Banco de Portugal

EUROSYSTEM

Papers presented by Banco de Portugal representatives at the 56th Session of the International Statistical Institute, held in Lisbon, 22 - 29 August 2007

Supplement 1/2007 to the Statistical Bulletin, August 2007

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Publications and Statistics

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FOREWORD

This publication covers the papers to be presented by *Banco de Portugal* representatives at the 56th Session of the International Statistical Institute, held in Lisbon, 22 – 29 August 2007.

Established in 1885, the **International Statistical Institute** (ISI) is one of the oldest scientific associations operating in the modern world, with more than 2,000 individual elected members, representing more than 133 countries worldwide.

The ISI has as its objective, "to promote the understanding, development, and good practice of Statistics worldwide. The ISI pursues its mission by promoting excellence in statistical research, training, education and practice of Statistics; by supporting the international statistical community in promoting the establishment and maintenance of sound statistical institutions; by fostering the appreciation in governments and the public at large of the true value of Statistics and statistical methods to all aspects of human endeavour; by facilitating collaboration among diverse groups and by continually evolving and developing new initiatives to maintain leadership of an evolving discipline in changing environments."

Associated with the ISI, the **Irving Fisher Committee on Central Bank Statistics** (IFC) was established on the initiative of a number of central bank statisticians who were attending the International Statistical Institute (ISI) Corporate Members Meeting at the 1995 ISI Session in Beijing. The IFC is a forum of central bank economists and statisticians, as well as others who wish to participate in discussing statistical issues of interest to central banks. The IFC is established and governed by the international central banking community and operates under the auspices of the Bank for International Settlements (BIS).

The IFC has adopted the name of Irving Fisher, an internationally renowned economist and statistician, for his work on economic measurement and many other topics related to monetary and financial stability of interest to central banks. His wide-ranging contributions to economics and statistics and his multi-disciplinary approach serve as an example for the IFC's objectives and activities.

The IFC sponsors various meetings at the 56th Session of the ISI. Some of them will be co-sponsored with other ISI sections.

The *Banco de Portugal* has been an active member of the IFC since its establishment. In the 56th session of the ISI, *Banco de Portugal* is responsible for the organisation of three **Special Topics Contributed Paper Meetings (STCPMs)**:

- Portfolio investment statistics (STCPM 27 also with IAOS)
  chair: M Sebastião (*Banco de Portugal, member of the Board of Directors*)
- Statistics dissemination public service (STCPM 28 also with IAOS)
  chair: J Cadete de Matos (*Banco de Portugal, Head of the Statistics Department*)
- The relationship with the providers of information for statistical purposes (STCPM 29 also with IAOS)
  chair: A Garcia (*Banco de Portugal, Deputy Head of the Statistics Department*)

In addition to these IFC sessions chaired by *Banco de Portugal* representatives, other contributions are presented at the 56th Session of the ISI by statisticians and economists[1] working at the *Banco de Portugal*.

In line with the main theme, the papers are grouped in the following sections: institutional and organisational framework; monetary and financial statistics; balance of payments statistics; financial accounts; securities statistics; non-financial corporations' statistics; other issues.

1 The views expressed are of the authors and do not necessarily reflect those of the Banco de Portugal.

We begin with the experience of the *Banco de Portugal* in terms of **institutional cooperation** in the statistics domain. The paper covers the different dimensions of institutional cooperation and gives several examples of protocols/ agreements in which the *Banco de Portugal* is involved.

Next we move to what has been elected as a strategic goal in the *Banco de Portugal*: **high quality statistical dissemination**; a description is given of how the *BPstat – Statistics online* was designed to work as an anchor for all the data and metadata disseminated by the Bank.

The concern with high quality in statistics is nonetheless present throughout the entire production cycle; in the third paper, there is a description of how the **statistics audit** is put into practice in the *Banco de Portugal*, as an innovative approach to address such goal.

Moving upwards in the production chain, we debate the importance of **involving the respondents in the statistical process**; we concentrate on the possible positive influences from a relationship based on transparency, cooperation and mutual trust with the respondents who provide the data and how this may affect many of these various quality dimensions. The analysis is based on the experience of the Bank, particularly in the field of monetary and financial statistics.

Also in the field of monetary and financial statistics, there follows an empirical **test of the expectations hypothesis of the term structure using Portuguese data**; the main findings support the cointegration hypothesis and the well known puzzle in the literature for short-term *vs.* long-term forecasts.

In the field balance of payments statistics, several contributions are presented. We begin with a study on **the impact of foreign direct investment in Portugal** through the financial performance of companies, where several indicators of profitability, operating efficiency and investment intensity are analysed.

Another contribution presents a **dynamic panel model for Portuguese workers' remittances outflows**, identifying some of the macroeconomic determinants of the outflows sent from Portugal to a set of nine developing countries, selected according to their relative weight (Angola, Brazil, Bulgaria, Cape Verde, Moldova, Mozambique, Romania, Russia and Ukraine).

The third paper contains a comparative study of software applications with the aim of defining a **methodology for the seasonal adjustment of the Portuguese Balance of Payments statistics**; following the results of the comparative analysis of the X-12-ARIMA and TRAMO-SEATS, there is a description of the methodological approach adopted by the Statistics Department of the *Banco de Portugal*.

Finally, this section concludes with an overview of **the Portuguese experience in compiling portfolio investment statistics** in the context of balance of payments and international investment position statistics. A special focus is given to the pros and cons of security-by-security data collection systems for integrated statistical production. The complexity of data collection systems based on custodians in a world of global financial markets is also addressed.

Measuring the market value of shares and other equity in the Portuguese financial accounts is one of the papers in the domain of financial accounts that we present. In order to comply with the valuation criteria established in the European System of Accounts, an alternative methodology was developed making use of data on non-financial corporations from the Central Balance-Sheet Database and of data from the security-by-security database, both kept by the *Banco de Portugal*.

The next paper presents a methodology to **estimate and predict quarterly financial savings of households** in an attempt to bridge the gap created by the current non availability of quarterly information on net lending/ borrowing. For each aggregated variable, the best quarterly indicators are selected, based on a balance between statistical significance and economic plausibility.

In the domain of public finance, the following contribution elaborates on the use of stocks and flows' statistical data to assess **public finance sustainability**.

The problem area of **imports and exports of financial intermediation services indirectly measured (FISIM)** is dealt with in the last paper of this section. In order to circumvent current shortcomings, i.e. the possibility of obtaining negative FISIM, the following are proposed: i) calculation of separate ERR for assets and liabilities; and ii) the definition of a reference rate that results from a weighted average of market interest rates according to the different term structures and currency denomination of the operations.

We move next to an overview of the Securities **Statistics Integrated System** maintained by the Statistics Department of the *Banco de Portugal*, as an example of how developments in information technology have led to a new trend in statistics production, moving towards microdata reporting.

Two studies are presented based on statistical data from non-financial corporations. In the first, the objective is to estimate an empirical model which evaluates **how corporate financial indicators influence their implicit interest rates**. Firms' financial indicators are computed using data from their financial statements. Their financial situation is assessed from a large set of indicators commonly used in this literature, specifically relating to firms' solvency, profitability, financial structure, indebtedness, productivity, liquidity and investment.

The second paper analyses the determinants of **the probability of default (PD) in Portuguese credit system loans to non-financial corporations**. The discussion is focused on the role of a set of characteristics of the lender, the borrower and the type of loan. The study uses information from the Portuguese public credit register maintained by the *Banco de Portugal*. It is found that loans granted by non-monetary institutions tend to be riskier, that both larger firms and larger loans have lower PD, and, finally, that a close bank-borrower relationship has a tendency to decrease the PD on the loans.

The last section, presents a note on the **total factor productivity (TFP) in the G7 countries**; using Bayesian stochastic production frontiers in a growth accounting exercise for the period 1960/2005, the authors assume a dynamic translog production function and use data on 21 OECD economies. The results provide information on the contribution of inputs to GDP growth, on capital and labour elasticities and on TFP contribution. Furthermore, TFP is decomposed into technological change and degree of efficiency.

Finally, the last contribution elaborates on **how to generate macro data relying on micro data surveys on household wealth**. An example is given on how the survey results were important to understand the macroeconomic developments in the Portuguese economy and some insights are given on macro data derived from the survey on the average size and structure of household wealth.

Statistics: the case for institutional cooperation

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1. Introduction

Statistics are a public good. They must therefore be produced efficiently, in order to maximize user satisfaction and minimize the overall social costs. In this regard, there are various forms of institutional cooperation that can be envisaged for top quality statistics to be compiled through efficient production processes, in line with international standards, and in order to comply with commitments to national and international organizations. Starting from the *Banco de Portugal* experience in this domain, we will illustrate the main dimensions of institutional cooperation in the field of statistics, specifically the most relevant from the point of view of cooperation between National Central Banks (NCBs) and National Statistics Institutes (NSIs).

2. Dimensions of institutional cooperation

A full coverage of institutional cooperation in the statistical domain involves several levels, depending on the entities taking part in the various phases of the production cycle.

First of all, reporting agents should be considered as the first link in the value chain rather than mere providers of raw data. In particular they should regard the final statistical output as a product of their own, which is also instrumental in the pursuit of their own interests. This view enhances the quality of the data provided and simplifies the development and updating of statistical requirements. Within this framework, the *Banco de Portugal* promotes a number of practices aiming at sound cooperation with the reporting agents. Among these are regular meetings with major financial groups and regular feed-back mechanisms.

Institutional cooperation is also relevant where national statistical entities are concerned. Best practices in this domain have proved to be particularly successful in terms of reducing the reporting burden and integrating arrays of statistical products.

The *Banco de Portugal* is active in the High Council of Statistics (HCS), the top forum of the Portuguese National Statistical System (NSS). This forum allows for sharing of production experiences as well as analysis of important statistical results with other participating institutions (such as the National Statistical Institute, General Government representatives, data producers' and data users' representatives, among them industrial associations, trade unions and universities).

In this framework there is close cooperation between the *Banco de Portugal* and other official entities, in particular the Portuguese NSI (Instituto Nacional de Estatística, INE). This cooperation takes various forms and the following initiatives in this field are worth mentioning:

(i) In 1998 the Banco de Portugal, the Ministry of Finance and the INE signed a protocol with the purpose of defining the co-ordination among these entities in order to fulfil Portugal's commitment to the IMF Special Data Dissemination Standard (SDDS). This protocol was very important to define individual obligations and implement the timetable for this Standard. It has contributed decisively to the positive assessment of Portuguese participation in the SDDS over the past 10 years.

(ii) Also in 1998 a protocol was signed between the *Banco de Portugal* and the INE, relating to implementation of the European System of Accounts (ESA 95). This protocol, which was updated in 2001, defined their joint responsibility in the compilation of Portuguese national accounts. The INE is in charge of compiling the non financial accounts whereas the *Banco de Portugal* took over responsibility for compiling the financial accounts. On the basis of this protocol, joint work in this field has been carried out, giving a relevant contribution to enhancing the quality of Portuguese national accounts.

(iii) Another protocol was signed in 1999 between the INE and the *Banco de Portugal*, relating to a joint venture from the year 2000 onwards. This was for a quarterly survey of non financial corporations, carried out since 1997 by the *Banco de Portugal*. The main purpose of this initiative was to avoid undertaking two similar surveys, thereby reducing the reporting burden for the corporations involved. In 2001, the sample was updated and the questionnaire adjusted in order to ensure better quality information.

(iv) With a view to launching a survey of Household Indebtedness and Wealth, a protocol was signed by the *Banco de Portugal* and the INE. This survey was carried out for the third time in 2006.

(v) In the area of balance of payments, two protocols were signed in 2004, with the General Directorate of Tourism and the INE. The aim was to collect additional data in order to compile tourism statistics. These protocols focus on two statistical operations, one being a survey on cross-border movement of travellers and the other a survey on international tourism expenditure. Results for the period 2004-2006 were first released in April 2007. These surveys will provide an additional source for the compilation of the tourism item in the balance of payment statistics.

(vi) At the beginning of 2006, an institutional cooperation agreement in the field of general government statistics was signed between the Banco de Portugal, the INE and the Ministry of Finance, covering the following areas: (a) definition and updating of the general government sector entities; (b) compilation of the general government accounts (financial and non financial) on a quarterly and annual basis; (c) compilation of public debt statistics; and, (d) a close analysis of the Excessive Deficit Procedure (EDP) report and the corresponding methodological background. For this purpose, a framework of common data sources and procedures has been drawn up by a working group made up of representatives of the institutions.

(vii) Finally, the *Banco de Portugal*, the INE, the Ministry of Finance and the Ministry of Justice have developed a joint project aiming to define a harmonized solution for the collection of annual data from the financial statements of non financial corporations. This project is known as IES, the acronym for "*Informação Empresarial Simplificada*" (Simplified Corporate Information). It was formally created by Decree-Law no. 8/2007 of 17 January. IES is the electronic submission of accounting, fiscal and statistical information that companies usually have to remit to the above mentioned authorities. Through IES, companies can fulfil four obligations to four authorities through one single electronic submission at one moment in time. This initiative integrates a set of measures that have progressively

streamlined administrative and legal procedures for companies, reducing the current reporting burden.

Also at a national level, cooperation with the supervisory bodies must be highlighted. The *Banco de Portugal* has informal agreements for regular remittance of data on the supervised entities, from the Portuguese Securities Market Commission (the securities markets supervisory authority) and from the Portuguese Insurance and Pension Funds Supervisory Authority.

At international level, cooperation within the European Union assumes a major role. The *Banco de Portugal* is part of the European System of Central Banks (ESCB) and, as such, has been permanently and deeply involved in building up a harmonized European statistical framework, not only directly with the European Central Bank (ECB) and the other NCBs but also with the Statistical Office of the European Communities (Eurostat) and the National Statistical Institutes, under the umbrella of the Memorandum of Understanding on economic and financial statistics agreed between the ECB's Directorate General for Statistics and Eurostat. In this way, it is possible for the ECB and Eurostat to apply the same statistical framework to the whole European Union while taking the national contributions into account. There is also close cooperation with other international institutions, in particular the IMF, the World Bank, the BIS and the OECD. This articulation includes both data reporting and discussion of concepts and methodologies.

Finally, another domain of institutional cooperation refers to technical assistance. This has comprised sharing of good practices, bilateral visits and organization/participation in seminars and workshops. In particular, this type of initiative has proved to be very fruitful with Portuguese speaking African countries, Brazil and East-Timor.

3. Golden rules for institutional cooperation

Best practices in the field of institutional cooperation have to be modelled on certain common rules covering knowledge, understanding and acceptance. In fact, a commitment of all parties involved in any cooperation process is a necessary condition for it to achieve its full potential. Where recommendations are to be followed on a voluntary basis, it is more likely that some cases of non compliance arise, posing a serious threat to an efficient statistical process. It is worth mentioning that both the ECB and Eurostat have adopted a more strict cooperation model in the sense of creating binding rules and even imposing penalties in cases of major deviations. In our view, this embodies a common motivation for obtaining top quality statistics for the European aggregates compiled from national contributions. From the beginning, the *Banco de Portugal* has been closely involved in this overall process, together with other European NCBs and NSIs, contributing to the building up of the European Statistical System, which is, we believe, recognized internationally as a success story.

One of the most important "rules of the game" is consistency with international standards for concepts, definitions and classifications. Only when this is guaranteed is it possible to make international comparisons and aggregations, and to ensure consistency across different statistical areas, seeking a perfect match with users' needs.

Additionally all the parties involved in this network of institutional cooperation need to be fully aware of their responsibilities and areas of competence both in order to avoid overlapping domains and to fully and efficiently cover the whole statistical spectrum.

4. Conclusion

Authorities with statistical responsibilities can only benefit from being engaged in processes of institutional cooperation, both nationally and internationally. These processes promote an efficient use of resources, avoiding duplication of efforts and reducing the reporting burden. They thus benefit the many agents that intervene in the production cycle, from data collection to dissemination.

Cooperation also enhances the sharing of best practices through multilateral contacts and technical cooperation on a bilateral basis.

Additionally, cooperation with other entities at international level enables the individual country representatives to explain specific national characteristics in international *fora*, respecting diversity within unity.

Moreover, by following international standards, national statistical contributions become part of a single harmonized and coherent system, allowing for international comparability and signalling their good quality to the users.

These can be taken as the ingredients needed for continuing successful implementation of a common statistical language worldwide.

High quality statistical dissemination– A strategic goal in Banco de Portugal

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1. Introduction

Some years ago the focus of the statistical systems was on the production side, based in the needs defined by the main "clients" – the Government, public entities and internal research. The statistics were reduced in coverage and detail because its use was also limited. In recent years this scenario has been changing considerably and at a high pace - the number of data requests received in the Banco de Portugal has been increasing as well as the detail and complexity requested by the most frequent and expert users, including from International Organisations.

This new reality is very welcome but it is, also, very demanding. It is good to know that people are paying attention to the data but, unfortunately, its use is sometimes not the most appropriate. All the effort to produce high quality statistics can be completely lost, for example, when a popular newspaper presents the statistics with a wrongful analysis of the figures.

There is a fundamental role to play by the statistics entities in promoting the use of statistics and, in particular, to assure that people understand and make the most appropriate and meaningful use of the information.

With the release of a completely new statistical dissemination system, the |BPstat – statistics online|, on 19 January 2006, Banco de Portugal confirmed that high quality statistics dissemination is a strategic goal.

2. High quality statistics – the main component

The Statistics Department in Banco de Portugal has been from its inception very much involved in producing high quality statistics. The reporting systems have been designed and implemented in cooperation with the data reporters. Most of collection systems are based in very elementary data, which reduces the burden in the data reporters and allows all the flexibility and the introduction of extensive quality control systems that are a fundamental element in assessing and improving the quality of the statistics.

These collection systems allowed building databases with enormous volumes of data, which are very powerful for statistical analysis. To have all this valuable information without taking the initiative to disclose it to the public was not a very comfortable situation, in particular when was visible the increasing number of statistical data requests that has to be analyzed and, when approved, to be answered. However, to put all this data available to the users in the traditional system of preformatted tables was like to create a "jungle" that would not help the "explorers" to find a particular "animal". Some progress was done in including some more tables in the Monthly Statistical Bulletin, but that is a limited solution due, in particular, to the constrains associated to such a way of dissemination.

It was necessary to progress to a new statistical dissemination policy that would move to a comprehensive and transparent environment where all public data and metadata would be available for all the users. However, there are several barriers to achieve that progress. Beside the technical, financial and operational aspects there are other difficulties in having open and

comprehensive statistical dissemination systems. Firstly, to disclose detailed statistical information and to guarantee the same level of quality that is applied for the main statistical indicators produced for several years is not easy and it is only possible incorporating sophisticated control quality systems. Secondly, to keep the data dissemination system based on traditional time-series structures would not work and it was only possible by implementing multidimensional structures, which may not be easy to handle by the people that have for long time accessing the data in predefined tables and/or in time-series databases.

The main component in a statistical dissemination system in the internet is the level of commitment, motivation and technical skills of the people that support the system. In more sophisticated data dissemination systems incorporating huge volumes of data, there are dozens of tasks to be organised, managed and planned. In the case of Banco de Portugal the number of people dealing with technical aspects in the statistical dissemination is very limited and is also involved in the development and fine tuning of the system, which is only possible if the system is running smoothly.

3. Functionalities easily available

The ***BPstat - Statistics online*** corresponds to the outcome of a significant investment of the Banco de Portugal in order to provide a statistical dissemination service in the Web. Its main purpose is to make available an easy and quick access to the statistics compiled by Banco de Portugal, as well as to the statistics and economic indicators published by other institutions.

This new statistical dissemination system is completely free and the registration is not mandatory, but recommendable to benefit from all the services. It offers to the users several functionalities and services allowing a user-friendly navigation through the statistical information, namely: 1) easy access to the data; 2) timely data and metadata; 3) access to the data on time-series or multidimensional analysis 4) table design facility according to the users needs, allowing to include data from different business areas in the same analysis; 5) creation of favourites; 6) pre-announced calendar 7) static or dynamic analysis, which are automatic updated when new information is available; 8) subscriptions of the alerts service, allowing to receive information about the publication of new statistical data in the different domains; 9) access to the metadata, available in a clear, logical and standardised structure; 10 fully bilingual - all information is available in Portuguese and English and it is deployed simultaneously; 11) inclusion of micro statistics and macro indicators; 12) search facilities; 13) graphic capacities; 14) user-friendly glossary; 15) print and export in the main formats 16) help online and hot-line available during business hours and through different channels, mainly by e-mail and telephone; 17) close contacts with main users; 18) relevant statistics available (inflation, monetary and financial statistics, non monetary financial institutions statistics; balance of payments statistics, international investment position statistics, public finance statistics, financial account statistics, foreign exchange rate statistics, payment system statistics, banking system statistics, Eurosystem statistics and general statistics); 19) system updated a minimum of three times a day; 209) news service informing on the most relevant events; 21) continuous investment in recovering historical information; 22) assessment of the data quality disseminated; and 23) record of all the accesses to the data and the functionalities applied in order to better understand the demand and the use of the system;.

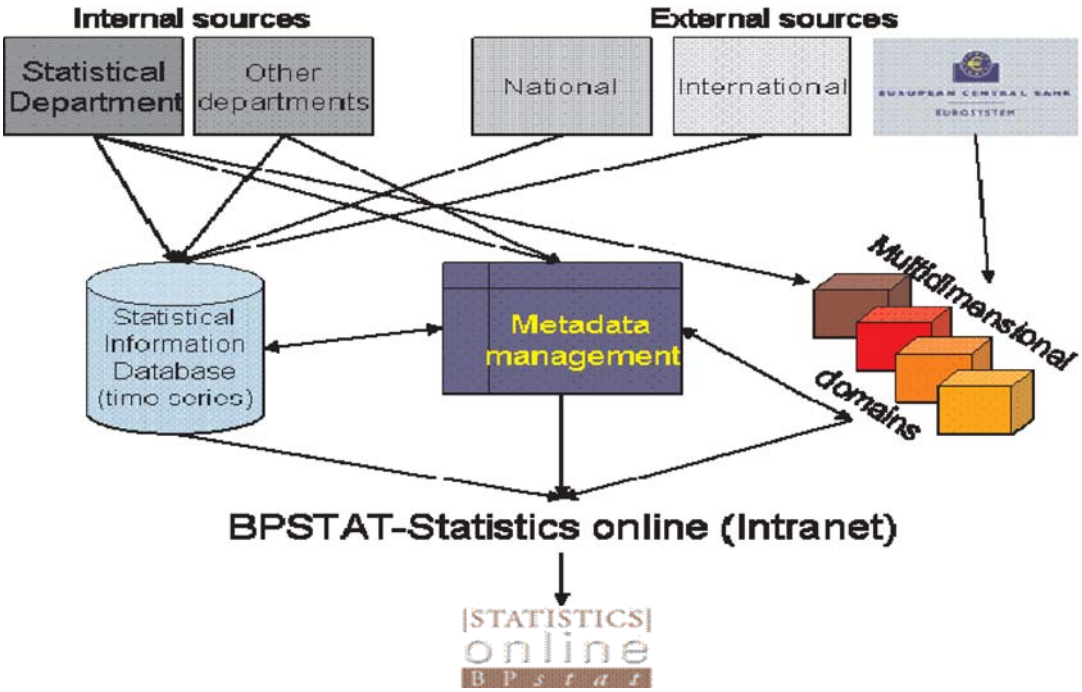
4. Integrated Statistical components

On the backside of a statistical web service there are some other systems that have to be integrated and able to communicate to each other. In the case of Banco de Portugal there are five main components. Firstly, a repository of time-series statistics (Statistics Information Database) that includes not only the main statistics produced in-house by all the statistical domains but also from other statistical institutions. Secondly, for the multidimensional analysis,

the cubes are direct linked to the statistical production systems, allowing the full refreshment of the data. Thirdly, the metadata management system is linked to the automatic update system that updates the data and metadata in the intranet. Fourthly, the BPstat intranet system receives the data and metadata from the three components and the final validations are performed. Fifthly, after assuring that no errors or inconsistencies were found, the data and metadata is copied into the internet version.

During the process of implementing a web statistical dissemination system all these components need to be tackled together - any failure in one of these components will damage the service. No need to say that the success of a web system depends very much in the performance of the system – the server and the communication channels need to be prepared to deal with a certain number of simultaneous visitors. However, there is a cost associated and it is fundamental to continuously monitor the system to have it fully operational and to observe whether it is possible to improve it under the budget constrains.

The increasing number of users is putting a burden in the system in specific periods, like the day when monthly data is released (usually the 15th working day – 11 o'clock). . For the credibility of the system itis mandatory to consider all possible actions to prevent that users face difficulties in accessing the statistics.



5. All public statistical data

An important goal is to put available all the statistical data that are not confidential. To do that, a huge effort needs to be carried out in order, firstly, to identify all the statistics in each business area that could be produced and, secondly, to assess whether it would have confidential problems. In the development of multidimensional analysis in the BPstat, all the dimensions and members were identified and a data model for dissemination was developed. Afterwards all the combinations of the different members of all the dimensions were assessed in order to construct a "security model" where all the possible combinations that could be disclosed to the general public were identified. In the end it was necessary to implement the model assuring that all the rules were well developed. This task is to be performed regularly. Once the work is finalised and the data are enclosed in the BPstat, there are no reasons to ask for data and metadata from the Banco de Portugal because it is all easily available in the internet. Previously to this exercise all the requests were evaluated and it could happen that the answer was not consistent because

the evaluation was performed by different people and the assessment might be biased for some reason.

All the statistical data produced by Banco de Portugal is firstly disclosed in the ***BPstat - Statistics online***, following a public calendar, in a tight timeframe to allow the users to access the data as soon as possible.

6. Comprehensive metadata

Metadata can not be just adding information at the end like in an old-fashioned paper report or having it in static files. We have to think differently, e.g., on footnotes appearing as pop ups whenever there is some relevant information on a dimension or a member.

During 2005 a huge investment in metadata was done by all the business areas of the Statistics Department in Banco de Portugal. In 2004 a discussion on the best way to include metadata in the new statistical dissemination system in the internet ended in a definition of two main groups of metadata: 1) Reference metadata and 2) Support metadata. For reference metadata it was decided to keep the approach developed for the Statistical Information database - this level of metadata covers all the characteristics of the series (in the time-series analysis) and the members and dimensions (in the multidimensional analysis). The Support metadata embrace all the other metadata and can be divided in three sub-groups: 1) Context metadata that follows the Data Quality Assessment Framework (see SDDS in www.imf.org) and provides, following a standardised and international methodology, information on each of the statistical domains available in the BPstat ; 2) Simple metadata that includes small texts (length lower than 256 characters) that are reusable by several components of the data (series, members, dimensions) and 3) Open metadata, which is the only one that do not follows any predefined structure, covers documents, pictures, tables, etc., and can be inside the BPstat system or, in most cases, accessible via a link to the site where it was produced (in most cases Banco de Portugal and ECB).

Two important aspects are: 1) the existence of a metadata management application that allows each statistical domain to manage its metadata and see all metadata (this application also manages the "news" component and user profiles, accesses and logs); and 2) a established procedure to validate new metadata to check whether it follows the standards defined.

7. Conclusions and the prospects ahead

We are confident on the direction that we took on statistical dissemination and we are aware of the work that still has to be done.

The ***BPstat - Statistics online*** considers the needs of less skilled or demanding users via the traditional time-series analysis and, in parallel, includes the multidimensional analysis that have been very well received from more intensive statistical users. Our experience shows that most people learn quickly and are not, anymore, looking for predefined tables but more interested in constructing their own personal statistical dissemination system based in the available functionalities.

There is a lot of room for improving, to add value to statistics, to help people to understand the figures and to push them to increase the use of statistics.

The future of ***BPstat - Statistics online*** has three main directions: 1) to increase the coverage (data and metadata), mainly in multidimensional analysis; 2) to extend the functionalities, aiming that users may handle the data directly or via their own applications; and 3) to contribute extensively for the statistical literacy by, e.g., enhancing the contacts with the users and by providing more detailed metadata on the concepts, methodology and the statistical processes associated to the statistical production and dissemination.

Statistics Audit: the experience of Banco de Portugal

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The Statistics Department of *Banco de Portugal* developed an organizational structure and working arrangements addressed to ensuring data quality through all phases of the statistical production process. To assess the quality of the statistical procedures in place, the quality dimensions, as laid down in the IMF Data Quality Assessment Framework (DQAF), are used. Moreover, following the restructuring of the Statistics Department in the beginning of 2004, the Statistics Audit Unit was created covering the following main functions: (i) data quality and legal provisions' full compliance assessment; (ii) definition of statistics audit planning and accomplishment of audit operations to the statistics produced in the Statistics Department; and, (iii) accomplishment of statistical audits to the reporting institutions' data sources. Currently, the Statistics Audit Unit is a light structure, composed of three senior members.

This paper focuses essentially on the work developed so far in the field of statistics audit in *Banco de Portugal*.

Main purposes of the statistics audit operations

The main purposes of the statistical audit operations are the following:

- Analyse and evaluate the different phases of statistical production procedures in place, from source data collection up to final statistics compilation and dissemination;
- Analyse the organizational and functioning aspects, in particular evaluate the burden and the share of functions and responsibilities in the statistical production process;
- Evaluate the efficiency of the procedures in place, identifying the good practices as well as improvement needs;
- Contribute to enhance methods and applied techniques and to improve the statistical production quality by issuing, when it applies, suggestions/ recommendations on current practices or by suggesting new procedures and/or organizational arrangements; and,
- Encourage and promote the share and comparison of good practices and procedures among the different areas of the Statistics Department.

