economy: Statistical analysis on the current account reversal´s sustainability*[10]

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Abstract

In the past, Portugal exhibited persistent deficits on the current and capital account. In 2012, this situation reverted and a surplus in the current and capital account has been registered since 2012. The aim of this paper is to explore external statistics as a key source to evaluate country´s economic performance. External macroeconomic imbalances have to be analysed beyond traditional current and capital account. In particular, real economy cannot be disregarded from financial flows and positions. The richness of statistical data availability constitute a relevant tool to monitor economies performance and support economic decision makers.

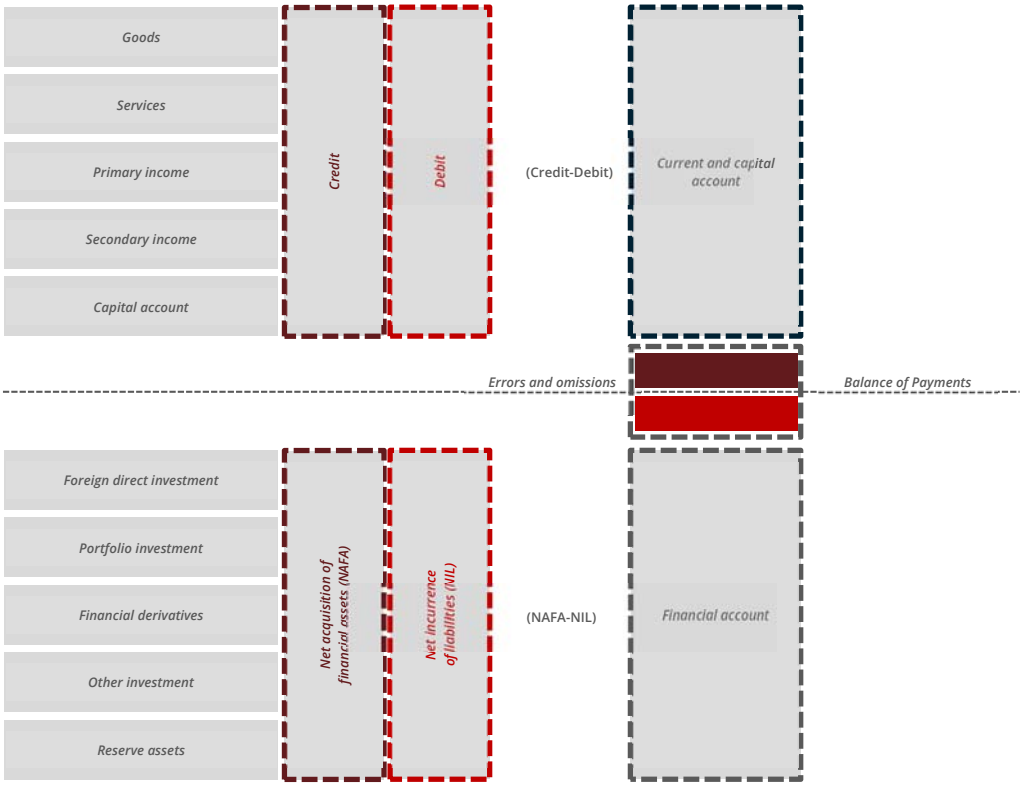
Keywords: macroeconomic imbalances, current and capital account, financial account, international investment position, VAR model

JEL classification: E66, O52.

1. Introduction

Balance of payments measures external transactions occurred between residents and non-residents in one economy, in a specific period of time. It is composed by two main categories that should be balanced on a regular basis - current and capital account and financial account[11] (Figure 1). Current account deals with real and short–term external transactions (international trade - goods and services - and income - primary and secondary), while capital account records physical assets, in/ out flows of capital that brings a change in a country´s foreign assets and liabilities. Financial account includes financial assets and liabilities external transactions.

Figure 1 · Balance of payments composition

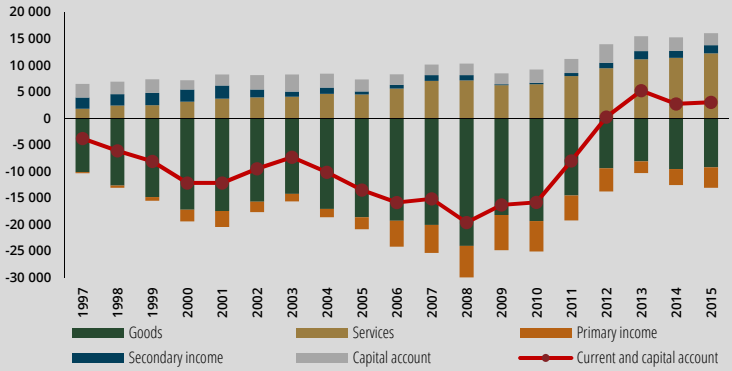


An economy that exhibits a deficit/ surplus in the current and capital account is considered as a net debtor/ creditor to the rest of the world with positive/ negative external inflows, meaning that its external net incurrence of liabilities is higher/ lower than its external net acquisition of net financial assets.

Until 2012 Portugal was a net external debtor. Chart 1 shows the Portuguese current and capital account and its main components. Services, secondary income (where migrants' remittances are included) and capital account contribute positively to the balance of current and capital account, while goods and primary income (income earned from production, capital and labour factors) contribute negatively.

Current and capital account cannot be however disregarded from its financial flows. In the Portuguese case, primary income for example, is mainly determined by investment income which is linked with the international investment position performance.

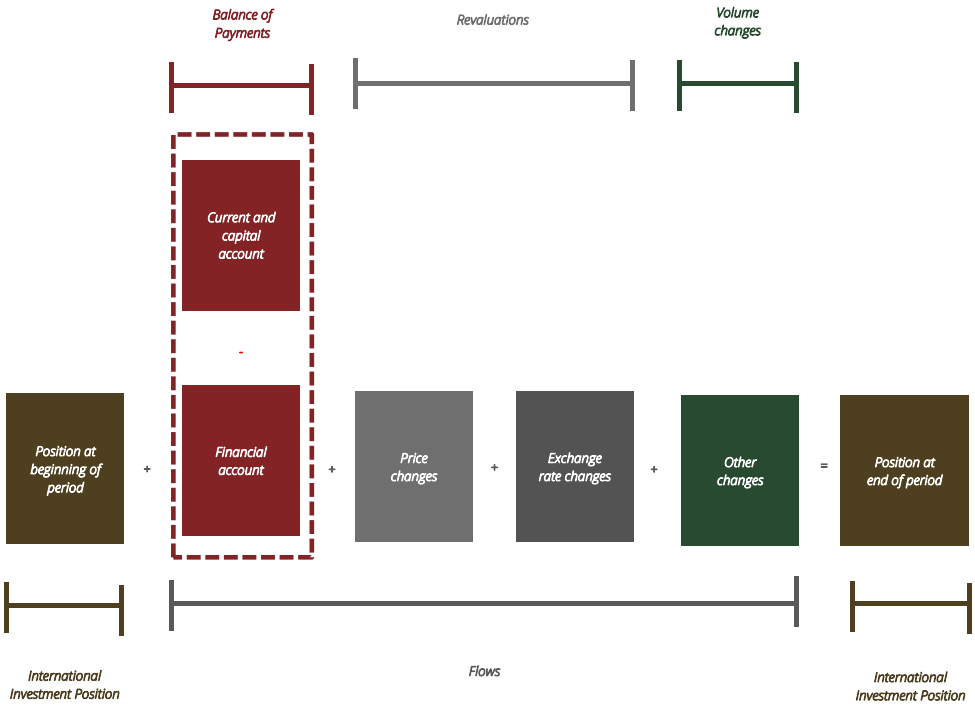
Chart 1 · Portuguese current and capital account by component, in MEUR



Source:_Banco de Portugal

The analysis of the current and capital account has to be complemented with financial transactions and the corresponding outstanding amounts. Financial transactions are one important component of the external stock amounts since the increase/ decrease of net financial assets will increase/ decrease the net international investment position. However, the change of the net international investment position is affected also by the existence of other flows; namely, price and exchange rate changes - earnings/ losses due to price (de)valuations/ exchange rates fluctuations - and other changes, which is a residual component expressing, for example, extinguished assets/ liabilities and statistical reclassifications (Figure 2).

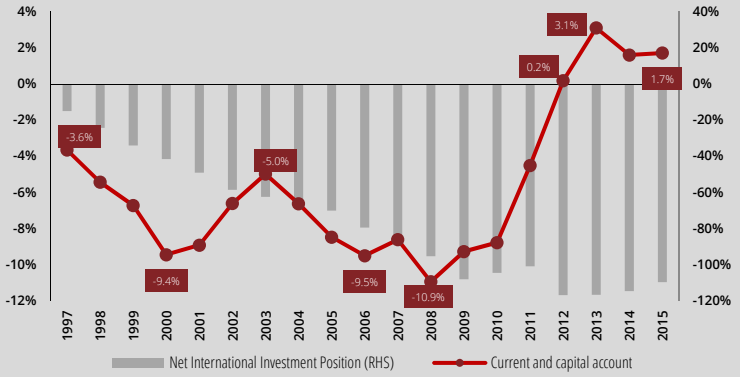
Figure 2 · International investment position decomposition



The ratio of the net international investment position to Gross Domestic Product (GDP) is commonly used to gauge the creditworthiness of a country. As stated by the European Commission: '*The more negative the net international investment position to Gross Domestic Product, the more country becomes vulnerable to volatility in international financial markets. Many countries that accumulated a large negative net outstanding amounts in the run-up to the crisis lost access to financial markets when the crisis struck and needed to accept international financial assistance to cover the deficit in their budgets*'. Therefore, it is a good statistical indicator to evaluate the risks to financial stability.

Portuguese current and capital account and the net international investment position are shown in Chart 2. For the time span considered, there is, in general, a positive relation between the two variables. However, for some years, there is a negative relation meaning that other flows than transactions explain the change in the stock amount and therefore cannot be disregarded. In 2012, for example, the current and capital account which stood at 0,2% of Gross Domestic Product (+4,7 p.p. when compared to 2011), the international investment position record -117% of GDP (-15,9 p.p.).

Chart 2 · Portuguese current and capital account and international investment position, in % of GDP



Source: Banco de Portugal

This paper does not aim to address any conclusion on the Portuguese recent current and capital account reversal sustainability. Instead, it takes Portugal as a case-study to demonstrate that the full understanding of one economy competitiveness cannot be dissociated from financial flows and positions and other macroeconomic statistics.

Currently, there exists a wide range of statistical data available which can provide a very important information to support decision makers and that can be used to monitor economies aiming to predict economic crises, for example.

Based on a statistical perspective and descriptive analysis, this paper focuses both on the level and composition of Portuguese debits/ liabilities *vis-à-vis* the rest of the world. Strengths and weaknesses are explored.

This paper comprises six sections. After the introduction in section 1, section 2 conducts a brief literature survey. Section 3 detail some external linkages between Portugal and other economies. Section 4 searches possible external risks and vulnerabilities of the Portuguese economy. Section 5 states some final considerations.

2. Literature survey

In 1817 David Ricardo supported that there are many economic benefits from international trade. External openness improves economic welfare if comparative advantages are explored. However, benefits can be offset if external economies connections are not wisely managed and understood.

International trade is the most relevant component of the Portuguese current and capital account. Its determinants are highly discussed in the literature. It is argued that current account is determined by both structural medium-term (more permanent) components and cyclical (transitory) determinants. Ca'Zorzi, Chudik and Dieppe (2012) use inter-temporal optimization to conduct a stock taking exercise on these relations. These authors argue that structural determinants are linked with gap between domestic savings and investment, demographic factors (for example, dependency ratio), trade imbalances, external competitiveness and dependency on production factors like energy. Although there are cyclical elements as business cycles that influence also the current account.

However, due to the complexity of the current and capital account, other macroeconomic indicators need also to be used to explain its evolution. Brimissis (2010) assumes that *'a higher fiscal deficit (...) decreases private saving (...) under the Keynesian model (...) supports the twin-deficit hypothesis (...) fiscal deficits usually be accompanied by wider current account deficits'*.

On the linkages between current and capital account and financial account, Obstfeld (2012) supports that external exposure cannot be dissociated to the financial account, because international crisis are the product of severe liquidity constraints: '*while policymakers must continue to monitor global current accounts (...) large gross financial flows entail potential stability risks that may be only distantly related*'. Accordingly, available literature suggests joint assessment of current and capital and financial accounts imbalances.

The sign and magnitude of the current account is also commonly discussed. Ghosh and Ramakrishnan (2012) state that '*whether a deficit is good or bad depends on the factors giving rise to that deficit*'. For instance, current account deficit can be used to mitigate external shocks, particularly when initial level of deficit is not excessive. External exposure soundness depends (*inter alia*) on risk minimization (portfolio diversification and solvency binomial).

On the current account reversals Ghosh and Ramakrishnan (2012) said that '*several economies during the recent global crisis (...) Such reversals can be highly disruptive because private consumption, investment, and government expenditure must be curtailed abruptly when foreign financing is no longer available (...)*'.

In this concern, current account reversals have to be monitored. Financial statistics and other economic indicators can provide an insight on the strengths and weaknesses of the reversals.

3. New financial landscape: The Portuguese case and international comparison

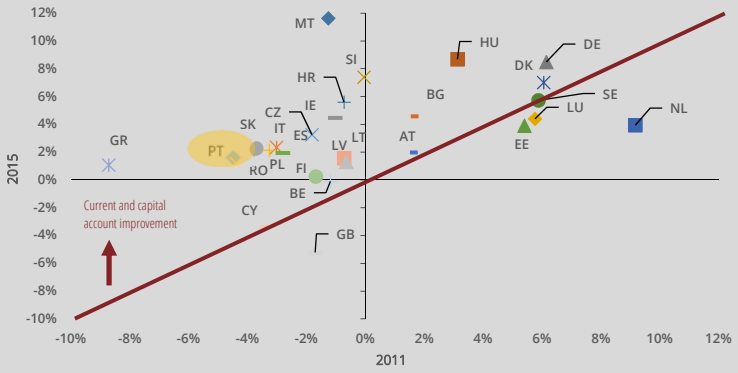
3.1. External linkages between Portugal and other economies

In 2015, the degree of openness - measured as the sum of exports and imports over nominal GDP - of the Portuguese economy was levelled at approximately 80%. When compared with the other European Union countries, Portugal stood in the 28th position. According to Eurostat data, other vulnerable economies were aligned with Portugal - Italy (29th), Greece (26th) and Spain (24th), with the exception to Ireland which ranked third more opened economy of the European Union.

The Portuguese external deficit between 1997 and 2011 reflected low external economic competitiveness. After 2012 Portugal becomes an external net lender. It is worth mentioning that this situation is followed by the recent world economic and financial crisis.

The Portuguese (PT) current and capital account reversal was not an exception when compared with other European countries (Chart 3). The majority of these countries evidenced current and capital deficits in 2011 and were external net lenders in 2015.

Chart 3 · European countries current and capital account balances, in % of GDP (2011 and 2015)



Source: Eurostat

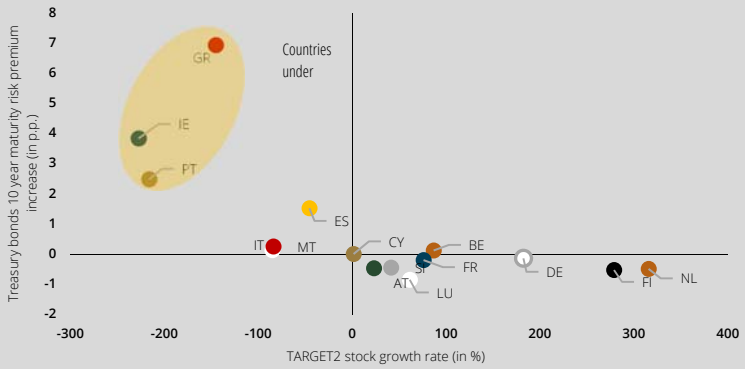
Euro-Area vulnerable economies liquidity constraints were attenuated by the accommodative policy led by ECB which reflected in the Trans-European Automated Real-time Gross settlement European Transfer system (TARGET2). Tressel (2014) argued that '*overall support provided by the Eurosystem to banks or sovereigns of various Euro-Area countries is reflected in the TARGET2 balances*'.

According to Sinn and Wollmershäuser (2011) '*Greece and Portugal financed their current account deficits in 2008 to 2010 through TARGET2*' suggesting that TARGET2 can predict external financing problems.

Chart 4 compares for a sample of selected Euro-Area countries, TARGET2 growth rate and 10 year Treasury bonds interest rate (risk premium) developments. According to this graphic, between 2008 and 2010, the accommodative policy led by ECB which reflected in TARGET 2 financed vulnerable Euro-Area economies as Portugal and Greece. For the particular case of Germany, Cecchetti et. al. (2012) argued that '*since the beginning of the financial crisis in August 2007, claims of the Deutsche*

Bundesbank on the Eurosystem through the TARGET2 system have gone from basically zero to more than €700 billion'. At the same time, international markets were already penalizing public debt issues - Treasury bonds risk premium increased, due to macroeconomic imbalances, in vulnerable economies.

Chart 4 · TARGET2 stocks variation and Treasury bonds risk premium (2008 – 2010)



Source: European Central Bank

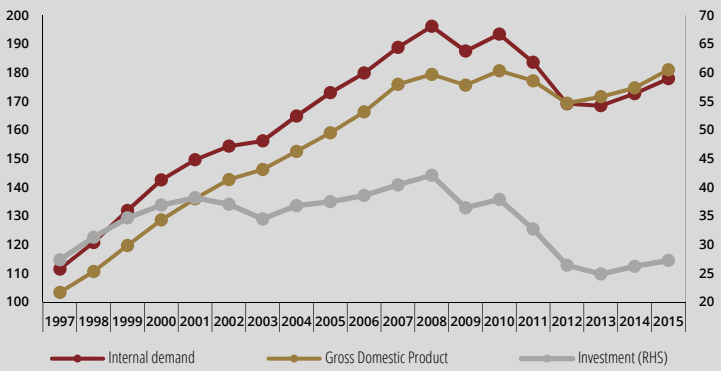
3.2. Portuguese current account and financial account

In Portugal, at the same time that current account increased, internal demand via investment (Chart 5) decreased.

According to the European Commission article '*The cyclical component of current-account balances*', '*The rebalancing of trade (and thus current-account) balances in the vulnerable countries is reflected in domestic demand declining faster than output*'. This situation can be observed in Portugal. After 2010 there was a decline of private investment; private consumption has generally declined more than GDP and contributed to raising saving rates.

The European Commission article states that: '*The countercyclical increases in fiscal deficits initially slowed the narrowing of current-account deficits in a number of vulnerable countries, but fiscal consolidation has contributed to improving their current-account balances since 2009-10*'.

Chart 5 · Portuguese Gross Domestic Product and internal demand, in 1,000 MEUR



Source: Eurostat

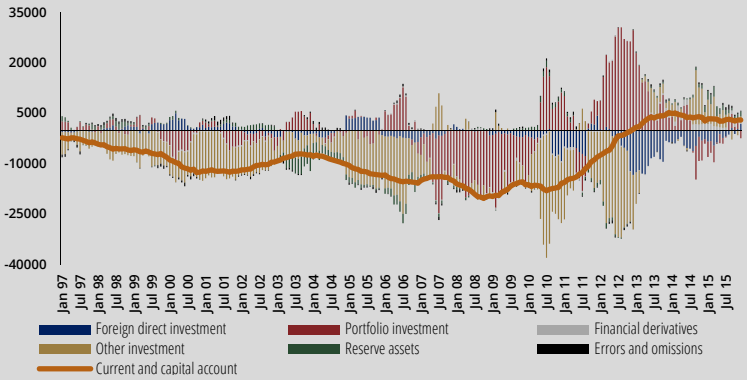
Current and capital account recent reversal is attributable to a combined increase in the services account surplus and an improvement in the goods account deficit.

Financial account, the mirror of the current and capital account - captures financial transactions which correspond in many circumstances to exports/ imports and/ or primary/ secondary income of the economy. However, there are transactions that may have impact in the same account.