Methodological approach (the AK list)

In order to conduct the statistical audits a methodological approach was set up. Despite possible minor adjustments (bearing in mind the targeted statistics as well as the increased experience), the main features of this methodology may be highlighted, in short, in the AK list:

A. Initial appointment with the responsible of the unit in charge of the statistics under audit
B. Collection, organization and analysis of the documentation made available by the unit

C. Submission of the "*Self Assessment Questionnaire*"
D. Fieldwork
E. Definition of a *Flow Chart* on the information circuit
F. Preparation of the *Check List* of procedures
G. Analysis of the answers to the Self Assessment Questionnaire
H. Graphical assessment of the statistical production system – *Radar Chart*
I. Report on the statistical audit process (1st draft) – submission to the unit under audit
J. Joint evaluation with the unit under audit of their comments on the report
K. Final report on the statistical audit process – submission to the Head of the Statistics Department

The first initiative is an appointment with the responsible of the unit in charge of the statistics under audit aiming at: (i) presenting the purpose as well as the process of the audit operation; (ii) making a preliminary assessment of the main tasks of the units compiling the statistics under audit; (iii) asking for supporting documentation; and (iv) explaining the nature of the "self assessment questionnaire" that will be submitted to the responsible of the unit.

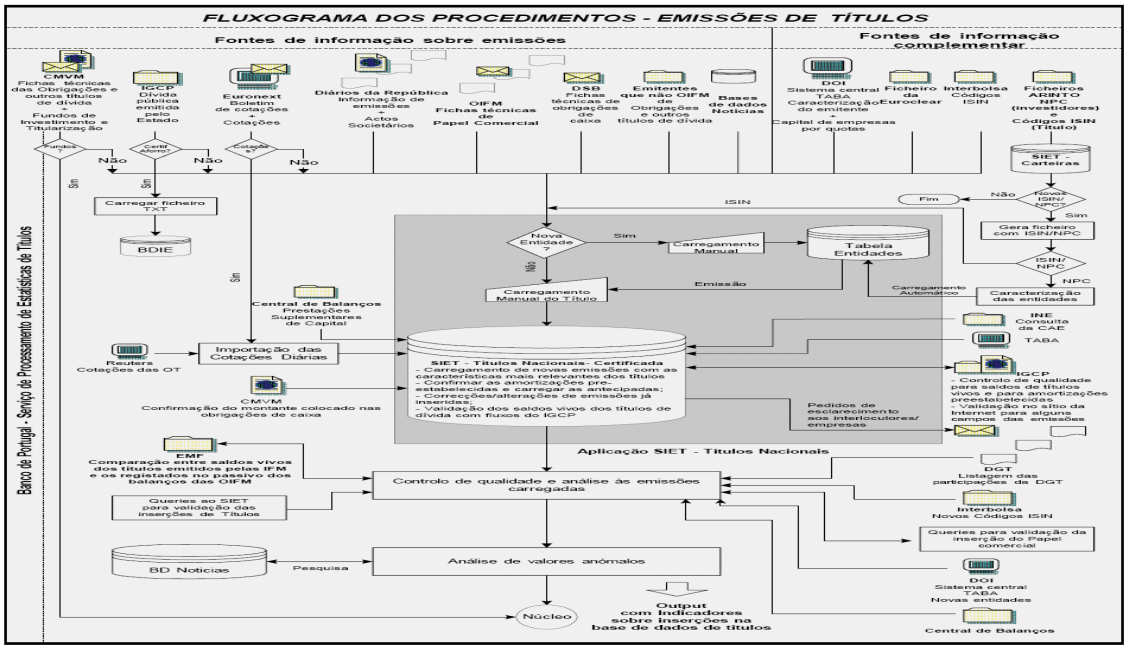
Collect, organize and analyse the documentation made available by the unit is the second phase of the methodology – usually it covers legal provisions, methodological manuals, handbooks/notes on procedures and practices in place, working checklists and schedules, among others.

Simultaneously the Self Assessment Questionnaire is submitted to the unit's managers – this questionnaire is organized in accordance with the dimensions of the DQAF, covering several questions for each dimension, and its main purpose is to have a previous assessment, from the point of view of the unit's responsible, of the different aspects that will be covered in the audit operation.

About a month after the submission of the questionnaire, the fieldwork starts – it covers appointments with the different teams (administrative, technical and management staff) involved in the statistical production process; desirably the effectives are joined in the accomplishment of their daily duties, side by side in real time, in spite of the concern of not interfering with the regular functioning of the unit; a local and direct assessment of the utility and the degree of up-to-dating of the manuals previously made available is also accomplished in this phase.

After gathering this information it is possible to work up a flow chart on the information circuit in order to have a graphic analysis of the various procedures (see figure 1, for an example).

Figure 1: Flow Chart



In parallel it is prepared a check list of the procedures with the purpose of organizing the different phases of the statistical production process. This check-list, besides allowing for a systematization of the different phases of the statistical compilation, may also be used as an assessment instrument by the unit's management and/or may be subject to a statistical audit process (see figure 2, for an example).

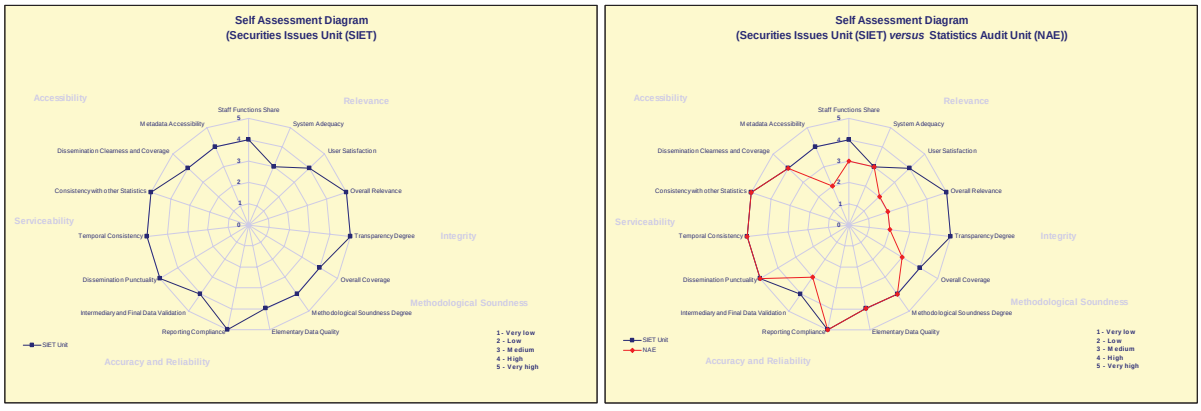
Figure 2: Check List

QUESTIONÁRIO SOBRE PROCEDIMENTOS DE PRODUÇÃO ESTATÍSTICA DE BALANÇOS

	QUESTÕES	Registo no Log	Sim	Não	Não aplicável	OBSERVAÇÕES
Equipas	Foi distribuído calendário de actividades para esse mês?					
	Controlou a chegada atempada da informação dos reportantes a seu cargo?					
	– PRIMUSnet (consultar ficheiros)?					
	– Via *e-mail* (monet e endereço pessoal)?					
	Se não chegou atempadamente, foi autorizada a situação de excepção?					
	Executou o *upload* manual dos ficheiros recebidos por *e-mail*?					
	Foram analisados os relatórios R1 e R2?					
	Enviou os R1 e R2 por *e-mail* para as instituições que comunicaram por *e-mail*?					
	Quadros foram integrados?					
	Se não integrou contactou o reportante?					
	Executou testes de coerência?					
	Consultou/analisou resultados dos testes de coerência e procedeu de forma adequada?					
	Analisou as variações significativas/anomalias (em Proclarity)?					
	Enviou e-mail de pedido de esclarecimento?					
	No caso de 2º reporte comparou com o anterior (diferenças) e executou/consultou resultados dos testes de coerência e procedeu de forma adequada?					
	Alterou valores segundo indicação da instituição, executou/consultou resultados dos testes de coerência e procedeu de forma adequada?					
	Validou com a informação do DMR?					
	Validou com a informação do ARISCO?					
	Validou com a informação do SIET?					
	Foram efectuados testes de coerência entre os quadros do 1º e do 3º blocos e procedeu de forma adequada?					
	Validou com a informação da CRC (Quadro C, titularização)?					
	Registou os contactos de validação da informação?					
	Registou o n.º de contactos na aplicação NUVENS?					
	Certificou a informação?					

At this phase, considering the information gathered so far, the Statistical Audit Unit is in position: (i) to promote a joint analysis with the unit's manager of the assessment questionnaire allowing for some adjustments if it is considered relevant; and, (ii) to answer all the quantitative questions at the end of each section of the questionnaire, aiming at contrasting graphically these answers with those of the unit's responsible – statistical production assessment diagram – radar chart (see figure 3, for an example).

Figure 3: Radar Chart



A report on the statistical audit process is worked up along the fieldwork and the main issues focussed are the following: (i) introduction; (ii) methodology of the audit operation; (iii) legal framework; (iv) relevance of the statistics concerned; (v) organizational issues; (vi) compilation procedures and practices and quality control; (vii) main results of the self assessment questionnaire; (viii) conclusions and suggestions/recommendations. This structure, which is supposed to be stable, allows, however, for some degree of flexibility in order to fit each statistics' specificities.

After the conclusion of the fieldwork a first draft of the report is finished and submitted to the unit under audit for comments and joint evaluation. After final adjustments (resulting, among others, from the unit's comments) the report is finally submitted to the Head of the Statistics Department whose dispatch, in general, asks for comments from the unit under audit and also for a joint definition of an implementation calendar of the suggestions/recommendations agreed upon.

Conclusions and main findings

The appraisal of the statistical audit operations conducted so far is quite significant. First of all it is worth mentioning the deep interest and good collaboration revealed by those intervening in the statistical production systems audited. In fact, there is a consensus that these operations, besides allowing for the assessment on the current features of the statistical systems in place and for the presentation of related suggestions/recommendations, also offer the possibility of conveying upwards the desires and aspirations as well as the shortcomings faced by the responsibles of the units under audit, which, otherwise, might encounter more constraints before being acknowledged.

Besides, the fact that these audit operations allow a detailed assessment on the current features of the statistical systems in place means that they also allow the identification and the share of good practices within all Statistics Department.

Another aspect that is noteworthy is that most of the suggestions/ recommendations raised by the statistical auditors and accepted by the units under audit are already being implemented or are included in the unit's planning for the years ahead, which, definitely, is an indicator of the relevance of the statistical auditing work that is being developed in the *Banco de Portugal* Statistics Department. It also draws the attention to the relevance of monitoring the implementation of these recommendations through a careful follow-up process.

To conclude, it should be mentioned that this success largely results from the fact that, though it is a highly demanding and time consuming task, quality control is a priority shared by all staff of the Statistics Department. Nevertheless, there is always room for further improvements.

Increasing the respondents' involvement in the statistical process. The *Banco de Portugal*'s experience in the field of monetary and financial statistics

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1. Introductory remarks

"Nothing is more important for monetary policy than good statistics."
Alexandre Lamfalussy, 1996

This famous quotation by the former president of the European Monetary Institute and director general of the BIS, stressing the fundamental importance that policy-makers attribute to quality in statistics, has not been in any way tarnished by the passage of time. Central banks have to compile significant amounts of data so as to suitably accomplish their respective missions. These statistics typically substantiate policy decisions that impact the economy – and ultimately peoples' lives – and provide a service to the community as a whole, by fulfilling an important part of its statistical data needs. Therefore, nurturing a culture of good practices in central bank statistics, directed to the deliverance of high quality statistical products that meet the users' requirements, is indisputably a design of paramount importance.

Data quality is often perceived by the public at large as simply the degree to which the statistics correctly describe the phenomena they are meant to measure. Central bank statisticians, however, know well that such narrow interpretation is insufficient to ensure that the quality of the information is suited for its intended uses. Under a strategy that aims at producing statistics that are "fit for use" in terms of the users' needs, as the one adopted by the *Banco de Portugal* (hereinafter referred as 'the Bank'), other dimensions of quality – e.g., relevance, timeliness, accessibility, interpretability and coherence – certainly have to be properly addressed, subject to users' requirements and priorities.

This paper, however, does not attempt at defining data quality or its dimensions – it suffices to say that we recognize major references in this area, such as the Fundamental Principles of Official Statistics adopted by the UN Statistical Commission, the IMF's Data Quality Assessment Framework, the OECD's Quality Framework or the European Statistics Code of Practice, to name a few; instead, it will concentrate on the possible positive influences that a relationship based on transparency, cooperation and mutual trust with the respondents who provide the data may have on many of these various quality dimensions, based on the experience of the Bank, particularly in the field of monetary and financial statistics.

2. Wise traditions in central bank statistics

The Bank has been involved in the production of statistics for quite a long time. It is safe to concede that, so far, the statistical data compiled and disseminated by the Bank have been able to ensure a high degree of satisfaction on the part of the key stakeholders to whom they were directed. To meet the users' requests and to constantly assess whether the information collected by the Bank properly matches the possible changes in those data requirements, being in close contact with the industry is essential.

In fact, the recognition of the good quality of the Bank's statistics has to be credited, to a certain extent, to the policy followed since long ago by the Bank, of actively working together with the data providers, fully exploring the possible synergies and mutual benefits that could be derived from such partnership – rather than having a more conservative, or pro-reactive, stance towards the respondents. From its very inception this approach has proven to be a fitting one.

A sample of these good practices is shown below:

(i) respondents are thoroughly informed about the reasons why the statistical information is being collected and the expected uses for these data;

(ii) the data to collect from the respondents, as well as the practical aspects related with the reporting, are unambiguously identified in the Banks' reporting instructions; these are, in turn, complemented by a handbook centred on some elements of a more operational nature (e.g., the technical specifications for the data transmission, linear constraints and consistency tests to apply to the reported data, a number of practical examples meant to ease the response and even some bridging

tables, tentatively aligning the statistical categories in the reporting scheme with the respondents' accounting framework);

(iii) the Bank provides assistance to the respondents (if necessary by means of specific training courses), so that the time and effort asked to them within the context of the data collecting process would be kept to a necessary minimum;

(iv) whenever the situation requires it (e.g., persistent non-compliance with reporting requirements) the Bank promotes high-level bilateral meetings with respondents to discuss the issues and try to find mutual satisfactory solutions;

(v) the Bank assumes an informal compromise not to change the statistical requirements for a certain period of time (typically a 5-year period), thus guaranteeing stability to the reporting scheme.

3. Paving the way for further enhancements in data quality

After the setting up of the Bank's Statistics Department[1], 10 years ago, the relationship with respondents experienced a remarkable thrust.

The ensuing concentration within a single institutional structure (the Statistics Department) of all the statistical processes that were previously dispersed by several Departments of the Bank created the conditions for:

(i) Streamlining the existing statistical processes, with a view at using more efficiently the available resources while improving the quality of the statistics. One important outcome of this venture was the creation of the Integrated System of Securities Statistics, intended to replace three different previously existing systems.

(ii) Eliminating redundant data requests, by using alternative sources of information available at the Statistics Department. As a result from this initiative, the statistics on the distribution of bank credit by geographic region, branch of activity and some very detailed breakdowns by institutional sector started to be compiled on the basis of Central Credit Register's data, allowing for the discontinuation of the reporting of this information by the monetary financial institutions (MFIs), the reference reporters for monetary statistics purposes.

(iii) Performing regular and systematic cross-checks on the data submitted by the respondents by means of the, so-called, overall consistency exercises. These exercises aim at evaluating the global accuracy of the information reported for statistical purposes, pairing the data from the various sub-systems (e.g. monetary statistics, securities statistics, balance of payments statistics, financial accounts statistics and the Central Credit Register data).

These events had important consequences to the quality of the Bank's statistics. The first two, on the one hand, contributed to alleviate the burden on reporters and translated into a more efficient use of the available resources. The overall consistency exercises, on the other hand, while delivering obvious gains in terms of data accuracy, produced an additional, worth noting, result – one that was neither deliberately intended nor entirely expected – on the respondents' internal processes: faced with the need to justify the discrepancies in the data submitted to the Bank for various statistical purposes, the respondents (in particular the larger ones) took the initiative of reorganising their own reporting procedures, particularly through a higher level of articulation among the different areas contributing to the report and, in some cases, making new organizational arrangements to deal with the statistical reporting in an integrated approach. Among other interesting outcomes, this led to:

(i) further improvements in data accuracy and conceptual compliance, thus enhancing the quality of the statistical information reported to the Bank;

(ii) a much better preparedness on the part of the respondents to discuss with the Bank's statisticians any data developments demanding explanation.

Exogenous factors also played a major role in this context, particularly the advances in information and communication technologies, which:

(i) allowed for the statistical processes, both at the Bank and at the respondents' level, to be automated, thus facilitating the introduction of computerised data validation and enhanced quality control;

(ii) provided the opportunity for the Bank to developed special computer applications – to be used on a voluntary basis and at no cost by the respondents – that, among other functionalities, supports the performing of preliminary validation tests (IT tests, coherence and inter-temporal plausibility tests)

[1] Formerly, the Bank's core statistical functions (e.g., balance of payments statistics and monetary and financial statistics) were located in the, now extinct, Research and Statistics Department; other Departments of the Bank, however, were also involved in the compilation of statistics.

intended to prevent basic reporting errors, with a view at facilitating even more the reporting of the statistical data;

(iii) permitted to evolve, from a reporting scheme based on the physical delivery of the data (e.g., on paper, in a diskette), to a much more efficient electronic reporting system, based on an extranet type of communications' infrastructure (named BPnet system) implemented by the Bank. The exchange of information within the BPnet system includes sending and receiving files, messages or documents and also the mechanisms to implement solutions computer-to-computer based on a dialogue inter-applications for the exchange of files and messages.

As one would expect, these developments had a very significant impact on efficiency of the data submission process and eased further the reporting burden on respondents.

4. Fostering a more active respondents' involvement

The above described developments were important to augment the Bank's credibility to its respondents. Nonetheless, a central bank can never afford having a complacent attitude towards the statistics for which it is accountable. The economy is constantly changing. To retain their relevancy over time, economic statistics must cope with the speed and the scope of these ever-present changes. The increasing demands for comprehensive, detailed and high-quality statistical data, stemming from Portugal's Economic and Monetary Union membership, suggested that additional steps would have to taken to retain – and, if possible, to expand – the high standards already achieved by the Bank's statistics.

To deal with the new challenges to the Bank's ability to preserve the quality of its statistics in a shifting and more demanding environment, the Bank decided to deepen the relationship with respondents by promoting the extension of their involvement in the statistical process to domains not strictly related with the compilation of statistics, particularly at the level of the conceptual phase of the new statistics.

Intuitively, one may argue that, since statistics are essentially compiled from data originated in the respondents' own information systems, it makes sense to join efforts with the reporting agents in the development of new statistics or when existing statistics have to undergo major changes. In this way, a faster convergence to an appropriate data collection method, in terms of feasibility, methodological soundness and efficiency, is to be expected, while attending to the need to keep the reporting burden on respondents at an acceptable level.

Other arguments may be pointed out in support of a higher involvement of respondents during the conceptual stage of the statistical process:

(i) Respondents are also data users, which means that they have a vested interest in the development of new statistics. The Bank's experience in this area suggests that this interest is not merely theoretical: for instance, some years ago, when the Bank was pondering to discontinue the collection of data on the geographical distribution of MFIs' credits and deposits, the respondents persuaded the Bank not to take such decision, on the basis of the usefulness for the industry of the aggregated statistics compiled from these data.

(ii) Respondents' participation may help increasing the accuracy of the initial statistical assessment that usually follows the emergence of a new data requirement. In line with the Bank's tradition, this assessment starts with statisticians analysing to what extent the data already available at the central bank meet the users' needs. In the likely event that the Bank is deficient in such data, it is sometimes helpful to have a precise idea of the quantitative significance of the new requirements (when the empirical importance of the phenomenon under scrutiny is unclear) – to see if it is reasonable or not to go ahead with the process. Clearly, without the respondents' collaboration this quantitative evaluation is impaired or not feasible at all. Moreover, the tentative identification of the most efficient and sound statistical approach for the collection of data could visibly benefit from a respondents' involvement in this phase – e.g., in discussing possible approaches for the actual statistical data collection and assessing its feasibility or efficiency to fulfil the information requirement.

The Bank's long experience provides abundant evidence of the mutual advantages resulting from a well-established relationship between statisticians and respondents. One interesting example addresses the classical trade-off faced by statisticians between a higher granularity in the statistical requirements and the minimisation of the burden on respondents. Intuitively, one would expect that asking for more comprehensive data would be against the best interests of the respondents (in the sense that it would presumably increase their reporting burden) and, therefore, would unwillingly opt for more aggregate data. Yet, when the Bank discussed this issue with the respondents, it was clear

that they favoured exactly the opposite view: from the respondents' perspective, it is easier and less costly to report detailed data than aggregated data. A similar situation was experienced in terms of the frequency of the data to be reported. Having different frequencies in a reporting scheme is also an undesirable feature from the respondents' perspective, although it implies extra work for the Bank's compilation systems.

(iii) Respondents are better positioned to provide an accurate assessment of the costs related to their data reporting obligations. For those requirements that are regarded as being technically feasible and relevant, the respective implementation and maintenance costs, both for the respondents and the Bank, will have to be assessed to see how they compare with possible benefits. The need to procure the respondents' involvement in the evaluation of data reporting costs is obvious and mandatory.

To increase the effectiveness of the relationship between statisticians and respondents, all along the conceptual phase of the statistical process, the Bank opted for promoting, whenever possible and deemed necessary, the formation of temporary groupings of experts, comprising Bank's statisticians and a sample of respondents representative of the potential reporting population, to deal with the technical issues related with the setting up of a new reporting scheme. These structures are intended to be flexible in the way they operate and to convey rapid response to any technical problem arising from the development of new statistics, thus facilitating the taking of decisions.

Another crucial issue related with the involvement of the reporting institutions in the statistical process is the feed-back provided by the Bank to the respondents on the basis of the data previously submitted by them. Individual indicators, allowing for the calculation of market shares or rankings in specific market segments, are recognised by the reporting institutions to be extremely valuable to support their business decision-making. The assistance of the respondents in shaping this set of indicators is essential to make it worthwhile. Indeed, when the Bank decided, back in 2000, to form a Monitoring Group comprising representatives of both the Bank and the reporting institutions (and/or their Associations), with the purpose of following closely the functioning of the Bank's Central Credit Register and proposing possible enhancements in its scope, the feed-back indicators were one of the first issues to be addressed. Putting together this Monitoring Group has proved to be an extremely successful initiative, even in seemingly steady-state situations. Based on the positive outcome of this experience, the Bank has already approved the creation of similar structures for other statistical domains.

5. Concluding remarks

The enhanced combined effect resulting from the cooperative interaction between statisticians and data providers has proved to be a key factor at improving the quality of the monetary and financial statistics of the Banco de Portugal.

The approach that has been followed by the Bank in building its data compilation systems, purposely taking on board both the users' and the respondents' concerns, has been a vital element in achieving high-quality data, in spite of very demanding deadlines. It also changed significantly the way the statistical reporting obligations were perceived by the respondents – from an unavoidable and costly burden to a procedure that can be beneficial for their respective businesses.

Testing the Expectations Hypothesis of the Term Structure with Portuguese Data[1]

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1. Introduction

Understanding the term structure of interest rates has always been viewed as crucial to assess the impact of monetary policy and its transmission mechanism, to predict interest rates and to provide information about expectations of participants in financial markets. In this paper, the expectations hypothesis (EH) of the term structure of interest rates, embedding the rational expectations hypothesis, will be tested with Portuguese data for interbank money market rates.

The EH, which states that the observed term structure can be used to infer market participants' expectations about future interest rates, has been at the origin of an extraordinary amount of econometric analysis; see, e. g., Campbell and Shiller (1987, 1991), Engsted and Tanggaard (1994), Hall et al. (1992), Hardouvelis (1994), Lanne (2000) and Tzavalis (2003). Some of the alternative ways of testing it will be briefly reviewed, both in the framework of single and multiple equation models. We will focus particularly on cointegration analysis and on the predictive ability of the spread.

The results obtained support only a weak version of the hypothesis and are in line with the majority of the conclusions in the literature. The empirical evidence supports the cointegration hypothesis of Portuguese rates and the puzzle well known in the literature of the expectations hypothesis: although forecasts of short-term rates changes based on the spread are in the correct direction, it fails in forecasting future long rates (wrong direction).

2. Some implications and testing procedures of the EH

In single equation models the focus is on pairs of interest rates. Assuming that interest rates correspond to I(1) processes, the EH requires cointegration between interest rates with different maturities. Denoting the long and the short rates with $r_t^{(n)}$ and $r_t^{(m)}$, respectively, the stationarity of the spread, $S_t^{(n,m)} = r_t^{(n)} - r_t^{(m)}$, is a necessary, although not sufficient, condition for the EH to hold. If the spread is stationary, interest rates are driven by a common stochastic trend, preventing them from drifting too far apart from the equilibrium, so that profitable arbitrage opportunities do not persist.

According to the EH, the spread is the optimal predictor of a weighted average of short-term interest rate changes over the life of the longer-term bond. Then, a test for the validity of the EH may be based on the equation

$$(1) \quad S_t^{*(n,m)} = \delta_0 + \delta_1 S_t^{(n,m)} + \xi_t,$$

[1] This is a much shortened version of a companion working paper, Lopes and Monteiro (2007).

where $S_t^{*(n,m)}$ denotes the perfect foresight spread, defined as $\sum_{i=1}^{k-1} \frac{k-i}{k} \Delta r_{t+im}^{(m)}$, with $\Delta r_{t+im}^{(m)} = r_{t+im}^{(m)} - r_{t+(i-1)m}^{(m)}$, testing $H_0 : \delta_1 = 1$.

The spread should be also the optimal predictor of short-term changes of long-term interest rates. Accordingly, another EH test can be specified testing $\lambda_1 = 1$ in

$$(2) \quad r_{t+m}^{(n-m)} - r_t^{(n)} = \lambda_0 + \lambda_1 \left[\frac{m}{n-m} S_t^{(n,m)} \right] + u_{t+m}.$$

As no other variable besides the spread should provide any help for predicting the mentioned interest rates changes, augmented versions of both tests can be performed including additional regressors in (1) and (2) and testing for their insignificance.

Concerning the predictive ability of the spread, available empirical evidence tends to agree that: a) the spread predicts the (long-term) changes in short-term rates in the direction stated by the theory ($\hat{\delta}_1$ is generally positive, although sometimes statistically different from unity); b) however, the spread does not predict the (short-term) changes in long-term rates in the direction required by the EH (usually $\hat{\lambda}_1$ is negative and significantly distinct from unity). This is the puzzle well known in the EH literature.

On the other hand, in the multiple equation model framework, the EH has two cointegration implications: i) in a system of l interest rates with different maturities there should be only one common stochastic trend, which is responsible for the long-run movement of all interest rates, and ii) in each of the $l-1$ cointegrating vectors the coefficients should sum zero. Both implications can be tested in the context of a VAR model using the popular Johansen's approach (Johansen, 1995). For the cointegration rank analysis, maximum eigenvalue and trace tests are available. The zero-sum restrictions will be tested employing likelihood ratio (LR) statistics. Besides these tests, Johansen's methodology also provides a test for the predictive ability of the spread concerning short-term interest rate changes. Under the EH, the factor loadings (usually denoted with α_{ij}) should be statistically significant in all equations except in the one for the longer-term interest rate (which is ordered last). Moreover, the spread will predict in the direction stated by the EH if the α_{ij} coefficients are negative for $i \neq l$ and j= 1,..., $l-1$.

3. Data and empirical results

In this study, we use interbank money market (IMM) rates, available at the website of Banco de Portugal (section B.10): monthly data for 1, 3 and 6 months rates — "value date of same day". Our dataset covers the period from January 1989 to April 2004, i.e., $T = 184$. For the missing observations (2, 17 and 40 for $r_t^{(1)}$, $r_t^{(3)}$ and $r_t^{(6)}$, respectively) an estimation procedure was performed[2]. At an initial stage, data for a 10-year government bond yield was also used. However, the rather limited scope of the results (available from the authors) lead us to omit their presentation. Due to space constraints, the empirical results are only briefly sketched.

The main conclusions for the single equation approach are the following:

1. Preliminary unit root testing, using ADF, PP (Phillips-Perron) and WS (weighted symmetric) tests provide overwhelming confirmation evidence for the I(1) hypothesis of interest rates.

2. The same tests, which may now be viewed as restricted cointegration tests, strongly support the stationarity of the spreads, i.e., cointegration with unity cointegration parameters. Augmented Engle-Granger tests provide somewhat weaker evidence for cointegration but this appears to result

[2] Several alternatives were analysed and we decided to adopt a two step procedure: i) in the first stage, whenever possible, missing data were estimated with the monthly variation for the same maturity but "value date deferred 1 or 2 days"; ii) for the remaining missing observations (20 for $r_t^{(6)}$), several alternative models were considered and a simple model in first differences minimizing MSFE was chosen.

only from the usual poor power behaviour of these because *t-ecm* tests (assuming weak exogeneity) provide very strong evidence for cointegration, specially when the dependent variables are the shorter-term rates. Finally, DOLS estimation and testing also provide clear evidence for unit cointegration parameters.

3. However, concerning the issue of whether the spread correctly predicts short rate changes, although the sign of the estimates agrees with the EH (i.e., predictions in the correct direction), the restrictions it implies are clearly rejected (with and without the inclusion of additional regressors).

4. Finally, there is no single trace of evidence for the validity of the EH when longer rate changes are considered: all the estimates are in the incorrect predictive direction and all the p-values for the restrictions are equal to zero.

Hence, the Portuguese case is no exception to the well known empirical puzzle.

Concerning the multiple equation approach, Johansen's ML method was implemented for systems with 2 and 3 IMM interest rates, including an unrestricted intercept[3]. However, all the procedures were also performed considering a restricted intercept, producing evidence which broadly agrees with those reported.

We faced two main problems in the modelling exercise: strong evidence for non-normality and for serial correlation of the disturbance vector. While non-Gaussianity is of no great concern (see, e.g., Lütkepohl, 2004), the latter problem may impart somewhat fragile estimates and inferences. Obviously, augmenting the information set is not an available option in the current context. Instead, we employed a robustifying strategy, considering several dynamic specifications.

Basically, we obtained results for two rather different types of dynamic specifications, i. e., for fixed and for data dependent lag lengths (p). For the former, we used $p = 6$ and 12 for all systems and $p = 18$ only for bivariate systems. For the latter, besides resorting to the usual AIC and SC criteria, we have also employed a sequential (GTS, "*general-to-specific*") strategy of eliminating insignificant lags based on likelihood ratio (LR) test statistics. When using the information criteria, we set $p_{max} = 18$ for bivariate systems and $p_{max} = 12$ for the trivariate case. For the GTS-LR strategy, we used $p_{max} = 12$ and 6, respectively, and besides individual lag testing we have also used a joint (confirmation) test, testing all the restrictions imposed on the initial model.

***Table 1.** P-values of trace tests for cointegration with estimated lag lengths*

		$\widehat{p}_{AIC}$			$\widehat{p}_{SC}$			$\widehat{p}_{LR}$		
rates	H_0	$\widehat{p}$	λ_{trace}	λ^*_{trace}	$\widehat{p}$	λ_{trace}	λ^*_{trace}	$\widehat{p}$	λ_{trace}	λ^*_{trace}
$r_t^{(1)}, r_t^{(3)}$	r=0	14	0.000	0.003	4	0.003	0.005	10	0.000	0.001
	r= 1		0.125	0.161		0.613	0.621		0.247	0.277
$r_t^{(1)}, r_t^{(6)}$	r=0	18	0.001	0.010	1	0.011	0.013	11	0.005	0.016
	r=1		0.172	0.227		0.664	0.667		0.214	0.245
$r_t^{(3)}, r_t^{(6)}$	r=0	18	0.055	0.165	1	0.000	0.000	11	0.023	0.052
	r=1		0.157	0.210		0.693	0.696		0.295	0.328
$r_t^{(1)}, r_t^{(3)}, r_t^{(6)}$	r=0	11	0.004	0.040	1	0.000	0.000	6	0.007	0.021
	r=1		0.084	0.197		0.000	0.000		0.193	0.273
	r=2		0.186	0.234		0.785	0.787		0.530	0.552

Although maximum eigenvalue statistics were also used, trace test statistics are more powerful and more robust to non-Gaussianity. In table 1, we denote the asymptotic p-values with λ_{trace} and their finite sample corrected versions with λ^*_{trace}.

[3] While allowing for an unrestricted intercept appears implausible, there is a statistical justification for doing it: better local power for the cointegration rank test (Lanne, 2000).

Considering bivariate systems, previous evidence for cointegration is generally confirmed but it appears weaker for the two longer-term rates. Strong evidence for cointegration is found in the trivariate system but, more importantly, there is only very weak support that the cointegration rank is equal to two. Actually, this condition seems to hold only when the SC criterion for lag selection is used. However, as is usually the case with SC, the chosen specification appears to be under-parameterized. As is well known, this tends to produce spurious finding for cointegration and for the number of cointegration vectors.

Taking these results into consideration, zero-sum restrictions regarding cointegration vectors are tested only in bivariate systems. Now the evidence clearly tends to support the EH, confirming the one obtained with DOLS. Cointegrating vectors estimates vary between $[1 \ -0,95]'$ and $[1 \ -0,99]'$.

Proceeding on the path of refining the restrictions required by the EH, weak exogeneity tests were performed. The empirical evidence clearly supports theory: at the usual 5% significance level and with one exception only (in a case where SC is used), longer-term interest rates appear as weakly exogenous for the cointegration vectors, i.e., the spread predicts short rate changes in the expected direction.

4. Conclusions

In general terms, mixed evidence for the expectations hypothesis is provided by Portuguese data. Strong support is found when general implications (as cointegration) are under scrutiny. However, when more detailed and stringent conditions are tested, the favourable evidence either becomes much weaker or disappears completely. In particular, the puzzle well known in the literature is also observed for the Portuguese case: although its forecasts of future short-term rates are in the correct direction, the spread between long and short rates fails to forecast future long rates.

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MEASURING THE IMPACT OF FDI IN PORTUGAL THROUGH THE FINANCIAL PERFORMANCE OF COMPANIES

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1. Introduction

"Foreign direct investment (FDI) is a type of investment involving a long-term relationship, reflecting a long-standing interest of an entity residing in an economy (direct investor) in an entity residing in another economy (company of direct investment), with the aim of exercising a significant degree of influence in the management of the resident company in the other economy. Direct investment involves both the initial transaction and subsequent transactions between the two entities and associate companies" (OECD, 1996).

In the post-European Union (EU) accession period, the growth of foreign investment in Portugal started in 1987, with high annual growth rates. Since the mid-eighties, a sustained foreign investment effort took place with high ratios of FDI to gross domestic product and of FDI to gross fixed capital formation, which attained in the late nineties impressive values of, respectively, around 20 and more than 50 percent. In fact, Portugal has become one of the EU success stories in FDI, with one of Europe's youngest and fairly skilled workforce, low operating costs, a wide range of sites and buildings at competitive prices, relatively low taxes, generous incentive schemes, reasonable training facilities and an attractive quality of life. The specific advantages of the country included also economic, political and social stability, on a privileged geographical location with access to markets in Europe, North American Atlantic, Latin America and Africa.

It is known that FDI has had some effects on the Portuguese economy, particularly on the modernization of the national industry and also on a better performance of the trade balance. In fact, even though the majority of foreign investment operations have been directed more recently to the tertiary sector, a few investments, sometimes very large ones, were made in some branches of the manufacturing industry, such as the manufacture of metal products, machines, transport equipment and material (including automobiles), chemical industries, foodstuffs and paper industries, that contributed to change the country traditional exports pattern, from the textiles and clothing to medium high technologies industries.

Despite the favourable social and economic framework existing in Portugal over this period, after a remarkable growth since 1986, FDI, which had an instrumental role in the process of renewal of the economy, tended to stabilise in the late nineties. In addition to the conjuncture factors, such as the evolution of the economic situation, experienced by all the major investors in Portugal over that period, the competition from other location as regards external capital, such as the economies of Central and East Europe and South-east Asia may have contributed to a reduction of the growth rate of FDI inflows into the country.

The objective of this paper is the presentation of a microeconomic approach to the effects of FDI, based on an original event study within the financial economics literature, of comparison between the pre- and post-financial and operating performance of a sample of companies resident in Portugal and receiving FDI in the nineties. Section 2 provides the testable predictions and methodology applied. Section 3 presents the empirical results found in several financial indicators used to measure the performance of the full sample and the of the sectoral, regional and geographical sub samples of FDI companies in Portugal.

2. Testable predictions and methodology

With the above-identified purpose, the methodology applied provides an analytical framework for the

comparison of companies' performance before and after a certain event has occurred, in the case the captivation of FDI. To measure the operational and financial performances accounting information and financial indicators were used: an approach to the business and companies magazine "*EXAME*" was ran in order to get the special annual numbers of the nineties' decade devoted to the five hundred greatest and best non-financial companies in Portugal ("*500 Maiores e Melhores*"), where data for each company's performance are published. A sample of thirty-one companies with foreign equity control was selected from the five hundred greatest and best companies in Portugal, taking into account its consistent representatively across the decade of the nineties concerning not only several variables deemed relevant in the FDI macroeconomic analysis like sector of economic activity, location and country of origin, but also respecting that they should had at least two annual observation in each period, the one before and the one after FDI.

Specifically, we tested the hypotheses that FDI had impact on the following financial indicators of the FDI receiving company: it increased the company's profitability, operating efficiency, investment intensity, output and dividend payments; and it decreased its employment and leverage.

To test the predictions, empirical proxies for every company of the sample for a period of seven years were computed: three years before through three years after receiving FDI for the first time (year zero), in the period from 1992 to 2001. Since the first year of receiving FDI includes both the period without and with FDI for all companies, it was excluded from the analyses. The condition for each FDI company to be included in the sample, of having at least two observations available for each window (pre and post), was fully met: in fact, from the thirty-one selected for the full sample, twenty companies had even the desired three observations in both periods (exception made for the dividends). Then the mean of each variable[1] for each company over the pre- and the post-FDI windows was calculated.

Having computed the pre- and post-FDI means for the full sample of 31 companies, the *Wilcoxon* signed-ranks test[2] was used as the method of testing for significant changes in the variables. This procedure tests whether the mean difference in variable values between the pre- and the post-FDI samples is significant statistically nil or not. The conclusions are based on the calculation of W, which for samples of at least ten observations, follows approximately a standard normal distribution and of the standardized test statistic **z**.

The *Wilcoxon* test begins by transforming each instance of Xa-Xb in its absolute value, which is accomplished simply by removing all the positive and negative signs. The cases in which there is zero difference between Xa and Xb are at this point eliminated from consideration, since they provide no useful information. The remaining differences are then ranked from the lowest to the highest, with tied ranks included where appropriate. Afterwards, a "+" sign is assigned to each rank when Xa-Xb is greater than zero and a "-" sign is assigned to each rank when Xa-Xb is less than zero. The value of W for the *Wilcoxon* test is then calculated as the sum of the signed ranks. The number of signed-ranks, here designated as Ns/r, is equal to the number of Xa-Xb pairs with which one began minus the number of pairs for which the absolute value of Xa-Xb is zero. The effect of replacing the original measures with ranks is two-fold. The first is that it brings one to focus only on the ordinal relationships among the measures - "greater than", "less than" and "equal to" – with no illusion that these measures have the properties of an equal-interval scale. And the

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[1] Euro/*Escudo* fixed rate converted figures for the years before the introduction of the European currency in the accounting reporting of companies were used, namely until the year 2000. Whenever possible, ratios using nominal data in both the numerator and the denominator were computed. In calculating real sales and sales efficiency (revenue per emplyoee), the sales revenue data were deflated using the appropriate consumer price index (CPI) values. A similar procedure was employed to compute net income per emplyoee and total assets per emplyoee. Real sales, sales efficiency, net income efficiency and total assets efficiency measures for year zero were defined as having an index value of 1.00 (normalized) with other years being expressed relative to unity in this year.

[2] The *Wilcoxon* signed-ranks test (**z** statistic) is a non-parametric test for the significance of the difference between the distributions of two non-independent samples involving repeated measures or matched pairs (for instance, Xa (after) and Xb (before)). It is thus an alternative to the t-test applicable to samples that fail to meet at least one of its assumptions - and we could not be completely sure about their observation in the FDI sample, namely the normality of the distribution.

second is that it transforms the data array into a kind of a closed system whose properties can then be known by dint of sheer logic.

Besides the application of the *Wilcoxon* methodology to the differences in the means of the variables after and before FDI, a similar procedure was run to identify the significance of the proportion of companies that changed as predicted (Proportion tests).

In addition to calculating Wilcoxon tests for each one of those financial variables for the full sample of thirty-one FDI companies, *Wilcoxon* similar tests for six sub samples were also performed: Industrial versus Non-industrial sector of economic activity; *Lisboa e Vale do Tejo* versus the rest of the country location; and European Monetary Union countries of origin of investment against the Rest of the world.

In the whole, including the difference in means test and the proportion test, both for the full and the sub-samples, one hundred and eighty-two *Wilcoxon* tests were ran.

3. Empirical results

The results from the application of the *Wilcoxon* test to the range of variables analyzed, for the full sample of FDI companies and for the three sub samples, are hereinafter presented.

Profitability was measured using three ratios: return on sales (ROS), return on assets (ROA) and return on equity (ROE). Profitability ratios are computed using net income as the profit measure in the numerator of all three ratios. Since ROS is a ratio of a two current-euro flow measures, it is the ratio on which focus should be put on. As expected, profitability increased significantly after FDI according to the three ratios for the full sample of 31 companies (see ***Table 1***). The mean increase in ROS after FDI was 2.6 percentage points, from 3.8 percent to 6.4 percent and 80.7 percent of the firms in the full sample experienced expanding profit margins after FDI. The ROE was even higher exhibiting an increase of 5.3 percent, as a result of the major share of net income on equity capital after FDI, and 77.4 percent of the full sample of companies changed as predicted. *Wilcoxon* tests show that all the three ratios of returns increased significantly (at the 1 percent level of significance) after FDI. Most of the sub samples also demonstrated significant post FDI increases in profitability.

Table 1 - Summary of results from tests of predictions of the Full Sample of FDI firms

Variables	Ns/r[3]	Mean before	Mean after	Mean change	z-Statistic for Differ. in means (after - before)	% of firms that changed as predicted	z-Statistic for significance of Proport. change
Profitability							
ROS	31	3.8%	6.4%	2.6%	2.96***	80.7%	4.37***
ROA	31	3.2%	5.4%	2.2%	2.86***	77.4%	4.28***
ROE	31	10.5%	15.8%	5.3%	2.41***	77.4%	4.28***
Operating Efficiency							
SALEFF	30	0.93	1.29	0.36	4.40***	90.0%	4.53***
TAEFF	29	0.89	1.27	0.38	4.15***	89.7%	4.45***
NIEFF	30	0.29	3.38	3.09	3.77***	83.3%	4.37***
Investment Intensity							
CISA	24	2.9%	2.3%	-0.6%	-0.28	54.8%	2.91***
CITA	29	2.4%	1.5%	-0.9%	-0.54	48.4%	3.09***

[3] Because data was not available for all the thirty-one companies of the full sample in all the years under analysis, whenever the sample of companies was smaller than the full one, the number of companies effectively used in each variable's analysis is referred.

Variables	Ns/r^3	Mean before	Mean after	Mean change	z-Statistic for Differ. in means (after - before)	% of firms that changed as predicted	z-Statistic for significance of Proport. change
Output							
RESAL	30	0.80	1.14	0.34	3.97***	90.0%	4.53***
Employment							
EMPL	31	1,664	1,885	221	1.62	51.6%	3.1***
Leverage							
DETA	21	65.6%	61.9%	-3.7%	-2.15**	78.3%	-3.61***
Payout							
DIVSAL	13	1.9%	3.6%	1.7%	1	53.9%	28***
PAYOUT	13	26.0%	35.1%	9.1%	0.79	61.5%	36***

***, **: Significant at the 1 and 5 percent level, respectively, with critical values of **z** at 2.326 and 2.576.

To measure efficiency, three measures were also employed, all inflation adjusted, namely sales per employee (SALEFF), net income per employee (NIEFF) and total assets per employee (TAEFF). Again, all three showed mean increases following FDI for the full sample, with NIEFF showing 3.09, the most significant value of the three measures. All but two (firms located outside *Lisboa e Vale do Tejo* in TAEFF and firms receiving FDI from non EMU countries in NIEFF) of the sub samples showed significant efficiency improvements after FDI.

Investment intensity was computed using two proxies, capital expenditures divided by sales (CISA) and capital expenditures divided by total assets (CITA). Against the expectations, capital spending was found to consistently decrease after FDI, although neither CISA nor CITA were significant according to the *Wilcoxon* test. All of the sub samples results were again also insignificant.

Changes in output were tested by computing the average inflation-adjusted sales level for the pre-FDI period and comparing it to the three-year level for the post-FDI period. Both the *Wilcoxon* and proportion tests showed that real sales increased after FDI, and the changes were significant at the 1 percent level under both measures. The mean increase in real sales from the average level during the three years prior to FDI to the average level afterwards was 34 percent. As in the case for efficiency improvements, all but two of the sub samples (the same than before) experienced a significant increase in real sales.

According to several theories, although employment may increase as a first reaction of FDI instalment in a recipient country, declines in employment levels may be expected after FDI companies undertaking rationality measures within their structures. The *Wilcoxon* test shows, on the contrary, an (almost significant) average increase in employment in Portugal in the period under review. Sub samples experienced different results according to the specific nature of each one.

Changes in leverage were observed through changes in total debt to total assets (DETA). As predicted, a significant decline in leverage for the full sample was documented. The average decline in DETA was 3.7 percent. All of the sub samples experienced also decline in leverage.

As a final test, examination of whether dividend payments, measured as cash dividends divided by sales revenue (DIVSAL) and by net income (PAYOUT), increased following FDI. Although the mean dividend payment increased 1.7 percent in the first case, from 1.9 percent to 3.6 percent, and 9.1 percent in the second one, from 26.0 percent to 35.1 percent, the increases were not significant according to the *Wilcoxon* test, perhaps due to the small size of the full sample here used which, by unavailability of data, could not be larger. The sub sample tests revealed that dividends increases were observed in several domains although not significant.

A dynamic panel model for Portuguese workers' remittances outflows

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1. Introduction

In the past, Portugal used to be almost exclusively an emigration country. From the nineteenth century and until the fifties almost two million people left the country, looking for better life conditions. For the first time, in 1991, Esteves referred to Portugal as an immigration country. Actually, in more recent years Portugal has become attractive for immigration, mainly from Brazil, Eastern European and Portuguese-Speaking African countries. With the increase of immigration into the country the remittances sent abroad have also been rising substantially in the last few years (see figure 1).

Nowadays researchers have a great interest in migration and remittances, because of their economic, social and demographic impacts in the countries affected by this phenomenon. There are a large number of studies regarding the identification of the migrants' remittances' determinants. Some of them use microeconomic data sets, mainly based on household surveys (for example, Lucas and Stark, 1985; Hoddinott, 1994; Agarwal and Horowitz, 2002; Amuedo-Dorantes and Pozo, 2006). Moreover there are some authors that study the macroeconomic determinants for remittances (for example, El-Sakka and McNabb, 1999; Higgins, Hysenbegasi and Pozo, 2004; Sayan, 2004; Aydas, Metin-Ozcan and Neyapti, 2005; Gupta, 2005; Vargas-Silva and Huang, 2006).

In this paper we identify some of the macroeconomic determinants of workers' remittances outflows sent from Portugal to a set of nine developing countries, selected according to their contribution to the total of migrants' remittances outflows (Angola, Brazil, Bulgaria, Cape Verde, Moldova, Mozambique, Romania, Russia and Ukraine). To account for the inertia in the remittances' behavior, a dynamic panel data model was specified. The model coefficients were estimated using the corrected Least-Squares Dummy Variable, derived by Kiviet (Kiviet, 1995; Kiviet, 1999; Bun and Kiviet, 2003).

The paper proceeds as follows. In section 2 are introduced some theoretical subjects about workers' remittances and the applied methodology; section 3 contains the estimation results and their economic interpretation and section 4 concludes.

2. Theoretical considerations

Workers' remittances are an item of the balance of payments' current account of each country. Remittances are considered current transfers, because they are transferred between countries without a quid pro quo. The inflows are the remittances received in a country and the outflows are the remittances sent from a country.

There are some recognized motivations for remitting. Sometimes the identification of those motives is not clear, as they may interact between each other. Even though, the main identified reasons to send remittances are altruism, self-interest and insurance. These motivations are generally connected with remittances' determinants.

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[1] The views expressed are of the author and do not necessarily reflect those of the *Banco de Portugal*.

Panel data has important consequences in estimation techniques. On the one hand, it allows the increasing of the estimates' precision, by combining time-series and cross-section data, which raises the degrees of freedom on the estimated models. On the other hand, it has important impacts in the inference, which depends on the panel characteristics.

Panels are frequent with microeconomic data, characterized by a large number of individuals N observed over a small number of time periods T. When $N \to \infty$, the OLS estimators are inconsistent, and therefore when N is large it is necessary to use specific techniques to avoid the inconsistency, as for example Arellano and Bond (1991) Generalized Method of Moments estimator. Panels with N small and large T are less frequent, but typical in macroeconomic applications. In this last case, the consistency problem is overturned, although biased estimators might be obtained. Judson and Owen (1999), recommend the use of Kiviet's corrected Least Squares Dummy Variable (LSDVC) estimator, for panels with small N and moderate T. Kiviet (1995) presents a method to correct the small sample bias of the LSDV estimator for samples where N is small and T only moderately large, by using asymptotic expansion techniques to approximate the bias in order to also include terms of at most order $N^{-1}T^{-1}$. In 1999, Kiviet derives the bias approximation more accurately, including also terms of at most order $N^{-1}T^{-2}$. Bun and Kiviet (2003) use simpler formulas in Kiviet's approximation (1999). This estimator is simultaneously efficient and unbiased, as the small sample bias is corrected.

3. Empirical results

Quarterly data were used for the period from 2000:1 to 2005:4. The source for the dependent variable (outflows of migrants' remittances) is the Balance of Payments statistics compiled by the *Banco de Portugal* (Portuguese Central Bank).

The explanatory variables intend to reflect the economic and financial evolution in the destination countries and in Portugal. The chosen variables reflect the availability of data for the selected countries, which in some cases have recent and developing statistical systems. So, the selected variables are the following: real exchange rates between the Euro and the domestic currencies of those countries; real interest rates; Gross Domestic Product (GDP) deflators as a proxy to inflation; and real GDP. In the latter cases quarterly data was estimated from annual data. The data sources are: *Banco de Portugal*; *Instituto Nacional de Estatística* (National Statistics Institute of Portugal); International Monetary Fund (International Financial Statistics and World Economic Outlook); and in some specific cases the selected countries' Central Banks. All the variables were considered in real terms and their logarithms were used (with the exception of the interest rates). The model was initially specified as follows:

$$\ln R_{it} = \beta_1 \ln R_{i,t-1} + \beta_2 \ln G_{it} + \beta_3 \ln G\_PT_t + \ln I_{it} + \ln I\_PT_t + \ln E_{it} + ITR_{it} + IR\_PT_t + \alpha_i + \varepsilon_{it},$$

with $i = 1,\ldots, 9$, $t = 2,\ldots, 24$. R_{it} is the volume of remittances sent from Portugal to the country i in the period t; G_{it} is the GDP of the countries; G_PT_t is the Portuguese GDP; I_{it} is the countries' GDP deflator; I_PT_t is the Portuguese GDP deflator; E_{it} is the exchange rate between the Euro and the national currencies (amount of national currency equals one Euro); IR_{it} are the interest rates of the nine countries and; IR_PT_t is the Portuguese interest rate. α_i is a fixed-effect and ε_{it} are assumed to be serially uncorrelated with zero mean and independently distributed across countries.

The coefficients were estimated using a Stata routine that computes bias corrected LSDV estimators and their bootstrap variance-covariance matrix, developed by Bruno (2005).

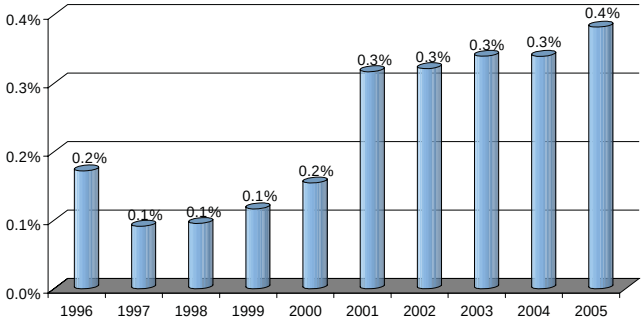
After dropping some of the coefficients, due to their lack of significance, we obtained[2]:

$$\ln \hat{R}_{it} = \underset{(0.046)***}{0.629} \ln R_{i,t-1} - \underset{(0.854)***}{2.733} \ln G_{it} + \underset{(2.101)***}{6.700} \ln I\_PT_t - \underset{(0.302)*}{0.528} \ln E_{it}$$

The results confirm the hypothesis of a dynamic specification, as the lagged dependent variable is very significant. Concerning the other regressors, it is possible to observe that the volume of remittances sent from Portugal decreases with the increase of destination countries' real GDP. On the other hand, with the rising of Portuguese prices, the volume of remittances increases. The exchange rates' coefficient estimate indicates that national currencies depreciation (Euro appreciation) conducts to a decrease in the volume of sent remittances. Finally, the interest rates do not have a significant influence on the remittances' volume, suggesting that the immigrants' motives are probably not related with financial investment.

Regarding long-term effects in the volume of remittances transferred, a one per cent increase on countries' real GDP implies a long-run decrease of 7.4 per cent on the remittances sent abroad. A one per cent increase on Portuguese prices has an average impact, in the long term, of 18.1 per cent on the remittances' volume increase. At last, an appreciation of one per cent of the Euro has the consequence of decreasing remittances by about 1.4 per cent.

Figure 1 – Workers' Remittances Outflows (% of GDP)



Sources: *Banco de Portugal* and *Instituto Nacional de Estatística*[3].

[2] * Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level (standard errors in parenthesis).

[3] Data available in June 2006.

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Defining a Methodology for the Seasonal Adjustment of the Portuguese Balance of Payments Statistics - A Comparative Study of Software Applications

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1 Introduction

The aim of this paper is to report the work undertaken at the *Banco de Portugal* with the intent of defining a methodology for the seasonal adjustment of the Portuguese Balance of Payments (BoP) statistics. In view of the pressing need for harmonization of seasonal adjustment procedures in the euro area, we decided to choose one of the two adjustment programs recommended by Eurostat, X-12-ARIMA (details can be found in Findley et al. (1998)) and TRAMO-SEATS (details can be found in Gómez and Maravall (1996, 1998, and 2001)). We compared in great detail the two programs by resorting to data from BoP statistics, encompassing over 160 time series. We addressed issues such as: (i) the fact that the diagnostic checks may not take into right account the principle of parcimony nor the stationarity and invertibility conditions; (ii) difficulties stemming from the seasonal adjustment of series with mild seasonality; (iii) the risk of the programs inducing seasonality where absent, and thence the importance of testing for seasonality prior to the series adjustment itself; (iv) direct and indirect seasonal adjustment methods; (v) hindrances to the enforcement that the yearly sum of the seasonally adjusted data concur with that of the actual series; and (vi) revisions policy and the impact of revisions on the seasonally adjusted series.

The paper has the following structure. In section 2, we describe and present the results of the comparative analysis of the X-12-ARIMA and TRAMO-SEATS, and in section 3, we describe the methodological approach adopted by the Statistics Department of *Banco de Portugal*.

2 Comparative analysis of X-12-ARIMA and TRAMO-SEATS

As the choice of the seasonal adjustment method is of the utmost importance in the definition of the methodology, we performed a comparison of the programs X-12-ARIMA and TRAMO-SEATS with the aid of the DEMETRA interface, developed by Eurostat, which permits the use of the mentioned programs in the same environment.

2.1 ARIMA Modelling

For each one of the series, we applied the automated modelling procedures of both X-12-ARIMA and TRAMO-SEATS. The results thus obtained were analysed and compared and it was established that:

- The TRAMO-SEATS program adjusted all the time series under study, whereas the X-12-ARIMA program was only able to model 25 per cent of the series. This can be explained by the fact that the latter

program considers only a reduced set of models.

- The same model was selected by both programs only in 5 per cent of the series. It should be noted that the results obtained are due to the fact that the procedures for the selection of the ARIMA model that best describes the underlying series vary according to the program applied.

- The TRAMO-SEATS identified seasonality in a significantly higher number of series than the X-12-ARIMA program. This result meets the thesis advocated by the U. S. Census Bureau (Hood, 2002), according to which the SEATS may induce residual seasonality when the original series displays no seasonality. This highlights the importance of the tests for the presence of seasonality undertaken by X-12-ARIMA and the problems that may appear with the use of TRAMO-SEATS in the modelling of time series without seasonality.

- The two programs entailed pre-adjustment routines with time series transformations and corrections of different number and degree, which led to distinct results in some cases.

Concomitantly, we undertook a detailed econometric analysis of the series, supported on the SAS software, which included: (i) the study of the estimated autocorrelation and partial autocorrelation functions; (ii) tests for the adequacy of the logarithmic transformation; (iii) tests for the presence of unit roots; (iv) estimation of the identified models; and (v) evaluation of the statistical significance of the estimated parameters, verification of the stationarity and invertibility conditions, analysis of the correlation matrix of the parameter estimators and assessment of the adjustment's quality by analysis of the corresponding residuals.

The results obtained by X-12-ARIMA and TRAMO-SEATS programs were validated according to the following procedure: the estimation of the models identified in the previous econometric analysis by resorting to X-12-ARIMA and TRAMO-SEATS; and subsequently the SAS estimation of the models identified by the automated modeling procedures of X-12-ARIMA and TRAMO-SEATS.

This analysis revealed that the majority of the models identified by X-12-ARIMA and TRAMO-SEATS do not comply with the principle of parsimony, as they include parameters that are not statistically different from zero. Moreover, some of the models do not satisfy the stationarity and invertibility conditions and others contain strong correlations between the estimators. In the latter case, we regard such models as unstable and the corresponding adjustment of bad quality. As previously mentioned, some of the series that do not have a statistically significant seasonality were seasonally adjusted by TRAMO-SEATS.

In the case of TRAMO-SEATS, the drawbacks of the models can be overcome by a direct intervention of the analyst which should encompass: (i) tests for the significance of the parametrical estimations; (ii) the analysis of the correlation matrix of the parameter estimators; and (iii) tests for the stationarity and invertibility conditions. We established that this procedure led to models coincident with those obtained by the detailed econometric analysis. As for X-12-ARIMA, limitations of the software do not allow for such intervention of the analyst.

2.2 Seasonal Decomposition

After the identification of the model that best describes each of the time series, the seasonally adjusted series can be obtained by the ad-hoc method of X-12-ARIMA or by the signal extraction techniques of TRAMO-SEATS. For the selection of one of the two methodologies, we gave special attention to the quality of the seasonal adjustment and to the minimization of the seasonal adjusted series revisions.

The tests undertaken in the realm of the analysis of the seasonal adjustment's quality confirmed the quality of all the series obtained by both methodologies. The study of the seasonal adjusted series revisions was carried out subsequently with the aim of selecting the most adequate method for seasonal decomposition.

The first step included the estimation of the series by TRAMO-SEATS during the period from January 1996 to December 2003. The model for each of the series was fixed and the predictions of the seasonal factors and of the seasonally adjusted series were calculated for the period from January 2004 to January 2005. Subsequently, the period from January 1996 to January 2004 was considered as the estimation set and,

for each series, the parameters of the respective model (previously fixed) were re-estimated. The predictions for the period from February 2004 to January 2005 were calculated. This procedure of adding an observation to the estimation set, re-estimating the parameters and computing new predictions was applied iteratively until the estimation set coincided with the period from January 1996 to December 2004.