On the financial side, different patterns can be referred before and after the world economic and financial crisis. Chart 6 displays the relation between current and capital account and financial account (broken down by functional category). According to this evolution four different phases can be inferred:

- Between [1997-2007] Portuguese current and capital account accumulated deficits. On the financial account, Portugal was mainly financed by external loans (other investment functional category);
- Between [2007-2010] there is also an accumulation of the current and capital deficits. In this period, Portuguese external financing was mainly obtained under portfolio investment - issuance of debt securities and equity by corporations (financial and non-financial) and general government. Portfolio investment is considered a more volatile investment than foreign direct investment;
- Between [2010-2014], under the recent Bailout Programme (Economic and Financial Assistance Programme), a reversal of the current and capital account is observed. Financial transactions were compensated within financial account and not in the current account. Portugal obtained external loans from the European Commission, European Central Bank and International Monetary Fund (IMF) (with a negative impact on other investment balance) and in the meantime there are long term debt securities amortizations with a positive impact on the net portfolio investment. Reserve assets[12] also increased after the Bailout programme. Net foreign direct investment shows also during this period a negative performance associated with intra-group inflows in the form of loans to suppress internal liquidity constraints; and,
- After 2014 there is an increase of the issuance of general government debt securities in the international markets - with a negative impact on the net portfolio investment. At the same time, there were European Union-IMF loan redemptions (other investment exhibited a positive sign). Direct investment decreased induced by some non-resident companies that controlled/ had significant degree of influence on the management on domestic firms.

Chart 6 · Portuguese balance of payments (12 month accumulated flows), in MEUR



Source: Banco de Portugal

3.3. International investment position performance

The new financial landscape brought also some changes in the net international investment position performance and composition.

Between 1997 and 2015, the Portuguese net international investment position was negative (-109% of the GDP in 2015), which reflects a potential risk to financial stability. According to the European Commission countries with largest negative net international investment positions manage to reduce their large current account deficits or even shifted to external surpluses, which are sufficient to stabilise and slowly reduce their net external indebtedness over the medium term.

However, a mere stabilisation of external indebtedness may not be enough to restore full confidence, in particular for countries where the large negative net international investment positions essentially reflect level of debt (as opposed to countries where large negative amounts is driven by significant inflows of foreign direct investment).

In Portugal, recent positive current and capital account developments have contributed positively to the increase of the Portuguese external wealth. Nonetheless, there are other flows which influence international investment position and external sustainability that cannot be disregarded.

Chart 7 depicts Portuguese net international investment position between 1997 and 2015, broken down by transactions, revaluations (exchange rate and price changes), and other flows. Until 2009, financial transactions were the most important contributor to the international investment position. After the financial crises, in 2009 (with a 'new financial landscape') the net international investment position was determined by revaluations and other changes in volume. Before 2009, financial transactions were the main driver.

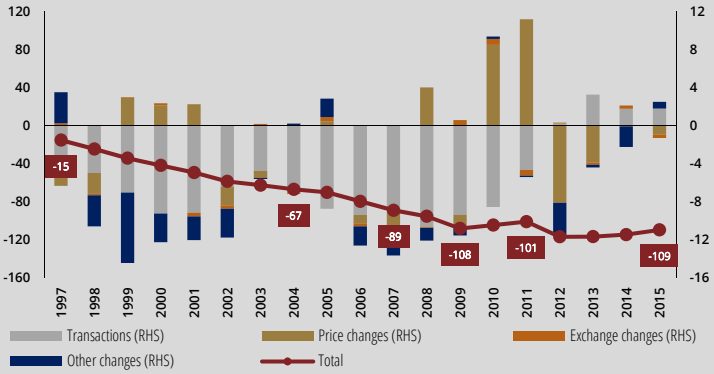
Price changes (a small component of the international investment position until 2008) increased after 2008 and was the main contributor between 2012 and 2013. Price changes show the valuation of Treasury bonds issued by general government held by non-residents, associated to the risk increase of the Portuguese economy. Non-financial corporation sector was also responsible to the price changes under the Portuguese stock exchange index (PSI 20). On the monetary financial institutions rather than central bank Banco de Portugal reported that '*both the return on equity and*

the return on assets improved considerably in 2015 (...) positive development in profitability was mainly driven by a significant reduction in the flow of impairments'.

Other changes which measure, for instance, write-offs played also an important role in the net international investment position between 2012 and 2014.

Finally, recent evolution of the net international investment position as a percentage of GDP, benefits from a denominator effect (especially in 2014 and 2015); GDP increase (around 2% and 3%, respectively), after a sharp decrease in 2012 (nearly 4%).

Chart 7 · Portuguese international investment position by type of flow, in % of GDP



Source: Banco de Portugal

When compared to other vulnerable economies, Portugal has a similar net international investment position performance to Greece and Spain (in 2015, -126% of GDP and -90% of GDP, respectively). Italian net international investment position accounted for -27% of GDP (the better performance among the European vulnerable economies). Ireland registered its worst amount in 2012 (-130% of GDP), recovering to -70% of GDP in just 3 years (2015).

In the context of the three European economies with recent Bailout Programs – Greece, Ireland and Portugal – Portugal is the only country that exhibits a negative change in the net foreign direct investment position.

Excluding equity and financial derivatives from the international investment position, Portuguese net external debt chiefs 102% of GDP in 2015; which is the highest value (virtually equal to 2012) since 1997.

3.4. Current account and financial components linkages: an empirical analysis

The causality between current and capital account and financial account is highly discussed in the literature. Ersoy (2011) conducted causality tests for Turkey in order to understand the relationship between these 2 variables: '*Granger causality that runs from financial inflows to current account deficits*

(..) investigation suggest that the current account sustainability may be provided via better management of financial account'.

In order to conduct an empirical analysis on the causalities and impacts of financial components into the current and capital account, a vector autoregressive model (VAR) was conducted. These models, became popular by Sims (1980) who provided a flexible framework to analyse the linkages and impacts among different financial/ non-financial variables.

In general – Pfaff et. al. - a VAR is a process constituted by K endogenous variables $y_t = (y_{1t},...,y_{kt},...,y_{Kt})$

$$y_t = A_1 y_{t-a} + ... + A_p y_{t-p} + u_t$$

Where A_i are coefficient matrices KxK for $i = 1,..., p$ and u_t is a K dimension white noise process.

In this respect, VAR models capture linear interdependencies between different time series. By exploring causality between different variables, these models allow to explore impact of shocks in explanatory variables in the dependent variables (impulse response functions).

Quarterly data was considered from 2001Q4 to 2015Q4 covering the following variables: the change rate of current and capital account seasonal adjusted in percentage of GDP; change rate of trade openness, sum of exports and imports as a percentage of GDP; change rate of net portfolio investment as a percentage of GDP; Portuguese stock exchange index variation (PSI 20); exchange rate measured in euro *vis-à-vis* US dollars, change rate of net other investment as a percentage of GDP. GDP used is seasonal adjusted.

In methodological terms, stationarity tests were run. Augmented Dickey-Fuller tests were considered for trend and intercept, intercept and none, and the conclusion is that variables have different degrees of integration (no cointegration). Non-stationary time series were transformed.

VAR lag length was chosen taking into account standard information criteria information. Quality tests and stability – inverse roots of AR characteristic polynomial, residual autocorrelation, for example – was analysed.

VAR Block Exogeneity tests suggest that the chosen independent variables jointly explain current and capital account variation. More particularly, trade openness, portfolio investment and the Portuguese stock exchange individually Granger cause the current and capital account variation. It is also worth mentioning that bidirectional causality was also found.

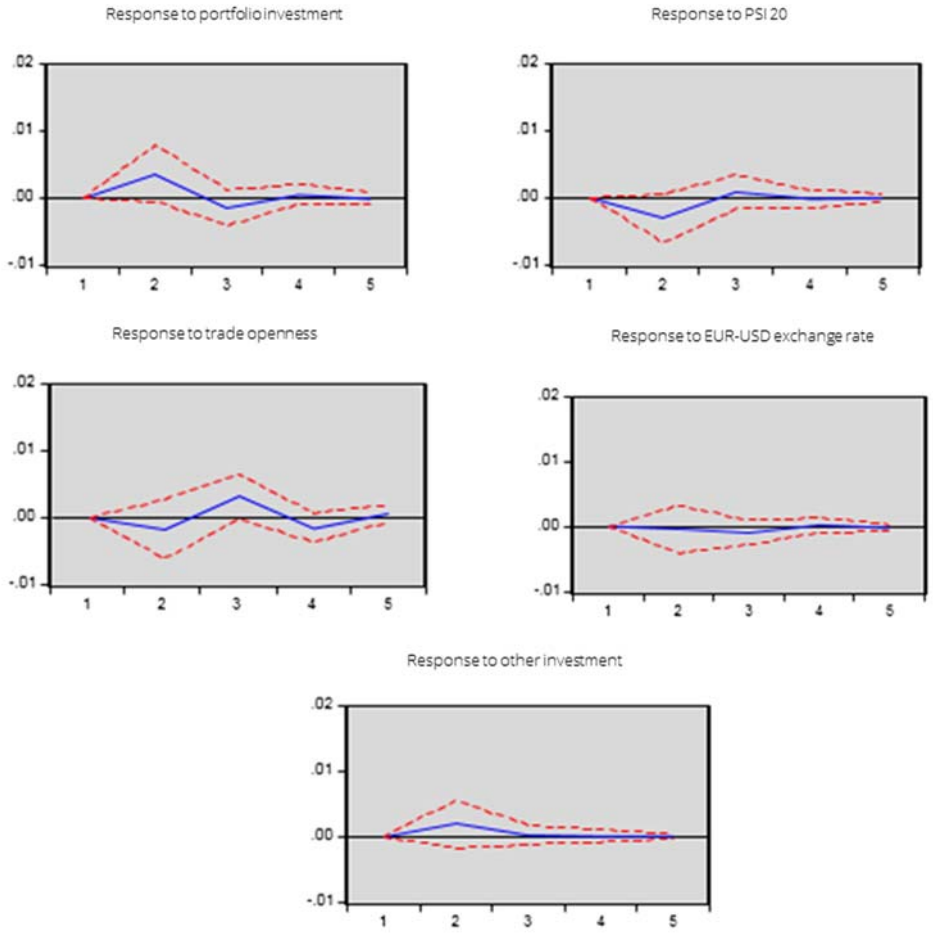
Non-accumulated 5 period impulse response functions are shown in Figure 4; mixed results among the variables considered. The two main lessons: i) there is statistical evidence of a link between the financial and current and capital account time series; and, ii) financial account components have a direct impact on the current and capital account.

Figure 3 shows a positive impact of the net other investment in the current and capital account and an accumulated positive impact of the net portfolio investment. Trade openness, have mixed effects but also positive accumulated effects on the current and capital account. Exchange rate has a negative impact since imports becomes less expensive and exports get more expensive, so there

is a negative impact on international trade. Portuguese companies index have negative almost null effects.

The results obtained are consistent with the joint analysis of the balance of payments/ international investment position, since financial transactions are linked with investment income and also can reflect the capacity of the economy to be a net creditor of the rest of the world. When there is an investment abroad (or positive net acquisition of financial assets) it means that the economy has the ability to be a net creditor of the rest of the world. It will have also a positive impact on the investment income meaning that the economy will receive more credits from those investments.

Figure 3 · Portugal: non-cumulative impulse response functions of the current and capital account variation



4. Looking beyond traditional components

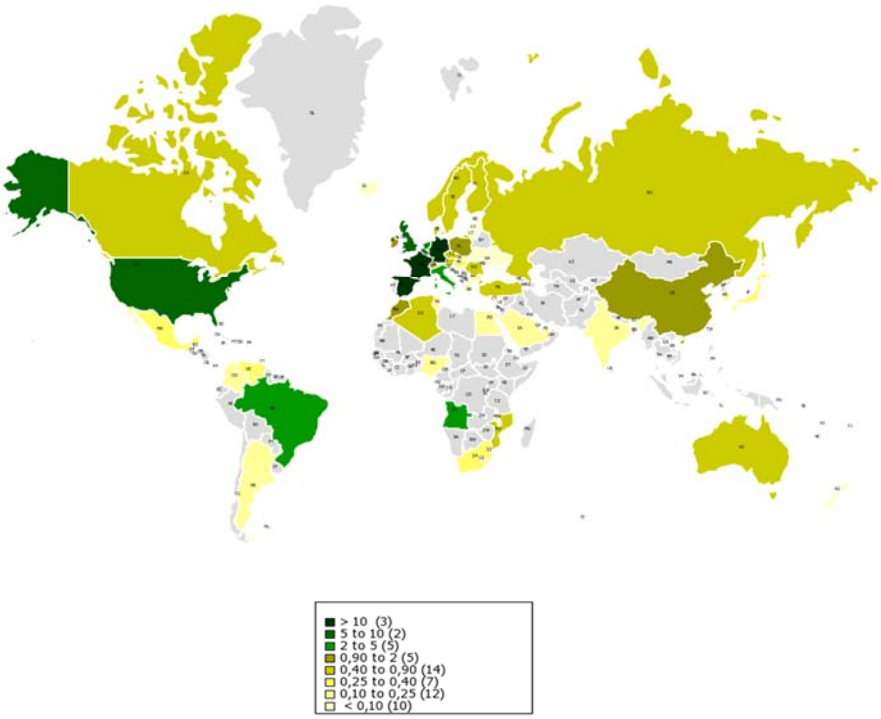
There are several indicators that have to be taken into account when analysing a country's risk exposures and vulnerabilities both on current account transactions and on financial flows.

The degree of a country diversification of exports/ imports is important to address risk exposures to international trade. In Portugal, international trade of goods and services plays the most relevant role in the current and capital account.

By counterpart country of destination, both Portuguese exports and imports are highly concentrated (Figure 4) on a restricted number of countries. In 2015, approximately 75% of the Portuguese exports and imports were mainly attributable to ten markets of destination. Spanish economy alone contributes with 20% and 31% for exports/ imports, respectively. It is also visible that international trade is mainly attributable to the European economy.

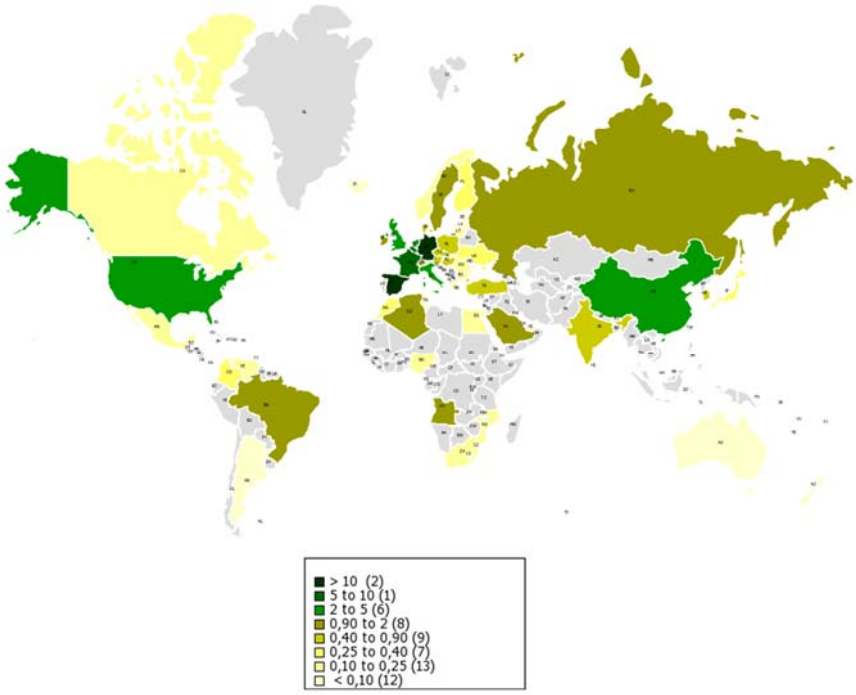
Between 1997 and 2015, Herfindahl-Hirschman Index reveals an increase of the exports geographical diversification, while imports suffered from the opposite phenomenon. It is important to state that the increase in exports diversification occurred after the world economic and financial crisis. Since 2008, Portuguese exports weight to non-European Union countries increased by 4,1 p.p. (United States increased by 1,2 p.p. and China by 0,9 p.p.). With the exception to Greece, this result can be also extended to other European economies. On the contrary, imports driven by non-European Union countries decreased by 1,7 p.p. (however, United States and China increased by 0,3 p.p. and 0,6 p.p., respectively).

Figure 4 · Portuguese international trade by geographical breakdown (2015)
Exports weight



Source: Banco de Portugal

Figure 4 · Portuguese international trade by geographical breakdown (2015)
Imports weight

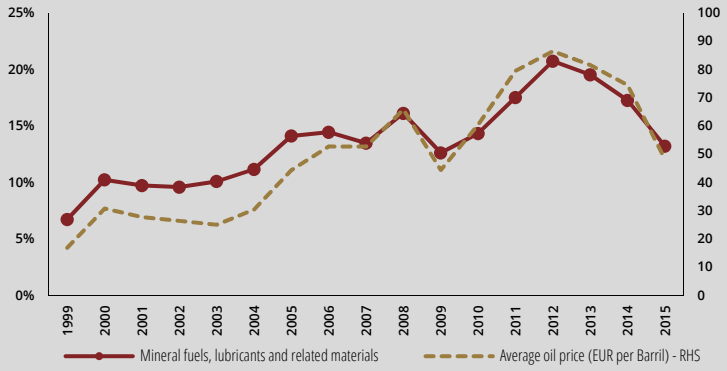


Source: Banco de Portugal

Standard International Trade Classification (SITC) is used to get an insight by type of product. In 2015, 13% of the Portuguese imports were related to mineral fuels, lubricants and related materials. At least in the short-run, energy is not substitutable therefore, there is a higher energetic dependency. Chart 8 shows that the weight of mineral fuels, lubricants and related materials is highly determined by oil price developments in international markets (correlation of 98%).

An inter-linked risk is associated to the fact that energy price changes are, most of the times, included in the price of exports (decrease of Portuguese manufacturers' margins). Imported energy price increases is associated to a Portuguese decrease in external competitiveness.

Chart 8 · Weight of mineral fuels, lubricants and related materials on Portuguese total imports and oil prices

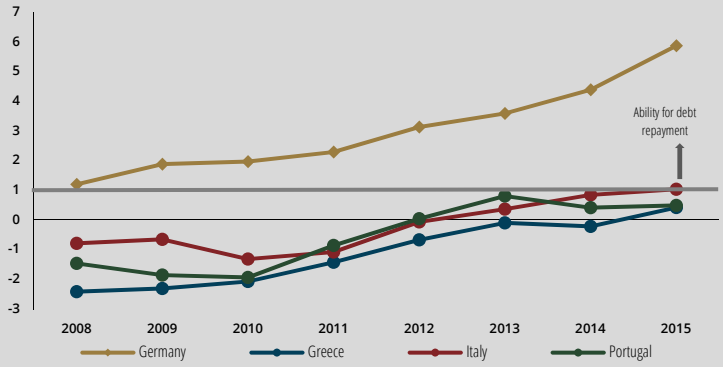


Source: Banco de Portugal and Eurostat

On the financial side, the Solvency Ratio of External Debt (SRED)[13] indicator, developed by Ucal and Oksay (2012), is applied for Portugal, Greece, Italy and Germany (Chart 9).

German economy exhibits a greater capability of repayment of debt when compared to Portugal, Greece and Italy (SRED greater than 1 for the entire period - 2008 to 2015). Although Portugal exhibits a favorable evolution on its external solvency situation in this period; after 2012, SRED slightly decreased, in contrast to the other vulnerable economies.

Chart 9 · Solvency Ratio of External Debt (SRED)*



Source: Eurostat

[Legend: According to Ucal and Oksay (2012), 'SRED value close to 1 means that repayment ability increases while a value of 1 or greater denotes increasing debt servicing ability whereas a value of less than 1 indicates that hard currency shortage is approaching']

*for some minor components there is no available information.

Other alternative measure for liquidity is the liabilities coverage – measured as the total liabilities over total assets. In 2012, this ratio stood at 162%; however, in 2015 total responsibilities *vis-à-vis* non-resident entities was virtually unchanged at 1.6 times greater than total assets. If data were publicly available, the level of risk associated to this level of indebtedness could be analyzed taking into account maturity mismatch – which aims to analyze if different obligations can be met with the available assets (treasury and liquidity management).

5. Final remarks

External statistics are an important source of information to evaluate competitiveness of one economy. The underlying macroeconomic aggregates enable to understand the external financing exposure, while permitting to address, together with other relevant statistics, its sustainability and potential vulnerabilities.

To address external sustainability issue, it is important to analyze current and capital account performance/ international trade markets (diversification of international markets, dependence on the imports ...). However, current and capital account *per se* do not fully explain the ability of a country to be an external creditor of the rest of the world and its capability to repay liabilities.

Balance of payments (financial account), international investment position and external data are the corollary of operations with different natures that reflect real economy and financial positions and flows. In this respect, economic opportunities and weaknesses cannot be dissociated of all this

implications, especially in a globalized world that increasingly relies on complex international financial transactions.