An identical procedure was followed by applying X-12-ARIMA to the models identified by TRAMO-SEATS. For each of the methods, the percentage values of the mean and of the absolute mean for the following differences were calculated: (i) the difference between the use of predicted and concurrent seasonal factors, i.e., difference between the forecasts obtained from the predicted seasonal factors (forecasts made with the information available up to December 2003) and the estimates obtained with all the information available until then; (ii) the difference between the forecasts obtained from the predicted seasonal factors (forecasts made with the information available up to December 2003) and the estimates calculated once all the annual information is made available; (iii) the difference between the estimates obtained from the concurrent seasonal factors and those calculated once all the annual information is made available; and (iv) the difference between estimates obtained from the concurrent seasonal factors and the respective monthly updates once an additional observation is included each month.

The results revealed that X-12-ARIMA and TRAMO-SEATS have, on average, similar behaviours. However, taking as a measure the maximum value of the revisions mentioned in (iv), the X-12-ARIMA program displayed a maximum value for the revisions much greater than that of TRAMO-SEATS. Since the use of concurrent seasonal factors generally produces more accurate estimates for the final seasonally adjusted data, together with the previously mentioned fact that X-12-ARIMA hinders the ability of the analyst to intervene in the adjustment process as well as in the statistical inferences, the TRAMO-SEATS program turns out to be more complete and versatile than X-12-ARIMA.

3 Conclusion

Bearing in mind the results obtained, we then turned towards the task of defining the procedures for the monthly seasonal adjustment of the BoP statistics. Even though the preferred choice is TRAMO-SEATS, it was verified that SEATS may induce residual seasonality in series that, according to the conventional tests, have no statistically significant seasonal effects. To surpass this limitation, it was decided to include, in the methodological procedure, an initial step that makes use of the X-12-ARIMA tests to evaluate the statistical significance of the seasonal component of each time series. Thus, the methodological approach adopted combines the two programs in an articulated way. In a first stage, the X-12-ARIMA is used to test for the presence of seasonal effects. Once the presence of seasonality is confirmed, the TRAMO-SEATS is then used in the selection and estimation of the ARIMA model and in the production of the seasonally adjusted data. Special attention is given to tests for the presence of outliers and of calendar effects and, in particular, of the Easter effect.

Furthermore, the seasonal adjustment procedure entails the evaluation of both the global statistic quality of the estimated ARIMA model, as well as, of the adjustment quality. The former includes tests for the statistical significance of the estimated parameters and for the stationarity and invertibility conditions. The adjustment quality is verified by the analysis of the respective residuals[1] and by testing the seasonally adjusted series for the persistence of seasonal effects. In those cases in which the quality criteria are not fulfilled, in particular when seasonal effects remain present in the adjusted series, it is necessary to perform an individual detailed analysis to identify and correct the possible causes. This process may imply a new ARIMA model estimation.

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[1] The most fundamental requirement of a seasonal adjustment, regarding quality, is that there remains no seasonal effect present in the seasonally adjusted series, i.e., that there is no residual seasonality. If the model adequately describes the time series under study, then the residuals should behave like a random walk process.

To guarantee the arithmetical consistency between the seasonally adjusted data, the outstanding amounts of each balance item are obtained by an indirect method, i.e., they are obtained by difference between the seasonally adjusted credits and debits. Similarly, the current account credit and debit data are also obtained by the indirect method, as the sum of the credits and debits of the seasonally adjusted component series. The seasonally adjusted series obtained by this method are later checked out for the presence of seasonal effects. Whenever the statistic tests disclose the existence of residual seasonality in the seasonally adjusted time series obtained by the indirect method, then the direct method should be chosen. It should be referred that the advantages and drawbacks of direct and indirect adjustments have been the object of debate amongst specialists (Ladiray and Mazzi, 2003). A definite conclusion on which one of these approaches is the best cannot be drawn from the available literature. Under most circumstances, the two adjustment procedures do not yield identical results. Only under very restrictive conditions do the results coincide.

Most seasonal adjustment programs permit the enforcement of time consistency, i.e., of the agreement between the yearly totals of the raw and the seasonally adjusted series. However, in addition of its lack of scientific support, time consistency lowers the quality of the seasonal adjustment and, consequently, the quality of the produced information. Moreover, imposing that the yearly sum of the seasonally adjusted data concur with that of the actual series, would create a discontinuity at the beginning of each year, when the annual sum of the actual data is not yet available. On the other hand, a prompt correction of this discontinuity by summing a scale constant is somewhat paradoxical, as this is tantamount to admitting the existence of a systematic bias in the seasonal adjustment. Consequently, it was decided not to enforce time consistency.

Another relevant issue in the production of seasonally adjusted series is the way the new information is incorporated in the model, i.e., the optimal frequency of review of the seasonal models/parameters/factors. In this respect, given the flexibility of the software programs and after evaluating other more conservative alternatives, it was decided that the parameters of the models should be re-estimated every month, incorporating the newly released observations of the raw series. This, in turn, entails the revision of the adjusted data. Every year, in April, when the annual revisions of the BoP statistics, and in particular of the current account, are carried out, the specifications of the ARIMA models should be re-evaluated. Nevertheless, this re-evaluation may be undertaken in other periods, whenever an appreciable change in the underlying information occurs. The aim of this procedure is to ensure that the seasonal adjustment incorporates the most recent available information and to avoid a significant revision which would be unavoidable if the value of the parameters were kept fix for the twelve months.

A more detailed description of the results presented here can be found in Banco de Portugal, Supplement 4/2005 to the Statistical Bulletin, November 2005.

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The Portuguese experience in compiling PI statistics

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There are different possibilities available when designing a data collection system for portfolio investment (PI) statistics, in the context of balance of payments (b.o.p.) and international investment position (i.i.p.). The possible systems may differ according to the targeted reporting agents, periodicity and level of aggregation and the corresponding results vary in terms of implementation and running costs, data availability and quality and of response burden.

Until 1999, the Portuguese PI statistics relied on an asymmetric system for assets and liabilities. Whereas in the later case, the data collection system implemented since 1991 was already based on a security-by-security (s-b-s) data model, on the assets side the inexistence of a unique and standardized identifier prevented the application of this method, and so data was collected from respondents aggregated by type of security, country of the issuer and currency of denomination. Another distinctive feature of both systems was the periodicity of the data collected. While monthly flows were available for both PI assets and liabilities, in the case of end-of-period positions the data collection ranged from monthly data, for the liabilities side, to annual data, for the assets side.

As already mentioned, the existing data collection system was implemented in the early 90's and by the end of the decade there was the necessity to make some changes and adjustments, mostly due to the need to improve the periodicity – of the end-of-period statistics – and coverage – in terms of the variables collected – of the PI assets.

1. Selection of a data collection model for PI statistics – level of detail

A data collection model for PI statistics may be defined as a combination of several features: the level of detail of the information collected – aggregated or on a security-by security basis – the type of information collected – both stocks and flows or collecting one and deriving the other – the collection method used – census or a sample survey – and the reporting channel – indirect reporting (settlement or custodian based) or end-investor direct reporting.

Aggregate reporting has the advantages for the compiler of reduced costs of implementation and maintenance, resulting in a relatively small amount of data to keep. However, it also holds the risk of potential miscalculation or the use of non-generalized aggregation procedures by the different reporting entities and it carries greater difficulties in cross-checking the data and in reconciling flows and stocks. Other non-negligible aspect is the greater risk of misclassification or double-counting between portfolio investment and direct investment, since this distinction will have to be implemented by each individual respondent and it may have limited information about the weight of a given investor in a company's equity capital. Also for respondents aggregate reporting usually means greater reporting burden in terms of details and breakdowns to be reported, the need to keep and maintain (in every respondent's system) a s-b-s database from which to derive such breakdowns and the need to make adjustments in the reporting systems every time new or additional output requirements emerge.

On the other hand, security-by-security reporting ensures accuracy and consistency of the data, although meaning a shift of costs and work from the respondent to the compiler in terms of aggregation procedure and maintenance of an individual securities database. The implementation of new requirements becomes more flexible and, in some cases, may not even imply the need to introduce changes in the

respondents reporting systems. This type of system can be used to derive flows from high-frequency stock data, reducing the reporting burden for reporting agents and allowing for quality checks at a very detailed level. The reporting burden will also be reduced since the amount of detail (in terms of breakdowns) to be reported by respondents decreases. Finally, s-b-s reporting is useful for the calculation of interest on an accruals basis and it may support synergies with other statistics, such as money and banking statistics and national financial accounts. The main disadvantages of s-b-s data collection models are the considerable costs to set up and maintain and the dependence on the availability of unique securities' identifiers.

2. Selection of a data collection model for PI statistics – reporting channel

According to the targeted respondents, three major reporting channels may be distinguished. The first option is an indirect settlement-based reporting by domestic banks for their own transactions and transactions on behalf of their clients. This alternative has the advantages of keeping the size of the reporting population relatively small while providing high-frequency timely data. It is easily adaptable to s-b-s reporting and carries minor problems concerning double-counting between portfolio and direct investment. The main problems come from the widespread use of netting and clearing techniques, that prevent the collection of gross investment and disinvestment, and the need for complementary reporting (e.g. for settlements through accounts with foreign banks). Also pure stock statistics will have to be collected separately, through one of the other possible channels.

A second option will be the direct reporting by resident issuers and end-investors which can assure the full reconciliation between flows and stocks and the collection of related income on an accrual basis. The distinction between direct and portfolio investment does not constitute a problem either. The major drawback of this alternative is the potentially large size of the reporting population, namely in the case of households. Also in the case of some specific sectors it may be difficult to receive timely and high-frequency data. The implementation of s-b-s reporting may be more difficult for sectors unfamiliar with this way of reporting and storing of information and, finally, statistical principles and methodology can differ from accounting principles used by a great number of respondents.

The third option is the indirect reporting by custodians or other financial intermediaries involved in securities transactions and holdings. This reporting channel has the same advantages of the first alternative (timely and high-frequency data, relatively small reporting population, easy to adapt to s-b-s reporting, allowing for micro-checks of the data) and at the same time it permits a full reconciliation between stocks and flows. However, it will require some complementary information collected directly from the end-investors in the case of securities held in custody abroad. Additional challenges will be the exclusion of repo-type transactions/positions or of direct investment holdings.

The selection of a direct or indirect reporting scheme depends, of course, on the national specificities, like the size of the targeted population or the reporting practice. Direct reporting is more suitable for banks' own holdings but indirect reporting may be the only practical approach for households. For other sectors, the most suitable reporting channel depends on several factors, like the average size of companies. Indirect reporting has advantages in terms of timeliness, efficiency and adaptability to s-b-s. However it may have difficulties to collect specific data like repo transactions or in distinguishing between portfolio and direct investment and will have to be supplemented with direct reporting in some cases, taking special care to avoid gaps (lack of coverage) or overlaps (double counting).

3. The Portuguese approach

The need to change the portfolio investment data collection system for b.o.p. and i.i.p. purposes led to the deep consideration of several dimensions of the problem, including the selection of the more appropriate level of detail and reporting channel as described in the previous points. The experience gathered from the simultaneous existence of an s-b-s reporting system (for PI liabilities) and an aggregated one (for PI assets) facilitated the choice for a data model of the s-b-s type. Some benefits of an s-b-s system as compared to an

aggregated approach were evident at that time. On the compilers side, the quality of the final statistics and the data control checks are facilitated and enhanced if data is collected on an individual basis. On the respondents side, the need to aggregate the data means that each one of them will have to keep a database of individual securities and run aggregation procedures, increasing by the number of respondents the workload needed to produce these statistics. The contacts held with respondents confirmed that they preferred an s-b-s solution and by that time the widespread use of the ISIN code in the financial markets overcame the practical difficulties of implementing such system in the case of resident's investment in foreign securities.

As to the selection of the respondents, the existing system was based on indirect reporting by resident custodians, complemented by direct reporting from end-investors holding securities in custody abroad, and this seemed to continue to be an appropriate solution, especially in terms of reliable and timely data.

As mentioned previously, one of the major drawbacks of an s-b-s reporting system are the significant costs involved in its development and further maintenance. The solution envisaged to reduce these costs was to adopt the system also for other statistics compiled in Banco de Portugal Statistics Department. In this context, it was implemented the Securities Statistics Integrated System (SIET) which collects data not only for b.o.p. and i.i.p. purposes, but also for money and banking statistics and for the national financial accounts. This option carried additional benefits: respondents do not have to extract from their systems only the information that is relevant for b.o.p. and i.i.p., i.e. residents' investment in foreign securities or non-residents' investment in national securities, but they provide data on all investors transactions/holdings in all securities; some data needed for financial accounts (residents' investment in national securities) was not available previously; and, an integrated collection system results in more consistent statistics in the end.

Another interesting outcome of this process was that, although respondents are obliged to report monthly flows and quarterly stocks, the large majority of them prefer reporting both monthly flows and stocks, arguing that this option brings fewer costs for them and prevents major inconsistency errors.

The data collected through this system is, therefore, very rich in terms of the information it may provide to compilers and users of PI statistics. Not only the traditional variables such as the (detailed) type of security, (detailed) institutional sector of the resident investor/issuer and a full geographical breakdown (on the assets side) are available, like other possible details may be provided for analysis, like the currency of denomination or the institutional/economic sector of the non-resident issuer. Changes in the underlying methodology may also be introduced with minor efforts, since the data collection system was designed in a broader manner comparing to the required output.

4. Compiling PI statistics

In the case of the PI liabilities side, the direct reporting option is usually not available and the indirect reporting through resident custodians is limited to the extent that non-resident investors use the resident financial system. Additionally, the two options are unable to provide a geographical breakdown of liabilities by creditor country. The Portuguese case follows a mixed approach, i.e. PI liabilities are calculated based on the net balance of all cross-border custody holdings between issuers, central securities depositories (CSDs), resident custodians and resident end-investors. The potential risk of misclassification or double-counting with direct investment is taken care of by relating the PI data with the direct investment surveys.

The geographical allocation of PI liabilities' end-of-period positions and related income by creditor country is the main limitation for the time being. It is an important issue for concern since it also limits the compilation and dissemination of meaningful bilateral i.i.p. statistics. In this context, the exploratory analysis of the Coordinated Portfolio Investment Survey (CPIS) data is being undertaken. Conducted by the IMF on an annual basis since 2001 and with 70 reporting countries (2005 edition), the CPIS is considered to be a valuable data source for the geographical allocation of PI liabilities. The analysis being done intends to derive measures to overcome some of its limitations, such as the existence of non-published confidential data, the geographical allocation of securities held as foreign reserve assets (collected through another, confidential, survey – SEFER) and the holdings of countries not reporting to the CPIS.

In the case of the PI assets, the indirect reporting system via custodians may not be able to capture all the relevant data, even when complemented by direct reporting of securities held in custody abroad, especially in the case of households. Although this is not considered to be a significant problem for the time being, since it is expectable that Portuguese households use the resident banking system for their investment decisions, it may become of increasing importance in the future, namely in a context of a more integrated financial system at the level of the European Union (EU) and, more specifically, of the Euro Area (EA). In this context, a third party reporting (TPR) schema could be further analyzed and developed at the EU/EA level.

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ABSTRACT

There are different possibilities available when designing a data collection system for portfolio investment statistics, in the context of balance of payments (b.o.p.) and international investment position (i.i.p.) domain. The possible systems may differ according to the targeted reporting agents, periodicity and level of aggregation and the corresponding results vary in terms of implementation and running costs, data availability and quality and of response burden.

Moreover, the developments occurred during recent years in the financial markets also condition the ability of these data collection systems to provide the relevant and complete set of data necessary to compile these statistics.

This paper intends to provide an overview of the Portuguese experience in compiling portfolio investment statistics in the context of b.o.p. and i.i.p. statistics, with a special focus in the pros and cons of security-by-security data collection systems for integrated statistical production. The complexity of data collection systems based on custodians in a world of global financial markets will also be addressed.

Measuring the market value of Shares and other equity in the Portuguese financial accounts

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1. Introduction

International comparisons from 1997 onwards of the ratios debt-to-equity (D/E)[1] and equity-to-Gross Domestic Product (GDP) (E/GDP)[2] tended to show values for Portugal which seemed to underestimate the equity instrument, namely as withdrawn from the financial accounts. The Portuguese figure of D/E was one of the highest at the European level[3] in particular in most recent years (above 1.1); E/GDP experienced a declining pattern especially from 1999 onwards, the number for Portugal being one of the lowest in Europe (around 1.0).

The historical data of Shares and other equity in the Portuguese financial accounts were firstly estimated on the basis of a constant sample of 10,000 non-financial companies available in the Central de Balanços (CB, the Portuguese acronym for Central Balance Sheet database) of *Banco de Portugal* (BP) and of extrapolators calculated by the *Instituto Nacional de Estatística* (INE, the Portuguese acronym for National Statistics Institute) using fiscal data on own funds for the year of 1997. Among other constraints, the market value available for some companies was not taken into account. It adds that fiscal data were not timely available for the compilation of financial accounts to be reported to international organisations.

With the aim of overcoming these difficulties an alternative methodology was then developed for the estimation of the liabilities in the instrument Shares and other equity within the Portuguese financial accounts. Section 2 of this paper presents concisely the conceptual framework. Section 3 provides the sources of data. Section 4 describes the methodology and the estimation algorithm used. The main results are shown in section 5. And section 6 provides a brief international comparison.

2. Conceptual framework

European System of Accounts (ESA 95) establishes that the valuation of the instrument Shares and other equity should be made with recourse to current prices (§ 7.52). For quoted shares, the value to consider should be the relevant market price observed in the stock exchanges or in other organised financial markets (§ 7.53); for unquoted shares (§ 7.54) an estimate should be produced with reference to quoted shares taking into account companies' differences in liquidity, activity sector and dimension; for other equity (§ 7.56) the estimate might use own funds or nominal value (of capital).

Given the constraints of practical implementation of the capitalisation method, namely due to differences observed with regard to the variables mentioned, European compilers[4] recommended to use own funds as an alternative. Own funds were considered a good proxy of market value for non quoted shares and other equity, allowing international comparison and being considered as of easy implementation. Own funds comprise nominal capital, supplementary capital, reserves and results.

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[1] Measuring the type of financing (own funds or indebtedness) adopted by companies.
[2] Measuring the importance of equity in the total product generated in the economy.
[3] For the calculation of the ratios non-consolidated data from financial accounts of several countries were used, namely, the instruments Securities other than shares, Loans, Trade credits and advances and Shares and other equity.
[4] Eurostat's Working Group on Unquoted Shares and European Central Bank's Sub-Group on Shares and Other Equity.

The methods used in Portugal for the valuation of the item Shares and other equity, by institutional sector of the issuer, are then the following (see Table 1):

Table 1: Methods of valuation of Shares and other equity

	Quoted	Unquoted	Other equity
Non-financial corporations	Market value	Own funds	Own funds
Financial corporations	Market value	Own funds	Own funds
Rest of the world	Market value	Own funds	Own funds

Estimated Observed

3. Sources of data

The alternative methodology found to overcome the difficulties mentioned above, gathers data from several sources, namely, from the *Ficheiro de Unidades Estatísticas* (FUE, the Portuguese acronym for Directory of Statistical Units), the *Sistema Integrado de Estatísticas de Títulos* (SIET, the Portuguese acronym for Securities Statistics Integrated System) and the CB:

- FUE: this file is based on data compiled by INE and comprised more than 350 000 active non financial companies resident in Portugal for the year of 2003. From this file data were gathered concerning the legal form of companies, the economic activity sector, the business turnover, the number of employees and the nominal capital.
- SIET: this is a security by security and investor by investor system ran by BP for the purpose of construction of portfolio investment statistics, which are then used within a set of financial statistics namely the financial accounts; the system compiles data relating to published issues of shares in Portugal, including the quotation for all quoted shares in the Portuguese market (70 companies in 2003) and the nominal capital for unquoted shares (16 725 companies in 2003) - the coverage of SIET for unquoted shares is supposed to be practically exhaustive.
- CB: this is a database ran by BP containing information of non-financial companies answering to the respective voluntary annual survey which asks for accounting data concerning balance sheet and profits and losses account; the database including data from around 18 000 companies (in 2003), is characterized by having a good coverage (biased) for large companies and with better financial performance and a statistical sample for the others. The database also includes data coming from the quarterly survey ran on a mandatory basis together with INE to a sample of companies (around 3 500 companies *per* year). For the purpose of valuation of Shares and other equity within the financial accounts information from this database was used related to the economic activity sector, the number of employees, the nominal capital and the own funds of non-financial companies.

4. Methodology and estimation algorithm

4.1. Non-financial corporations

In the financial accounts, the liabilities of Shares and other equity for Non-financial companies (K_{nfc}) were divided into the following sub-components:

$$K_{nfc} = K_{qs} + K_{nqs} + K_{oe}$$

For quoted shares (K_{qs}) the market value was directly used from the SIET which includes quotations for all companies listed in the Portuguese stock exchange. For unquoted shares (K_{nqs}) and other equity (K_{oe}) [5], in the absence of market values, an estimate of the respective own funds were considered as a

[5] K_{oe} includes immobile non-financial assets, such as land and buildings, held by non-residents; this value was directly extracted from the international investment position.

proxy to be used.

4.1.1 Yearly estimates

The construction of an estimate for the year of 2003[6] was a first step in the development of the methodology. This estimate was then used as an anchor for the estimation of the set of values to be applied to the whole period of 1997 to 2005.

Base year

With regard to unquoted shares (K_{nqs}), data concerning the nominal capital was compiled from the SIET. Then own funds were extracted from the CB for the common companies between the two databases. Given the fact that not all unquoted shares companies registered in the SIET reported their figures to the CB, extrapolators based on observed ratios in CB of own funds to nominal capital were then applied to the non-financial companies of the SIET not included in the CB.

If the CB sample was considered as representative and homogeneous, one could have applied the mean ratio of own funds to nominal capital observed in CB to the nominal capital observed in the SIET to obtain an estimate for the own funds of unquoted shares companies residing in SIET and not answering to CB: unfortunately since the annual survey has a volunteer character, it was reasonable to admit that companies answering had, in principle, a better economic and financial performance than the non-answering ones. Under these grounds, instead of a single ratio a stratification of ratios according to the economic activity sector[7] and the dimension[8] of companies were felt as necessary. With information concerning the economic activity sector and the number of employees from FUE, the unquoted shares companies residing in SIET were then distributed by the several *strati* identified.

Own funds for unquoted shares were afterwards calculated according to the following expression:

$$K_{nqs} = K_{nqs\_obs} + K_{nqs\_est}$$

K_{nqs_obs} indicates the value of own funds of unquoted shares companies answering to the CB which accounted in 2003 for about 27 per cent of the number of unquoted shares companies in the universe of SIET.

K_{nqs_est} was calculated according to the following expression:

$$K_{nqs\_est} = \sum_i \sum_j (1 + \alpha_{ij} \cdot \partial_{ij}) \cdot NK_{nqs\_est\_ij}$$

$NK_{nnqs\_est\_ij}$ represents the nominal capital of companies registered in SIET not answering to CB, pertaining to economic sector of activity i and to dimension class j;

$(1 + \alpha_{ij})$ is the ratio of own funds to nominal capital observed in CB for economic sector of activity i and to dimension class j, i.e.,

$$1 + \alpha_{ij} = K_{nqs\_obs\_ij} \Big/ NK_{nqs\_est\_ij}$$

In general the extrapolators α_{ij} were positive since nominal capital is one of the parcels of own funds; however outliers coming from companies with ratios above ten or negative were excluded.

The coefficients ∂_{ij} were used in order to calibrate the natural bias of the extrapolators α_{ij} arising from the sample of CB. They were attributed a variable weight of discrete values of 1, 0.5 and 0, if the

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[6] The choice of 2003 as a base year was due to the fact that the data in the FUE for this year could be considered as more complete and with a higher coverage.

[7] The thirteen economic activity sectors considered were: agriculture, hunting, forestry and fishing; construction; education, health and other community, social and personal services activities; hard manufacturing industry; hotels and catering (restaurants and others); light manufacturing industry; mining and quarrying; post and telecommunications; production and distribution of electricity, gas and water; real estate; rental and supply of services to non-financial corporations; transports and storage; and wholesale and retail trade and repair of motor vehicles.

[8] The five classes considered according to the number of employees were: more than 250; 51 - 250; 9 - 50; 2 - 8; 0 - 1.

representatively of the CB sample, in terms of number of companies in each stratus, was respectively over 50 per cent, between 50 per cent and 25 per cent and below 25 per cent, as compared with the universe of unquoted shares in the SIET (see Table 2).

Table 2: CB coverage of unquoted shares by sector of economic activity and dimension class

	Number of employees					
Economic activity sector	> 250	51-250	9-50	2-8	0-1	
Agriculture, hunting, forestry and fishing	100%	67%	28%	8%	3%	17%
Construction	96%	55%	24%	9%	5%	22%
Education, health and other community, social and personal services activities	92%	69%	24%	5%	5%	26%
Hard manufacturing industry	93%	58%	43%	32%	9%	53%
Hotels and catering (restaurants and others)	97%	50%	18%	5%	4%	24%
Light manufacturing industry	95%	68%	32%	14%	5%	47%
Mining and quarrying	100%	65%	37%	17%	8%	37%
Post and telecommunications	93%	83%	50%	22%	43%	52%
Production and distribution of electricity, gas and water	80%	81%	76%	63%	31%	56%
Real estate	67%	61%	34%	14%	7%	10%
Rental and supply of services to non-financial corporations	88%	47%	27%	25%	29%	29%
Transports and storage	95%	58%	38%	15%	12%	38%
Wholesale and retail trade and repair of motor vehicles	88%	62%	32%	12%	6%	29%
	93%	61%	31%	16%	13%	27%

Coverage by number of companies
more than 50%
between 50% and 25%
less than 25%

With regard to other equity (K_{oe}), a similar procedure to the one above described was used, the difference being the fact that the reference universe was the FUE and not the SIET. For a small part of companies (4 per cent of companies of FUE) own funds were directly obtained in CB and for the rest an extrapolation exercise was made based on the application of observed ratios in CB to the nominal capital in FUE. Since the representatively of the CB sample for other equity was smaller than for unquoted shares, the number of calibrators with a nil value showed higher (see Table 3).

Table 3: CB coverage of other equity by sector of economic activity and dimension class

	Number of employees					
Economic activity sector	> 250	51-250	9-50	2-8	0-1	
Agriculture, hunting, forestry and fishing	0%	30%	16%	5%	2%	5%
Construction	75%	25%	7%	2%	1%	3%
Education, health and other community, social and personal services activities	82%	38%	8%	1%	0%	2%
Hard manufacturing industry	77%	36%	14%	5%	2%	10%
Hotels and catering (restaurants and others)	100%	25%	4%	1%	0%	1%
Light manufacturing industry	95%	44%	17%	6%	2%	9%
Mining and quarrying	0%	52%	30%	9%	5%	17%
Post and telecommunications	0%	75%	20%	6%	8%	9%
Production and distribution of electricity, gas and water	100%	28%	39%	17%	24%	27%
Real estate	0%	17%	13%	3%	1%	2%
Rental and supply of services to non-financial corporations	67%	26%	7%	1%	1%	2%
Transports and storage	80%	40%	15%	4%	1%	4%
Wholesale and retail trade and repair of motor vehicles	77%	49%	15%	3%	1%	4%
	78%	37%	12%	3%	1%	4%

Coverage by number of companies
more than 50%
between 50% and 25%
less than 25%

The final values obtained for both components of unquoted shares and other equity are presented below. One can then conclude that, for both types of capital, the values directly observed in the samples were predominant as compared with the ones that were estimated (see Table 4).

Table 4: Estimates of unquoted shares and other equity for 2003

	Unquoted shares		Other equity	
Observed values	84 703	84.7 per cent	34 215	59.6 per cent
Extrapolated values with $\partial_{ii} = 1$	4 344	4.3 per cent	660	1.1 per cent
Extrapolated values with $\partial_{ii} = 0.5$	7 040	7.0 per cent	1 336	2.3 per cent
Extrapolated values with $\partial_{ii} = 0$	3 939	3.9 per cent	21 193	36.9 per cent
Total	100 026		57 404	

Unit: 10^6 euros and per cent of total

In order to validate the *ad-hoc* values chosen to ∂_{ij}, two linear regressions were constructed, one for unquoted shares and another one for other equity, according to the following formulation[9]:

$$Ln(K - NK) = \alpha + \beta_1 Ln(NK) + \beta_2 Ln(NE) + \beta_3 Ln(BT) + \delta_j D_j + \xi$$

The regressions tried to explain the difference between the own funds and the nominal capital upon the use of the variables available in the FUE, i.e., the nominal capital, the number of employees, the business

[9] Where K stands for own funds, NK for nominal capital, NE for number of employees, BT for business turnover and D for a dummy representing the economic activity sector.

turnover and the economic activity sector. After running the regressions for the CB companies (for which all the data are available), the coefficients obtained were then applied to the rest of the companies. Their results confirmed the global values of unquoted shares and other equity obtained before.

Period 1997-2005

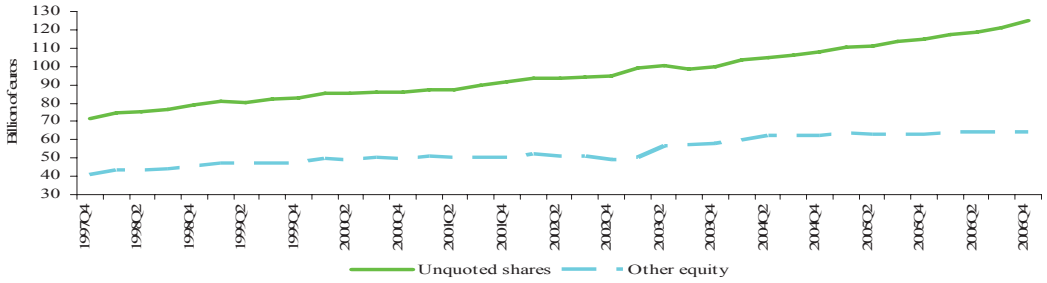
For the period before and after 2003, in the case of companies answering to the CB, the data directly compiled from the annual surveys were used.

In the case of the unquoted shares and other equity companies, for both types not included in the CB sample, an hypothesis of evolution of the respective own funds with both the nominal GDP and the figures computed for the invariant sample of CB was put forward.

4.1.2. Quarterly estimates

From the yearly estimates quarterly figures were obtained with recourse to an indicator whose basis reflected the seasonal behaviour of the companies' own funds. For the construction of the basis of this indicator, accounting data from the CB quarterly survey were used. The time series of the indicator were then compiled through the application of the quarterly nominal GDP growth rate to that basis. The quarterly indicator was afterwards applied to the annual figures of own funds through the quarterly oriented software ECOTRIM. The results obtained show a stable quarterly evolution of both types of capital (see Figure 1).

Figure 1: Quarterly Non-financial corporations' liabilities in unquoted shares and other equity



4.2. Extension to institutional sectors other than Non-financial corporations

The exercise of valuation of Shares and other equity ran for Non-financial corporations was then extended to the liabilities of Shares and other equity of the other institutional sectors, namely the Financial sector and the Rest of the world.

For quoted shares, the quotation prices in the Portuguese stock exchange were used. In the case of the Rest of the world, although most Portuguese investment abroad is channelled to unlisted companies, quoted prices of non-resident companies in the respective stock exchanges gathered through commercial data providers were also used for quoted shares.

For unquoted shares and other equity companies, in the case of the Financial sector, own funds were derived from balance sheets. In the case of the Rest of the world, the sources used were, on the one hand, the foreign direct investment (FDI) surveys ran on an annual basis by the BP to the direct investors and asking for accounting data of own funds of the non-resident companies and for the percentage of participation in the FDI companies and, on the other, the transaction prices reported within the SIET foreign securities portfolios held by residents.

4.3. Transactions estimates

The estimates above mentioned were applicable to the end of period positions of Shares and other equity. The estimates for flows were derived taking into account the following issues: changes in nominal and supplementary capital were considered as transactions; changes in other own funds' components were classified as price changes; reinvested earnings coming from FDI were after summed to the transactions; and the capital injections made by the General government in public companies with accumulated net losses were, finally, removed from the Shares and other equity item in the financial accounts.

5. Main results for the period 1997-2006

5.1. Number and valuation of Non-financial corporations, by type of equity

In 2003, for a number of Non-financial corporations of around 5 per cent of FUE which constituted the reference universe, an amount equivalent to 77 per cent of the market value or own funds could be observed either in the SIET (quoted shares) or in the CB (unquoted shares and other equity). That meant the estimation of around 23 per cent of the market value or own funds for a number of around 95 per cent of companies (see Figures 2 and 3).

Figure 2: Number of companies – 2003 –

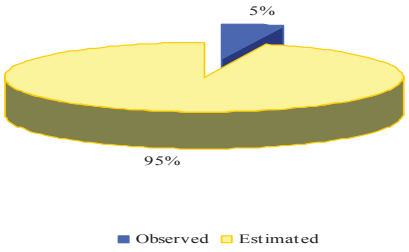
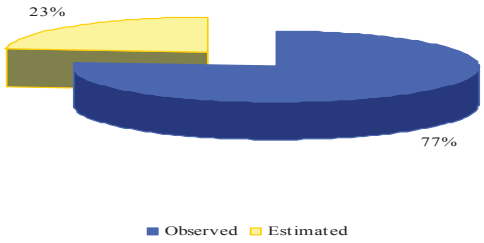


Figure 3: Market value



In the quoted shares domain, all the stock exchange quotation prices were used, coming from direct observation in the SIET. Here the main characteristic is that for a few companies, relevant market prices fluctuations may be observed (see Figures 4 and 5).

Figure 4: Number of companies – Quoted shares –

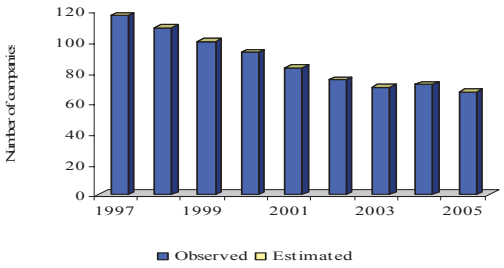
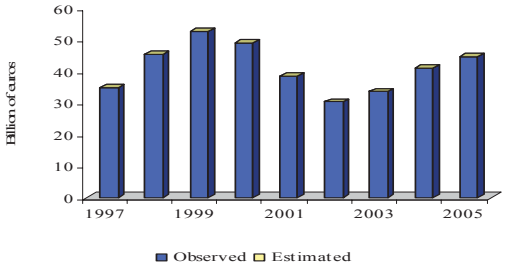


Figure 5: Stock market value



In the unquoted shares segment, for 23 per cent of the number of companies of SIET, 56 per cent of own funds were in yearly average observed in the CB (the use of a sample since 2000 in CB has also contributed to a higher coverage). The main characteristic here is that own funds are more stable than stock exchange prices (see Figures 6 and 7).

Figure 6: Number of companies – Unquoted shares –

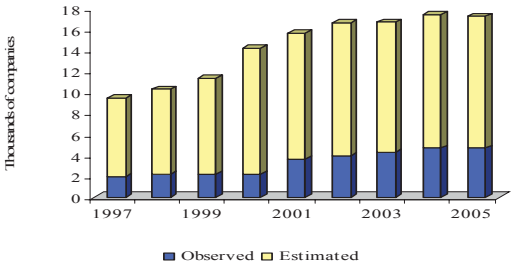
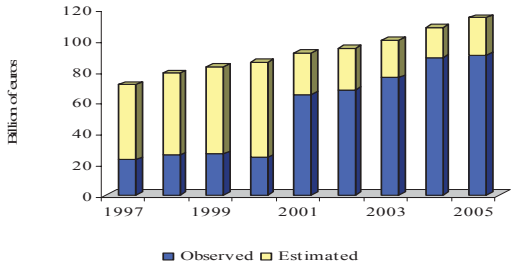
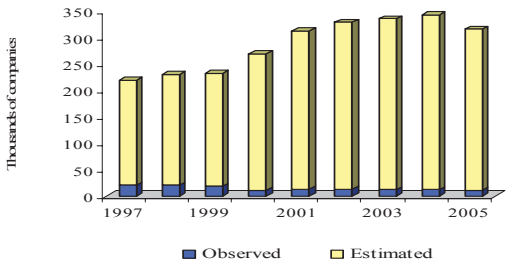


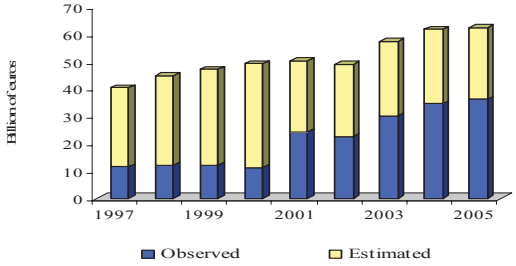
Figure 7: Own funds value



In the other equity domain, for 5 per cent of the number of companies of FUE, 41 per cent of own funds were in yearly average observed in the CB (the use of a sample since 2000 in CB has also contributed to a higher coverage). The main characteristic here is that own funds are again less volatile than stock exchange prices (see Figures 8 and 9).

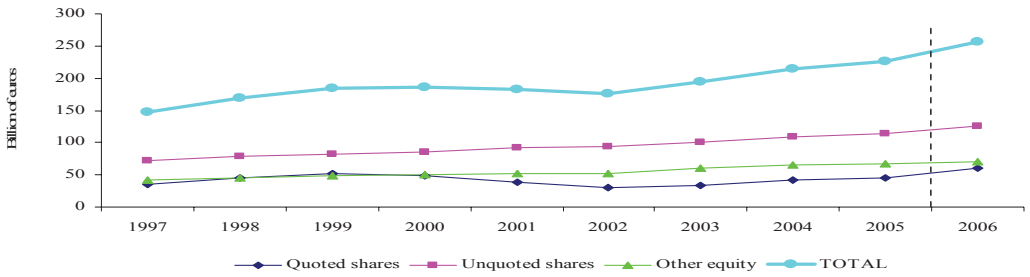
Figure 8: Number of companies – Other equity – *Figure 9: Own funds value*





The evolution of the whole item of Shares and other equity for the Non-financial corporations sector in the Portuguese financial accounts, which rose from around 148 billion € in 1997 to almost 226 billion € in 2005, is mainly determined by the evolution of the quoted shares component; its behaviour is in line with the peak reached in the stocks' markets during the late nineties in the last decade and with the following fall of the early years of the present century. However, the distribution of the liabilities in Shares and other equity by type of equity still shows the unquoted shares as the main component of the Portuguese equity item weighting around half of the whole (see Figure 10).

Figure 10: Non-financial corporations' liabilities in Shares and other equity, by type of equity

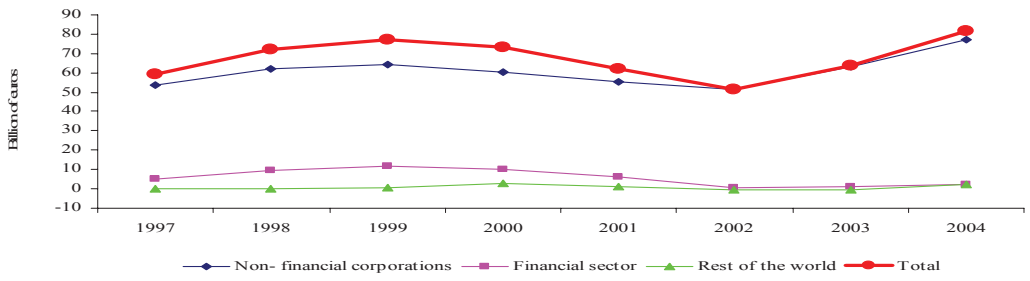


5.2. Total liabilities of Shares and other equity in the Financial accounts

The results obtained with the methodology hereinabove presented, which takes into account the international recommendations of market valuation for Shares and other equity in the financial accounts, implied a revision in high of around 68 million € *per* year in the Portuguese accounts; this increase was reflected in the stocks accounts from 1997 to 2005 mainly as a result of price revaluations.

The institutional sector breakdown of the liabilities in Shares and other equity points to the Non-financial corporations sector as the main responsible for the increase of this item in the period under review; the share of this sector in the augment of the whole economy has even increased to almost 100 per cent as from 2002 onwards (see Figure 11).

Figure 11: Changes in liabilities stocks of Shares and other equity, by institutional sector



5.3. Total assets of Shares and other equity in the Financial accounts

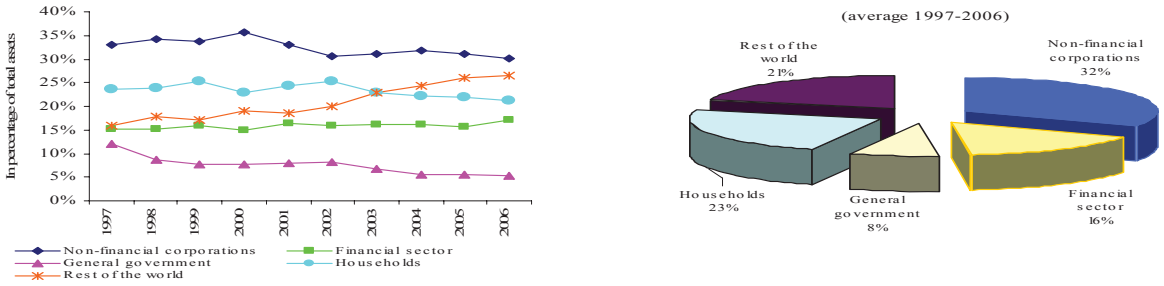
The revision in high of the liabilities of Shares and other equity in the financial accounts of Portugal

led naturally to also an increase of the assets in the same instrument. As such the portfolios of the various institutional sectors turned closer to the respective market values.

For quoted shares, SIET provided market prices data to value the portfolios' holders on an investor-by-investor basis and allowing their attribution to a certain institutional sector. For unquoted shares and other equity several sources were used, namely: the Ministry of Finance provided information (at nominal value) on the General government holdings, the balance of payments/international investment position statistics provided information for the Rest of the world, the Financial corporations balance sheets values were adjusted according to the percentage of the sector's holdings in the total holdings observed in SIET and the Non-financial corporations, the Non-profit institutions serving households and the Households were identified as a residual using SIET.

The evolution of the breakdown of the assets in Shares and other equity by institutional sectors shows that the Rest of the world enlarged its share in the total from 16 per cent in 1997 to 26 per cent in 2006; on the opposite, the General government decreased from 12 per cent to 5 per cent in the same period, which may be related to the privatisations (still) running in the Portuguese economy (see Figure 12). These assets were, in average for the period 1997-2006, distributed through the several institutional sectors according to the following shares: Non-financial corporations with 32 per cent of the total, Households with 23 per cent, Rest of the world with 21 per cent, Financial corporations with 16 per cent and General government with 8 per cent (see Figure 13).

Figure 12: Evolution – Holders of assets in Shares and other equity – Figure 13: Distribution



6. International comparison

From the international comparison of the ratios D/E and E/GDP, after reviewing the figures of the Portuguese financial accounts, one can conclude that the methodology of estimation of own funds hereinbefore described led to values for Portugal which are closer to the ones presented by other countries (see Figures 14 and 15).

Figure 14: Debt-to-equity

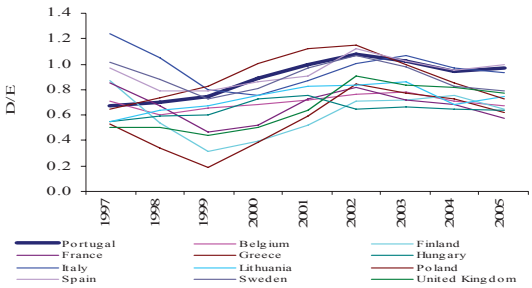
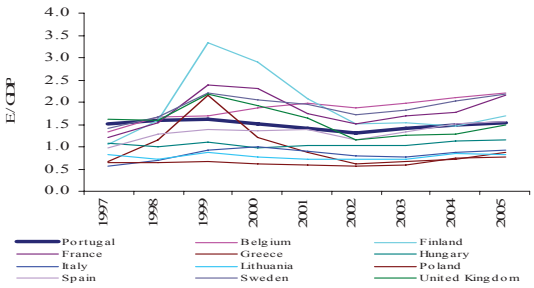


Figure 15: Equity-to-GDP



Non-consolidated values / Source: Eurostat New Cronos

These ratios and other, like the return-on-equity which is also based on the non-financial companies' equity capital, play a role in the exercise of Financial Soundness Indicators ran by the International Monetary Fund.

Estimating and predicting quarterly financial savings of Households

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1. Introduction

The Households financial savings are one of the most important outcomes from the financial side of the national accounts framework, which is defined for European countries by the European System of Accounts (ESA 95). More recently, an ECB Guideline and an EU Regulation started also to require from national compilers the production of quarterly financial and non-financial accounts, respectively. Banco de Portugal started a few years ago the compilation of a subset of quarterly investment and financing for the non financial sectors, and, more recently, the compilation of a complete set of quarterly financial accounts for all sectors, from 1997 onwards. INE is the responsible for the compilation of the non-financial accounts.

The net of all resources and expenditures, coming from the non-financial accounts, is called "net lending/borrowing" and the net of all changes in financial assets and liabilities (except for other price and volume changes), coming from the financial accounts, is called "financial savings". Both net lending/borrowing and financial savings should be of similar quantity, as they represent the same economic reality from different perspectives. To overcome the gap created by the present non availability of quarterly net lending/borrowing, this article presents a methodology to estimate and predict quarterly financial savings of Households, which are not seasonally adjusted (as required in the ESA 95), from annual net lending/borrowing.

2. Methodology

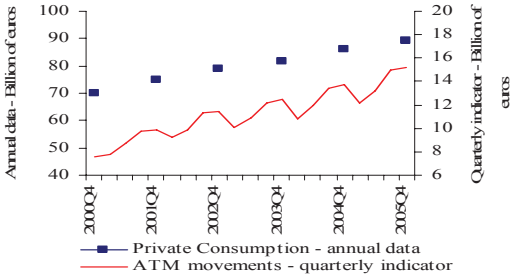
The methodology for the transformation of annual into quarterly net lending/borrowing of households is based on distribution and interpolation procedures. According to the methodology followed in this article, the quarterly components of the net lending/borrowing, such us private consumption, disposable income, gross fixed capital formation and others are estimated based on associated indicators. In general, the infra-annual pattern of the aggregated variables is obtained from related quarterly indicators. The statistical methods used were originally developed by Chow-Lin (1971) to estimate the quarterly figures, as they ensure consistency in the aggregation of the elementary series for the specific aggregates. These statistical methods can solve two problems at the same time: the quarterly pattern of annual data and the forecast of quarterly data for the subsequent quarters.

The first step is the selection of the best quarterly indictors for each aggregated variable. The selection is made based on a balance between the statistical significance and the economic reasonability of the related indicators and the aggregated variables. According to the ESA 95 rules for financial accounts, the aggregates to estimate must be nominal and non-seasonally adjusted, as so the associated quarterly indicators must also be nominal and non-seasonally adjusted. A software designed by Eurostat specifically for this purpose, ECOTRIM[1], was used, as it allows for the selection of the best quarterly indictors and for the selection of the statistical model that best fit each case (e.g Fernandez, Litterman).

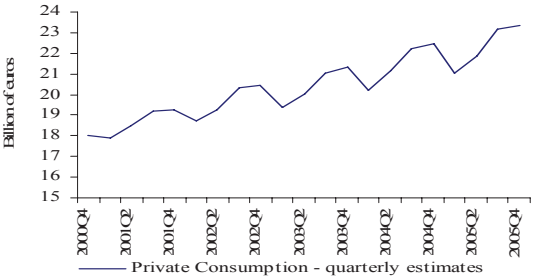
The following graphs illustrate the estimation of quarterly figures for the annual data on private consumption.

[1] Barcellan and Buono (2002).

Graph 1 – Annual data and quarterly indicator

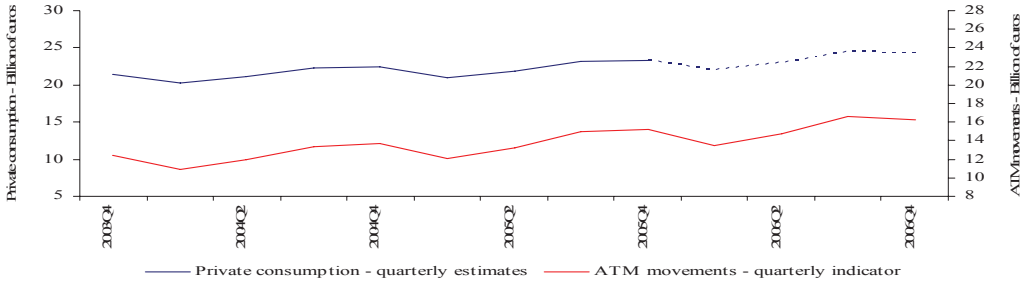


Graph 2 – Quarterly estimates



The forecasting of the quarterly figures for the current year, also based on a quarterly indicator, is illustrated by graph 3.

Graph 3 – Quarterly forecast



The non-financial accounts aggregates and the respective associated indicators used in this exercise are presented in the following table.

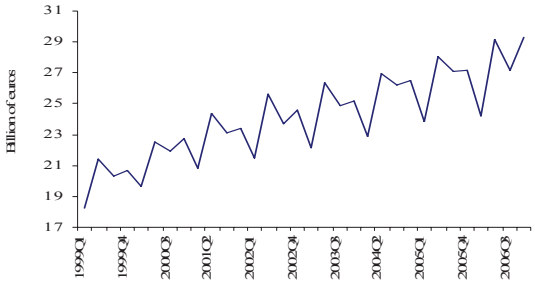
Table 1 – Annual Variables and Associated Indicators

Net lending (+) / borrowing (-) of households	**Associated indicator(s)**
= Resources (Capital account)	
= Gross saving	
= Disposable income (after D8)	
= Disposable income	
= Compensation of employees	
= General government	Compensation of employees of General government
+ Private sector	Social contributions receivable by General government
+ Corporate and property income	
= Corporate and property income - Dividends	Savings certificates - accrued interest
	MFI interest on deposits
	MFI interest on loans
+ Dividends	Portuguese centralised securities database
+ Current transfers	
= Domestic transfers	Social benefits
+ External transfers	Private current transfers
- Direct taxation	General government direct taxation revenue
- Social contributions	Social contributions receivable by General government
+ Adjustment for the change in net equity of households in pension funds reserves (D8)	Without associated indicator
- Private consumption	
= Current consumption	ATM movements
+ Durable goods	Estimate of passengers vehicles sales
+ Tourism	
= Imports of tourism	Travel and tourism - debit
- Exports of tourism	Travel and tourism - credit
+ Capital transfers, receivable	Capital transfers - non financial accounts
- Uses (Capital account)	Estimate of commercials vehicles sales
	Loans for house purchases (new houses)

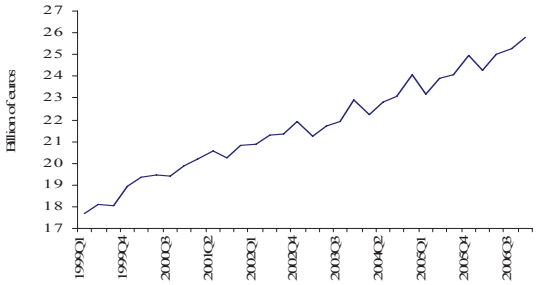
3. Results

A brief analysis of the results is presented in this chapter. Portuguese households disposable income is higher in the second and in the forth quarter (Graph 4). This is mainly due to the extra income generated by the vacation and Christmas salary. Also the dividends received in the second quarter are a reason for the peak in the second quarter.

Graph 4 – Disposable Income



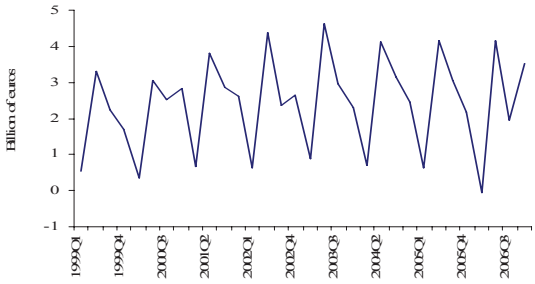
Graph 5 – Private Consumption



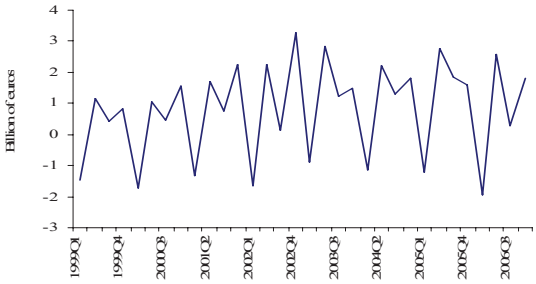
Households increase their private consumption gradually during the year (Graph 5). As gross savings is derived from the disposable income minus the private consumption, households have higher gross savings in the second quarter and lower gross savings during the rest of the year, notably in the first quarter (Graph 6).

Finally, the net lending/borrowing of households, which is the conjunction of the several effects mentioned for the other variables is markedly higher in the second and fourth quarters, and much lesser, and often negative in the first quarter (Graph 7).

Graph 6 – Gross Savings



Graph 7 – Net Lending (+) / Borrowing (-)



When testing the seasonality of the net lending/borrowing, we conclude that there is a strong seasonal pattern, confirming the peak in the second and fourth quarter and the sharp drop in the first quarter (Table 2).

Table 2 – Testing for seasonality

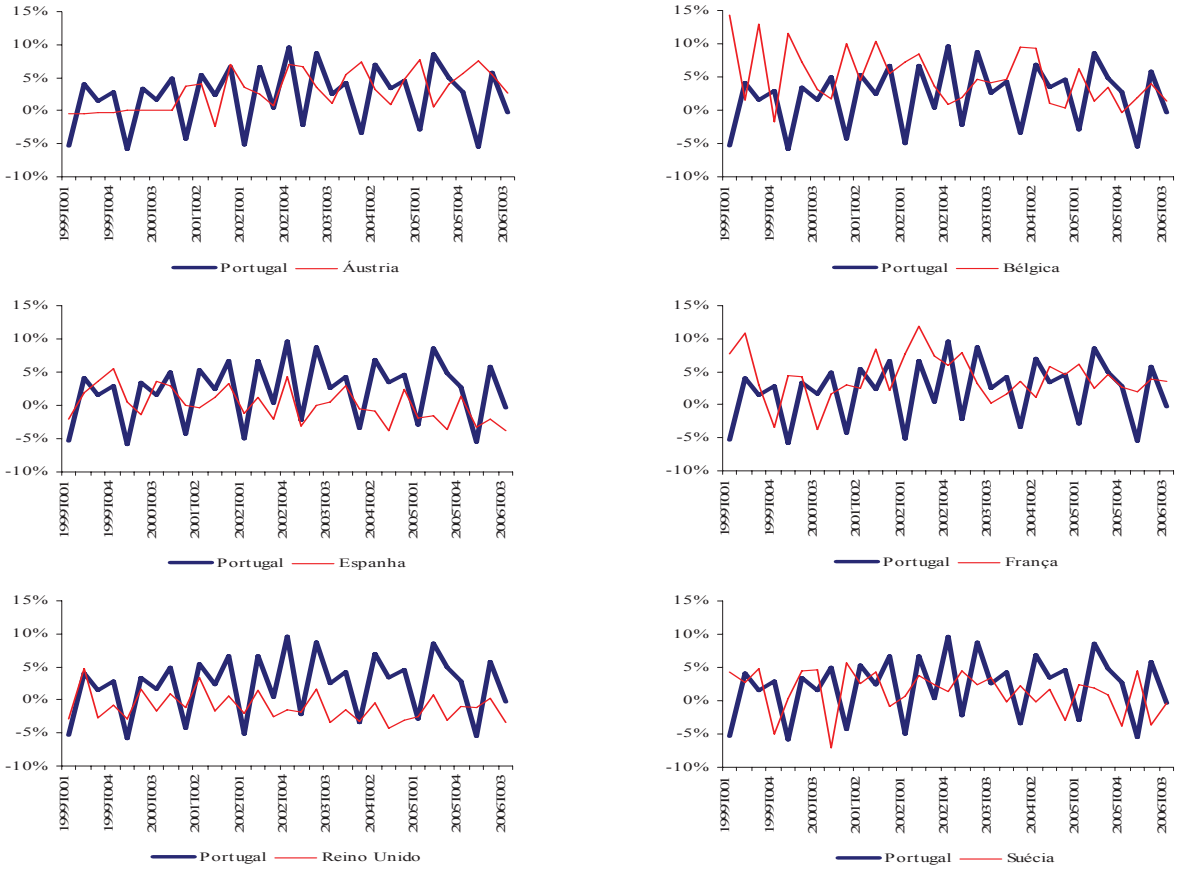
$R^2 = 0.76$	Coefficients (t-stat.):	
Adjusted $R^2 = 0.68$	I Quarter = -0.62 (-4.59)	III Quarter = 0.28 (2.04)
Standard Dev. = 0.36	II Quarter = 0.71 (5.24)	IV Quarter = 0.64 (4.69)

4. International comparison

We conclude that Austria (2.7 %) and Portugal (2.4%) have similar net lending/borrowing as a percentage of GDP, on average, between 1999 and 2005. Belgium (5.3 %) and France (4.2 %) have higher ratios, while, Sweden (1.5 %) and Spain (0.5 %) show lower ratios. Finally, United Kingdom (-1%) is the only country of this comparison that display negative net lending/borrowing on average during this period.

From the following graphs we can anticipate strong seasonality of the net lending/borrowing for most of the countries.

Graph 8 – Net Lending (+) / Borrowing (-) as a percentage of quarterly GDP – international comparison



When testing for seasonality, we conclude that there is a strong seasonal pattern for Austria, Belgium and Portugal, although revealing different patterns. Seasonality in Spain is somewhat similar to the one found for Portugal, as it reveals a strong fall in the first quarter and a peak in the fourth quarter.

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Public Finance Sustainability: Stocks and Flows

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The Stability and Growth Pact convergence criteria were defined by reference to national accounts framework. In the context of a European centralized monetary policy, the Pact is an instrument for conducting prudent fiscal policies. However the deficit threshold set at 3%, lacks an economic rationale reflecting a political consensus on an operational rule to be easily applied.

The economic theory showed that a constant deficit as percentage of GDP ensures that debt and interest rates converge to non-infinity figures. However, it is not possible to conclude that an optimal deficit threshold corresponds to 3%. The existing Pact does not highlight the importance given by the economic theory to other components such as economic growth. Several authors have focused on the analysis of dynamic elements of economic growth. At present, the basic idea is to let the automatic stabilizers to act, on the side of revenue, and to impose constraints to expenditure.

Moreover according to the economic theory it is not possible to actually conclude that the monetary union is an optimal area and that the Stability and Growth Pact criteria are due to the existence of an optimal monetary union. The Pact was implemented to avoid negative externalities in the Euro area but it cannot be seen as an instrument for ensuring public finance sustainability.

Some of the ideological differences that split the economists for some decades are disappearing. Governments are commonly seen as non-efficient entities in managing resources and subsequently the management of resources is being allocated to private entities. Very common examples are the multiple public and private partnerships which are celebrated between the public and private sectors. For such reasons, economists are not so interested in analysing the role of the public sector in the economy as they were in the past.