Statistical data is provided with a very detailed information. If correctly understood (impacts, methodology and linkages) it could perform economic predictions and anticipate economic crises. As mentioned above, in the case of Portugal the new financial landscape after the financial crises had some important statistical implications on the international investment position (and external debt) main components. In this concern, the external sustainability of the current account cannot disregarded financial components.

Although economic and financial crises are difficult to predict, statistical information can assess to monitor economies and support economic decision makers.

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Notes

* 8th IFC Conference, Basel, Switzerland, 8 September 2016.

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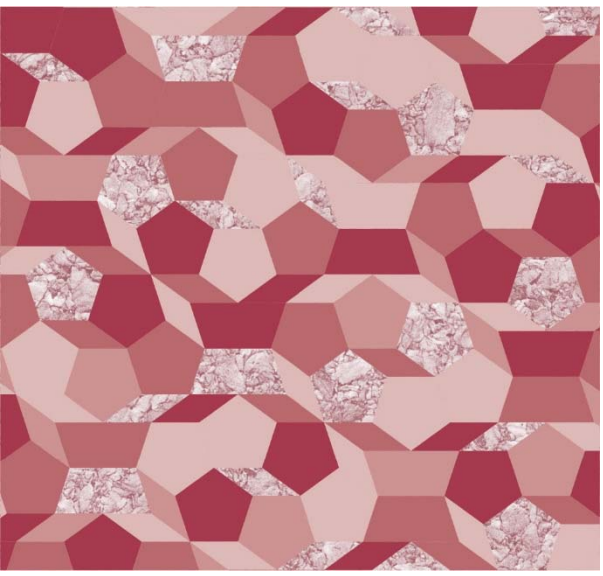
11. Current and capital account is not always equal to the financial account due to some statistical imperfections, lack of information, leads and lags measured by *errors and omissions*.

12. External assets controlled by monetary authorities and readily available to be used (high degree of liquidity).

13. Measured by the current and capital account as a percentage of interest and principal payments.



IV
Compiling statistics: Special case studies

Unconventional monetary policy – is there a call for unconventional statistics?

Banks International Asset Portfolios: Optimality, Linkages and Resilience

The indebtedness of Portuguese SMEs and the impact of leverage on their performance

Unconventional monetary policy – is there a call for unconventional statistics?*[14]

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Central banks across the world have been progressively adopting "unconventional" monetary policy measures which include, among others, zero or negative reference rates and expanded assets purchase programmes, aimed at pursuing price stability, easing the funding conditions for households and firms and ultimately promoting economic growth. In order to monitor the impacts from these measures it is essential the provision of good quality and timely statistics. In light of the current international statistical data requirements, namely in terms of the banks' balance-sheets and interest rates, financial accounts and public debt data, we will assess if these "conventional" statistics are fit for that purpose.

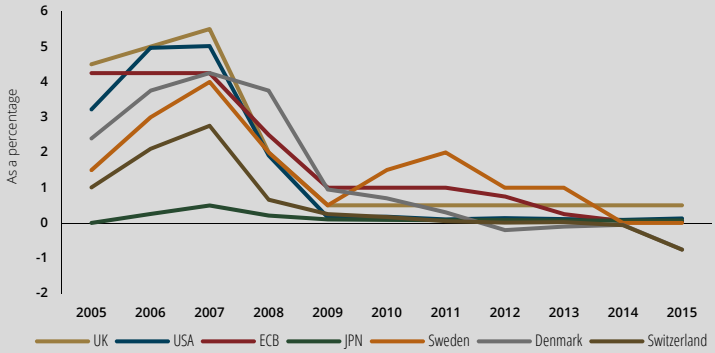
Keywords: unconventional monetary policy; central-bank balance sheet; credit aggregates; public debt

JEL classification: E52; E58; G21; H63

1. Introduction

Central banks conduct monetary policy to achieve the goals they are mandated to by means of an attempt to influence broad financial and macroeconomic conditions. One of the most traditional ways to do this is through the injection of reserves into the banking system according to the banks' demand in order to indirectly steer the interbank interest rate. Throughout the financial crisis that started in 2007-2008 this traditional tool proved to be insufficient to provide additional monetary policy accommodation in light of the combined effect of: i) liquidity shortages and market impairments, resulting from elevated liquidity and credit risk premia, which impeded the transmission of the intended monetary policy stance; and ii) a further easing of the stance was needed at times when short-term nominal interest rates were at their effective lower bound. Reference interest rates declined sharply from 2007-2008, becoming progressively very close to zero or even negative; indeed, at the end of 2015, reference interest rates in Switzerland and Denmark were negative (Chart 1).

Chart 1 · Reference interest rates



Source: European Central Bank; Bank of England; Board of Governors of the Federal Reserve System; Bank of Japan; Riksbank; Danmarks Nationalbank; Swiss National Bank and Swiss Exchange

Central banks around the world moved thus beyond their traditional operating framework to make use of their balance sheets as a monetary policy tool. According to the ECB (2015), faced with the strains and risks of the financial crisis, central banks began using their balance sheets taking one or more of the following actions:

- increasing liquidity provision to their banking systems elastically, i.e. accommodating banks' increased demand for liquidity, and modifying the modalities of liquidity provision to give funding reassurance, in some cases by also providing term lending;
- launching direct lending operations for the non-bank private sector or purchasing private sector assets;
- starting to purchase medium and long-dated public sector securities, or securities guaranteed by governments, on a large scale;
- offering explicit verbal guidance on the evolution of policy in the future, including indications about the future use of the central bank balance sheet if specific developments materialise.

As the ECB (2015) puts it, the provision of term funding combines liquidity support and credit easing. The idea is that by lowering banks' funding costs and credit spreads it will translate into looser financing conditions for final borrowers in the economy. This is also often referred to as quantitative easing (QE).

Accommodating the banking system's increased demand for liquidity and providing term funding will result in a larger central bank balance sheet. In the case of central bank interventions targeted at credit easing, it is the composition of the balance sheet's asset side that is of primary importance, in the sense that the assets on the balance sheet reflect the monetary authority's intention to ease conditions in specific markets. To do so, the monetary authority makes more active use of its balance sheet to improve upon or substitute for private financial intermediation, as well as to enable or enhance the transmission of the intended degree of accommodation. Credit easing measures are targeted at market segments that are closely linked to private non-financial sector borrowing conditions. This link may be direct – for example in the case of interventions that ease conditions in commercial paper markets – or indirect, where the central bank's action influences market prices

of assets that, in turn, affect the price applied to the underlying credit – as in the case of interventions in markets for products securitised on loans to households or companies. The measures taken by the central bank will depend on the specific characteristics of the impairment and the idiosyncrasies of the markets targeted, as well as more broadly on the financial structure of the economy and the set of tools available to the central bank.

In the words of Ms. Sabine Lautenschläger, Member of the Executive Board of the ECB and Vice-Chair of the Supervisory Board of the Single Supervisory Mechanism, at the Eighth ECB Statistics Conference, Frankfurt am Main, 5 July 2016, "conducting this kind of unconventional monetary policy is rather difficult when decisions have to be taken on the basis of conventional data, i.e. traditional aggregate statistics. Mitigating systemic risk in very turbulent times on that same basis is equally difficult." She added that "(...) even when policy decisions are taken on the basis of aggregate statistics, as is usually the case, moving towards granular data offers the big advantage of timeliness and flexibility: raw information can be organised and aggregated in different ways depending on the specific policy question at hand."

There is thus a call from monetary policy makers for unconventional data, which is not aggregate but granular, i.e., micro data. In fact, on the same occasion, Mr. Yannis Stournaras, Governor of the Bank of Greece, argued that "micro data firstly improve our understanding of the transmission mechanism of monetary policy and secondly allow us to better understand the aggregate data and thus better forecast their evolution." and that "having a richer set of granular data can help internalize the impact of monetary policy actions on wealth distribution and ultimately lead to a more precise modelling of the transmission mechanism."

In this paper, we start by looking at the evolution of central banks' balance sheets, using information available on the Bank of Japan, Bank of England, the Federal Reserve of the United States (Fed), the Eurosystem and Banco de Portugal. We will complement this analysis with statistical data concerning: new business interest rates, corresponding credit amounts and credit growth rates granted to households and non-financial corporations. Additionally, we will use financial accounts and public debt data, in order to assess the impact of these QE measures on the public debt holder structure. The case of Banco de Portugal will serve to illustrate the multiple uses of micro data given the variety of databases managed by the Statistics Department as documented by Drumond and Lima (2016).

2. Unconventional monetary policy around the globe

Japan was a front-runner of unconventional monetary policy actions, embarking on a policy of quantitative easing in 2001, nowadays followed by major industrialized countries to tackle the recessionary turbulence after the recent global financial crisis (Kimura and Nakajima, 2013). Japan adopted quantitative easing measures in March 2001, in order to control deflation (Shirakawa, 2002). The central bank set the reference interest rate close to zero and increased liquidity in the financial system, purchasing government bonds and asset-backed securities (Pelin Berkmen, 2012), aiming at encouraging the banks to grant loans to the private sector.

In the United States, according to the Federal Reserve Monetary Policy Releases, there were essentially three unconventional monetary policy programmes: the first, which started in November 2008, was the purchase of agency debt, agency mortgage-backed securities and long-term Treasury securities; the second consisted in additional purchases of long-term Treasury bonds (November 2010, as announcement date) and the third comprised a purchasing programme of agency

mortgage-backed securities and long-term Treasury securities (September 2012, as announcement date) (Rosengren, 2015). Similarly, these measures have been taken while interest rates were kept close to zero. When the economy showed signs of improvement the Fed decided to decelerate the quantitative easing programmes, in terms of purchasing assets, while maintaining low interest rates. At its December 2015 meeting, the Federal Open Market Committee (FOMC), the Federal Reserve's monetary policy committee, raised its target range for the federal funds rate by 25 basis points, marking the end of an extraordinary seven-year period during which the federal funds target range was held near zero to support the recovery of the U.S. economy from the worst financial crisis and recession since the Great Depression.

In the United Kingdom, the Bank of England decided, in March 2009, to lower interest rates to levels close to 0.5% in order to stimulate the economy. Since this reduction did not have the desired results, it was further created an asset purchase programme, specifically of public debt securities. Through this programme, the Bank of England succeeded in reducing the yields on government bonds and encouraged investment by investors to whom the central bank had acquired the securities (Joyce et al., 2011).

In the case of the European Central Bank (ECB) and the Eurosystem, three types of unconventional monetary policies have been carried out: LTRO (longer-term refinancing operations), TLTRO (longer-term refinancing operations targeted) and APP (Asset Purchase Programme). The APP includes the following programmes: Covered Bond Purchase Programme (CBPP – securitized bonds of mortgage loans and of the public sector), Asset-Backed Securities Purchase Programme (ABSPP – securitized bonds of loans granted to non-financial corporations), Public Sector Purchase Programme (PSPP for bonds issued by governments and international or supranational institutions located in the euro area) and, introduced in June 2016, the corporate sector purchase programme (CSPP). This programme aims at consolidating the pass-through effects of asset purchases to the real economy. In March 2016, before pursuing this new programme, the ECB announced a new series of targeted long-term refinancing operations (TLRO II). The ECB decided to keep these programmes with progressive reductions in interest rates, cutting the benchmark interest rate to a new record in 2016, namely, to levels close to or at zero.

Monetary policies known as LTROs and TLTRO are open market operations, in which the ECB lends money to banks, requiring assets as collateral. The aim is to encourage banks to facilitate lending to the private sector. According to DeMertzis and Wolff (2016), on a study on the effectiveness of the ECB's asset purchase programme, the LTRO programmes have been successful, while the TLTRO programme did not have the expected success, constraining the ECB to adopt new quantitative easing programmes in particular the APP. Since the creation of the APP, national central banks of the euro area and the ECB significantly increased the weight of public debt on their balance sheets (see Chapter 3).

3. Evidence from statistical data

3.1. Central banks's balance sheet

Accommodating the banking system's increased demand for liquidity and providing term funding has resulted in larger central banks' balance sheet. In the case of central bank interventions targeted at easing the credit conditions, it is the composition of the balance sheet's asset side that is of primary importance, in the sense that the assets on the balance sheet reflect the monetary authority's intention to ease conditions in specific markets. In this section we analyse the evolution

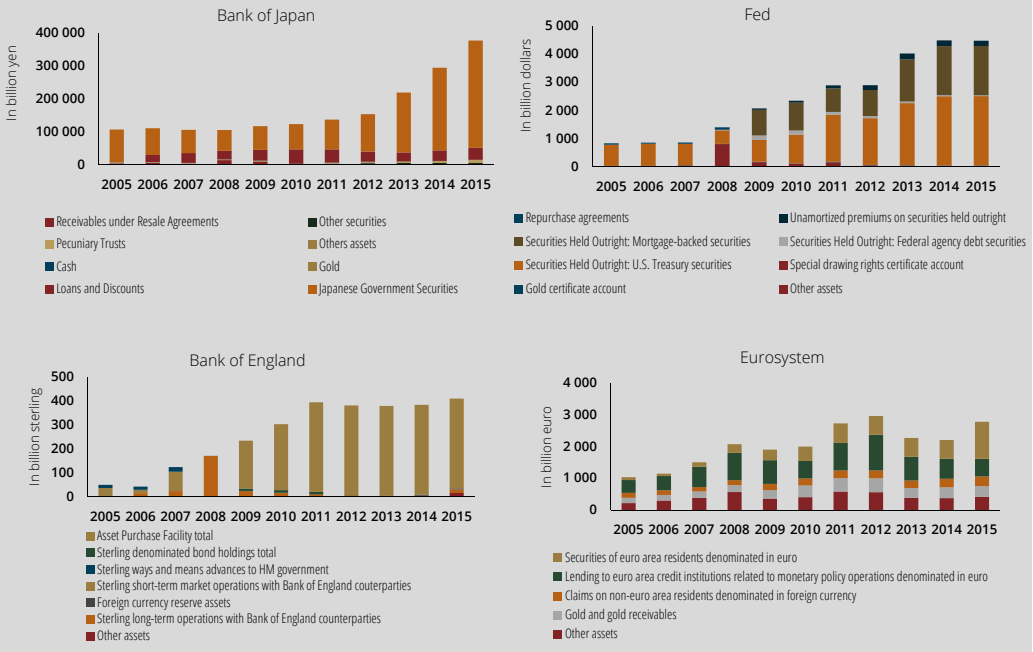
and the impact of these measures in the balance sheets of the selected monetary authorities involved in setting this new type of monetary policy. Chart 2 illustrates the evolution of the assets, between 2005 and 2015, for the Bank of Japan, the Fed, the Bank of England and the Eurosystem.

Starting with Japan, the balance sheet mirrors the massive purchases of securities issued by the Japanese government. The purchase of public debt securities reached the amount of 325 002 billion yen in 2015, which represented an increase of 361% when compared to 2007, around 75% of the Japanese GDP in 2015.

In the United States, from 2009 onwards, the Fed's balance sheet reflects the effect of unconventional monetary policies measures adopted, namely the purchase of mortgage-backed securities, as well as US Treasury securities, reaching respectively 1 747 billion dollars and 2 462 billion dollars in 2015. When compared with 2009, the stock of Securities Held Outright (mortgage-backed securities) increased 92% and the purchase of US Treasury securities 217%.

For the Bank of England, it is noteworthy the impact of the Asset Purchase Facility programme starting in 2009. At the end of 2015, the amount held in the portfolio of the central bank was 375 billion pounds, representing an increase of 88% when compared to 2009[15].

Chart 2 · Balance sheets | assets side



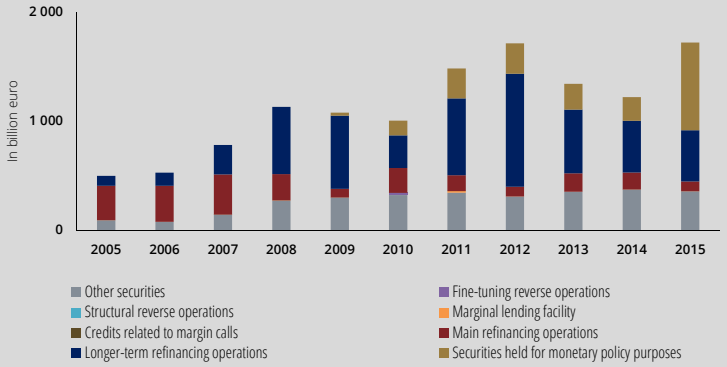
Source: European Central Bank; Board of Governors of the Federal Reserve System; Bank of Japan; Bank of England

In the case of the Eurosystem, we can observe the impact of LTRO in 2008, 2011 and 2012, also observed in chart 3, through the increase of long-term refinancing operations, which was reduced in 2013 and 2014, with the repayment made by banks.

In 2008, the component "Lending to euro area credit institutions related to monetary policy operations denominated in euro" amounted 860 billion euros, an increase of approximately 111% over 2005. Similarly, in 2008, it is visible the purchase of euro-denominated covered bonds under the

Covered Bond Purchase Programme by the ECB, which contributed to an increase of 179 billion euros in "Securities of euro area residents denominated in euro" compared to 2005. In 2014, the ECB undertook additional policy measures, namely the TLRO and a new purchase programme of covered bond and asset-backed securities purchase programme. However, the impact on the balance sheet of the Eurosystem was not significant as shown in Chart 2. In 2015, the ECB's balance sheet increased significantly again, as a result of the new debt purchase programme, which further raised the item "*Securities of euro area residents denominated in euro*", which includes government bonds purchased under the PSPP, by 571 billion euros from 2014 to 2015. Chart 3 details the monetary policy operations denominated in euro carried by the Eurosystem by type.

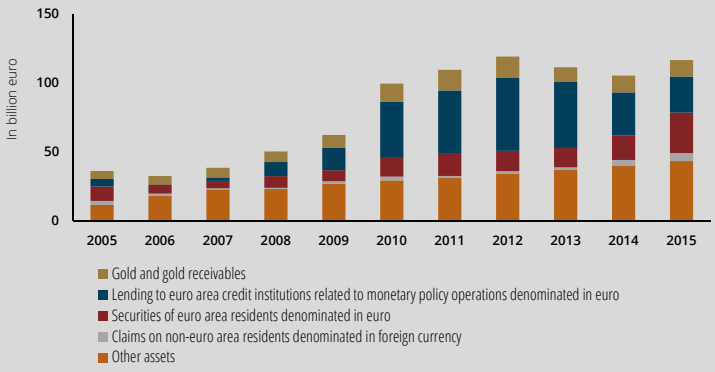
Chart 3 · Monetary policy operations denominated in euro | Eurosystem



Source: European Central Bank

In the case of Banco de Portugal, it is noteworthy the trend observed since 2009, with a sharp increase in component "*Lending to euro area credit Institutions related to monetary policy operations denominated in euro*" (Chart 4). In 2015, it is worth noting the increase in "*Securities of euro area residents denominated in euro*" held by Banco de Portugal compared with 2005 (182%), which was strongly influenced by the purchase of government bonds under the PSPP.

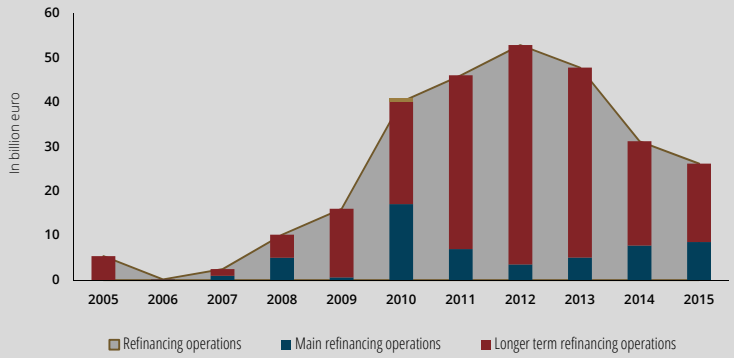
Chart 4 · Banco de Portugal | assets side



Source: Banco de Portugal

Chart 5 details the refinancing operations carried by Banco de Portugal by type, where it can be observed the predominance of long-term refinancing operations.