The Stability and Growth Pact is an administrative procedure that was able to impose a given behaviour to governments that take economic decisions based not only on efficiency and equity criteria but also on the accounting features of a given operation. A good example is the sale of assets. Governments might be selling more assets than foreseen due to the positive impact on net lending/net borrowing and because a Stability and Growth Pact deficit threshold exists.

It is to be noted that a unique criterion has been adopted for the whole EU, 27 economies with different structural problems. It is extremely useful to develop specific alert mechanisms for each of the member states. The European Commission has started to implement this kind of analysis after the last amendments to the Stability and Growth Pact.

Besides understanding why the threshold was settled and how the convergence criteria are used, it is worth analysing the content and nature of such indicators and what they aim to measure. The concept of public finance sustainability has been used in the literature in different ways. Nonetheless, sustainability is usually linked with debt, stock of capital or on how public expenditure leads to the increase of the stock. It is well accepted that the level of wealth in an economy can be measured by the stock of capital to evaluate the degree of ownership and control of assets, by each of the economic agents or in a more aggregated form, by each of the institutional sectors.

The statistical component of the Stability and Growth Pact allows comparisons over time and across the space. Basically, two options could have been adopted. The first option would be to incorporate, for a statistical measurement, existing concepts according to their legal status which would have implied adopting

a more formal approach. The public accounting framework is usually based on such criteria classifying the entities according to their legal status; recording some transactions (still) on a cash basis. Nonetheless more and more the public accounting framework transits from a cash basis to an accrual basis at national level in all member states and in some of them this approach has been implemented for some years.

The second option would be to define concepts and statistical indicators that are most useful for the purpose of economic policy. This was the option followed when basing the Stability and Growth Pact convergence criteria on the national accounts conceptual framework. It is important to understand whether the selected indicators are well defined by reference to national accounts.

The inclusion of the concepts of national accounts for the statistical purposes of the Stability and Growth Pact has had some consequences in the accounting framework. The European Commission has released several methodological decisions in the last years devoted to general government which had implications in the other institutional sectors – the national accounts are an integrated framework. These several methodological decisions strengthened the economic perspective of the system and aimed to avoid the adoption of the so-called creative measures by governments. The other advantage in adopting this second option was that the national accounts work as a common measure, not depending on the national accounting specificities of member states.

At present, a balance of non-financial transactions (deficit) is to be analysed together with a stock of financial transactions (debt) within a conceptual framework of a broader nature. One of our proposals is to focus the analysis of public finance sustainability on net worth. Complementary aspects are to be highlighted, and there is the need for analysing and compiling a stock of non-financial assets. The net worth corresponds to the difference between the total of assets (financial and non-financial) and liabilities. The assets are entities that allow general government to exercise ownership rights and to have economic benefits. The liabilities reflect the obligations of general government, in providing an economic benefit towards other institutional sectors. The net worth by the end of the year will correspond to the net worth at the beginning of the year plus changes in net worth due to saving and capital transfers, changes in net worth due to other changes in volume of assets and to nominal holding gains/losses. The net worth is a measure of wealth that indicates the resources controlled by general government in the economy.

Having such a complementary and broader view of the system has the advantage of integrating flows and stocks. At present, the expressions “above” and “below” the line are commonly referred when analysing the impact of a given transaction in the system meaning, respectively, the impact on non-financial and financial transactions. A dynamic approach would imply integrating this reasoning and to refer not only to flows but to stocks.

Besides the net lending/net borrowing, there are other balances in the system of national accounts which have been adopted at international level when analysing general government accounts. It is the case of the balance of changes in net worth due to saving and capital transfers. It excludes gross fixed capital formation when compared with the net lending/net borrowing that is the final balance of the capital account. The relevant aspect to be highlighted is that a sale of a non-financial asset does not provide an income, as it is defined in the system and has no impact on net worth. The possibility of having such a synthetic indicator of changes in net worth due to saving and capital transfers would reflect the privileged balances adopted by the International Monetary Fund (IMF) and the business accounting approaches. The acquisition/disposals of assets are not recorded as an expenditure/revenue establishing a substantial distinction with a European system (ESA95) that works as the basis for the Excessive Deficit Procedure.

However, in our view the main disadvantage in using this flow is that it implies recording extraordinary operations as revenue (capital transfers), such as the transfer of pension funds from a corporation to general government. These kinds of transfers have been recently observed in EU member states.

The first proposal, of using the indicator net worth requires the compilation of stocks for non-financial assets and this is not made in most of the member states. Moreover, the transmission of these figures is not requested by the European legislation. If that was the case, it would be easier to articulate flows and stocks

and to assess the "profitability" of the non-financial assets. As an example, there is an increasing trend for analysing the quality and composition of capital equity held by government in public corporations. In many cases, government has equity in public corporations that have negative own funds.

The composition of assets is a relevant matter both for financial and non-financial assets. Government behaviour is not similar to a private agent due to policy reasons. Nonetheless, a first assessment of sustainability should focus on net worth in equivalent conditions as for a private entity. This might lead to the exclusion of the so-called assets of "bad quality", and therefore it is worth investigating whether it is useful to have a categorization for non-financial assets. Governments might be obliged to acquire equity in public corporations for financing reasons because they operate in important sectors of the economy but governments also have assets with the purpose of increasing the welfare of the populations, for recreational or cultural purposes which include mostly public goods. The reasons why these assets are acquired are connected with social reasons or for supporting a given activity or sector. It is important to assess the value of the non-financial assets comparing them with those owned or controlled by private entities.

Other issue related with the above is the delineation of the public sector. According to the definitions of national accounts, general government includes those institutional units that are non-market producers which provide their output to other units at free, or at prices that are not economically significant. In practice, at European level, it is used the so-called "50% rule" for assessing whether an institutional unit is non-market. However, this criterion is not so straightforward under some circumstances. One example relates to those institutional units that only exist and were born for being financed by government because without such financing they would need to close doors. One of our proposals would be to consider a broader public sector with the inclusion of all those institutional units where operational and economic viability is ensured by government. Such producers implement public policies and in most of the circumstances do not face real market conditions.

Other relevant issue is that future or implicit liabilities are not recorded in the core national accounts. These are important for assessing the sustainability of public finances in the medium and long term. Some examples are the pension liabilities, health, education or unemployment. The reasoning adopted in the Stability and Growth Pact is to evaluate accumulated deficits and the national accounts are based on factual events not recording future expenditures (provisions are not recorded in national accounts). The issue to be discussed is whether the actual framework must change allowing for such recording or if these liabilities should be shown as memorandum items, a complementary indicator.

For concluding about the above proposals and on using other indicators such as the net worth to assess public finance sustainability it is important to validate empirically these arguments. In our view it would be important to assess the sustainability of public finances based on net worth to conclude to what extent the conclusions would differ from those obtained when using the convergence criteria under the Stability and Growth Pact.

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ABSTRACT

A conceptual analysis of the deficit and debt criteria under the Stability and Growth Pact is undertaken and the main features are presented. In the context of a European centralized monetary policy, the Pact is an instrument for conducting prudent fiscal policies. However the deficit threshold set at 3%, lacks an economic rationale, being mainly the outcome of a political consensus on an operational rule which can be easily applied.

The Stability and Growth Pact is based on the national accounts conceptual framework. One of our proposals is to focus the analysis of public finance sustainability on net worth. A balance of non-financial transactions (deficit) is to be analysed together with a stock of financial transactions (debt) within a conceptual framework of a broader nature. Complementary aspects are to be highlighted, such as the need for analysing and compiling a stock of non-financial assets.

For carrying out this analysis, several issues are explored including a comparison of different accounting systems. The European national accounting system is compared with both the International Monetary Fund system and with business accounting. Other aspects such as delimitation of general government and to what extent the existing framework is able to capture future or implicit liabilities are further analysed.

Financial Intermediation Services Indirectly Measured (FISIM) – the problematic of imports and exports

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I. Methodological description of the new method and the impact on GDP

The principal function of a financial intermediary is the capture and redistribution of financial funds in the economy for which there is no explicit charge. In the context of National Accounts this issue assumes particular importance given the need to measure the remuneration of these services and its allocation across institutional sector and economic activities. Therefore, Eurostat has developed a methodology on Financial Intermediation Services Indirectly Measured (FISIM).

From 2005 onwards a new method for the calculation and allocation of FISIM (Regulation EC No. 1889/2002) has been adopted by the Member States. According to this Regulation, FISIM are computed as the difference between the interest received/paid and the interest that would have been obtained if a reference rate (ERR) was applied. The reference rate is obtained by the ratio between flows and stocks derived from transactions between financial institutions.

Following the new methodology, FISIM is calculated by consumption sector, according to the purpose of the operations; there is thus a component of FISIM allocated to final consumption (FC), exports (X) and imports (M), in the corresponding institutional sectors current accounts. Contrary to the "old" method this new method as an impact on GDP equal to $\Delta GDP = \Delta FC + \Delta X - \Delta M$.

In this paper we will focus on FISIM on imports and on exports. This issue is relevant because the new approach leaves room to some theoretically surprising outcomes like negative FISIM on exports that, according to a Eurostat decision, should be treated as positive FISIM on imports. Furthermore, this change of sign and the consequent adjustment on imports poses difficulties to the calculation of FISIM at constant prices.

This study explores some possible explanations for the existence of negative FISIM on exports in Portugal, namely taking into account that cross-border flows of FISIM between Financial Intermediaries should involve less risk than transactions with non-financial institutions. Additional explaining factors might be also associated with the residency of the counterpart (intra vs. extra Monetary Union) and its relation with the intermediary (within vs. extra economic group).

In order to circumvent the current shortcomings, i.e. the possibility of obtaining negative FISIM, we suggest: i) the calculation of separate ERR for assets and liabilities; and ii) the definition of a reference rate that results from a weighted average of market interest rates according to the different term structures and currency of denomination of the operations.

II. Some possible explanations for the existence of negative FISIM on exports

Concerning the results of implementing the FISIM calculations by Member States, for the period 1995 to 2004, we observed that, in the case of Portugal, FISIM on exports shown negative figures for some periods as a consequence of negative transactions between resident and non-resident financial intermediaries.

The main arguments to justify the existence of negative FISIM are the following: i) the broad concept used to classify loans and deposits; ii) the relationships between financial institutions comprising the same international financial group; iii) the existence of different tax schemes across countries; iv) the different

currency structures of loans and of deposits; and v) despite all these factors only a single reference rate is used both for loans and for deposits.

Although we are concerned with the Portuguese case we believe that these arguments are relevant for other countries too.

III. Proposal for an alternative calculation of FISIM on exports

Bearing in mind the factors mentioned in section II and in order to overcome the identified problem, we propose an alternative calculation method for the ERR, using a weighting scheme: the ERR would be a result of an average of market interest rates, weighted by the share of each operation on the total of loans (or deposits). The weighing scheme should be sufficiently disaggregated, as to truly reflect the loans/deposits major characteristics, in terms of their different maturity and currency denomination.

This is equivalent to computing the ERR according to the formula below:

$$ERR = \frac{\sum_{m=1}^{M}\sum_{c=1}^{C}(r_{mc} \times S_{mc})}{\sum_{m=1}^{M}\sum_{c=1}^{C} S_{mc}}$$

$\boldsymbol{S_{mc}}$ refers to the outstanding amount on each instrument (loans/deposits) within maturity band $\boldsymbol{m}$ and denominated in currency $\boldsymbol{c}$. To each $\boldsymbol{S_{mc}}$, an individual reference market rate – $\boldsymbol{r_{mc}}$ – is assigned. The ERR is thus a weighted average of the individual $\boldsymbol{r_{mc}}$, where the weights are given by the respective $\boldsymbol{S_{mc}}$.

In our case study we consider 3 maturity bands (short, medium and long term) and 4 currency denominations (euros, dollars, pounds and Japanese yens), which means that we calculate 12 individual reference market rates.

In practical terms, for the purpose of implementation, several rates can be used. For example, for short-term loans/deposits, the interest rates Euribor3M, LiborUSD3M, LiborGBP3M and LiborJPY3M should be assigned; for the operations denominated in EUR, USD, GBP, JPY, respectively, for long-term operations the swaps interest rates (indices ISDAFIX) might be a good proxy.

For the calculation of income on loans and deposits of non-resident non-financial institutions MIR data[1] could be applied.

IV. Case study: PT negative FISIM on exports between financial institutions

In this section, using *Banco de Portugal* data, we present the results obtained for Portugal according to the calculation method proposed.

In a first exercise we calculated FISIM on exports for the Portuguese economy using income and stocks, quarterly data on loans and deposits, available in the Statistical Department of *Banco de Portugal*, for the period of 2003 to 2006.

The Regulation EC No. 1889/2002 states that the only institutions producing FISIM are the Financial Intermediaries (FI), i.e., Other Monetary Financial Institutions (OMFI) and Other Financial Intermediaries (OFI). Given that from past data OFI have played only a very minor role as producers of external FISIM, we assumed that they were a non-producer sector.

For the computation of FISIM on exports a narrow definition of loans and deposits has to be applied, i.e., deposits on OMFI abroad (asset side) and credits granted by non-resident OMFI (liability side) should be excluded and considered for the purpose of FISIM on imports. However, this distinction is not originally available in the data sources. Therefore, this exercise relies on two premises: i) short-term loans granted to

[1] Monetary interest rates statistics for the outstanding amounts of loans and deposits of non-financial corporations and households resident in the Euro Area, available from MBS statistics.

MFI, resident or non-resident, should be classified in the category of deposits as stated in ESA 95; ii) Eurofix3A was the rate assigned to loans up to one year granted by non-resident to resident MFI. Thus, according to these assumptions, short-term loans granted to non-resident MFI and loans up to one year granted by non-resident to resident MFI (income and stocks) were excluded from the asset and liability side respectively.

The outcome of this exercise is shown in the table below.

Unit: 10^6 EUR

	Mar-03	Jun-03	Sep-03	Dec-03	Mar-04	Jun-04	Sep-04	Dec-04	Mar-05	Jun-05	Sep-05	Dec-05	Mar-06	Jun-06	Sep-06	Dec-06
TOTAL Exported FISIM on loans	**52**	**50**	**54**	**57**	**56**	**61**	**58**	**51**	**47**	**42**	**42**	**37**	**34**	**31**	**29**	**29**
Non-resident non FIs	36	34	32	31	33	34	35	35	34	32	33	29	30	27	27	30
Non-resident FIs	16	16	22	26	23	27	23	16	14	10	9	7	4	4	3	-1
TOTAL Exported FISIM on deposits	**16**	**16**	**28**	**37**	**30**	**40**	**40**	**28**	**28**	**25**	**22**	**31**	**29**	**38**	**34**	**18**
Non-resident non FIs	0	0	6	10	7	12	17	12	14	15	13	23	25	34	32	19
Non-resident FIs	16	16	22	26	23	27	23	16	14	10	9	7	4	4	3	-1
TOTAL Export of FISIM	**69**	**66**	**83**	**94**	**86**	**101**	**98**	**79**	**76**	**67**	**64**	**68**	**62**	**69**	**64**	**47**

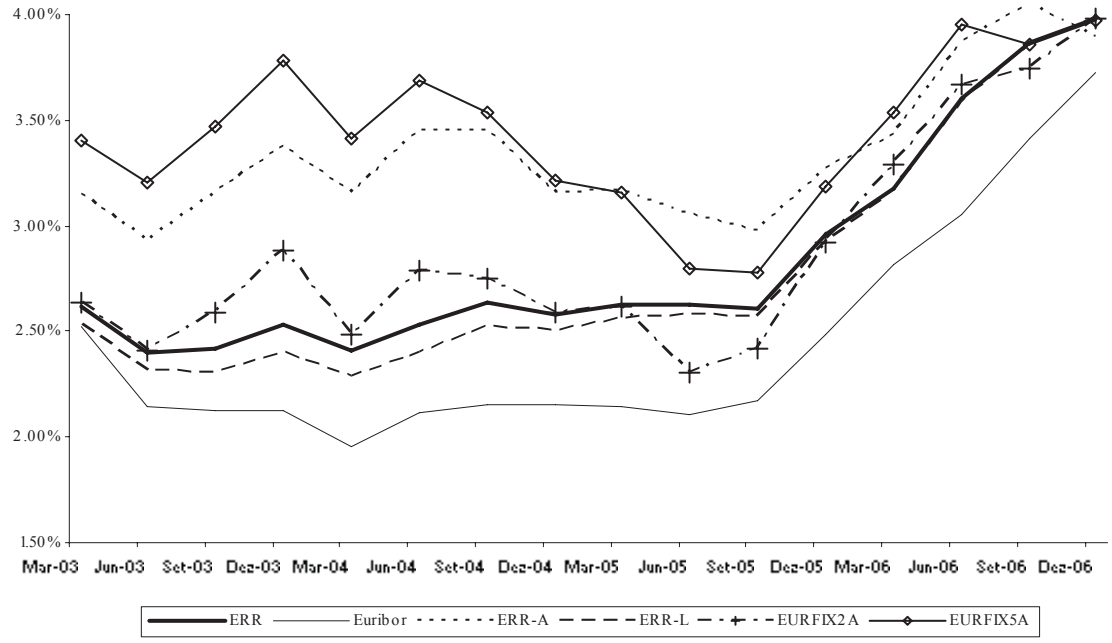
The results give evidence of positive FISIM on exports, between financial and non-financial institutions, for all periods except the last one. It is worth noting that, between financial institutions, the amounts are not significant, which support the view that transactions between FI lead to a FISIM close to zero. In fact, these non-negative results contrast with the one previously compiled according to the conventional method.

The negative FISIM in the last quarter of 2006 results from an implicit rate on deposits higher than the implicit rate on loans; these two rates have been converging for the last periods.

The chart below shows that ERR is determined by the transactions on the liability side, as ERR and ERR-L move closely. This feature reflects the asymmetric structure of the assets and liabilities. The reference rate on loans follows also the evolution of ERR and ERR-L, but at higher levels and closer to the EURFIX5A, reflecting the long-term structure of the transactions on the asset side.

We also concluded that *Euribor* is not a good substitute for the reference rate even though it was one of the FISIM Workshop of 30th June of 2004 suggestions.

Evolution of the ERR



In order to assess the relevance of cross-border intra-group relations we focused also our attention on the analysis of the operations conducted by the individual institutions. With reference to the asset side, the

implicit reference rate is mostly determined by only one institution that is an affiliate placed in the Portuguese off-shore, belonging to a financial group whose head-office is located in the Monetary Union. Typically, this type of institutions is mainly engaged in gathering funds through the issuance of securities that are relocated to the parent enterprise as a loan. These loans have been remunerated at an interest rate higher than the ERR and, in some cases, comparable with the interest of the securities issued. This procedure might be a form of neutralizing the interest rate risk or a mean to explore different tax schemes.

In what regards the liability side, the main responsible entities for the FISIM on exports are institutions that have transactions with their subsidiaries in other countries, namely in France, Cayman and Macau. Another type of operations concerns triangular operations where the resident MFI obtains deposits from non-resident enterprises in country X that are then transferred to the non-resident parent enterprise resident in country Y. These operations typically do not reflect true economic and financial market conditions and therefore the relevant ERR has to be adjusted accordingly.

Another aspect refers to the currency in which the operation is denominated; EUR is the predominant currency, but USD (Assets: 17%, Liabilities: 12%), GBP (Assets: 4.2%, Liabilities: 3.7%), and JPY (Assets: 2.3%, Liabilities: 0.7%) have also some contribution. Thus, in order to achieve a free risk rate for cross border transactions we have reflect the structure of the universe of currencies concerned. Finally, the term structure of the operations is also important as the incorporation of future interest rates expectations is also reflected differently in the market interest rates; for example for long-term operations we take swaps interest rates rather than *Euribor*, that is more adequate for the short-term.

For data between 1998 – 2004 we replicated the exercise using annual accounting data available at our Supervision Department obtaining similar results.

V. Conclusions

In order to overcome some of the unexpected outcomes achieved in the FISIM conventional computation, notably negative values, we propose the calculation of two reference rates, one for the asset side and one for the liability side, ERR A and ERR L respectively, which leads to a null FISIM between financial institutions.

Moreover, we suggest the definition of a reference rate that results from a weighted average of market interest rates according to the different term structures and currency of denomination of the operations. This reference rate should reflect the diversity of the underlying operations, and should therefore incorporate the main determinants of the loans and deposits interest rates.

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Annex III. Financial intermediation services indirectly measured (FISIM) (SNA) – See the United Nations Statistics division web page

Statistical Integrated Systems: evolution or revolution?

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Evolution
a gradual process of change and development
Revolution
a very important change in the way that people do things
In "Cambridge Dictionaries Online" (dictionary.cambridge.org)

1. Introduction

Information technology developments led to a new trend in the way statistics are produced: traditional aggregated reporting is gradually being replaced by item-by-item reporting. The advantages of this approach are enormous, ranging from lower reporting costs to higher compilation flexibility. Although item-by-item reporting requires dealing with large volumes of data, this has become easier due to the evolution in network and communication protocols, database systems and multidimensional analytical systems. Consequently, old multiple heterogeneous collection and compilation systems are being replaced by integrated systems.

Statistical data on securities, periodically released by Banco de Portugal, are compiled on the basis of the Securities Statistics Integrated System (SIET – *Sistema Integrado de Estatísticas de Títulos*). This system was developed by the Statistics Department of Banco de Portugal with the purpose of gathering in a single repository all the information deemed necessary to comply with reporting requirements on securities. SIET makes it possible to meet user needs, at both the national and international level. Quite ambitious in its aims, the system has been a challenge for data quality managers and a source of opportunities for data "explorers".

With developments in financial markets worldwide, securities statistics have increasingly gained importance. Therefore, subjects related to coverage, quality and harmonisation of securities statistics produced in the various countries are a growing concern at the international level and, in particular, within the scope of the European System of Central Banks (ESCB). In this context, integrated statistical systems enable a more efficient and harmonised production of statistical data. SIET, being an integrated system that includes data on issues and portfolios and covers all the economy's institutional sectors, makes it possible to cope efficiently with most information requirements in the field of securities statistics.

This paper overviews SIET architecture: inputs, processing and enrichment modules, and outputs. We discuss whether this integrated system is an evolution of previous disaggregated systems or configures a revolution, given the new opportunities it creates. A glance into the near future foresees the integration of information from the Centralised Securities Database (CSDB), an ongoing project of the European Central Bank (ECB).

2. SIET features and main components

SIET is an information system that stores data on securities issues and portfolios on a "security-by-security" ("s-b-s") and "investor-by-investor" basis, except in the case of investors belonging to the households' institutional sector, whose data are aggregated by the investor's country. This means that data considered relevant for statistical analysis are collected, validated and stored for each security, each issuer and each investor. The existence of a reference database with individual information on securities and issuers allows for the collection of statistical information from reporting entities on a "s-b-s" basis. This approach implies lower reporting costs, given that there is no need for reporters to aggregate background information according to multiple criteria. Furthermore it enables a better information monitoring and a greater flexibility when exploring data and building statistical analysis.

SIET comprises two information segments: one on securities issues and another on securities holders. In the segment on securities issues, information is collected on securities issued by resident entities in Portugal, either issues taking place in the Portuguese market or in external markets. In the portfolios segment, information is collected on the securities portfolios of the different resident investors, as well as on the portfolios of non-resident investors in domestic securities. Additionally, information on the features of foreign securities that are held by resident investors is obtained from commercial databases.

SIET replaced a relatively large set of procedures for the collection of data on securities, while extending the coverage of reporting to all investing sectors and enabling a better quality control. As regards data on issues, the procedures for researching and collecting information underwent some evolution, whereas reporting on securities' holders was totally changed. In fact, previously, the report on securities portfolios covered only information on external transactions and on operations conducted by monetary financial institutions (MFIs). Today all sectors are covered.

Data on issues are collected from several sources. In accordance with the provisions of Article 13 of the Organic Law of Banco de Portugal and of Article 6 of the Guideline of the European Central Bank of 6 February 2003 (ECB/2003/2) on monetary and financial statistics, Banco de Portugal shall ensure the production of securities statistics covering issues by Portuguese residents and it may require of any public or private body the direct supply of information deemed necessary for the compilation of these statistics.

At the securities portfolios level, information is reported according to an Instruction of Banco de Portugal on "Securities Statistics - Transactions and Positions". Based on this legal background, detailed information is collected on investments by residents in domestic and foreign securities and on investments by non-residents in domestic securities.

Figure 1 illustrates SIET architecture. The system relies on two relational databases and one analytical database. Collected data are stored and validated (first level of quality control) in the "transactional database". Data estimation of missing information is also done in this database. Validated and "enriched" data are daily copied to the so called "exploration database". A second level of quality control is made on aggregate data, by carrying out consistency tests and comparisons with other information sources. Statistical outputs are produced from the "exploration database" as well as from the "multidimensional database". This analytical database was recently developed and it is a quite powerful tool since it enables user friendly multidimensional analysis of the information.

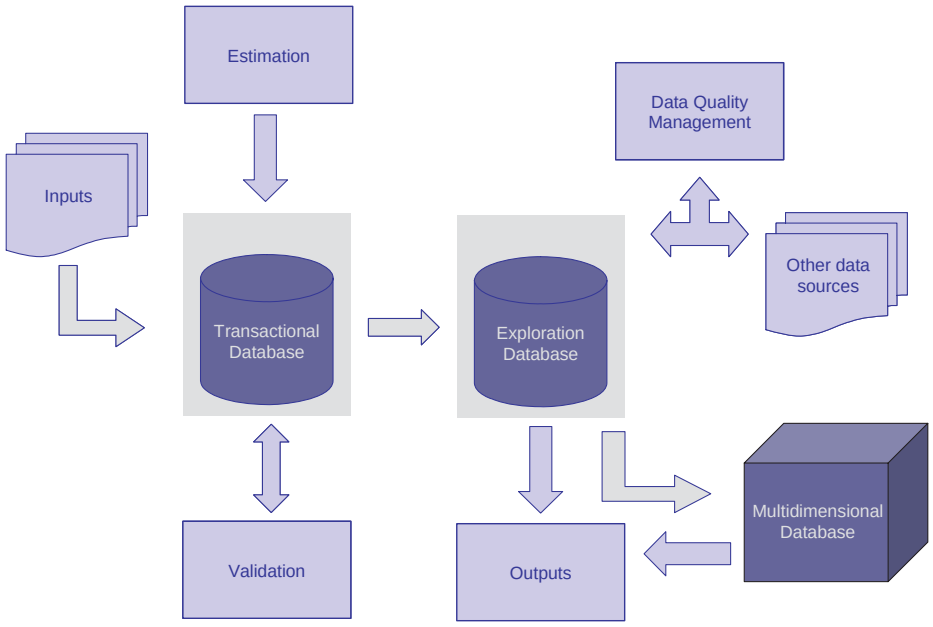

Figure 1: SIET architecture.

SIET stores information on the type of instrument, the institutional sector and the residency of the issuer/investor, prices (quotations), transactions and positions associated with securities issues (issues, redemptions and outstanding amounts) and transactions and positions associated with securities portfolios (purchases, sales, stocks). Classification of securities and entities follows the European System of National and Regional Accounts (ESA/95), complemented by Annex XIX of the Guideline ECB/2003/2. Securities are preferably identified through the ISIN code (International Securities Identification Number) and resident issuers/investors through the NPC (Portuguese acronym for Legal Person Identification Number). Standard unique identification codes are fundamental for sharing and integrating information from different sources. The ISIN code accomplishes this purpose for securities. Unfortunately, for entities there is not such code at an international level.

3. Opportunities and challenges

SIET aimed at being a system that would make it possible to address all Banco de Portugal's needs at the level of statistical information on securities. The development and implementation of the system was quite challenging and ambitious and the outcome turned out to be very positive.

While preparing the project, reporters were contacted and the new reporting scheme was discussed. One may think that asking the reporters to send individual information on transactions and positions would be burdensome. However, most reporters were also developing their own information systems and sending individual information was easier and less expensive than aggregating it according to several statistical criteria.

For compilers at the Statistics Department there was the need to deal with much more data. Gradually, methods were developed in order to rapidly identify possible errors or discrepancies. Like in all new systems, there was a learning curve.

Having an integrated system with individual data presents several advantages from a statistical compilation perspective:

- Classification of information for statistical purposes is done by statistical experts and follows a common methodological framework.
- Calculations are done locally according to internally defined algorithms.
- Valuation adjustments follow uniform criteria.
- Consistency between transactions and positions are monitored in detail.
- Comparison between issued and held outstanding amounts is done at the security level.
- Outputs are compiled according to multiple criteria without having to ask the reporters to do so.

SIET promotes consistency across statistics produced by Banco de Portugal. In fact, securities issues statistics are an output of SIET. In addition to the component of analysis and release at the national level, these statistics are reported to international organisations, namely the ECB and the Bank for International Settlements (BIS). Moreover, SIET's information is used as input for the compilation of a wide set of statistics produced at Banco de Portugal, which are also disseminated at the national and international level:

- In the field of monetary and financial statistics, SIET enables the validation and detailing of the information reported in MFI and non-monetary financial institutions' balance sheets, as regards their securities issues and own portfolios. Additionally, investment funds statistics are also produced using SIET.
- Within the scope of balance of payments and international investment position statistics, SIET data on external transactions and positions in securities are used to produce the portfolio investment item (assets and liabilities).
- For the compilation of public finance statistics, SIET information is used in order to obtain the issues of the different general government sub-sectors and to determine the share of these securities that is taken by general government entities (for data consolidation purposes).
- Values reported to the central balance sheet data office on the activity of non-financial corporations

are also compared with SIET data, for the purpose of quality control, of the information collected by both systems, regarding securities issued and purchased by these entities.

- Finally, at the level of national financial accounts, SIET data are used to compile assets and liabilities items of the various institutional sectors of the economy, in debt securities and equities, broken down by type of security and maturity.

SIET is an open system in the sense that new components may be developed and integrated. The component related to the estimation of missing information is currently being enhanced and, in the near future, information on foreign securities will be obtained from the CSDB (see below), benefiting from the increased quality of this information.

From our experience, the development of an integrated system for securities statistics has provided major improvements and opportunities in this field. More than a gradual change on statistical production, this configures a very important change in the way things are done, and in that sense we could call it a revolution.

4. The near future

The compilation of statistical information on securities entails a number of difficulties, both in terms of classification and valuation and at the level of the holders' identification. The problems are not related to the lack of information sources, given that there are several commercial databases that provide information on individual securities and several ESCB central banks maintain their own databases. However, in some cases, there are gaps and, in other cases, information is not consistent among different sources. These were the main reasons for the development, at the ECB, of a reference securities database with information on a "security-by-security" basis – the CSDB.

The purpose of the CSDB is to set up a database with complete, consistent, validated and updated information on all securities relevant to the ESCB's statistical objectives. The existence of a single database should promote consistent results and an efficient data collection and compilation. This database uses information from commercial databases and other sources, among which are the National Central Banks (NCBs) that maintain "s-b-s" databases. Data quality management will benefit from the cooperation between the different ESCB members, the BIS and some national statistical institutes.

From the statistical viewpoint, the CSDB serves two purposes: to supply information for the compilation of aggregates for the euro area, such as securities issues statistics, and to supply reference information on securities and issuers, so as to cope with the collection of statistical information on a "s-b-s" basis, and enabling the production of improved aggregate statistics.

The development of the CSDB is being carried out gradually: in phase 1, completed in May 2005, the system was implemented at the ECB; in phase 2, currently ongoing, mechanisms will be implemented for on-line access and application-to-application communication for NCBs.

Currently, several countries are already collecting information on portfolio investment on a "s-b-s" basis for the production of balance of payments and international investment position statistics. In the near future, all euro area members will follow this approach, using the CSDB for the classification of information on securities. In this sense, the CSDB will be a major contribution to a more efficient production of harmonised statistics.

Banco de Portugal has actively collaborated in this project since its beginning. Information on Portuguese securities, extracted from SIET, is being sent to the ECB on a monthly basis. Also, monthly extracts of the CSDB are being used for data quality checking.

We conclude by re-emphasizing that recent changes in financial markets, due to globalisation and innovation, brought new challenges and demands to statistics. Simultaneously, technological evolution continues to provide opportunities to develop increasingly integrated systems, based on "item-by-item" data. These developments, together with an increasing collaboration between institutions at national and international levels, are definitely contributing to the production of more accurate, reliable, and comparable statistics.

What determines firms financial costs? A system GMM approach

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1. Introduction

Most economic models usually consider that the economic impact of changes in financial conditions can be assessed using a limited set of financial variables, such as risk-free interest rates or long-term government bond yields, as suggested by Benito and Whitley (2003), among others. This implies that in these models the conditions prevailing in financial markets, as well as in credit markets, do not affect the economic activity. Bernanke *et al* (1999) show that credit market frictions should be included in macroeconomic models. Their work suggests that when credit markets are characterised by asymmetric information problems and agency costs, Modigliani and Miller's (1958) theory of the irrelevancy of funding choices does not apply. Being so, the inclusion of financial variables in macroeconomic models becomes strictly necessary.

Within the monetary policy transmission literature, credit channel models consider that changes in the financial situation of both lenders and borrowers can lead to changes in overall macroeconomic conditions and in inflation. This suggests that financial conditions may in fact exert significant pressure in the transmission of monetary and real shocks to the economy. Furthermore, given the asymmetric information problems that dominate credit markets, lenders may require higher risk premiums on the loans they grant, as showed by Benito and Whitley (2003). These higher risk premiums are justified by the increase in corporate default probabilities when the demand for external funding increases and when there is a broad-based deterioration in these economic agents' balance sheets.

It was precisely within this framework that Bernanke *et al* (1999) introduced the financial accelerator model. This model departs from a standard macroeconomic model by including the asymmetric information problem when modelling the supply of external funding to non-financial corporations. In this model, the relationship between the external finance premium and firms' net worth plays a crucial role. The external finance premium is defined as the difference between the cost of funds raised externally and the opportunity cost of funds internal to the firm. Given the frictions prevailing in credit markets, the external finance premium varies inversely with the firm's net worth. More specifically, it is assumed that when firms contribute with only a small share of their own funds to an investment project, their interests are not necessarily aligned with those of financial institutions, which implies an increase in agency costs. These costs must then be offset by an increase in the external finance premium. It should be noted, however, that if a large share of investment is supported by own funds, the external finance risk premium should be smaller. In fact, this premium will be null if the investment is completely financed with the firm's equity. The firm's net worth can represent its commitment towards the investment projects.

The financial accelerator effect is mirrored by the external finance premium and by the firms' net worth. Hence, a decrease in net worth should lead to an increase in the external finance premium and to a higher dependency on external funding sources. This will ultimately lead to a decrease in firms' output and investment. This is the core of the financial accelerator theory. Given that a negative shock in the economy implies a deterioration in firms' net worth, the reaction of investment and production to this shock is largely

amplified.

Within this framework, the main purpose of this paper is to explore the heterogeneity contained in a panel dataset with detailed accounting information, in order to empirically evaluate the financial accelerator theory, which states that a deterioration (improvement) in firms' financial health should increase (decrease) the external finance cost. This funding cost will be measured by an implicit interest rate, computed with the available accounting data. This implicit interest rate is defined as the ratio between interest paid and total debt. In sum, our objective is to estimate an empirical model which evaluates how corporate financial indicators influence their implicit interest rates. Firms' financial indicators are computed using data on their financial statements. Their financial situation is assessed with a large set of indicators commonly used in this literature, namely in what concerns firms' solvency, profitability, financial structure, indebtedness, productivity, liquidity and investment.

2. Data and methodology

The firm-level data used in this work comes from the Central Balance-Sheet Database of Banco de Portugal. This database includes economic and financial information for a large sample of Portuguese non-financial corporations. This information includes accounting data from firms' financial statements gathered through an annual survey. This database contains, from 2000 onwards, information concerning approximately 17.500 firms. At least two consecutive years of information are available for 15.000 firms amongst these. These 17.500 firms represent nearly 5% of the total number of firms operating in Portugal, 37% of the total number of employees and 58% of total value added by non-financial corporations. For every year the database includes a random and a non-random component. The first includes mainly large companies and firms that replied to the survey in the previous years. In turn, the random component is obtained through a method of stratified random sampling, by randomly choosing firms in each stratum. These strata are homogeneous in terms of business volume and its definition takes into account economic activity sectors and firm size cohorts. In this work we have used data concerning the years 1998 to 2004. We had to eliminate a few observations with unreasonable extreme values on the implicit interest rate (see Morais (2007), for more details).

The structural model used in our empirical study makes possible the analysis of the relationship between firms' financial conditions and their funding costs, by exploring the heterogeneity offered by firm-level information. Therefore, Equation (1) specifies the implicit interest rate of a firm i at time t, i_{it}, as a function of k variables and indicators, x_{it}, concerning firms' financial situation, of d dummy variables[1] and of the one-period lagged interest rate. Hence,

$$(1) \quad i_{it} = \beta_0 + \beta_1 i_{it-1} + x_{it}\beta_2 + dummies_{it}\beta_3 + \mathrm{v}_i + \mathrm{u}_{it} \qquad i = 1,\ldots,\mathrm{N} \text{ and } t = 1,\ldots,7$$

where β_0 and β_1 are unknown parameters, β_2 and β_3 are respectively $k \times 1$ and $d \times 1$ vectors of unknown parameters, v_i a random variable resulting from firms' unobserved heterogeneity constant in time and u_{it} is the idiosyncratic error. The definition of the variables and their descriptive statistics can be seen in Table 1 below.

Table 1 – Definition of the variables and descriptive statistics

Variable	Definition	N	mean	sd	min	p5	p25	p50	p75	p95	max	Skewness	Kurtosis
Implicit interest rate	Interest paid / Total debt x 100	61 303	10.79	8.53	0	1.69	4.86	8.12	14.14	29.72	42.19	1.46	4.84
Employees		61 303	66	263	0	2	6	16	48	248	17 227	25	1 086
Firm age (years)		61 303	19	15	0	3	9	14	24	49	104	2	8
Sales as a % assets	Sales / Total assets x 100	61 303	1	1	0	0	1	1	2	3	81	9	247
Liquid assets as a % assets	Bank deposits and cash / Total assets x 100	61 303	7	11	0	0	1	3	8	29	100	3	16
Liquid assets	(Bank deposits and cash + Short-term debt receivables + Inventories + Short-term investments) / Short-term debt payables x 100	61 303	208	345	100	103	124	150	191	370	4 738	10	125
ROA	Net income / Total assets x 100	61 303	1	9	- 76	- 13	0	1	3	11	40	- 2	19
Solvency ratio	Equity / (Total assets - Equity) x 100	61 303	261	1 173	- 253	- 20	32	83	185	799	41 132	17	413
Leverage	Total debt / Equity x 100	61 287	392	1 225	- 4 780	- 454	103	221	450	1 779	8 187	2	23
Investment as a % assets	(Tangible + Intangible + Financial assets) / Total assets x 100	61 303	33	25	0	2	12	29	50	82	100	1	3
Available collateral	Tangible assets / Total assets x 100	61 303	29	23	0	1	9	24	44	74	100	1	3
Labour productivity	Sales / Employees	60 104	189	3 005	0	13	34	68	144	480	597 383	163	29 911
Capital productivity	Sales / Tangible assets	60 313	49	1 380	0	0	2	5	14	79	213 959	108	13 954

[1] We defined yearly dummies, in order to evaluate the common effects to all firms in a given year, size dummies, in order to control for firm size (taking into account the European Commission Recommendation of 6 May 2003 (2003/361/EC)), as well as sector dummies, defined accordingly with the national classification of economic activities.

The direct estimation of the model presented in Equation (1) by OLS (ordinary least squares) would lead to inconsistent estimates due to endogeneity problems, as thoroughly discussed in Bond (2002). Consistent estimates can be obtained with Blundell and Bond (1998) GMM system estimator which is appropriated for panels with a large number of units observed in few periods as ours. Moreover, the mentioned authors claim that their method is advantageous over Arellano and Bond (1991) in treating weak instruments and persistent variables. Furthermore, we use robust estimation of covariances to prevent from inconsistency due to the presence of heteroskedasticity (which is rather frequent in heterogeneous cross-sectional data as ours) and/or autocorrelation.

3. Estimation results

The results from the estimation are presented in Table 2. These results focused on 36.182 observations, for 13.018 firms and where obtained using the Stata 9.1 module xtabond2, developed by Roodman (2005).

Table 2 - Estimation results with two step system GMM

Dependent variable: Implicit interest rate $_t$	**Coef.**	**St. error**	**p-value**
Implicit interest rate $_{t-1}$	0.1855	0.0518	0.000
Solvency ratio $_{t-1}$	-0.0008	0.0002	0.001
ROA $_{t-1}$	-0.0324	0.0082	0.000
Liquid assets $_t$	-0.0010	0.0002	0.000
Firm age	-0.0198	0.0082	0.015
1999	0.0400	0.2544	0.875
2000	0.6378	0.1737	0.000
2001	1.4281	0.0000	0.000
2002	0.3764	0.1355	0.005
2003	-0.0192	0.0897	0.831
Small $_t$	-2.8100	0.9179	0.002
Medium $_t$	-1.6054	0.8285	0.053
Large $_t$	-3.6241	1.5609	0.020
Agriculture, fishing & mining $_t$	4.1946	3.6025	0.244
Manufacturing $_t$	4.4758	1.0045	0.000
Utilities $_t$	-9.4051	11.3766	0.408
Construction $_t$	3.1237	1.1692	0.008
Commerce $_t$	7.3657	1.4720	0.000
Tourism & restaurants $_t$	2.4120	1.6444	0.142
Transports & communications $_t$	1.5642	4.9230	0.751
Education & and healthcare $_t$	-6.8799	5.6355	0.222
Constant	5.5892	0.6215	0.000
Wald chi2 (joint significance)	772.4 df = 21	Prob > chi2	0.000
Hansen test (overidentifying restrictions)	107.06 df = 116	Prob > chi2	0.712
AR(1) Arellano-Bond test in first-differences	z = -9.48	Prob > z	0.000
AR(2) Arellano-Bond test in first-differences	z = 1.65	Prob > z	0.098

The results displayed in the table suggest the existence of a negative relationship between firms' financial situation and the implicit interest rate, which is consistent with the financial accelerator theory. It is shown that the coefficient on the implicit interest rate at *t-1*, which is statistically significant at 5%, positively influences the implicit interest rate in the following period. This coefficient is rather low, 0.19%, which shows a non persistent behaviour of the implicit interest rates over the years. In turn, the coefficient of the solvency ratio in *t-1*[2], defined as the ratio between own funds and external finance, suggests that firms with higher solvency levels seem to benefit from lower implicit interest rates. As mentioned by Bernanke (1999), equity can be considered as the participation of the firm in the investment project, signalling the firm's commitment towards that project. The negative sign showed by the solvency ratio helps to support this hypothesis. Firms which have available a larger share of equity to fund their investment projects are able to obtain lower interest rates. In addition, the coefficient on profitability, measured as ROA in the previous year, shows that more profitable firms are able to benefit from lower funding costs, as would be expected, given that more profitable firms are usually better able to honour their debt contracts. Moreover, the results obtained suggest that firms with higher liquidity ratios, measured as the coverage of liquid assets by short term debt, show lower interest rates, as would be expected. The coefficient estimated for firm age suggests that older firms should present relatively lower interest rates. Additionally, the coefficients estimated for time

[2] We considered the solvency ratio and ROA at *t-1*, given that usually banks decisions are based on firms' financial statements from the previous year.

dummies are consistent with the downward trend shown by interest rates on loans to non-financial corporations over the last few years. In turn, the coefficients on size dummies show that, as would be expected, smaller firms usually pay higher interest rates. Finally, the results obtained for sector dummies show that utilities, education and healthcare firms usually face lower funding costs than real estate firms (omitted dummy variable), even though these differences do not seem to be statistically significant. This result can be partly explained by the fact that some utilities, education and healthcare firms are to a large extent state-owned, which may imply lower funding costs. Furthermore, the analysis of sector dummies confirms that manufacturing, commerce and construction firms show relatively higher interest rates than real estate firms.

All the statistical tests performed on the estimated model show that its statistical properties are acceptable. The Wald test confirms that all the estimated coefficients on the explanatory variables (excluding the constant) are jointly significant. Furthermore, the Hansen test does not reject the validity of the overidentifying restrictions.

4. Conclusion

This work intended to evaluate the relationship between the financial situation of Portuguese firms and their funding costs. In order to achieve such objective, we used detailed information on these economic agents at the micro level. This information was based on a panel dataset comprising more than 20.000 non-financial Portuguese firms, which is part of the Central Balance-Sheet Database held by Banco de Portugal. With the aim of obtaining sound and reliable empirical results, we applied a relatively recent econometric methodology, usually known as system GMM. Such technique makes possible the dynamic analysis of the information contained within panel datasets.

The results obtained confirm the existence, in Portugal, of an inverse relation between firms' financial situation and their funding costs, measured by our estimates of an implicit interest rate. Variables such as solvency, profitability and liquidity show this inverse relation. Firm age, as expected, proved to have a negative impact on the determination of implicit interest rates. Moreover, the use of control variables for firm dimension and sector demonstrated to have particular relevance in the determination of implicit interest rates. We also observe that micro firms seem to have higher implicit interest rates than the remaining firms. These results are broadly consistent with the hypothesis underlying the financial accelerator theory, which suggests that improvements in firms' financial health imply a decrease in their funding costs.

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Determinants of the Probability of Default of Loans to Non-Financial Corporations

A Study Based on the Portuguese Public Credit Register

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Credit risk, which can be summarized as the uncertainty about counterparty's ability to service debt, is commonly recognized as one of the greatest threats to the stability of the financial institutions. The increased concern about this subject is evident in the new Basel Capital Accord (Basell II) which has focused the attention of the financial institutions and their regulatory entities due to its innovations in determining capital requirements, namely in its great deal of attention towards credit risk analysis.

Empirical tests confirm the value of central credit registers data for credit risk analysis. In fact, their worldwide establishment was motivated by the observed need of that information by supervision entities, financial institutions and macroeconomic policy makers. Nevertheless, the number of countries where that data is analysed through advanced statistical models is quite low. Indeed, despite the fact that 53 financial regulators, among the 57 countries with Public Credit Registry (PCR) inquired by World Bank surveys, use that data, only 30 per cent refer the application of statistical models to analyse it [Powell *et al* (2004)].

This study presents one application of a PCR in helping access the credit risk of financial loans to Non-Financial Corporations (NFC). The measurement of the credit risk of a specific portfolio requires knowledge about the distribution of losses, in particular about its expected value. This depends on the size of the exposures and on their Probability of Default (PD), which, in turn, derives from the main factors impacting on credit quality. This paper will focus on these later factors. More precisely, we will use the information stored in *Central de Responsabilidades de Crédito* (CRC), the Portuguese PCR, to analyse the determinants of the PD of loans granted by credit institutions operating in Portugal to resident NFC.

The Portuguese Public Central Credit Register

CRC is a database operated by Banco de Portugal on the basis of credit-related information supplied by participants, i.e., all resident institutions granting credit. The CRC began its activity in October 1978 and since that date Banco de Portugal has aggregated credit liabilities on a monthly basis.

Associated with the CRC is a set of services relating to procedures and circulation of information. The main purpose of the CRC is to provide a service for participants that need to assess risk when extending credit. To this end, these institutions have access to the total liabilities of each borrower within the financial system. Other important and legally authorized uses of the CRC are for statistical[1] and supervision purposes.

The very low threshold applied in the Portuguese CRC - 50€ - the smallest one among European Union PCR, implies that virtually all credit operations are covered, but also entails a greater probability of reporting errors given the large number of registries reported. This way, the action of Banco de Portugal on CRC goes beyond receiving and centralizing all the information. Before releasing any data, quality control checks are

[1] The Banco de Portugal' Statistical Bulletin publishes since 2005, with reference to data beginning in 2002, a set of tables with information concerning non-financial corporations' indebtdness that are based on CRC data.

applied and suspicious figures are double checked with the reporting institution. These procedures, combined with all the internal control made by each reporting institution, are important to the fulfilment of the main goal of this database that is to provide to users a service with a high standard of quality. With a 100 per cent coverage of the credit institutions in Portugal and with all the quality control applied, the reliability of the final data is fairly assured what is crucial to assure the legitimacy and generality of the conclusions of this study.

Database and statistical model

Directly from CRC, or from a complementary database with NFC data used at Banco de Portugal, we have collected a large set of explanatory variables that will be used to model the PD of NFC borrowings. Not all the needed information was directly available, which required a previous procedure of selecting, extracting and matching information from different files and databases and subsequently merging them into a unique dataset. Following these actions we end up with 216,342 observations, each one referring to a new loan granted in the period 2001-2005 to an individual NFC, with the total amount of credits reaching €50,285 million. The total number of defaults is 21,714 (10 per cent of the observations) reaching €1,335 million (2.7 per cent of the credit granted).

The econometric specification relies on a binomial logit model. Additionally, as Hausman *et al* (1998) noticed, misclassification of dependent variables in a discrete response model causes inconsistent coefficient estimates when traditional logistic regression is used. This misclassification means that the response variable is being classified in the wrong category, which in our study, may arise because a default loan is being considered as regular or a regular loan is being wrongly considered in default. We have tested for these two cases and both were statistically not significant, this being indicative of good quality on CRC information, i.e., that no serious misclassifications errors exist in our dependent variable.

Model interpretation

Against this background we start our analysis by noticing that the LR test for the joint significance of all regressors presents a p-value of 0.00, clearly accepting the explanatory power of the final model. Also the individual statistical significance of the majority of the estimated parameters is quite high. The fraction of correct predictions is around 90 per cent, the model passes the RESET specification test and, finally, it fulfils all the additional logit specification tests. Following the acceptance of the model we will now analyse the effect of each of the independent variables on the probability of default of loans granted to NFC. We start by analysing the characteristics of the operation and the lending institution.

There is a decreasing relation between the size of the loan and the PD. This conclusion was expected and matches with the available evidence. The economic meaning should be that higher loans tend to be analysed more closely given the relevance that defaults would have in terms of amounts for the financial institution.

Referring to the effect on PD of the type of lending institution we notice that Non-Monetary Financial Institutions (NMFI), except leasing companies, seem to be engaged in riskier loans, being the loans granted by Financial Credit Institutions (IFIC) the ones presenting the higher PD. IFIC is a new type of credit institution, existing in Portugal since 2003, that has managed to grow quite swiftly mostly by aggregating other type of NMFI as leasing, factoring or credit purchase financing companies. Our model shows evidence that IFIC have turned out to be more risk oriented than most of the other categories of NMFI which most of first came from.

The considerable negative coefficient estimate for leasing companies can be determined by the fact that in this kind of operations the leased good tend to be owned by the lending institution, acting this way like a guarantee. Nonetheless, the impact of collateral on default probability is not straightforward being indeed a subject that has raised a great deal of discussion in the literature[2].

[2] As a follow up to this paper, with the restructure of the Portuguese credit register, information on collateral will be available and the answer to the role played by guarantees on default probability would be more reliable and easier to obtain.

From the Monetary Financial Institutions sector we can identify that top-banks appear to be more risk adverse than the remaining sector, although the coefficient estimate for other banks, except credit cooperatives, is not very different. The credit cooperatives appear to be more risk prone than even the majority of the NMFI but their coefficient is not statistically significant.

Finally, it is interesting to notice that in later years most of the major Portuguese financial groups have created IFIC by merging all other types of NMFI, presenting now a distinct separation in their activity: on the one hand there is the major institution - bank, that following the results of our model are more risk adverse, and on the other hand the IFIC, probably more oriented to cover riskier operations.

Regarding maturity, we find evidence that loans with short-time horizons are associated with higher PD. This can be explained by the deeper analysis dedicated to long-term loans derived from the fact that the financial soundness of the borrower can incur in greater risks along the large period of time that their relation will last. This conclusion goes in the same direction of those found in some Spanish studies [Jiménez and Saurina (2004)].

The low value of the estimated parameter associated with the age of the financial institution granting the credit does not indicate that this effect may be pronounced.

Having analyzed the characteristics associated with the loan we turn now to the NFC features. In what concerns the dimension of the borrower we have classified NFC into micro, small, medium and large companies. The estimated parameters clearly denote a decreasing relationship between the size of the borrower and the PD which is in line with the conclusions achieved by Farinha (2005). In fact, the largest difference is noted for the large corporations where their PD is clearly smaller than all of the remaining classes. Between small and medium companies there does not seem to exist a great difference. Micro firms, as expected, exhibit a higher PD. It is usual in the literature the use of the size of the loan as a proxy for the size of the institution. Here we notice that both variables have the same decreasing relationship with the PD, however, their separate inclusion is important as they individually provide relevant information.

Concerning the impact of the economic activity sector on the loan's PD, the results of the model confirm the relevance of this variable and the existence of significant different impacts according to the sector where the company operates. The safer sectors tend to be those of services like production and distribution of electricity, gas and water; education and other social services; and services to NFC. On the opposite side are tradable activities from the primary and secondary sector, probably because of the negative effects arising from their higher exposure to the international competition. One important point that should be noticed here is the relatively high positive estimate parameter for loans granted to the construction sector. Hence, loans to this sector are proving to be risky and that can be troublesome for the stability of some financial institutions given the relevance they present in the credit portfolio of the resident financial institutions.

The geographical distribution results tend to have less statistical significance when analysed individually. Reflecting the high concentration of new loans verified for *Norte* and *Lisboa e Vale do Tejo* regions, which together are responsible for more than 70 per cent of the total credit portfolio of the financial institutions, they present here the higher impact on PD.

There are also some interactions between the economic activity sector and the territorial unit that proved to be statistically relevant. The most important are the ones relating *Alentejo* with mining and quarrying and that between *Madeira* and construction. The coefficient estimates tell us that these activities have an increasing effect over PD in those regions.

Another effect that has also been long discussed in the literature is the role played by relationship banking in PD. The dummy variable introduced in our model takes the value of 1 if the NFC is receiving credit from only one Financial Institution (FI), which can be seen as a good indicator of a close FI-NFC relationship. From the results obtained we can infer that in Portugal a close link between the borrower and the lender tends to assure less hazardous credit operations. A reason for this may be that when a close relation exists the lender will be more reluctant in considering a loan in default when a payment delay occurs. Furthermore one company with higher risk may encounter more difficulties in borrowing higher amounts

from one single institution and it can try to overcome that problem by having multiple FI connections.

The results obtained for this variable go in the opposite direction of those found by Jiménez and Saurina (2004) for Spain. Indeed, their main conclusion on this subject was that multiple borrowing was related with lower PD. The justification was based on a better screening process for these types of borrowers. However, there are a large set of studies that have found results similar to ours like, for example, Farinha and Santos (2002) for the Portuguese case and Schechtman, Garcia, Mikio and Parente (2004) for Brazil.

Concerning the variable indicating the existence of equity capital taken by foreign holders, we can notice by the estimated parameter that these companies tend to have lower PD. The explanation can be twofold. First, only companies presenting financial soundness indicators are attractive to foreign investors. Second, the investment arising from the foreign shareholder avoids the default event.

The variable we used to identify companies receiving loans in the international banking system reveals a negative connection with PD; however, it suffers from lack of statistical significance.

Finally, the age variables indicate that the oldest NFC exhibit lower PD on their loans. This is an expected outcome given that is probable that mature firms are financially sounder than younger ones.

Conclusion

This paper has analyzed the determinants of the PD of loans granted by the resident credit system to resident NFC. We have focused our attention on the loans, companies and credit institutions characteristics. The major contribution of this study arises from the use of a large dataset taken from the Portuguese public credit register that virtually contains information on all loans granted by the resident credit system.

Most of the results obtained are in line with what was previously referred in literature. This is the case of the negative relation between the PD and the volume and maturity of the loan as well as the size of the borrower. Here, it is interesting to notice that although being used as substitutes in many studies, the dimension of the firm, measured by the number of employees and business volume, and the variable indicating the size of the loan were used together and both gave relevant statistical results. The relevance of the company's geographical location and economic activity sector for determining the PD is also in harmony with previous studies results.

Moreover, there are some variables, like relationship banking and type of lender, whose impacts on PD are not so straightforward. The results of our model indicate that a closer relation implies a lower PD and that leasing companies are the ones granting credit with lower risk. Additionally, we also found evidence that banks tend to be more risk adverse than non-monetary institutions with relevance for IFIC that appear to be the ones accepting the highest risk level.

There are still some limitations in the database used as foundation for this study. The awareness of that was behind the initiative of reformulating CRC. In a few years, once this is in place, more information will be available on loans characteristics (e.g: collateral, rating or maturity), which will allow a deeper and more complete analysis on such an important topic as credit risk.

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Total Factor Productivity in the G7 Countries: A Short Note

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The analysis of the composition of economic growth in the G7 countries has been motivated by the possible identification of regularities that contribute to explain economic success. Such analysis must be carried out in a long term perspective and the relevant production function should reflect the existing world technology and not just domestic conditions. Moreover, in order to assess the relative performance of each country, economic growth should be disentangled in a way that total factor productivity (TFP) is not determined as a mere residual. The seminal papers in modern economic growth literature are those of Solow (1956), Romer (1986, 1990) and Lucas (1988). The empirical research literature in this area followed two different strands. One strand decomposes economic growth in a given economy on factor accumulation and total factor productivity. The other strand of literature bases on cross-country regressions, with a multitude of explanatory variables. In the last years the progress on computation methods facilitate the use of Bayesian statistical methods in economic research. Nevertheless, the utilization of Bayesian inference techniques in growth accounting is still very limited. The exceptions are the initial contributions of Koop, Osiewalski and Steel (1999, 2000). Throughout this paper we heavily rely on these contributions. In this paper we use Bayesian stochastic production frontiers in a growth accounting exercise for the period 1960/2005, assuming a dynamic translog production function and using data on 21 OECD economies. The results provide information on the contribution of inputs to GDP growth, on the capital and labour elasticities and on TFP contribution. Furthermore, TFP is disentangled into technological change (TC) and degree of efficiency. Intuitively, these components represent two different aspects. TC corresponds in general to more *efficient* production techniques. Improvements in efficiency correspond to better institutional and organizational arrangements, i.e. the more *efficient* use of the current level of inputs and technology. However, in practice, it is often difficult to establish a clear distinction as TC and efficiency interact. Thus, not surprisingly, although the statistical method used provided contributions for both components, the degree of precision is smaller than the one associated with the computation of total TFP. In addition, it should be noted that, although using less conventional methods, this paper is still a growth accounting exercise. Thus, it does not reveal economic causation channels.