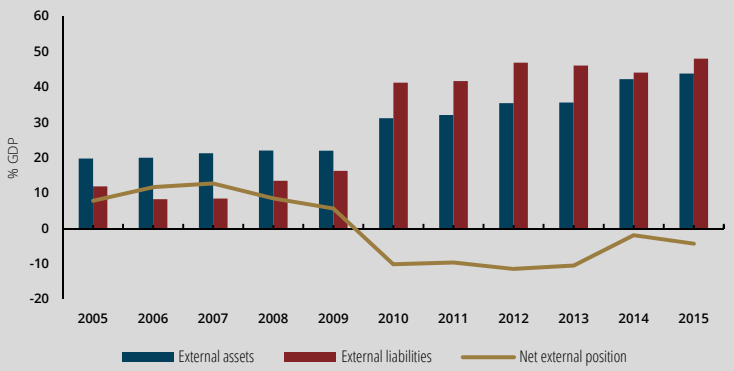
Chart 5 · Banco de Portugal | refinancing operations



Source: Banco de Portugal

The monetary policy operations conducted by Banco de Portugal in the context of the Eurosystem also had a significant impact in terms of the Bank's net external position, as measured in the framework of external statistics and the international investment position data. As Branco et al. (2015) illustrate, until 2009, Banco de Portugal exhibited a positive net external position; from 2010 onwards the net external position is negative (Chart 6). Nonetheless, it is possible to identify two distinct phases: first, 2010-2012, where the growth of external liabilities is not accompanied by an increase in the external assets at the same pace, thus leading to a deterioration of the net external position; and second, 2013-2014, where we can observe a decrease of external liabilities, thus contributing to an improvement of the net external position, reaching towards the end-2014 a relatively balanced record, which, in 2015, deteriorated a bit further.

Chart 6 · Banco de Portugal – net external position

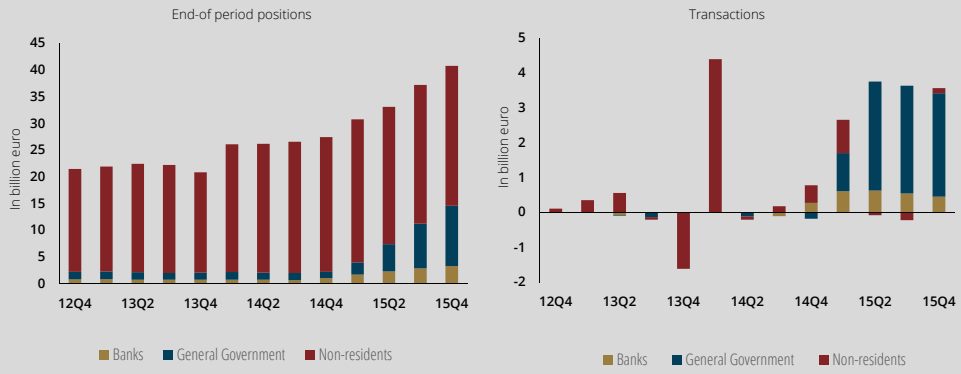


Source: Banco de Portugal

This evolution reflects the role of the central bank as an intermediary in the Eurosystem in financing resident banks – which is recorded as a liability of Banco de Portugal against the Eurosystem and as an asset against the resident banks. In fact, according to the Banco de Portugal's Annual Reports (2010-2013), "*In 2010 there was an increase in positions relating to monetary policy operations. This reflects the current market situation, which is marked by a continued increase in the demand for liquidity in the money market. In a context of financial market instability, liquidity management by Portuguese credit institutions, like in other countries, continued to be translated into high primary liquidity demand throughout the whole year, evidenced by a sharp rise in the relative value of the main refinancing operations and longer-term refinancing operations. The increase in claims related to monetary policy operations during the review period also reflects a rise in the portfolio of securities held for monetary policy purposes. The growth of claims related to monetary policy operations causes a very sharp rise in the Bank's intra-Eurosystem liabilities." As for 2013, "The total (net) balance of monetary policy operations, carried out within the framework of the Eurosystem, recorded a significant reduction in 2013 compared with 2012 (€-5 956 million), reversing the growth trend seen in the past few years. The significant decline in the amount outstanding of these operations was chiefly due to the decrease in the provision of liquidity to domestic credit institutions (€-4 920 million) in the context of the deleveraging process of their balance sheets."*

As mentioned earlier, from the analysis of Chart 4 it is noteworthy an increase of debt securities held by Banco de Portugal in 2015. Chart 7 illustrates that this resulted from the purchase of domestic government bonds. These securities were acquired under the Eurosystem's PSPP. These data is available from the financial accounts dataset, with counterpart data published by Banco de Portugal since April 2016, from 13Q4 onwards (see also section 3.3). It remains to be seen the impact stemming from the CSPP launched in June 2016.

Chart 7 · Debt seurities held by the Banco de Portugal by counterpart sector



Source: Banco de Portugal

3.2. Interest rates and credit growth

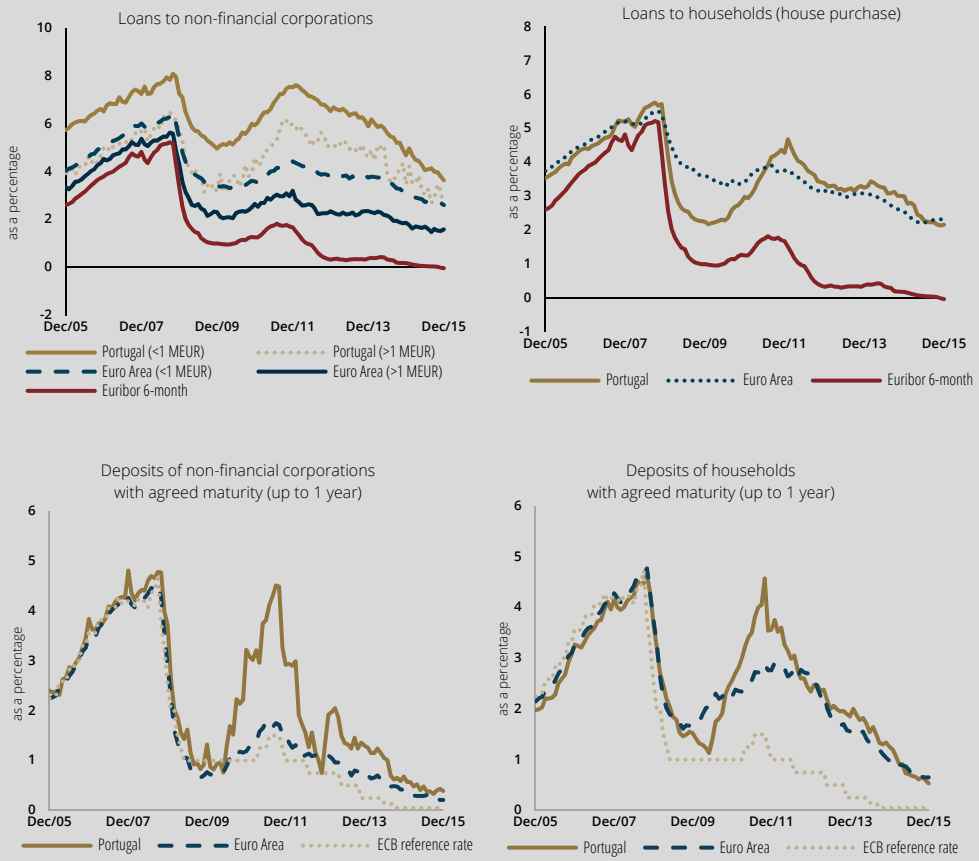
In a context of historically low interest rates and monetary policy measures aiming at promoting credit easing, statistical data on banking interest rates and credit developments are key to assess the impact of such measures. With aggregate data alone, policy makers miss lots of valuable information, namely the underlying distribution "hidden" behind the simple average.

In this section, we use "MFI interest rate statistics" that cover all interest rates that monetary financial institutions (MFIs) resident in the euro area – except central banks and money market funds – apply to euro-denominated deposits from and loans to households and non-financial corporations resident in the euro area, both for new business and outstanding amounts[16].

In the case of Portugal, the cost of loans to households has slightly decreased since 2012. At the end of 2015, interest rates (house purchase) were below the levels of the euro area. Similarly, since 2012, the cost of loans to non-financial corporations (NFCs) has been gradually decreasing (Chart 8). In December 2015, interest rates on new loans to NFCs were the lowest since the start of the data collection. In turn, spreads implied in these rates, using the six-month Euribor as the reference rate, stood at levels close to those of the period immediately before the sovereign debt crisis, but above those prevailing until 2008.

The decline in interest rates on new loans mainly reflects the monetary policy pursued by the ECB. In addition, the spread between average interest rates on new loans to NFCs in Portugal and the euro area has narrowed, although it remains considerably above the levels seen before 2008 (Chart 8). This convergence reflects, at least partly, decreased constraints on corporate financing – which had been the result of tighter policies on the supply of bank loans during the crisis period – and a gradual improvement in economic activity, contributing to a higher credit quality for firms (Banco de Portugal, 2016).

Chart 8 · Banking interest rates – Loans and deposits (new business) – Portugal

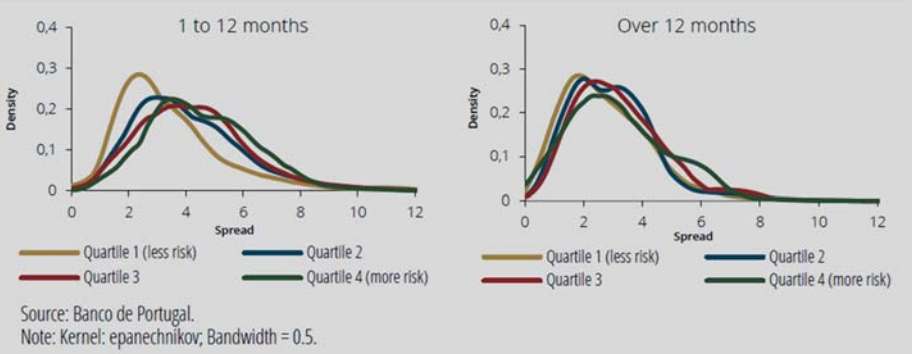


Source: Banco de Portugal and European Central Bank

Following a data request in the context of the Economic and Financial Assistance Programme to Portugal and, to better assess current credit conditions of the non-financial corporations and monetary policy transmission, Banco de Portugal started collecting individual data on new bank loans and respective interest rates. This database covers all new operations starting with reference period December 2014 (in its initial stage it was limited to banks with volumes of €50 million or higher). Combining these individual data with reference data and data available in other databases, we are able to study how interest rates vary according to the characteristics of the firms. In this respect, one of the main determinants of the interest rate applied to each firm is the credit risk associated to it. In fact, Banco de Portugal has recently taken decisive steps towards further exploring the informational potential of its own Central Credit Register (CCR) and balance sheet databases in an ongoing project that aims at creating an in-house credit assessment system, thus attributing a credit notation to each firm (Neves, 2014).

The relation between risk and interest rates on new loans to non-financial corporations was analysed in the latest Financial Stability Report, published by Banco de Portugal in May 2016. In order to assess the relationship between the level of risk of NFCs and the spreads on new loans, NFCs were divided into four classes according to their risk of default. From this breakdown, by comparing the distribution of spreads on new loans by risk class for the 2013-15 period, it was possible to assess the differentiation of rates between levels of risk. The analysis concludes that in 2015, the highest rates were generally associated with higher-risk firms (Chart 9).

Chart 9 · Average spreads on new bank loans to NFCs - Loans by maturity and risk quartile in 2015 – Portugal



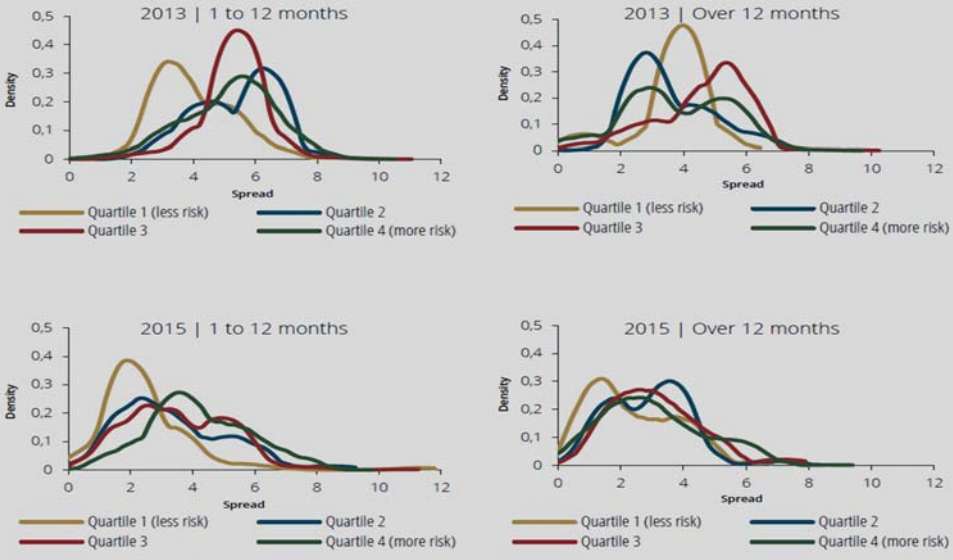
Source: Banco de Portugal.
Note: Kernel: epanechnikov; Bandwidth = 0.5.

Source: Banco de Portugal, Financial Stability Report, May 2016

The degree of differentiation seems smaller for longer maturities. Additionally, recent data point to a decline in interest rates on new loans for NFCs with both low and high credit risk, as suggested by the shift to the left of interest rate distributions.

Chart 10 illustrates that for new loans of over €1 million, the differentiation between risk classes in 2015 was greater than in 2013. This effect is particularly relevant in loans with longer maturities, where the apparent absence of differentiation in 2013 is in contrast with the risk differentiation observed in 2015.

Chart 10 · Average spreads on new bank loans to non-financial corporations – loans of over 1 million euro by maturity and quartile in 2013 and 2015 – Portugal



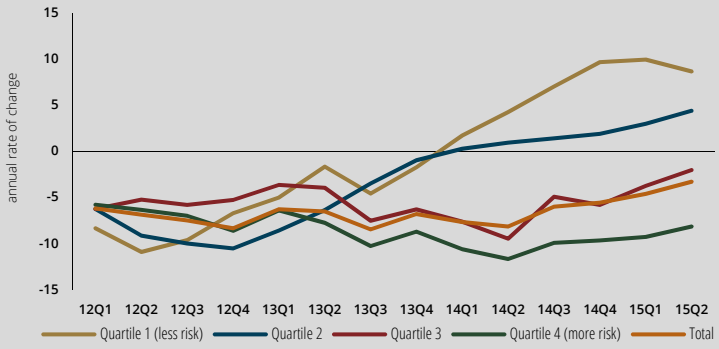
Source: Banco de Portugal.
Note: Kernel: epanechnikov; Bandwidth = 0.5.

Source: Banco de Portugal, Financial Stability Report, May 2016

Given that underlying the definition of quartiles is a credit risk assessment that already takes into account enterprise size, large enterprises alone do not justify the pattern observed. An analysis of loans of up to €1 million shows an apparent risk differentiation in 2013 and 2015, but also a gradual blurring of the distinction between quartiles with lower risk, which corroborates the indicators that have more recently pointed to greater competition by medium-risk firms. Summing up, evidence points to the existence of a differentiation in risk premia on new loans to NFCs. Risk differentiation is more noticeable in loans with a maturity of up to one year, particularly those of over €1 million.

Turning the attention to annual growth rates for loans (in terms of end-of period positions), Drumond and Lima (2016) conclude that, on aggregate, Portuguese banks are granting credit mostly to less risky firms (see Chart 11), suggesting that the overall reduction in the credit supply, confirmed by the negative year-on-year growth rates for NFCs as a whole, may have been part of a "flight to quality" in lending. Ferrando et al. (2015), on an investigation of the effect of sovereign stress and of unconventional monetary policy on small firms' financing patterns during the euro area debt crisis, found that after the crisis started, firms in stressed countries were more likely to be credit rationed, both in the quantity and in the price dimension, and to increase their use of debt securities. However, unlike the evidence suggested from Portuguese data, the authors concluded that more transparent and creditworthy firms in the euro are experienced a relatively larger decline in credit access, suggesting that the overall reduction in the credit supply was not part of a "flight to quality" in lending.

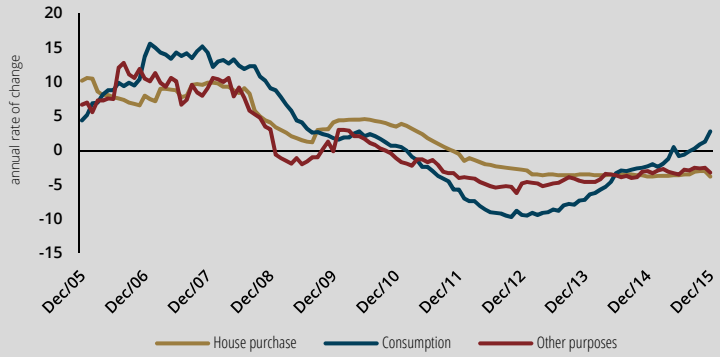
Chart 11 · Loans to NFCs by risk category | Portugal



Source: Banco de Portugal

Also in the case of households, micro data can be of use in order to better understand the driving forces behind the aggregates. Chart 12 shows the growth rate of loans to households; after several years of negative growth across all purposes, it is noticeable that consumption loans are picking up at a relatively steady pace, exhibiting already a positive annual rate of change, while housing loans are still decreasing. In this respect, we could consider an additional breakdown of the data presented, according, for example, to the main characteristics of the borrowers: age, education, occupation, source of income, indebtedness, wealth, etc. So far, this data is not available at Banco de Portugal.

Chart 12 · Bank loans to private individuals by purpose – Portugal



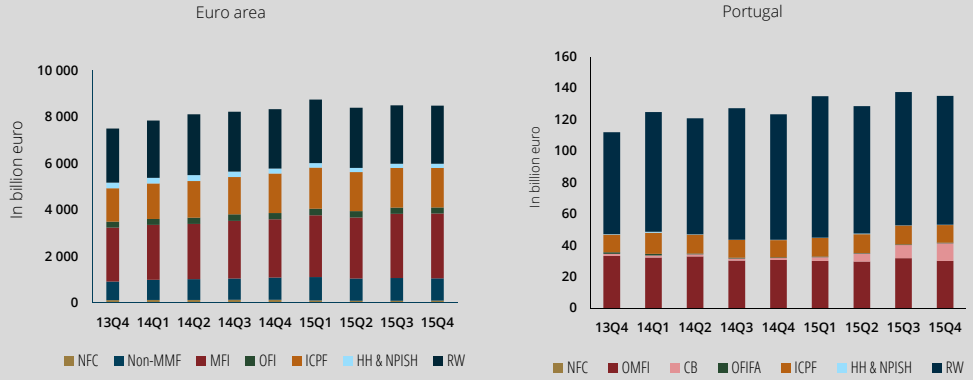
Source: Banco de Portugal

Complementarily, Household Survey Data can also be relevant to better understand the impact of unconventional monetary policies on income distribution. Frost and Saiki (2014) find evidence that, in the case of Japan, the impact of the portfolio channel of unconventional policies have increased income inequality. According to the authors the mechanism is straightforward: an increase to the monetary base (through purchases of both safe and risky assets) tends to increase overall asset prices, which will benefit primarily upper incomes, who hold a larger amount and share of overall savings in equities, and thus benefit from greater capital income.

3.3. Public debt holder structure

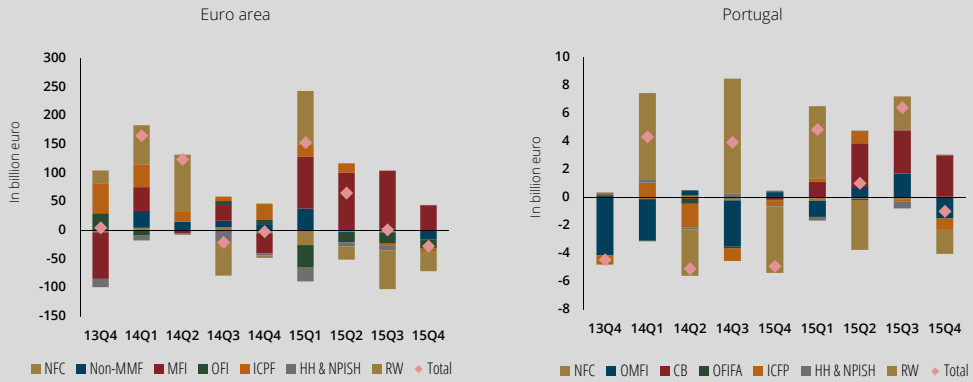
Following the introduction of public sector purchase programmes, central banks emerge as key investors in government debt. The availability of detailed statistical data, not only from the perspective of the assets of the central bank, but also from the perspective of the liabilities of the general government – the so-called from-whom-to-whom approach – becomes thus extremely relevant.

Chart 13 · Debt securities issued by general government, breakdown by holder (end-of period positions)



Source: Banco de Portugal and European Central Bank

Chart 14 · Debt securities issued by general government, breakdown by holder (transactions)



Source: Banco de Portugal and European Central Bank

Legend: NFC - Non financial corporations; MFI - Monetary financial institutions; CB – Central Bank; Non-MMF - Non MMF investment funds; OFI - Other financial institutions (Financial corporations other than MFIs, insurance corporations, pension funds and non MMFs investment fund); OFIFA - Other financial institutions (Financial corporations other than MFIs, insurance corporations and pension funds); ICPF - Insurance corporations and Pension Funds; HH & NPISH - Households and non-profit institutions serving households; RW – Rest of the World.

In charts 13 and 14 we use data available in the framework of the quarterly financial accounts, Guideline (EU) 2016/66 of the ECB of 26 November 2015 amending Guideline ECB/2013/24 on the statistical reporting requirements of the ECB in the field of quarterly financial accounts (ECB/2015/40). Starting with data from end-2013 onwards, it is possible to breakdown of debt securities issued by the general government according to the ESA2010 sector classification of the holder. However, given that the banking sector is considered as a whole, it is not possible, in the context of the current guideline, to separate the holdings of the central bank from those of the other banks. Nevertheless, this detail is currently published by Banco de Portugal. In addition, for holdings by the non-resident sector, it is not possible to identify the share held by other central banks. Possibly, this is a limitation that can be overcome in the context of the Securities Holdings Statistics Database, a European System of Central Banks (ESCB)-wide project with the objective of

collecting security-by-security holdings by institutional sectors of euro area/EU reporting countries for both direct holdings and indirect holdings (third party holdings).

This type of data will also be instrumental to assess the impact of the CSPP launched in June 2016 by the ECB.

4. Concluding remarks

In the aftermath of the financial crisis that started in 2007-2008, central banks around the world moved beyond their traditional operating framework to make use of their balance sheets as a monetary policy tool. The quantitative easing transmission channels are very diverse: confidence, policy signalling, portfolio rebalancing, market liquidity and money/lending (Joyce et al., 2011).

In order to thoroughly understand these transmission mechanisms and better define the monetary policy measures, there is thus a call from monetary policy makers for unconventional data, which is not aggregate but granular, i.e., micro data. As highlighted by a Member of the Executive Board of the ECB, "conducting this kind of unconventional monetary policy is rather difficult when decisions have to be taken on the basis of conventional data, i.e. traditional aggregate statistics".

Furthermore, the degree of interconnection and integration of the economies and the markets worldwide calls for the extension of such initiatives at the international level. In this respect, the following cases are worth mentioning:

- The Analytical Credit Dataset (AnaCredit). Efforts of conceptual harmonisation and convergence across the EU have already started regarding the CCRs. In order to get a better overview of the level of indebtedness of the borrowers in an environment of increasing financial integration across European Union Member-States, the overarching aim of this ESCB project is the setting up of a long-term framework for the collection of harmonised granular credit data.
- The Securities Holdings Statistics Database (SHSDB). SHSDB is an ESCB-wide project with the objective of collecting security-by-security holdings by institutional sectors of euro area/EU reporting countries for both direct holdings and indirect holdings (third party holdings).
- The Legal Entity Identifier (LEI). LEI is a 20-character, alpha-numeric code, to uniquely identify legally distinct entities that engage in financial transactions. The LEI code is associated with reference data for each entity, currently including core identification information, such as the official name of the legal entity, the address of its headquarters and address of legal formation. As a result of joint public and private sectors efforts, the LEI supports authorities and market participants in identifying and managing financial risks.

In statistics, like in many other areas, there is the need for continuous improvement and innovation. A stepwise approach is not only wise but the most realistic to be followed.

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Notes

* 8th IFC Conference, Basel, Switzerland, 8 September 2016.

14. The opinions expressed here are those of the authors and not necessarily those of Banco de Portugal or the Eurosystem. Any errors and omissions are the sole responsibility of the authors. The authors are thankful to the comments and suggestions provided by André Dias, Lígia Nunes and Sérgio Branco.

15. For the purpose of the analysis, from 2009 to 2012, it was considered in the instrument "Asset Purchase Facility Total" the amount not covered by the Bank of England weekly report regarding quantitative easing.

16. The legal requirements for MFI interest rate statistics were originally laid down in Regulation ECB/2001/18, which was recast by Regulation ECB/2013/34 (amended by Regulation ECB/2014/30). MFI interest rate statistics refer to interest rates individually agreed between a bank and its customer and are converted to an annual basis taking into account the frequency of interest payments, while being quoted in percentages per annum. New business is defined as any new agreement between a household or non-financial corporation and the bank. These comprise all financial contracts in which the terms and conditions of the interest rate on the deposit or loan are specified for the first time, and all new negotiations of existing deposits and loans. Prolongations of existing deposit and loan contracts which are carried out automatically, i.e. without any active involvement of the household or non-financial corporation, and which do not involve any renegotiating of the terms and conditions of the contract, including the interest rate, are not considered as new business.

Banks International Asset Portfolios: Optimality, Linkages and Resilience*

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Abstract

The world economy has been living under the shadow of the latest global financial crisis. The persistence of high indebtedness levels across the world maintains these concerns on the agenda of economic institutions. This paper tries to address two main questions. First, it examines the cross country asset portfolios and uses network theory to map linkages between banking systems and discuss its resilience to shocks. Second, it assesses how distant are portfolios from an optimal diversification strategy.

Keywords: Banks, Cross-Border Asset Portfolio, Networks

JEL classification: F65, G15, G21.

1. Introduction

Over the last decades, financial markets became more integrated and the size of cross-border portfolios increased significantly. Although the size of cross-border portfolios are strongly affected by valuation effects, international financial integration has deepened. This has been facilitated by higher liberalization of capital movements, as well as by technological progress in the communication and information industries. Nevertheless, many investors still do not seem to fully diversify their external portfolio assets, which are highly concentrated in a few non-resident countries. The high financial integration and the concentration of portfolios in few non-resident countries contributes to propagate and amplify the impact of crisis in specific economies, thus giving rise to aggregate shocks. The role of bank's portfolios is particularly important in this respect because the systemic linkages are stronger and potentially disruptive.

The literature on the propagation of financial crisis has expanded in the recent years and it is too broad to be mentioned here. On the bank dimension recent examples are Bremus and Fratzscher (2014). These authors argue that cross-border bank lending has decreased and the home bias in the credit portfolio of banks has risen in the euro area. Their results suggest that expansionary

monetary policy has encouraged cross-border lending, both in euro area and non-euro area countries. In addition, improvements in regulatory policy and increases in financial supervisory power have contributed to higher cross-border lending. Papers that assess banks' international capital flows in the period of the financial crisis with view on financial stability are Hills and Hoggarth (2013) and Hoggarth, et al. (2010). In addition, in its 2012 report, the Committee on International Economic Policy and Reform (2012) signals that the procyclicality inherent in capital flows is not adequately addressed and makes a point for reinforced policy coordination. The literature on financial networks has also greatly expanded. For example, Joseph et al. (2014) analyse the network of cross-border equity and long-term debt securities portfolio investment and measure the robustness of the global financial system and the interdependence of financial markets. Finally, a paper that is important for the purpose of our study is that of Buch et al (2010). The aim of this paper is to identify optimal international asset portfolios for banks by using the mean–variance portfolio model with currency hedging. The benchmark portfolios are compared with the actual cross-border asset positions of banks from 1995 to 2003. Differences between the two portfolios are explained by some additional factors as regulations, institutions, cultural conditions / other financial frictions.

In this article we focus on the representation of the bank's international portfolio in a network setup. In this context the main cross-country portfolio linkages are represented as a directed and unweighted network, complemented by some basic measures that describe its topology and allow for a basic assessment of resilience. In addition, we operate a simple conceptual exercise where the existing portfolios are compared to those that emerge from an optimal allocation strategy.

This article is organised as follows. Section 2 briefly describes the international banking statistics database used. In section 3, the banks' international portfolios are described in December 2007 and March 2016 (the last available period), corresponding to the situation before the international financial and economic crisis and the present moment and their linkages are presented. Section 4 uses optimal portfolio theory to obtain the alternative banks' international assets allocation and discusses deviations relatively to the portfolio actually observed. Finally, section 5 presents some concluding remarks.

2. Data sources and description

2.1. International Banking Statistics

Data on International Banking statistics is disseminated by Bank for International Settlements which is composed by two datasets - Locational Banking Statistics (LBS) and Consolidated Banking Statistics (CBS).

These two datasets refer to the international holdings of assets by banks at a country level from a set of reporting countries. However, they address different aspects of international banking activity. LBS data are a key source of information on the currency and geographical composition of resident banks' balance sheets while CBS provides information about banking systems' risk exposures, in particular country risk. CBS measures worldwide consolidated claims of banks headquartered in reporting countries, including claims of their own foreign affiliates but excluding inter-office positions.

2.2. Locational Banking Statistics

According to the BIS definition, Locational Banking Statistics are designed mainly to capture financial claims and liabilities of internationally active banks (i.e excluding only resident domestic banks without positions *vis-à-vis* non-residents of the reporting country). The statistics cover all on balance sheet positions and some off-balance sheet positions in the area of trustee business. The reporting basis underlying the statistics is the residence of the reporting banking office (conforms to balance of payments and international investment position statistics). These offices report exclusively their own (unconsolidated) business, including their international transactions with any of their own affiliates (branches, subsidiaries, joint ventures), including claims and liabilities *vis-à-vis* non-residents in any currency, claims and liabilities *vis-à-vis* residents of the reporting country in local currency as well as in foreign currencies.

The Locational Banking Statistics comprise two subsets - locational banking statistics by residence (LBS/R) and locational banking statistics by nationality. The first subset combines the breakdown by residence of the reporting bank with a full country breakdown of counterparties, whereas the latter shows a breakdown by nationality of the reporting bank. Locational banking statistics by residence were considered for the purpose of this paper. The underlying assumption is that residence is a better proxy to capture shocks taking place in specific locations. Nevertheless, the results will are qualitatively unaltered with LBS by Nationality.

The database covers the time period between 2004 and the first quarter of 2016 and is provided by the Bank for International Settlements (BIS) and similar to the published by the BIS in its Quarterly Review, but more detailed (with respect to bilateral asset positions). It comprises bilateral quarterly asset outstanding amounts for all instruments (Loans and deposits, debt securities and other assets and liabilities), counterparty institutional sectors (Banks, General Government, Households and NPISHs, Nonbank financial institutions, Non-financial corporations) denominated in all currencies, with respect to non-resident counterparty countries located in each of the recipient countries[17]. Locational banking statistics are not consolidated which means that the claims of foreign subsidiaries of reporting banks are not included[18].

A sample of twenty one countries was considered to perform this analysis: Australia, Austria, Belgium, Brazil, Canada, Denmark, Finland, France, Germany, Greece, Italy, Ireland, Japan, Luxembourg, Netherlands, Portugal, Spain, Sweden, Switzerland, United Kingdom and United States.

For these reporting countries foreign financial claims of banks located in the territory *vis-à-vis* counterparty country is available, and also information of foreign financial claims of banks located in other countries *vis-à-vis* these reporting countries.

3. Mapping the network of cross-border portfolios

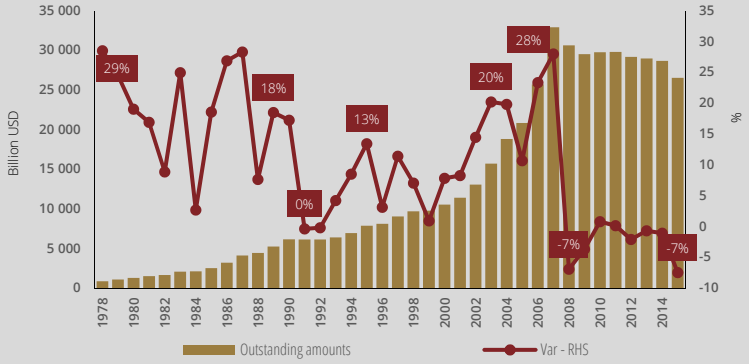
3.1. Bilateral portfolios

Banks bilateral cross-border asset positions are defined as bank claims against non-resident countries located in each of the countries in the sample.

In the last decades, the banks' foreign asset positions grew significantly. According to the BIS data on the LBS/R, in 1978 the total end-of-period cross-border claims outstanding amount *vis-à-vis* non-residents was 883 billion of USD and in 2015, 26536 billions of USD (Chart 1).

Over the last decade cross-border claims under locational banking statistics show a different pattern, notably since the international economic and financial crises. Chart 1 evidences that, between 2005 and 2007, LBS/R rose from approximately 13,000 billion of USD dollars to 33,000 billion of USD dollars (with a maximal annual variation of 28% in 2007). In 2008, at the peak of the international financial and economic crises, the annual growth rate of cross-border claims was -6.9% (the sharpest annual decrease since 1978). Since then, LBS/R levelled at 31,000 billion of USD dollars approximately.

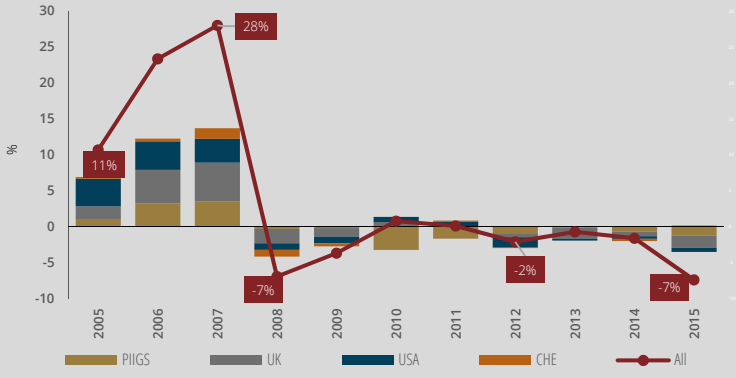
Chart 1 · Cross-border claims and annual growth



Source: BIS statistics

Taking a geographical breakdown (Chart 2), United Kingdom (UK), PIIGS – Portugal, Italy, Ireland, Greece and Spain, USA and Switzerland, were the main contributors to the reduction recorded in 2008. With exception for 2010 and 2011, where UK and USA showed a positive change, for the remaining years all these countries contributed negatively.

Chart 2 · Cross-border claims – annual change (%) and main contributions by counter party country



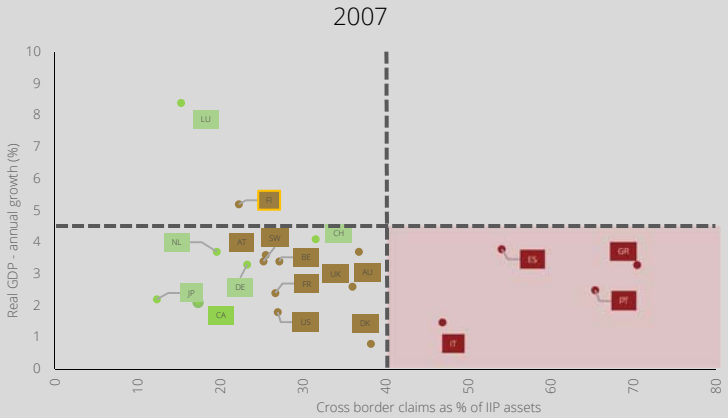
Source: BIS statistics

Chart 3 depicts cross-border claims as a percentage of the international investment position (IIP) assets and also annual growth of real gross domestic product, for the sample of 21 countries in 2007 and 2015 (with the exception of Ireland, whose IIP for 2007 is not available).

The chart shows that PT, ES, GR and IT) were those where the cross-border claims as percentage of IIP decrease the most after the crisis.

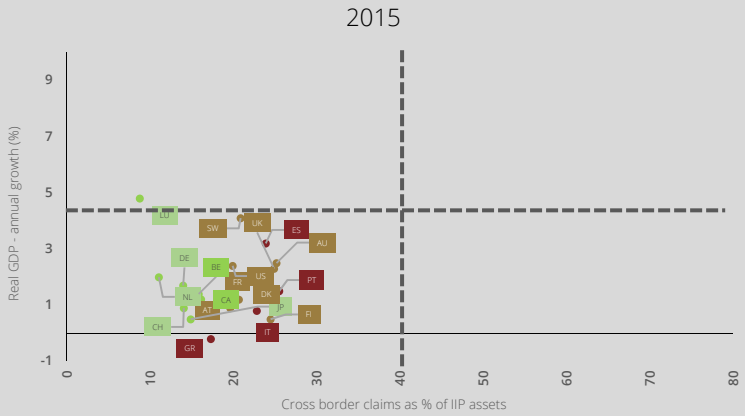
In 2007 these economies recorded large amounts of cross-border claims in total of IIP assets (above 40%) and an annual growth of real gross domestic production below 4% (Chart 3).

Chart 3 · Real GDP and Cross border claims as % of IIP assets by counterpart country 2007 and 2015



Source: BIS statistics

In 2015, the cross-border claims for this set of countries, was below 30% of their total IIP assets, close to that of other countries in the sample.



Source: BIS statistics

The whom-to-whom matrices permit tracing the debtor/creditor relationships between countries, i.e. they can be used to show asset balance sheet positions cross-classified by debtor country and creditor country. Based on the bilateral BIS statistical information on LBS/R, these matrices were constructed for the selected sample in December 2007 and 2015 (Tables 1 and 2).

Table 1 · Whom-to-whom matrix cross-border claims- December 2007

DEBTOR \ CREDITOR	AU	AT	BE	BR	CA	DK	FI	FR	DE	GR	IE	IT	JP	LU	NL	PT	ES	SE	CH	UK	US
AU		0.0%	0.0%	0.2%	0.9%	0.1%	0.2%	0.7%	0.6%	0.0%	0.1%	0.0%	0.8%	0.1%	0.5%	0.0%	0.1%	0.1%	0.4%	1.2%	0.8%
AT	0.6%		0.8%	0.4%	0.4%	1.3%	1.0%	0.6%	4.5%	3.8%	1.3%	2.6%	0.1%	0.7%	1.4%	1.2%	0.8%	0.5%	1.4%	0.8%	0.4%
BE	1.2%	4.6%		1.2%	1.1%	2.0%	2.0%	7.1%	4.2%	6.8%	12.5%	3.5%	0.6%	4.1%	16.1%	4.8%	3.7%	1.7%	1.0%	4.6%	1.9%
BR	0.0%	0.7%	0.1%		0.3%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.2%	0.2%	0.0%	0.0%	0.3%	0.4%
CA	0.4%	0.0%	0.1%	2.4%		0.0%	0.0%	0.1%	0.1%	0.1%	1.9%	0.0%	0.1%	0.0%	0.3%	0.0%	0.0%	0.0%	0.1%	0.7%	4.6%
DK	0.1%	0.0%	0.7%	0.1%	0.0%		5.2%	0.2%	0.8%	0.1%	1.4%	0.1%	0.0%	1.1%	0.2%	0.1%	0.3%	21.3%	0.2%	1.1%	0.2%
FI	0.0%	0.1%	0.0%	0.0%	0.0%	10.1%		0.1%	0.2%	0.0%	0.1%	0.1%	0.0%	0.1%	0.1%	0.1%	0.1%	9.1%	0.1%	0.1%	0.0%
FR	10.2%	8.6%	15.4%	6.2%	2.5%	3.1%	3.9%		14.6%	15.4%	10.2%	22.1%	12.8%	11.0%	10.8%	22.0%	20.6%	6.5%	6.1%	12.8%	6.7%
DE	6.1%	40.3%	7.0%	4.7%	4.5%	24.1%	11.9%	12.0%		19.8%	14.2%	21.4%	4.3%	29.5%	11.8%	18.7%	24.9%	13.5%	8.2%	16.9%	10.3%
GR	0.0%	0.2%	0.3%	0.0%	0.0%	0.0%	0.0%	0.3%	0.3%		0.1%	0.1%	0.1%	1.9%	0.2%	0.6%	0.1%	0.0%	0.0%	0.7%	0.1%
IE	6.3%	2.8%	2.1%	0.1%	5.2%	5.0%	2.5%	2.2%	4.3%	4.2%		9.9%	2.8%	1.0%	3.2%	3.7%	6.4%	3.7%	1.2%	6.8%	3.6%
IT	0.1%	16.5%	2.6%	1.8%	0.1%	0.4%	0.3%	4.1%	6.3%	3.0%	3.3%		0.2%	5.5%	1.2%	2.4%	3.7%	0.4%	0.8%	1.8%	0.4%
JP	21.0%	2.4%	5.5%	10.2%	11.7%	3.4%	3.9%	7.9%	8.0%	3.4%	4.0%	3.6%		8.4%	3.5%	1.0%	2.2%	4.3%	4.6%	7.2%	20.0%
LU	2.6%	4.6%	8.2%	3.7%	3.5%	6.7%	1.7%	6.7%	15.1%	6.4%	1.8%	5.9%	0.7%		3.1%	4.3%	4.9%	4.3%	6.0%	2.0%	1.7%
NL	3.3%	1.9%	20.6%	12.9%	0.7%	3.3%	1.5%	2.6%	4.3%	6.2%	5.0%	4.7%	2.3%	3.7%		3.3%	4.1%	2.6%	2.7%	9.4%	2.9%
PT	0.1%	0.3%	0.3%	3.4%	0.0%	1.1%	0.0%	0.4%	0.8%	2.0%	1.2%	0.4%	0.0%	1.1%	0.6%		2.3%	0.1%	0.2%	0.3%	0.2%
ES	0.7%	1.3%	3.0%	4.9%	0.2%	0.8%	1.6%	4.7%	1.9%	0.9%	1.4%	3.2%	0.3%	1.3%	4.7%	19.4%		1.0%	0.7%	3.4%	1.4%
SE	1.3%	0.4%	0.5%	0.7%	0.5%	16.8%	28.3%	0.4%	1.6%	0.1%	0.6%	0.2%	0.0%	0.4%	0.8%	0.1%	0.5%		0.2%	1.2%	0.3%
CH	0.6%	4.8%	5.8%	1.3%	0.8%	0.7%	0.3%	4.0%	4.2%	1.2%	1.4%	0.6%	8.3%	12.2%	5.3%	0.8%	0.3%	0.8%		9.0%	2.3%
UK	33.1%	9.2%	23.6%	16.6%	32.3%	19.7%	13.6%	36.4%	25.6%	26.2%	35.5%	18.2%	49.0%	16.5%	32.2%	16.6%	22.6%	27.2%	43.1%		41.9%
US	12.3%	1.5%	3.3%	29.1%	35.2%	1.1%	22.0%	9.6%	2.5%	0.3%	4.1%	3.3%	17.4%	1.7%	4.0%	0.6%	2.0%	2.9%	22.8%	19.8%	

Table 2 · Whom-to-whom matrix cross-border claims- December 2015

DEBTOR \ CREDITOR	AU	AT	BE	BR	CA	DK	FI	FR	DE	GR	IE	IT	JP	LU	NL	PT	ES	SE	CH	UK	US
AU		0.02%	0.06%	0.29%	2.77%	0.06%	0.05%	1.45%	0.87%	0.03%	0.67%	0.00%	1.61%	0.18%	0.81%	0.00%	0.23%	0.15%	0.44%	4.66%	2.45%
AT	0.21%		0.82%	0.26%	0.27%	0.83%	0.75%	0.60%	4.33%	0.16%	0.67%	2.10%	0.01%	0.72%	0.87%	0.93%	1.42%	0.56%	1.26%	0.49%	0.32%
BE	0.58%	1.65%		0.19%	0.76%	1.11%	1.50%	3.83%	4.86%	0.54%	5.27%	1.84%	0.42%	3.02%	9.84%	1.37%	3.07%	1.01%	2.01%	4.38%	1.35%
BR	0.01%	0.17%	0.00%		0.01%	0.18%	0.00%	0.26%	0.03%	0.00%	0.00%	0.03%	0.02%	0.13%	0.03%	0.15%	1.50%	0.00%	0.01%	0.15%	0.39%
CA	2.67%	0.06%	0.06%	3.32%		0.22%	0.07%	0.27%	0.43%	0.00%	2.31%	0.01%	1.49%	1.69%	0.83%	0.00%	0.05%	0.50%	0.30%	1.93%	7.65%
DK	0.22%	0.95%	0.77%	0.02%	0.16%		7.80%	0.79%	2.10%	0.12%	0.72%	0.18%	0.05%	0.79%	0.45%	0.40%	0.86%	21.40%	0.64%	1.10%	0.32%
FI	0.21%	0.72%	0.82%	0.10%	0.55%	30.78%		1.17%	1.79%	0.01%	0.05%	0.16%	0.01%	0.58%	0.72%	0.06%	0.40%	17.03%	0.10%	1.62%	0.60%
FR	4.17%	6.86%	25.58%	7.10%	4.00%	4.93%	3.05%		10.75%	1.88%	13.61%	30.12%	15.87%	15.99%	10.32%	18.44%	29.66%	3.94%	11.64%	12.18%	6.28%
DE	6.08%	40.72%	9.96%	2.23%	5.33%	10.45%	10.68%	15.18%		54.64%	8.28%	14.86%	1.74%	24.59%	18.18%	14.37%	21.41%	13.25%	13.12%	10.15%	4.42%
GR	0.00%	0.01%	0.04%	0.00%	0.01%	0.00%	0.00%	0.02%	0.13%		0.01%	0.03%	0.00%	5.27%	0.18%	0.00%	0.02%	0.01%	0.01%	1.06%	0.01%
IE	1.16%	1.22%	2.50%	0.37%	1.32%	1.23%	0.71%	2.05%	1.58%	0.08%		7.20%	0.34%	0.91%	2.16%	1.07%	2.88%	0.65%	0.35%	3.26%	0.83%
IT	0.34%	19.45%	1.73%	0.35%	0.28%	0.41%	0.53%	5.02%	5.33%	0.51%	3.06%		0.04%	3.26%	1.22%	1.81%	8.60%	0.26%	1.19%	3.40%	0.96%
JP	30.60%	1.68%	9.79%	7.17%	10.07%	2.90%	1.64%	11.89%	8.35%	0.48%	7.34%	4.88%		11.77%	7.41%	0.46%	4.23%	7.70%	4.28%	7.97%	31.78%
LU	1.40%	3.40%	5.64%	5.38%	1.21%	1.39%	2.41%	7.31%	11.14%	2.38%	1.36%	6.52%	0.51%		3.21%	5.55%	2.54%	3.47%	5.67%	2.13%	1.08%
NL	3.88%	4.80%	21.94%	1.69%	1.78%	1.99%	5.77%	6.35%	6.87%	1.20%	12.09%	3.09%	0.88%	4.30%		2.95%	3.78%	3.69%	4.99%	10.17%	3.34%
PT	0.01%	0.04%	0.19%	0.45%	0.04%	0.12%	0.19%	0.38%	0.33%	0.36%	0.84%	1.21%	0.00%	0.59%	0.82%		3.17%	0.02%	0.19%	0.40%	0.08%
ES	0.20%	1.30%	1.93%	5.87%	0.31%	0.15%	0.56%	3.89%	1.69%	0.42%	0.99%	8.36%	0.07%	0.65%	3.48%	31.35%		0.23%	1.02%	1.93%	1.76%
SE	0.36%	0.06%	0.37%	0.48%	0.25%	30.03%	39.45%	0.29%	2.48%	0.06%	0.15%	0.06%	0.12%	1.11%	0.63%	0.04%	0.48%		0.30%	1.54%	0.88%
CH	1.28%	5.11%	2.11%	0.64%	1.70%	3.62%	2.90%	4.09%	4.06%	3.50%	1.25%	1.22%	0.69%	4.94%	2.56%	3.69%	1.36%	2.21%		6.76%	2.76%
UK	25.68%	9.43%	13.50%	15.05%	15.64%	9.24%	12.41%	28.93%	29.09%	32.75%	33.64%	17.06%	28.61%	14.16%	29.96%	17.07%	12.80%	17.54%	35.56%		32.76%
US	20.95%	2.36%	2.20%	49.04%	53.56%	0.36%	9.53%	6.24%	3.79%	0.88%	7.69%	1.07%	47.53%	5.36%	6.32%	0.27%	1.55%	6.36%	16.92%	24.72%	

Source: BIS data

The sample represents 79% of the total amount for all the counterparty countries in 2007 and 71% and 2015. For all the outstanding amounts reported, this sample covers 84% in 2007 and 81% in 2015. Cross-border claims above 2% of the total cross-border claims reported are shaded. This matrices show that the investments of France, Germany, United Kingdom and United States represent for almost the creditor countries amounts above the threshold (above 2 per cent of the total cross-border investments).

3.2. The network representation

In this section, we use the whom-to-whom matrices previously presented to construct the network of bank´s international asset portfolios. In this respect, a directed and unweighted network for

locational banking statistics is designed. The nodes correspond to the 21 individual countries (N=21) considered in the sample. The existence of an edge between two countries relies on threshold criterion that aims to reflect the importance of country j (creditor) on the total bank´s international portfolio assets (IAP) of country i (debtor). The threshold is set at 2 per cent of total bank´s international asset portfolios. Hence, the edge is directed from a country i to a country j if country i bank´s international asset portfolio in country j is larger than the threshold. More formally:

$$\overrightarrow{a_{i,j}} = \begin{cases} 1, & if\ \frac{IAP_{i;j}}{IAP_j} > 0.02\ for\ each\ country\ i \neq j, j = 1,2,\dots 21 \\ 0, & otherwise \end{cases}$$

Where $A = [a_{i,j}]$ is the NXN connectivity or adjacency matrix.

The choice of this threshold ensures that the resulting network easy to interpret and visualise, while capturing the relevant interrelations between nodes.

The analysis in this paper disregards the strength of the edges identified using the binary information contained in the data (unweighted network). Since the network is directed, every node has two different degrees: indegree and outdegree. The indegree is the number of incoming edges, whereas the outdegree is the number of outgoing edges.

Formally, the number of indegrees is given by:

$$d_s^{in} = \sum_{r=1}^{N} \overrightarrow{a_{ji}}$$

And the number of outdegrees is given by:

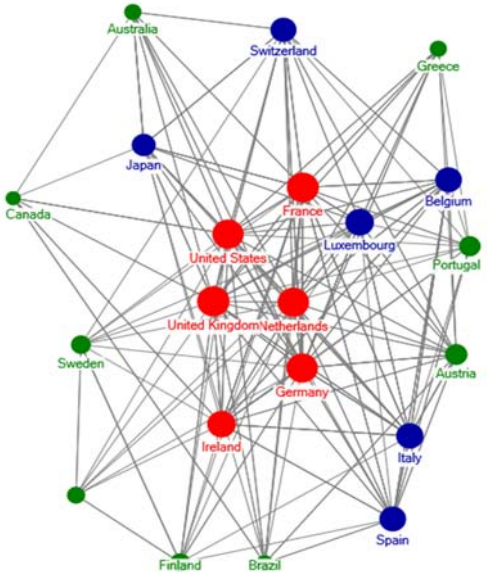
$$d_s^{out} = \sum_{r=1}^{N} \overrightarrow{a_{ij}}$$

Figure 1 shows the network representations for bank´s international asset portfolio for two distinct periods: December 2007 (before the financial crises) and March 2016 (the most recent available period).

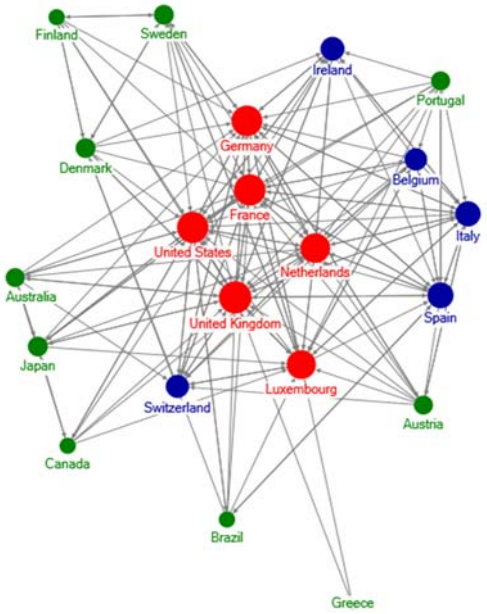
As previously mentioned, the network is directed and the arrows represent the edges, pointing towards countries which threshold is above 2% of the total banks asset holdings.

Figure 1 · Network charts of bank´s international asset portfolios in 2007 and 2016

2007



2016



The size of each node is proportional to its total degree (sum of indegree and outdegree) and the color of the node is mapped to its indegree, with "Green", "Blue" and "Red" indicating less than 5 in degrees, between 5-14 in degrees, more than 15 degrees, respectively. The network charts are based on the Harel-Koren fast multi-scale algorithm and are drawn with the use of NodeXL (see Hansen et al. (2010), an open-source template for Excel for analysis complex networks (*http://nodexl.codeplex.com/*).

Each country is represented by a circle (node) with arrows (edges) directed from the investor (debtor) to the counterparty country (creditor - who holds the bank´s international assets). In this

setup, a force directed layout algorithm is typically used to determine the location of the nodes in the network visualisation. All network charts in this article are based on the Harel-Koren fast mutiscale algorithm (Haren and Koren 2002) and are drawn with the use of NodeXL (Hansen et al. 2010). The colour of each node is mapped to its indegree, with "Green", "Blue" and "Red" indicating less than 5 in degrees, between 5-14 in degrees, more than 15 degrees, respectively.

Larger countries tend to have bigger nodes and to locate in the center of the network, because they hold an important amount of the bank´s international asset portfolios. Smaller economies tend to locate in the outer layers of the network. Usually its banks invest their international assets abroad and the other countries do not invest there. Given the construction of the network, it is natural that the large are at the centre but there are other things. Ireland is in this group, there are some interesting linkages between the countries outside this core group.

Between 2007 and 2016 there are some changes in the number of edges and in the position of nodes in the network. In 2007, there are six core countries (with more than 15 indegrees) – UK, USA, DE, FR, IE and NL. In 2016, there are five core countries - UK, USA, NL, FR and LU. (DE and IE are not core countries in the first quarter of 2016 but LU). Austria increased the number of indegrees in 2016.

Metrics

The examination of aggregate network measures provides some additional insights about its structure Table 3 provides some metrics on the network in 2007 and 2016.

Table 1 · Network overall metrics

	2007	2016
Nodes	21	21
Total Edges	291	171
Average degree	13.14	10.60
Average Geodesic Distance	1.27	1.54
Eigenvector Centrality	0.05	0.05

Beyond the number of nodes and edges, other metrics are displayed in table 3. These measures aim to describe the entire network, i.e., they consider not only the position and importance of each node but also the complete set of interactions that establish the key properties of the whole network.

A very simple aggregate metric is the average degree of the network, which measures its average connectivity. In the first quarter 2016, there was a decrease in the average degree, compared to 2007 which means that, on average, each country has lower number of creditor / debtor relations. Therefore, the network became less complex and weakly connected.

The average geodesic distance is the average over all nodes of the length of the shortest path between two nodes increases between 2007 and 2015. This indicator is lower in 2015 when compared to 2007 meaning that in 2015, these 21 economies are less integrated.

The eigenvector centrality is an aggregate metric that characterises how a network is centred around one or a few important nodes by examining the differences in centrality between the most

central node in a network and all others. This measure ranges between and allows us to take basic inferences regarding the resilience of the network to shocks.

4. Optimal cross-border portfolios

In this section we perform a stylized exercise aiming at the identification of what would be the banks' optimal cross-border portfolios. This is a conceptual exercise because the decision of banks relatively to where assets should be placed depends on more parameters than past observed volatility and return. For example geographical proximity, historical and political linkages certainly play a role. In addition, the exercise does not consider the possibility of short portfolios, i.e., banks' having liabilities versus other locations, or holding assets in the domestic banking system. These options are to be tried in a future version of the paper.

In order to compute the optimal cross-border portfolio we apply the standard theory that assesses the return and risk components of banks' portfolio choices.

The portfolio risk comes from the covariances of its different assets, while the marginal contribution to return variance is measured by the covariance between the asset's and portfolio's return rather than by the variance of the asset itself.

On the basis of this model, banks located in each country will decide in which countries to invest their assets in order to maximise asset returns. However, in their decision risk component is integrated to avoid excessive exposure to external market risk.

In order to determine the optimal portfolio, it is assumed that asset returns follow three main indicators equally weighted: i) the change rate of the individual stock market country indexes for all the countries in the sample; ii) exchange rate change; iii) change rate of dividend yiels (10 years). These data was obtained on a daily basis between 1st January 2001 and 25 February 2016 but it was considered that banks take portfolio investment decisions with information regarding the latest 1.5 years.

Next, the main steps of the derivation are briefly sketched. The expected return for an asset i is given by the average during the time period considered:

$$\overline{R_i} = \sum_{t=1}^{N} \frac{R_{i,t}}{N}$$

Where N denotes the numbers of observed returns of asset i , and $R_{i,t}$ denotes the t^{th} observed return of asset i .The portfolio is given by a linear combination of the different asset returns. Thus, the expected return is expressed by:

$$\overline{R}_p = E\left[R_p\right] = \sum_{i=1}^{N} x_i \overline{R_i}$$

where $x_i = \frac{1}{N}$ denotes the proportion of asset i held in the portfolio. It is assumed that there is no short selling, i.e., capital can only be obtained with recourse of own savings, $x_i > 0, \quad i = 1,2,..N.$

In addition, total asset´s proportion has to be equal to the total capital available: $\sum_{i=1}^{N} x_i = 1$.

The risk of each asset i is defined by its dispersion - the standard deviation:

$$\sigma_i = \sqrt{\sum_{t=1}^{N} \frac{\left(R_{i,t} - \overline{R}_i\right)^2}{(N-1)}}$$

And the correspondent portfolio is given by:

$$\sigma_p = \sqrt{\sum_{j=1}^{N} x_j^2 \sigma_j^2 + \sum_{j=1}^{N} \sum_{\substack{k=1 \\ k \neq j}}^{N} \left(x_j x_k \sigma_{j,k}\right)}$$

Where $\sigma_{j,k}$ denotes the covariance between asset j and k:

$$\sigma_{j,k} = \operatorname{cov}\left(R_j, R_k\right) = \sum_{t=1}^{N} \frac{\left(R_{j,t} - \overline{R_j}\right)\left(R_{k,t} - \overline{R_k}\right)}{(N-1)}$$

Moreover, ρ is the correlation coefficient between assets A and B which is always between -1 and 1 and is expressed as follows:

$$\rho = \frac{\operatorname{cov}\left(R_A, R_B\right)}{\sigma_A \sigma_B}$$

The optimal diversification model finds the composition of all the portfolios that correspond to the efficiency criterion defined for a given set of assets, and construct the corresponding efficient frontier. It minimizes the risk for a given return or maximizes the return for a given risk, which can be written as follows:

$$\begin{aligned} &\underset{\{p\}}{Min}\, \sigma_p^2 \\ &s.to. \quad E\left[R_p\right] = E \\ &\qquad \sum_{i=1}^{N} x_i = 1 \end{aligned}$$

The constant correlation model is applied to calculate the optimal portfolios. This method is based on an optimal ranking of the assets, established over the simplified correlation representation model. To determine the optimal portfolio, the Sharp ratio is calculated for all the available assets:

$$SR = \frac{E\left[R_i\right] - R_f}{\sigma_i}$$

Where $E[R_i]$ denotes the expected return on asset i; R_f denotes the risk-free rate; and σ_i denotes the standard deviation of the return of asset i.

The results are classified from the highest value (more desirable) to the lowest value (less desirable) to hold in the portfolio. A threshold is determined to decide which assets will be part of the optimal portfolio (those above the threshold) assets below the threshold will be excluded. The cut-off point C^* is computed as follows:

$$C^* = \frac{\rho}{1-\rho+i\rho}\sum_{j=1}^{i}\frac{R_j - R_f}{\sigma_j}$$

Where R_j denotes the expected return on security j, σ_j denotes the standard deviation of the return of asset j, and ρ denotes the constant correlation coefficient:

$$\rho = \frac{\sum_{i=1}^{N}\sum_{\substack{j=1 \\ j\neq i}}^{N}\rho_{i,j}}{\frac{N(N-1)}{2}}$$

Where $\rho_{i,j}$ denotes the correlation between assets i and j; and N denotes the number of assets in the portfolio. N was used earlier for the number of returns observed for each asset.

The weight of each asset is expressed as:

$$x_i = \frac{Z_i}{\sum_{i=1}^{N} Z_i}$$

where $Z_i = \frac{1}{\sigma_i(1-\rho)}\left[\frac{(R_i - R_f)}{\sigma_i} - C^*\right]$.

We show the results using the network representation that emerge from the optimal portfolios before and after the crisis. The first period before the crises is considered between January 2006 and June 2007. The period after the crises corresponds to June 2012 and November 2013.

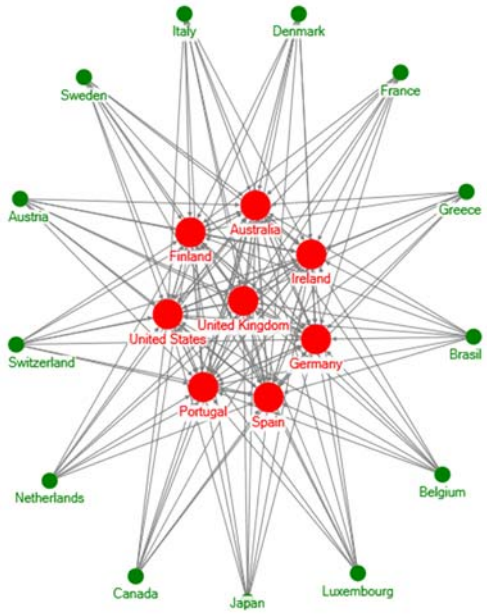
The comparison of the optimal portfolios with those that actually existed must be cautious because other aspects determine bank's international decisions. For example, the deviations between the actual and the benchmark portfolios may be attributable to factors that affect the risk and returns from cross-border asset holdings as Regulations, institutions and information costs that produce frictions as in Buch et al. (2010). Another caveat relatively to the concept of a global optimal portfolio allocation should be mentioned. The optimal portfolio is based on a partial equilibrium approach because it assumes that decisions of reallocation towards some country can always be implemented. However, even if it is optimal to reallocate towards some country, the supply of assets available may be limited, especially if the destination country is small and most source countries

are reallocating in the same way. Therefore, the excess demand for the assets increases their price and reduces the implicit rate of return, leading to a new optimal portfolio.

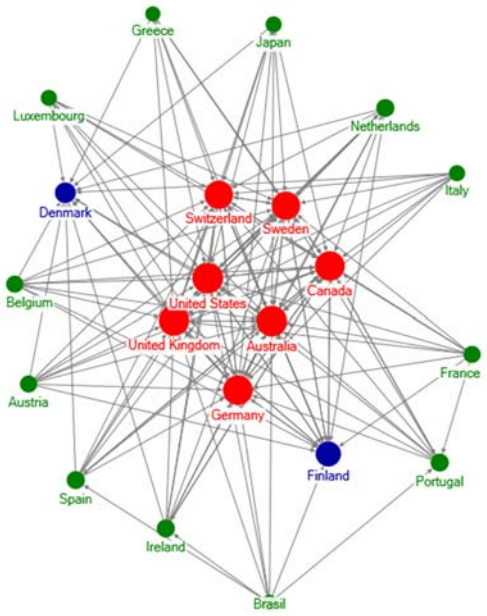
Nevertheless, some insights emerge from the exercise performed. In order to highlight these differences we make use of the network presented in section three – Mapping the network of cross-border portfolios to map the linkages that would arise from banks' international optimal asset portfolios (Figure 2).

Figure 2 · Network charts of bank´s optimal international asset portfolios in 2007 and 2016

2007



2013



The size of each node is proportional to its total degree (sum of indegree and outdegree) and the color of the node is mapped to its indegree, with "Green", "Blue" and "Red" indicating less than 5 in degrees, between 5-14 in degrees, more than 15 degrees, respectively. The network charts are based on the Harel-Koren fast multi-scale algorithm and are drawn with the use of NodeXL (see Hansen et al. (2010), an open-source template for Excel for analysis complex networks (*http://nodexl.codeplex.com/*).

There are deviations between the actual and the optimal portfolio. The number of core financial linkages is higher in the optimal portfolio, meaning that banks should engage in stronger geographic diversification. There are also differences in terms of the core countries. Under the optimal portfolio, countries should invest more outside the euro area countries, UK and US.

As it would be expected, the optimal portfolios are similar for all countries, thus the network shows more symmetry. In fact, if all countries broadly face the same set of alternatives, the optimal portfolio should be nearly the same. However, it is interesting to see to what extent has the optimal portfolio changed after the international economic and financial crisis. The results show that comparing these two different time periods (between and after the crises) the core countries diminished from 8 countries (DE, UK, PT, US, FI, IE, ES, AU) to 7 countries (DE, AU, CA, CH, UK, US, SE). It means that there were four countries, namely PT, ES, IE, FI that reduced the importance in the network, three countries - CA, CH and SE were considered as core countries after the crises, and Denmark also increased its importance.

Table 2 shows the metrics of the network for the optimal portfolio network.

Table 2 · Optimal portfolio network overall metrics

	2007	2016
Edges	21	21
Total Edges	160	160
Average degree	12.38	12.57
Average Geodesic Distance	1.32	1.31
Eigenvector Centrality	0.048	0.048

The overall metrics suggest that there is a stabilization of the two networks in terms of the number edges, average degree and eigenvector centrality.

The average degree level increased between 2007 and 2013, and average geodesic distance decrease (from 1.32 to 1.31). The centralization of eigenvector centrality may shed some light regarding changes in the resilience of the networks (it does not change from 0.048).

5. Final remarks

Although financial markets became more integrated over the years, after the economic and financial crises there was some reduction of the cross-border assets and questions relating to the reshaping international banks portfolios of and its resilience to shocks emerged in the policy-debate.

The whom-to-whom portfolio matrices provide basic information regarding the identification of the main linkages. In this context, network theory offers convenient visualization tools that provide interesting insights in terms of the cross-border banks' portfolio. In addition, it is interesting to assess how large are deviations between actual portfolios and those that would result from the optimal portfolio theory.

The paper concludes that with the financial crises the international linkages between countries changed and the number of core countries diminished. Some countries moved their position in the network. In particular, vulnerable economies deviated from the centre after the financial crisis.

When comparing to the optimal portfolio it deviates significantly from the actual one (before and after the crisis) more diversification needed. More countries appear in the centre. The network that corresponds to the optimal portfolio has also changed with the crisis. In 2013, the core countries changed – Portugal, Spain and Ireland deviated from the centre while new countries – Canada, Sweden and Switzerland became the core countries.

The analysis performed in this paper is admittedly very preliminary and important caveats limit the interpretation of results. However, the utilization of network methods in connection with the concept of an optimal global portfolio seems to be a promising avenue for further research.

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Notes

* 8th IFC Conference, Basel, Switzerland, 8 September 2016.

17. Additional definitions and concepts can be found in Guidelines for reporting the *BIS international banking statistics*: http://www.bis.org/statistics/bankstatsguide.pdf

18. Domestic claims of banks in the reporting countries are also not included.

The indebtedness of Portuguese SMEs and the impact of leverage on their performance*

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Abstract

Small and medium-sized enterprises (SMEs) account for a relevant part of Portuguese companies' turnover and number of employees, standing for half the loans granted to non-financial corporations by resident financial institutions. Tracking their performance is one of the pillars of monitoring the country's financial stability. Focusing on these companies' performance, and using Banco de Portugal's Central Balance-Sheet Database and Central Credit Register data, stylised facts suggest that financial debt is not usually used to increase profitability. Instead, indebtedness seems to be increasingly linked to companies that eventually cease their activity. Implications regarding monetary policy, financial stability and risk assessment are also addressed.

Keywords: Enterprises, Indebtedness, Leverage, Profitability, SMEs, Financial stability

JEL classification: D22

1. Introduction

Small and medium-sized enterprises (SMEs) are a relevant part of the non-financial corporations (NFC) sector in Portugal. Although debt has historically played a significant role in these companies' sustainability, it is not clear whether it has been used as a tool to expand their activity and achieve a better performance, or just as a way to carry on with their day-to-day operation, often leading to a situation where debt stands for a burden on company's operating profitability. Understanding this issue seems to be of particular relevance in the context of the recent economic and financial crisis and considering the deleveraging effort recently undergone by the Portuguese economy.

From the perspective of the financial system, it is also important to determine the extent to which debt is used to foster higher profitability levels. Unsustainable debt from the non-financial corporations' perspective is naturally linked to an increase in non-performing loans from credit institutions, with obvious impacts on its capital requirements. Such assets (from the financial sector's perspective) may even be written-off from its balance sheets. It is therefore of the utmost relevance to determine the extent to which financial debt is being properly used by such an important part of Portuguese companies.

2. Data

The current analysis is mainly based on data obtained from the Central Balance-Sheet Database (CBSD) of Banco de Portugal's Statistics Department. The CBSD is a micro database that gathers the economic and financial information of all Non-Financial Corporations[19] (NFCs) in Portugal. This information is reported directly by the companies through the submission of Informação Empresarial Simplificada (Simplified Corporate Information), an integrated report of economic, financial and statistical information (based on non-consolidated accounting data) which companies have to report, on an annual basis, to the Ministry of Finance, the Ministry of Justice, Statistics Portugal and Banco de Portugal.

Only the subset of SMEs was considered for the purpose of this analysis. Companies are categorised as SMEs if they employ fewer than 250 and more than 10 employees and have an annual turnover between 2 million euros and 50 million euros and/or an annual balance sheet total between 2 million euros and 43 million euros, a classification that follows European Commission's Recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises.

Microenterprises and large enterprises were not, hence, under the scope of this analysis[20]. In 2014, although accounting for only 10% of the total number of enterprises, SMEs represented 42% of the total turnover generated by Portuguese NFCs and 45% of the number of employees (Chart 1), a prominence in the Portuguese economic structure that has been relatively stable throughout the last years. SMEs are even more relevant within certain economic activity sectors. Indeed, in 2014 they stood for 28% of the enterprises of the "Manufacturing" and "Water supply; sewerage, waste management and remediation activities" sectors (Sections C and E of NACE Rev. 2), 60% of the turnover generated by companies within the "Education" and "Water supply; sewerage, waste management and remediation activities" sectors (Sections P and E of NACE Rev. 2) and for 64% of the number of employees of the "Manufacturing" sector (Section C of NACE Rev. 2) (Chart 2).

Chart 1 · NFC's structure by size class (2014)

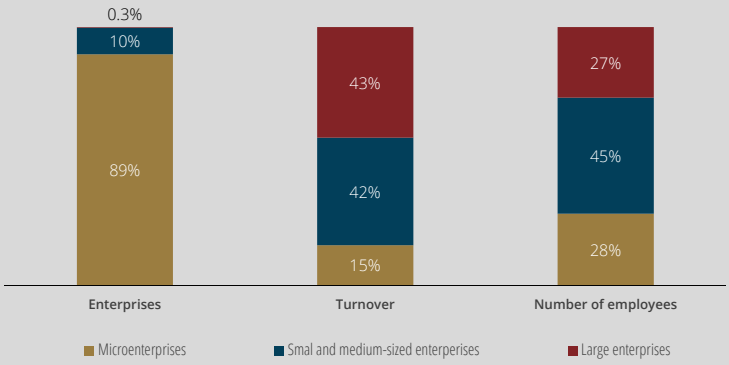
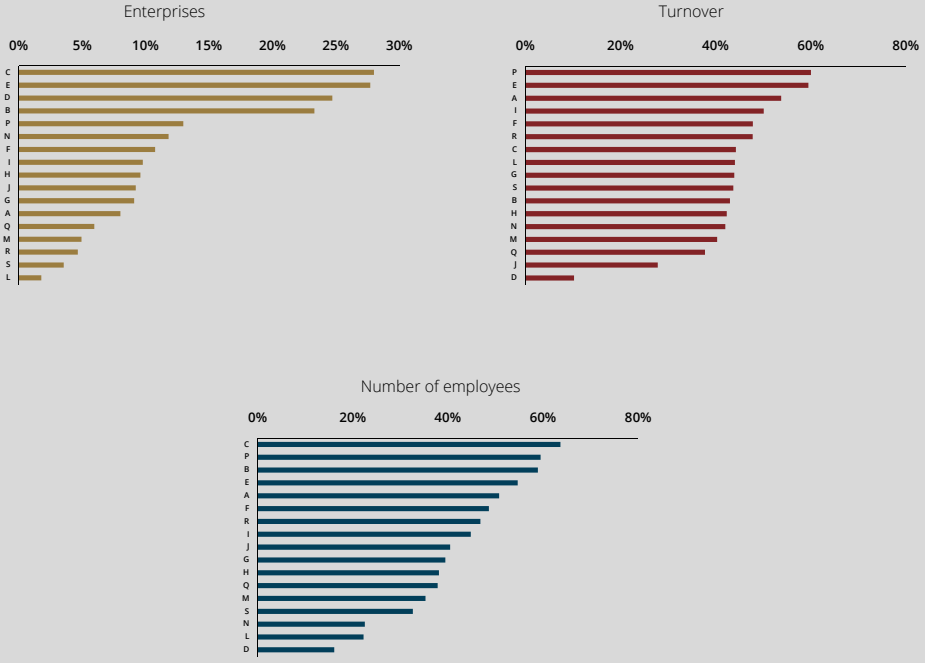
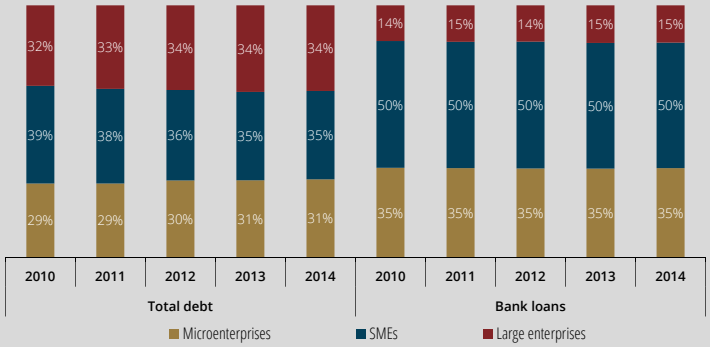


Chart 2 · SMEs weight by NACE Rev. 2 Section (2014)



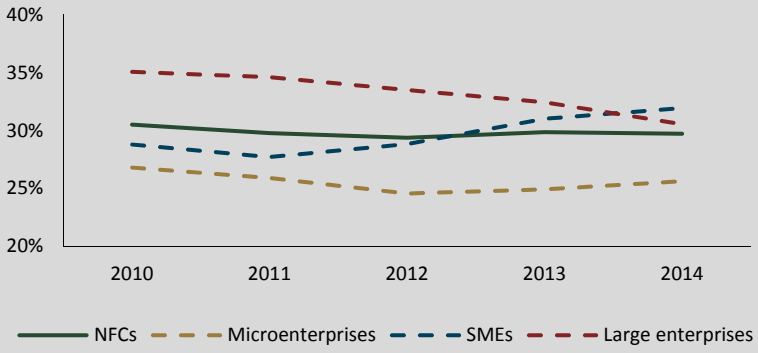
Breaking down NFCs total debt (understood as the total amount of balance sheet liabilities) by size class, it is relevant to notice that SMEs represented more than one third of such aggregate in the whole period under analysis. They accounted for 35% of the NFCs total debt in 2014 (Chart 3). Although NFCs total debt is almost equally distributed across the different size classes, data compiled by Banco de Portugal's Central Credit Register[21] show that SMEs stood for half of the bank loans granted by Portuguese Credit Institutions to the NFC sector during the 2010-14 period.

Chart 3 · NFC's liabilities by size class (2010-14)



Debt has played a significant role in these companies' sustainability. Looking at NFCs' capital ratio (which determines the proportion of a company's assets funded by equity), in spite of a slight increase in recent years, 68% of SMEs' assets were funded by debt in 2014 (average capital ratio of 32%) [Banco de Portugal (2015)] (Chart 4).

Chart 4 · NFC's capital ratio by size class (2010-14)



3. Methodology

Bearing in mind the aspects previously discussed regarding SMEs' weight in the Portuguese economy and their financial situation concerning indebtedness, the purpose of this analysis is to understand how SMEs' level of indebtedness or financial leverage is reflected on their profitability within a three year period.

In order to conduct such assessment, several indicators were considered to perform an evaluation of each company's indebtedness: the capital ratio (relating equity to total assets), a financial leverage ratio (calculated as the ratio between financial debt and the aggregate of equity and financial debt), the debt to equity ratio (relating total liabilities to equity), and other financial distress indicators such as the ratio between financial debt and earnings before interest, taxes, depreciation and amortization (EBITDA) or the inverted interest coverage ratio (i.e., the ratio between interests paid and EBITDA).

Regarding profitability, some of the most traditional indicators were considered: the return on assets ratio (which relates the net profit to the company's total assets), the return on equity (the ratio between net profit and total equity), as well as operating and net margins indicators (where EBITDA and net profit are related to each company's total income, respectively).

Regardless of their usefulness in most economic and financial analysis, several of these indicators have limitations on their calculation requirements for individual companies. For instance, ratios using equity as their denominator are often not computed when equity is negative. On the other hand, ratios using specific parts of each company's balance-sheet and income statement reports may often be impossible to calculate due to missing values (for example, when elements such as interest paid or even financial debt are considered). Although the analysis was conducted for all the above mentioned ratios (bearing in mind their specific limitations, in each case), only the capital ratio and the return on assets ratio were selected to assess each company's indebtedness and profitability levels, respectively. These ratios capture the main features that the analysis was meant to focus upon and, additionally, they maximize the number of analysed companies as there is only one obstruction to their calculation - the existence of companies with null values for total assets - which is common to both indicators.

As so, the capital ratio was considered as an indirect measure of each company's indebtedness, considering that it measures the solvency of the company by determining the proportion of assets financed by equity. The return on assets ratio was considered to be this analysis profitability proxy, given that it measures how efficiently a company can manage its assets to produce profits.

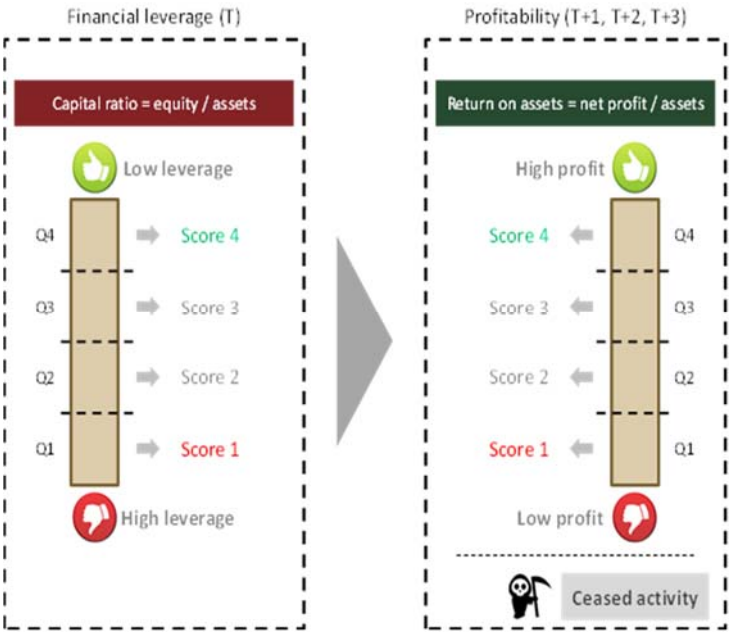
The CBSD data were used in order to determine each company's capital ratio and return on assets ratio for each year in the 2006-14 period. Subsequently, SMEs were scored from 1 to 4 according to their level of financial leverage and their positioning within the quartile distribution of individual capital ratios of SMEs. This score translates the company's performance as either being in the bottom 25% of the registered performances (score 1), above 25% but below 50% of its peers (score 2), above 50% but below 25% of its peers (score 3) or above 75% of its peers (score 4). The higher the company's capital ratio, and hence the score, the lower the company's financial leverage.

The same procedure was carried out regarding the profitability ratio. SMEs were then scored from 1 to 4 according to their level of profitability and their positioning within the quartile distribution of individual return on assets ratios of SMEs. In this case, the higher the return on assets ratio, and hence the score, the higher the company's profitability level.

Each company's leverage score in period T was then linked to its profitability score in the subsequent three years (periods T+1, T+2 and T+3). Results are first displayed as average values of the analysed indicators in the 2006-14 period, and, subsequently, as average values of two different time periods within that time span.

A special flag was considered when the company ceased its activity, a situation determined using Banco de Portugal's business register (which combines information from several databases managed by Banco de Portugal, as well as other administrative sources) [Gonçalves et al. (2013)] (Figure 1).

Figure 1 · Summary of the proposed analysis framework



Considering the particular scope of this analysis and the above mentioned methodology, it is important to mention that once a company is categorised as SME in period T, it will be evaluated according to its profitability level for the three subsequent years, regardless of any changes in the company's size class during this period. This avoids discarding companies due to size classification changes, as this would probably introduce unnecessary "noise" in the current analysis. Nevertheless, it is important to notice that each year's quartile distribution of individual indicators is determined solely by the set of SMEs of that year.

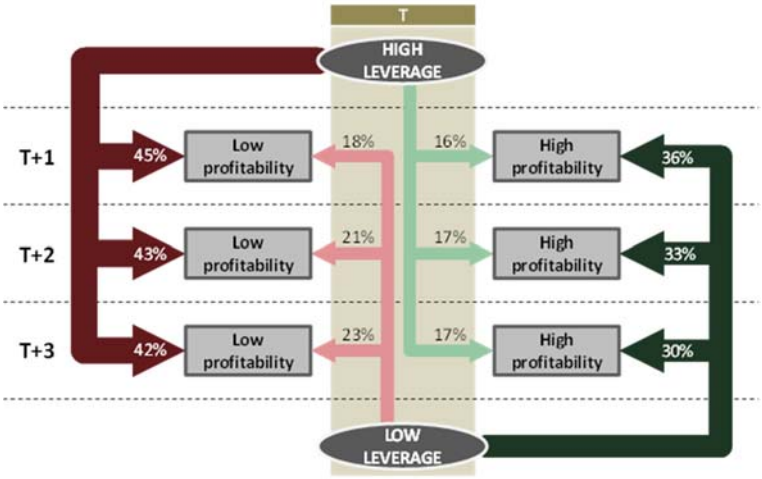
4. Results

Focusing the analysis on the share of SMEs that ceased their activity on the three year time span following its indebtedness score classification, results seem to indicate that this situation is more relevant among Portuguese SMEs with the lowest capital ratio levels (hence, highest financial leverage levels). About 6% of SMEs with the lowest capital ratio levels in one year ceased their activity in the following year, a share higher than the share of enterprises that ceased their activity one year after having registered low leverage levels (1%). In a three year time span (bearing in mind that these results are cumulative across this time period), 20% of companies with the highest financial leverage levels ceased their activity. These results contrast with the 5% registered among enterprises with the lowest levels of financial leverage (Chart 5).

Chart 5 · Share of SMEs that ceased their activity according to financial leverage scores in T

Among companies that did not cease activity, data reveal that SMEs with the highest financial leverage in period T are most commonly linked to low profitability levels in the following years. Indeed, 42% of SMEs with the highest leverage levels in one year registered the lowest profitability levels after three years, a share relatively similar when one year and two year time spans are considered (Figure 2). The stability of the results across different time spans enabled the analysis to be focused on the financial leverage of SMEs in period T and their profitability level three years after (T+3).

Figure 2 · SMEs by financial leverage scores and profitability scores (high and low levels, at different time spans)



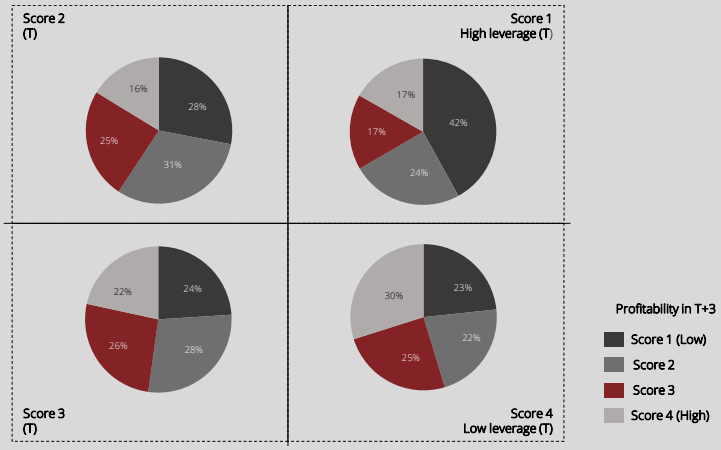
The link between companies with the highest leverage levels in one period and the lowest profitability levels three years after seem to be more noticeable when the set of least leveraged SMEs is considered. In this case, the percentage of SMEs posting the lowest profitability levels after three years drops to 23%, which compares with the previously mentioned share of 42%, when the highest leveraged SMEs are considered.

On the other hand, only 17% of the most highly leveraged SMEs reached high profitability levels in three years. For the least leveraged firms the percentage increases to 30%.

These stylised facts seem to indicate that high financial leverage is not usually associated with short/medium term profitability for Portuguese SMEs. Therefore, it could be argued that a significant share of Portuguese SMEs seem to be indebted (carrying non-profitable debt) rather than leveraged (debt leading to higher profitability levels).

Another aspect the data seem to point to is that (with the exception of SMEs with an indebtedness score of 3) profitability levels seem to be closely linked to the same indebtedness score (Chart 6). Within SMEs of the lowest leverage quadrant (score 4 at time T), the most relevant share of companies at time T+3 is the one related with the ones with the highest profitability levels (score 4 at time T+3). The same can be pointed out at leverage score 2 (where SMEs with profitability score 2 are the most relevant after three years) and leverage score 1 (where, as pointed out, the lowest profitability score stands for the largest share of SMEs).

Chart 6 · SMEs by financial leverage scores (in T) and profitability scores (in T+3)

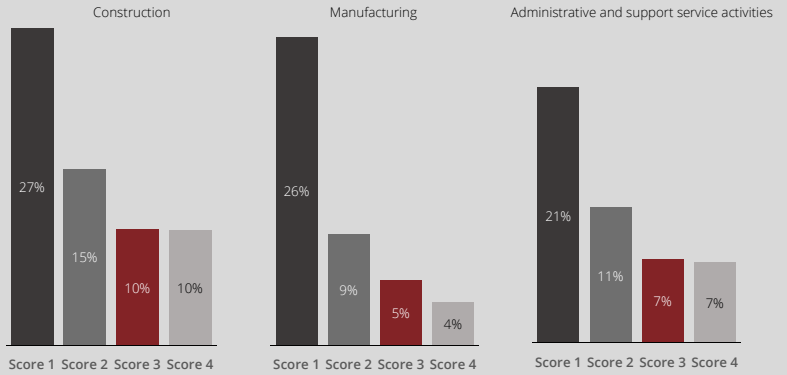


4.1. Breakdown by economic activity sectors

The results previously analysed were broken down according to the NACE Rev. 2 classification of economic activity, allowing the analysis to focus on specific economic activity sectors.

Considering different Sections of NACE Rev. 2, and focusing the analysis on the share of enterprises that ceased their activity, it is possible to identify economic activity sectors where this proportion is higher. This situation is particularly relevant in "Construction", "Manufacturing" and "Administrative and support service activities" (Sections F, C and N of NACE Rev. 2, respectively) (Chart 7).

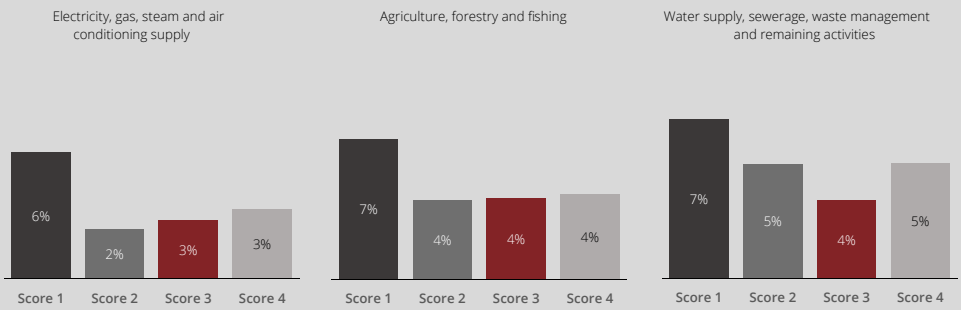
Chart 7 · Share of SMEs that ceased activity in the three subsequent years according to financial leverage scores (sectors with highest shares) – by NACE Rev. 2 Section



"Construction" (Section F of NACE Rev. 2) stands out as the sector with the highest share of companies that ceased activity in the three year period after a high indebtedness level (leverage score 1) had been registered (27%), followed by "Manufacturing" (26%) and "Administrative and support service activities" (21%) (respectively, Sections C and N of NACE Rev. 2). Still, it is important to mention that, among SMEs that ceased activity in the referred time span, "Manufacturing" displays the largest differential between the share of companies that ceased their activity having registered the highest and the lowest indebtedness levels (a differential of 22 percentage points between both cases).

By contrast, sectors such as "Electricity, gas, steam and air conditioning supply", "Agriculture, forestry and fishing" and "Water supply, sewage, waste management and remediation activities" (Sections D, A and E of NACE Rev. 2, respectively) exhibit the lowest share of SMEs with the highest leverage levels that ceased activity in the ensuing three-year period (Chart 8). Market regulation regarding utilities may determine to some extent the fact that Sections D and E of NACE Rev. 2 seem to have the lowest share of companies ceasing activity despite of them having the highest indebtedness ratios.

Chart 8 · Share of SMEs that ceased activity in the three subsequent years according to financial leverage score (sectors where shares are lowest)



Regardless of the economic activity sector, the share of SMEs that ceased their activity after a three year period seems to be larger among SMEs with the highest indebtedness levels (score 1 in period T).

Considering only the companies that did not cease activity, the analysis then focused specifically on the subset of companies with the highest leverage levels (leverage score 1 in period T) and the lowest profitability levels after a three year period (profitability score 1). This high-low leverage-to-profitability situation and the structure of SMEs under these circumstances (according to their economic activity sector) was then compared to the breakdown of all the SMEs in order to understand if a particular sector is over- or under-represented in this leverage-to-profitability situation (Table 1).

Results show that the "Accommodation and food service activities" sector (Section I of NACE Rev. 2) is more relevant in the high-low leverage-to-profitability situation, when compared to its relevance among total SMEs. This sector accounts for a 15% share of the subset of companies with high leverage and low profitability levels, a share 7 percentage points higher than this sector's share among total SMEs. Likewise, "Real estate activities" (Section L of NACE Rev. 2) is also over-represented in the analysed subset of SMEs, with a share 2 percentage points higher than the one this sector accounts for when the total population of SMEs is considered.

Table 1 · SMEs' structure by leverage-to-profitability situation and economic activity sector

NACE Rev. 2	Total SMEs (1)	High leverage and low profitability (2)	=(2)-(1)	Low leverage and high profitability (3)	=(3)-(1)
A – Agric., forestry and fish.	2.3%	2.5%	0.2%	2.7%	0.4%
B – Mining and quarrying	0.6%	0.5%	-0.1%	0.6%	0.0%
C – Manufacturing	28.3%	23.7%	-4.6%	26.9%	-1.3%
D – Elect., gas, steam	0.4%	0.2%	-0.2%	0.6%	0.2%
E – Water supply, sewerage	0.6%	0.4%	-0.3%	0.6%	-0.1%
F – Construction	15.6%	13.3%	-2.4%	9.1%	-6.5%
G – Wholes. and retail trade	23.0%	21.2%	-1.8%	24.0%	1.0%
H – Transportation	4.1%	3.1%	-1.0%	4.3%	0.3%
I – Accomod., food storage	8.0%	15.2%	7.2%	9.2%	1.2%
J – Information and commun.	2.0%	2.1%	0.1%	2.4%	0.4%
L – Real estate activities	1.3%	2.9%	1.6%	0.8%	-0.5%
M – Prof., scient., tech. activ.	4.4%	3.2%	-1.2%	7.2%	2.7%
N – Adm. and support serv.	3.6%	4.4%	0.8%	3.3%	-0.3%
P – Education	1.7%	2.4%	0.7%	2.1%	0.4%
Q – Human health, soc. work	2.7%	2.3%	-0.4%	4.9%	2.2%
R – Arts, entert., recreation	0.5%	1.0%	0.5%	0.3%	-0.2%
S – Other service activities	0.9%	1.7%	0.8%	0.8%	-0.1%

Sectors such as "Manufacturing", "Construction" and "Wholesale and retail trade; repair of motor vehicles and motorcycles" (respectively, Sections C, F and G of NACE Rev. 2) seem to be under-represented in the high-low leverage-to-profitability situation when compared with the share they account for among total SMEs (-5, -3 and -2 percentage points, respectively).

The same kind of analysis was conducted taking into consideration the subset of SMEs with low indebtedness levels in period T (leverage score 4) and the highest levels of profitability in period T+3 (profitability score 4). The low-high leverage-to-profitability situation determined yet another structure of enterprises. Within these SMEs, the "Construction" sector (Section F of NACE Rev. 2) stood out as being under-represented, when compared to its relevance among the total number of SMEs. This sector stood for only 9% of SMEs under the referred low-high leverage-to-profitability situation, a percentage 7 percentage points lower than its share among total SMEs. Conversely, "Professional and scientific activities" and "Health and social activities" (Sections M and Q of NACE Rev. 2, respectively) stood out, displaying a larger share of companies in the low-high leverage-to-profitability situation than the one registered when considering total SMEs.

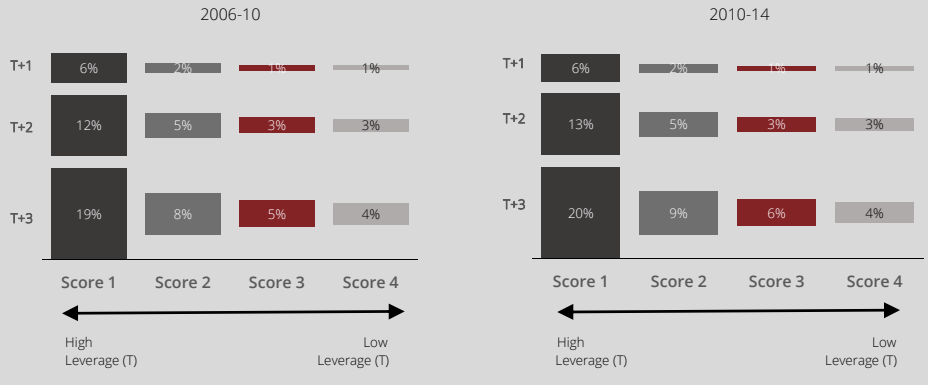
4.2. Breakdown by different time periods

The data used for this analysis encloses a relatively large time span, across which the world as seen significant changes affecting differently each country's economic and financial situation. In the case of Portugal, in the aftermath of the global financial crisis registered at the end of the first decade of the 21.st century, an economic and financial assistance program was implemented, targeted at solving some of the imbalances of Portuguese economy, regarding both the behaviour of public agents (namely, the structural deficit of the Portuguese Public Administration) and the increasing indebtedness of private economic agents (households and NFCs).

Hence, it would be important to see if the above mentioned results are somewhat different when distinct time spans are considered. In order to do so, the available data were broken down into two subsets of data, the first of which covering the period between 2006 and 2010, and the second set of data concerning the 2010-14 period.

Data seem to point to the fact that the share of SMEs ceasing activity in the three year period after having registered the highest indebtedness levels is not seemingly different between both time spans: this share stood at 19% and at 20% in the 2006-10 and 2010-14 periods, respectively (Chart 9).

Chart 9 · Share of SMEs that ceased their activity according to financial leverage scores by different time periods

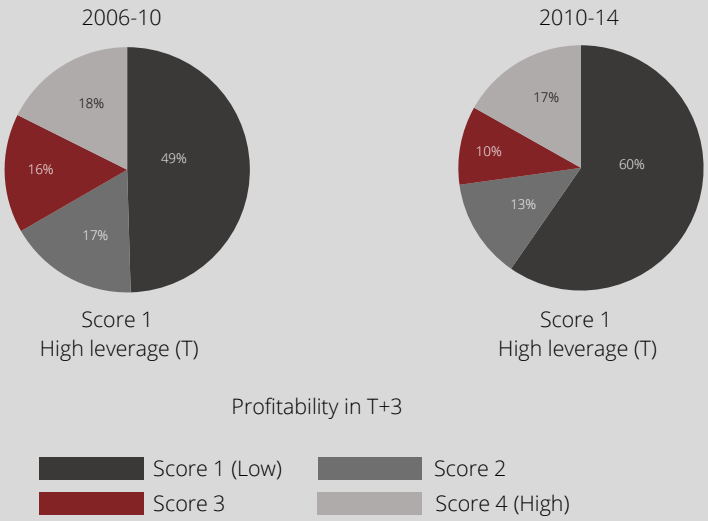


Notwithstanding, it is possible to identify economic activity sectors where the difference between both periods is more noticeable. For instance, the "Transportation and storage" sector (Section H of NACE Rev. 2) stands out with an increase of 6 p.p., from 16% in the 2006-10 period to 22% in the 2010-14 period. Likewise, in the "Agriculture, forestry and fishing" sector (Section A of NACE Rev. 2), the share of SMEs ceasing activity in the three year period after having registered the highest indebtedness levels doubled, from 4% to 8%. Inversely, in the "Electricity, gas, steam and air conditioning supply" sector (Section D of NACE Rev. 2) the share of companies in the same situation that ceased activity seems to have decreased: while the percentage of SMEs in this situation stood at 8% in the 2006-10 period, it dropped to 1% during 2010-14.

On the other hand, concerning the share of companies that did not cease their activity, results seem to indicate that in the most recent period under analysis, the share of SMEs with the lowest profitability levels (profitability score 1) among companies with the highest indebtedness levels (leverage score 1) is higher than in the previous period (44% in the 2010-14 period, compared with 41% in the 2006-10 period). Also, the share of enterprises with highest profitability levels (profitability score 4) among less leveraged enterprises (leverage score 4) seems to be lower in the second period under analysis (28% in the 2010-14 period, compared with 32% in the 2006-10 period).

The differences registered between the obtained results in the two periods seem to be particularly relevant in some economic activity sectors, especially among the enterprises with the highest indebtedness level and low profitability situation three years after. The "Accommodation and food service activities" sector (Section I of NACE Rev. 2) stands out with a 11 p.p. difference between the two periods (while 49% of the high indebted SMEs registered a profitability score of 1 during 2006-10, this percentage raised to 60% in 2010-14) (Chart 10).

Chart 10 · Accommodation and food service activities' SMEs with high financial leverage scores in T and different profitability scores in T+3, at different time periods



5. Conclusions

Given the relevance of SMEs within the NFC sector in Portugal, the current analysis intended to explore the importance of financial debt on these companies' performance. The analysis aimed at revealing some stylised facts on the link between SMEs' indebtedness and profitability levels: are Portuguese SMEs indebted (carrying non-profitable debt) as opposed to being leveraged (using debt as a mean to increase activity and reach higher profitability levels)?

Stylised facts show that the latter is, in general, not the case. The most leveraged SMEs seem to be, in broad terms, more prone to ceasing their activity in the short/medium term. This fact is consistently registered across different economic activity sectors, regardless of the time period considered to conduct such an analysis.

SMEs with the highest indebtedness levels do not seem to be associated with higher profitability levels during the same time period. Instead, they seem to have the lowest profitability levels, as opposed to less leveraged SMEs which tend to reach higher profitability levels.

From the perspective of the financial system, these results are of the utmost importance. They seem to indicate that, for each company, there is an ideal level of indebtedness which can be perceived as a good indicator of the company's capability to repay its debt and to obtain new financing. Debt above such levels may often be binding the company's future profitability in some way.

Given that unsustainable debt from the non-financial corporations' perspective often leads to default, the ability of financial institutions to identify and deal with such risk is of paramount importance. This is particularly true in the context of recent developments regarding credit constraints and new capital requirements.

A trustworthy assessment of each financial institutions credit at risk, based on a correct evaluation of its borrower's financial soundness is, therefore, particularly relevant. This evaluation, however, should be carried out regarding both the new credit granted by financial institutions to new and current customers, but also previously granted credit perceived as performing, regardless of the real performance of its counterparts. Hence, credit institution's balance sheets should be evaluated considering the possibility to write-off or set up provisions on credit that, although still performing, might be at risk. Such situations should be assessed based, not only on the counterparty's ability to repay its debt, but also on its ability to do so while reaching higher performance levels, given the evidence provided that SMEs often seem to carry non-profitable debt and, hence, non-repayable financing.

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Notes

* 8th IFC Conference, Basel, Switzerland, 8 September 2016.

19. According to the 2010 European System of National and Regional Accounts (ESA 2010), the NFC sector includes private and public companies and excludes sole proprietors (included in the households' institutional sector). For the purpose of this analysis, holding companies (categorised under Section K of NACE Rev. 2) were also excluded. Companies developing activities classified under Sections O, T and U of NACE Rev. 2 were also excluded, as well as companies with no know NACE Rev.2 classification.

20. According to the European Commission Recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises, microenterprises are defined as enterprises which employ fewer than 10 employees and whose annual turnover and/or balance sheet total does not exceed 2 million euros. Large enterprises are those that are neither categorised as microenterprises, nor as SMEs.

21. The Central Credit Register is a database managed by Banco de Portugal, which gathers information provided by participating entities (resident institutions) regarding credit granted. For more information, please refer to Banco de Portugal Booklet No 5, Central de Responsabilidades de Crédito (Portuguese version only).