The Stochastic Frontier Approach

Before presenting the model it is important to discuss some methodological issues. Firstly, contrary to most of the traditional empirical growth accounting exercises, the GDP growth decomposition is jointly and simultaneously computed for several economies, under the assumption that there is an international production function (IPF). On conceptual grounds it means that all countries have access to the same technology, implying that if two countries have equal labour and capital endowments the one with higher GDP is more efficient, i.e. stands closer to the stochastic IPF. The speed of interna-

tional dissemination of TC and its implications in terms of growth theory are discussed by Basu and Weil (1998). They argue that the dissemination of TC in the production systems occurs at a slower pace than the diffusion of knowledge. In the OECD countries, knowledge diffusion should occur at a very fast pace, meaning the existence of a common set of potentially available production technologies. Therefore, the time that elapses until a country effectively adopts the technological innovations in its production systems becomes reflected in its relative production efficiency. In addition, if there is a TC potentially available for all, the IPF expands in time in some way. We simply assumed that TC evolves according to a linear trend during each period considered. The analysis focuses on eight 11 year periods (10 annual growth rates), for which stochastic production frontiers were computed. The length of the periods is enough to encompass the average duration of the economic cycles, thus averaging out cyclical effects on the macroeconomic variables considered. All results of the growth accounting exercise are presented in terms of 10 year average growth rates or contributions. The partition of the sample in sub-periods is necessary because of the assumption on the dynamics of TC. In fact, it does not seem reasonable to assume that technology evolves linearly throughout several decades. Regarding the production function specification, a translog formulation was used. This formulation comprehends as a special case the (log)Cobb-Douglas production function, though it is much more flexible than the latter. Temple (2006) argues that the assumption of a Cobb-Douglas specification may lead to spurious results in economical and statistical terms. Traditional growth accounting exercises treat TFP as unobservable (omitted variable), limiting specification testing. In fact, if the researcher had identified a good proxy for TFP and the data were actually generated by a translog, a suitably specified regression would accurately recover the parameters of that translog production function, and reject the Cobb-Douglas specification. Classical econometrics allows for the estimation of stochastic production functions, namely through maximum likelihood methods but relies in asymptotical inference which may not be supported by relatively small samples. We opted to use Bayesian methods as they have the relative advantage of allowing inferences even when samples are small. Moreover, Bayesian methods permit to rationally combine observed data with economically meaningful priors. In practical terms, for each parameter in the model, observed data and initial assumptions (priors) generate a posterior distribution function. The posterior distribution functions of all parameters are derived simultaneously, leading to the posterior distribution function of GDP growth components. The prior for the posterior distribution function of the efficiency parameter is an asymmetric positive distribution. The rational behind this assumption is twofold. Firstly, this parameter measures the distance to the production frontier so it should not be negative. Secondly, there is a smaller probability of finding observations as we move further inner the production frontier. This assumption is common in the literature. As to the specification of the distributions, given its relative advantages, we chose a normal-gamma model (normal distribution of the residual component and gamma distribution for the efficiency component).

The model

The model considered for the growth accounting exercise follows Koop, Osiewalski and Steel (1999). The GDP is defined by:

$$(1) \quad Y_{ti} = f_t\left(K_{ti}, L_{ti}\right)\tau_{ti} w_{ti}$$

where Y_{ti}, K_{ti} and L_{ti} denote the real output, the capital stock and labour in period t $(t = 1, ..., T)$ in country i $(i = 1, ..., N)$, respectively. Furthermore, τ_{ti} $(0 < \tau_{ti} \leqslant 1)$ is the efficiency parameter and w_{ti} represents the measurement error in the identification of the frontier or the stochastic nature of the frontier itself.

As mentioned above, the basic model assumes a flexible translog production function:

$$(2) \quad y_{ti} = x_{ti}^{'}\beta_t + v_{ti} - u_{ti}$$

where:

$$(3) \quad x_{ti}^{'} = \left(1, k_{ti}, l_{ti}, k_{ti}l_{ti}, k_{ti}^2, l_{ti}^2\right)$$
$$(4) \quad \beta_t = (\beta_{t1}, ..., \beta_{t6})'$$

and lower case letters indicate natural logs of upper case letters. The logarithm of the measurement error v_{ti} is $iid\ N(0, \sigma_t^2)$ and the logarithm of the efficiency parameter is one sided to ensure that $\tau_{ti} = \exp(-u_{ti})$ lies between zero and one. The prior for u_{ti} is taken to be a gamma function with a time specific mean λ_t. The contribution of input endowment, technology change and efficiency change to GDP growth is defined in a fairly simple way. The GDP growth rate in country i in period $t+1$ can be written as:

$$(5) \quad y_{t+1,i} - y_{t,i} = \left(x_{t+1,i}^{'}\beta_{t+1} - x_{t,i}^{'}\beta_t\right) + (u_{t,i} - u_{t+1,i})$$

where the first term includes TC and factor accumulation and the second term represents efficiency change. The first term can be further decomposed as:

$$(6) \quad \frac{1}{2}(x_{t+1,i} + x_{ti})'(\beta_{t+1} - \beta_t) + \frac{1}{2}(\beta_{t+1} + \beta_t)'(x_{t+1,i} - x_{ti})$$

The technical change for a given level of inputs results from the first term of the previous equation and is defined as:

$$(7) \quad TC_{t+1,i} = \exp\left[\frac{1}{2}(x_{t+1,i} + x_{ti})'(\beta_{t+1} - \beta_t)\right]$$

and the input change defined as the geometric average of two pure input change effects, relatively to the frontiers successive periods:

$$(8) \quad IC_{t+1,i} = \exp\left[\frac{1}{2}(\beta_{t+1} + \beta_t)'(x_{t+1,i} - x_{ti})\right]$$

The efficiency change is defined as:

$$(9) \quad EC_{t+1,i} = \exp(u_{ti} - u_{t+1,i}) = \frac{\tau_{t+1,i}}{\tau_{t,i}}$$

For each of these growth components 10-year geometric averages are computed. As mentioned above we assumed that TC evolves linearly in each decade. Therefore we adopted the following formulation:

$$(10) \quad \beta_t = \beta^* + t\beta^{**}$$

and

$$(11) \quad \sigma_t^2 = ... = \sigma_T^2 = \sigma^2$$

Thus the model can be written as:

$$(12) \quad y = X^*\beta - u + v$$

with

$$(13) \quad y = \left(y_1^{'}...y_T^{'}\right), u = \left(u_1^{'}...u_T^{'}\right), v = (v_1...v_T)', \beta = \left(\beta^{*'}\beta^{**'}\right)'$$

where β is a 12×1 vector and:

$$(14)\quad X^* = \begin{bmatrix} X_1 & X_1 \\ . & . \\ X_t & tX_t \\ . & . \\ X_T & TX_T \end{bmatrix}$$

where X_t is a 21×6 vector.
At this stage the full likelihood function of the model can be written as:

$$(15)\quad f_N^{TN}\left(y \left| X^*\beta - u, \sigma^2 I_{TN}\right.\right) p\left(\sigma^{-2}\right) p\left(\lambda^{-1}\right) \prod_{t=1}^{T}\prod_{i=1}^{N} f_G\left(u_{ti} \left| 1, \lambda^{-1}\right.\right)$$

where f_N^{TN} stands for a multivariate $T \times N$ normal probability distribution function, f_G stands for a gamma probability distribution function and:

$$\begin{aligned} p\left(\lambda^{-1}\right) &= f_G\left(\lambda^{-1} \left| 1, -\ln\left(\theta\right)\right.\right) \\ p\left(\sigma^{-2}\right) &= \sigma^2 \exp -\frac{10^{-6}}{2\sigma^2} \end{aligned}$$

Note that the prior for λ^{-1} assumes a gamma distribution with the first parameter equal to 1, meaning a very flat prior and second parameter such that $(-ln(\theta))^{-1}$ is the prior median efficiency. We assume $\theta = 0.03$ so that the median of the efficiency distribution is 0.75. The robustness of results to this prior was confirmed taking different initial values for θ. As for σ^{-2} we assume the usual flat prior. Given this prior structure the posterior marginal distributions that compose the Gibbs sampler are easily derived. The conditional for β is:

$$(16)\quad p\left(\beta \left| Data, u, \sigma^{-2}, \lambda^{-1}\right.\right) \propto f_N^{2J}\left(\beta \left| \widehat{\beta},\ \sigma^2\left(X^{*\prime}X^*\right)^{-1}\right.\right)$$

where

$$(17)\quad \widehat{\beta} = \left(X^{*\prime}X^*\right)^{-1} X^{*\prime}\left(y + u\right)$$

The conditional for σ^{-2} to be used in the Gibbs sampler is:

$$(18)\quad p\left(\sigma^{-2} \left| Data, \beta, u, \lambda^{-1}\right.\right) \propto f_G\left(\sigma^{-2} \left| \frac{n_0 + TN}{2}, \frac{1}{2}\left[a_0 + \left(y - X^*\beta + u\right)'\left(y - X^*\beta + u\right)\right]\right.\right)$$

Next, the conditional for u is:

$$(19)\quad p\left(u \left| Data, \beta, \sigma^{-2}, \lambda^{-1}\right.\right) \propto f_N^{TN}\left(u \left| X^*\beta - y - \frac{\sigma^2}{\lambda} i, \sigma^2 I_{NT}\right.\right)$$

Finally the marginal posterior distribution for the λ^{-1} is:

$$(20)\quad p\left(\lambda^{-1} \left| Data, \beta, u, \sigma^{-2}\right.\right) = f_G\left(\lambda^{-1} \left| 1 + TN, -\ln\left(\theta\right) + \sum_{t=1}^{T}\sum_{i=1}^{N} u_{it}\right.\right)$$

The sequential Gibbs sampling algorithm defined by equations 16 to 20 was run with 420.000 iterations for each separate decade, with a burn-in of the first 20.000 iterations to eliminate possible start-up effects. The traditional algorithm convergence criteria were computed and the posterior distributions were analyzed.

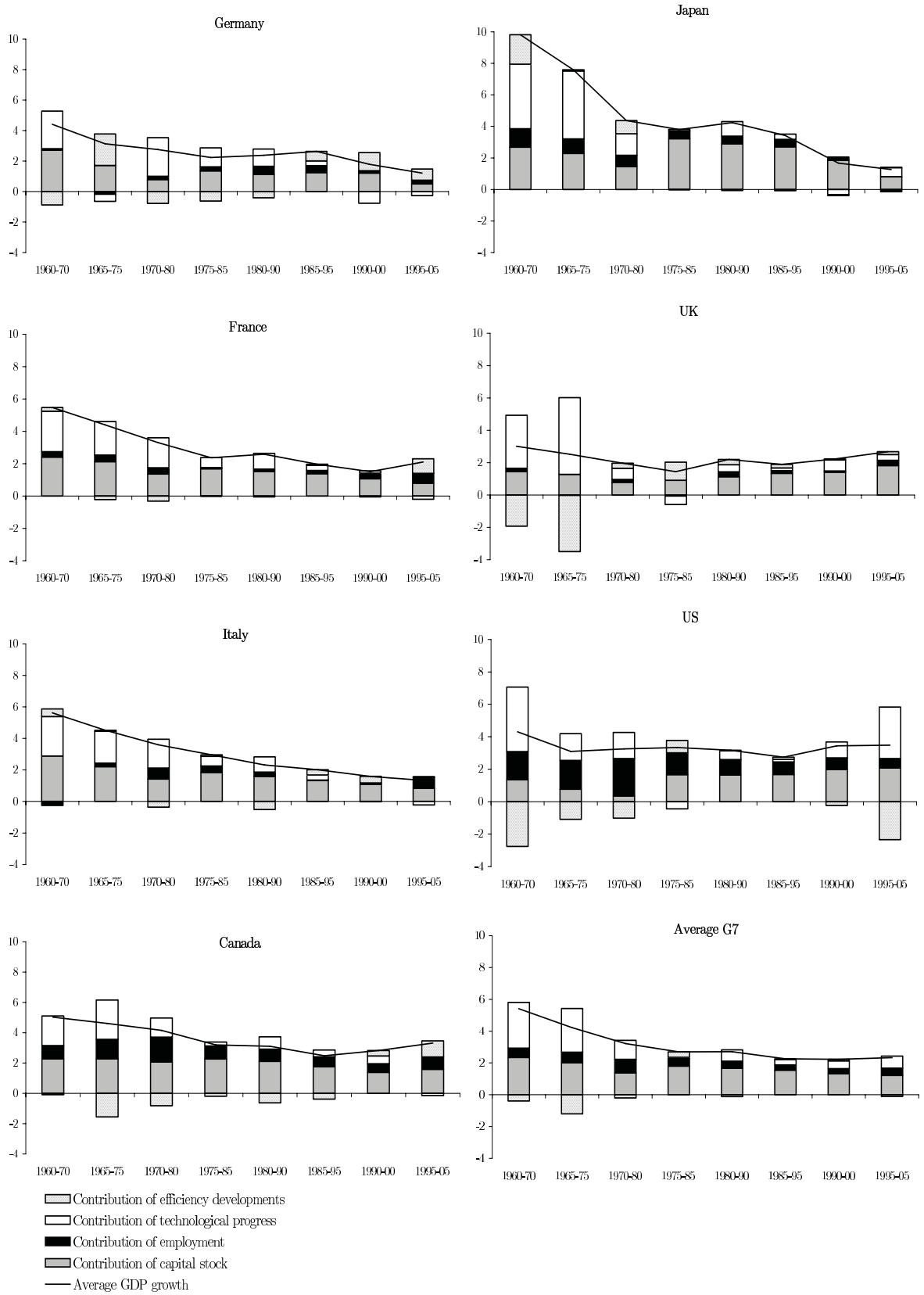
Database

The data used for employment and GDP from 1960 until 2005 was obtained from the European Commission AMECO database (December 2005 version). As for the capital stock, for the first period in the sample, the stock of capital in each country was obtained from King and Levine (1994). These levels were updated using the capital real growth rates existing in the AMECO database. The reasons for this procedure are twofold. On the one hand, we did not adopt the initial capital stock of AMECO because, as an assumption, it simply corresponds to 3 times the GDP at 1960, which is an obvious limitation. On the other hand, it is not possible to use only data from King and Levine because it ends in 1994. Other alternative series of capital stock were tested but the results do not change qualitatively. It should be noted that, in spite of the international conventions on national accounts compilation, there are important country specific practices that tend to blur international comparisons. The compilation of value added for some services, namely those associated to general government activities, also poses difficulties in international comparisons. These problems may affect the results obtained, though, we hope, not dramatically.

Growth Accounting for the G7 Countries - Country specific results

Figure 1 plots the contributions of factor endowments and TFP to the average real GDP growth rates of the G7 countries. The contribution of inputs is separated into labour and capital, using the respective computed elasticities, and the contribution of TFP is disentangled into TC and efficiency developments (the numeric results basing this graph as well as other details of the growth accounting exercise can be found in a extended version of this paper, available as working paper at Banco de Portugal website in the following address: http://www.bportugal.pt/root/publish/wp/2007-9.pdf). Next we briefly analyze the results for each country. The US economy presents a relatively stable growth pattern. Firstly, it presents average growth rates around three and four per cent in the decades considered. Secondly, it shows a relatively high contribution of labour to GDP growth during all the periods considered. Part of this reflects the entrance of baby boomers in the US labour market during the 1960's and the 1970's and significant immigration flows. Thirdly, the contribution of capital is close to the G7 average, showing some increase in the last decades. As for TC, there were positive but decreasing contributions to GDP growth in the beginning of the sample, reaching a negative value in the decade 1975-85, the period when the effect of oil shocks was mostly felt. After that period the contributions increased, reaching more than 3 per cent in the decade 1995-05. The contribution of TC to GDP growth is strong in the first and last decades. Nevertheless, in both periods the contribution of efficiency was negative, partly offsetting the contribution of technology. We discuss the interpretation of such result in the next subsection. The growth pattern of Canada resembles that of the US in some points. The contribution of employment to GDP growth is also significant. The contribution of capital is also important and stable. Nevertheless, the contribution of TC in the last two decades considered is smaller than in the US and there is a considerable contribution of efficiency in the period 1995-2005. As regards the G7 countries that are euro area members - Germany, France and Italy - some differences in the growth patterns are identified. Germany recorded a trend decrease in the average GDP growth rates mostly attributable to a lower TFP contribution. The labour contribution has been low with the exception of the 1980-1995 period and the contribution of capital accumulation was lower than in the US and Canada with the exception of the 1960-70 decade. As for TFP performance the TC contribution decreased since the 1970's, being negative in the period 1990-2000. This latter result is probably capturing the consequences of the German reunification. Conversely, in the period 1990-2005 the efficiency contributed positively to GDP growth, meaning that, although the existing input combination penalized growth, the economy became closer the computed production frontier. The

Figure 1: Growth accounting in the G7 countries



French economy shows a qualitative behaviour that is close to the Italian case, and, to a lesser extent with Germany. In fact, comparing with Germany two major exceptions are worth mentioning. Firstly, the contribution of technology to GDP growth in the decade 1990-2000 is not negative. Nevertheless, it is close to zero and it has shown a significant decrease since the 1960's. Secondly, there is a large contribution of labour input to growth in the period 1990-2005. The Italian economy recorded a continuing decrease in the 10-year average real GDP growth rate since the 1960's. This story of decline is mainly associated with the decreasing contribution of TC. This is similar to what was identified for France and Germany, but unlike these countries it has not benefited from increased efficiency in the last decade considered. Though, like France, it recorded a positive contribution of employment in the 1995-2005 period. The UK shows a poor growth pattern in the period considered, though with some revival in the last decade. Is has not recorded high real GDP growth rates during the 1960's and 1970's and the recent performance is only slightly better than that of the G7 countries that are euro area members. The contribution to GDP growth is shared by all factors, with a predominant role for capital. In the period 1960-1975 the contribution of TC was very high, partly offset by efficiency losses. Such TFP pattern has been attributed to underinvestment and restructuring in some industries, driving to a shift of resources to services. The improved performance recorded in the last decade may reveal some payback of these structural changes. The Japanese economy recorded a golden economic growth period in the 1960-1975. The contributions of inputs and mostly of technology gains were strong. From the 1970's until the 1990's the growth pattern changed with real GDP growth benefiting mostly from capital accumulation, labour input and some technological gains. In the 1990s the asset bubble crisis translated into a negative contribution of TFP (both technology and efficiency) to GDP growth. In the 1995-2005 period the average GDP growth was low, relying on the contribution of capital and technology.

Growth Accounting for the G7 Countries - general results

One of our general results confirms that a large part of economic growth tends to be is attributable to TFP. So in this respect, no news. However,when looking at the contribution of technology and efficiency to the overall TFP performance some results are worth mentioning. Firstly, the contribution of TC is stronger than efficiency improvements. Secondly, the periods of high technology gain are frequently associated with negative contributions of efficiency. A possible explanation may argue along the following lines. When new technologies appear, countries may have an input-mix that is suitable to take advantage of these gains. However, while these new techniques are not effectively adopted, the GDP growth will not reflect these potential gains and the contribution of efficiency is reduced. In addition, it is also true that periods of strong TC imply high adjustment costs that, in our model, would be captured in the efficiency component. Another result that deserves mentioning is the changing we have observed in the shape and in the dynamics of the computed world translog production function. The changes seem to indicate that that new technologies favor higher capital-labour ratios, meaning that the TC and potential TFP gains are centered in sectors with higher capital content. Such finding is consistent with the idea that productivity gains are essentially associated with technology and capital intensive economic activities. The changes in the shape of the stochastic IPF have consequences in the elasticities computed for capital and labour in each country. The path of the computed elasticities for capital in the G7 countries was quite similar until the period 1995-2005. It is noticeable a sharp decrease in the capital elasticity in the 1970-1980 period, where severe supply shocks occurred. In the recent periods the surface of the stochastic production function seems to have became more convex, setting higher computed elasticities of capital for large economies with lower capital-labour ratios. Finally, a related debate concerns the type of returns to scale. The neoclassical view bases on the principle that capital presents diminishing returns at some point, leaving produc-

tivity gains to be explained by TC. However, the new growth theory, based on endogenous growth models, deviated from this result either based on the existence of spillovers or on issues of measurement and quality of the production factors. Departing from a simple growth accounting perspective, our analysis provides some results in this area: the sum of the capital and labour elasticities seems to point to the existence of increasing returns to scale in the G7 countries.

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RÉSUMÉ (ABSTRACT)

The paper presents results of a non-conventional economic growth exercise for the G7 countries, from 1960 until 2005. A dynamic international translog stochastic production frontier is computed through Bayesian statistical methods using panel data on 21 OECD economies. Economic growth is decomposed in TFP and input accumulation contributions', the former being divided in two components: efficiency developments (the distance to the world production function) and technological change (the expansion of the world production function). The paper adopts the methodology suggested by Koop, Osiewalsky and Steel (1999), though it covers a much larger period, allowing for the identification of intertemporal growth patterns. The growth accounting exercise is carried out for eight periods, each one covering ten yearly growth rates, with overlapping sub periods of five years. The results obtained show that the contribution of technological change to total TFP is typically stronger than efficiency improvements. The US and Canada recorded a TFP acceleration after the mid 1980s, following declines in the previous decades. In addition, the inputs accumulation gave a relatively stable contribution for GDP growth throughout the sample period. Italy and France present a continuous declining trend in TFP contribution, though more marked in the latter case. Germany and the UK seem to have moved to a new lower floor of TFP contribution in the last decades. Japan, presents a downward trend in TFP contribution that is even more pronounced than in Italy. However, some reversal was seen in the Japanese TFP in the last decade considered. The shape of the international stochastic production function changed along the period considered, benefitting more capital intensive input-combinations, more pronounced for larger economies. In addition, there is some evidence of increasing returns to scale in the G7 countries.

How to generate macro data relying on survey micro data on household's wealth?

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I. Introduction

Information on the level, the composition and the distribution of wealth across households is an important element for both economic analysis and economic policy.

The lack of information on real assets and on the distribution of wealth across households have been the leitmotiv for producing a survey on Portuguese households wealth (*Inquérito ao Património e Endividamento das Famílias*, hereafter IPEF) by the central bank in association with the National Statistical Institute (NSI)[1]. This survey is the only statistical source that makes it possible to link information on income, expenditure, financial assets, real assets and debts of households. The micro data obtained from the survey has been used to study the heterogeneity of households behaviour, namely the differences in the share of risky assets in their portfolios and the size of their debts, according to several characteristics like income, education levels, age or region. The survey results were also useful to clarify some puzzling aspects in macroeconomic analysis, which will be mentioned further on, and to give some inference on the average size and structure of households wealth.

The paper is organized as follows: in the next section, there is a brief reference to the survey's advantages and shortcomings; in the third section, it is presented an example on how the survey results were important to understand the macroeconomic developments in the Portuguese economy; in the fourth section, macro data derived from the survey on the average size and structure of households wealth are commented; and finally, the last section concludes with some remarks.

II. IPEF advantages and shortcomings

The IPEF has been conducted by the central bank and the NSI as an additional module of an already existing survey[2]. The central bank provides financial support, collaborates in the questionnaire conception and supplies technical training to the NSI interviewers. The NSI monitors all the field work and produces the data base combining the wealth data with information from the associated survey. This data base, after being subject to an anonymisation procedure, is then provided to the central bank.

Hence, the IPEF has not been an entirely independent statistical operation. The reasons for these associations were mainly the following: i) the possibility of crossing information on wealth with information on other socio-economic characteristics obtained from the other survey; ii) the relatively large sample size, including more than 6 thousand households (for the last one it is expected to have information on more than 8 thousand households); iii) the feature of being monitored by the NSI, gives the IPEF more credibility and integrity than in the case of private agencies involvement in data collection.

However, the survey has an important drawback. The sample design does not take into account the specificities of wealth surveys. The consequent problems, that are well documented in the literature[3], are mainly the following: i) as the wealthy households are a small fraction of the population, the probability of

[1] Until now, there were three editions of the IPEF: the first in 1994, the second in 2000 (whose results are used in this paper) and the third in 2006/2007. Unfortunately, the data from the last one was not yet available when this paper was concluded.
[2] The IPEF was associated with the employment survey in 1994 and with the households budget survey in the other two editions.
[3] See for example Kennickell, 2005.

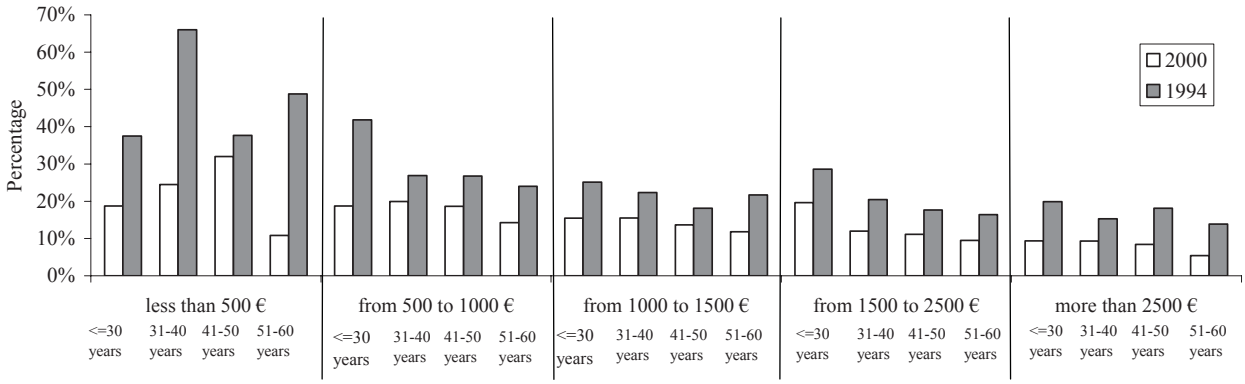
being selected in the survey sample will be in dramatic contradiction with their relative share in total wealth; ii) the propensity to respond to surveys on wealth is smaller in the case of wealthy households; and iii) the probability of underreporting the level of owned assets (particularly, financial assets) is also higher in the case of wealthy households. Additionally, in absence of adequate incentives, the interviewers may not exert the necessary efforts in interviewing rich people. All these aspects would suggest the need for "over-sampling" the rich households.

However, the relatively large size of the sample and the availability of information on some benchmark variables tend to compensate the above mentioned problems. Moreover, the difficulties associated with the under-representation of wealthy households do not seem to affect in the same manner all types of assets and liabilities. As a matter of fact, some real assets, like principal residence and related debt, appear to be less affected[4].

III. The use of micro data in macro-economic monitoring

In Portugal, in the second half of the nineties, there was a considerable and sudden rise in households indebtedness to historical unprecedented levels (from 36 per cent of disposable income in 1995 to 85 per cent in 2000). These developments reflected the decrease of interest rates and also changes in the supply side of the credit market that allowed more households to enter the credit market (see Ribeiro, 2007). This is important to understand why private consumption kept growing above GDP after EMU accession. The results of the IPEF provide evidence of a significant lowering of liquidity constraints on households expenditures in that period. Chart 1 presents the survey data broken down according to household monthly income and age of the representative[5]. Comparing the results obtained in 1994 and in 2000, for all the categories of (age/income) considered, there was a considerable decline of the average debt burden. In fact, micro level survey data was very useful in disentangling the growing number of indebted households from the increase in the average leverage of individual households. According to the survey data the rise of household indebtedness at an aggregated level was not achieved at the expense of increased leverage at the individual level. Rather, they are supportive of increased possibilities for household to smooth consumption over the business cycle. Since 2000, aggregate indebtedness has continued to rise steadily, so that a more recent picture of households' leverage at the micro level is of utmost importance.

Chart 1 - Average debt burden by sub sample of IPEF – income and age



IV. Some macro data derived from the survey

The previous example showed the importance of distributional considerations (only possible with micro data) for understanding the behaviour of macroeconomic variables. Micro survey data may also be very useful in complementing the usual sources for the compilation of aggregated data. This section of the

[4] In Portugal most of the households own their residence, and, in general, they tend to a have an associated mortgage.
[5] For details see Farinha (2004).

paper presents estimates of the population averages for some key variables. These estimates were obtained from the 2000 survey results after adjusting the original sample data. The adjustment aims at reducing the consequences of the under-representation of rich households due both to the sample design and the incidence of non-response. The next subsection briefly describes the methodology followed.

IV.1 the methodology

The methodology followed in this paper corresponds in practice to a special form of adjustment of the original micro data[6]. This special form refers to the class of Generalized Regression Estimators (GREG). This adjustment makes use of known population values for some of the variables that are potentially correlated with non-coverage and non-response. The relation between each variable of interest and these auxiliary variables is parameterised using standard linear regression in a multivariate context. For each variable of interest, the proposed estimator for the population average is given by:

$$\bar{y}_{GREG} = \bar{y}_S + (X_P - \bar{X}_S)\hat{B}$$

where $\bar{y}_S$ is the sample average of the interest variable, X_P and $\bar{X}_S$ and are respectively the vectors of population and sample values of the auxiliary variables. $\hat{B}$ is a vector of estimated coefficients obtained in the following regression model:

$$\tilde{y}_i = \tilde{X}_i B + \varepsilon_i \quad i = 1,...,N_S$$

where, for household *i*, $\tilde{y}_i$ is the weighted level of the interest variable and $\tilde{X}_i$ is the vector of the weighted levels of the auxiliary variables. N_S is number of sample elements.

To obtain the population reference values for the auxiliary variables the following sources were used: a) 2001 Census data on age, degree of education, number of persons per household, by geographical location; b) national accounts data on disposable income; c) Banco de Portugal data on credit to households with geographical breakdown[7]. The variables of interest correspond to the main groups of assets (real and financial assets) and liabilities.

IV.2 the results

Table 1 presents the results obtained for those variables, in 2000, before and after the adjustment. In addition, it includes the results for Italy reported by Brandolini et al (2004), just to have a reference to confront with our results in very broad terms[8].

Table 1 - Household net worth in 2000 - euro and percent

Wealth component	Portugal				*Italy*			
	Unadjusted survey data		Adjusted survey data		*Unadjusted survey data*		*Adjusted survey data*	
	Mean	Share	Mean	Share	*Mean*	*Share*	*Mean*	*Share*
Total tangible assets	99322	94,2	157076	90,3	*164200*	*87,1*	*195500*	*72,5*
Principal residence	62194	59,0	86055	49,5	*94500*	*50,1*	*101600*	*37,7*
Other real estate	23577	22,4	52405	30,1	*30900*	*16,4*	*52400*	*19,4*
Other tangible assets	13551	12,9	18615	10,7	*38800*	*20,6*	*41500*	*15,4*
Total financial assets	11479	10,9	25845	14,9	*27800*	*14,7*	*77900*	*28,9*
Transaction and savings accounts	8628	8,2	16661	9,6	*13100*	*6,9*	*30600*	*11,3*
Other financial assets	2851	2,7	9184	5,3	*14700*	*7,8*	*47300*	*17,5*
Total assets	110801	105,1	182921	105,1	*192000*	*101,8*	*273400*	*101,4*
Debt	5383	5,1	8902	5,1	*3400*	*1,8*	*3700*	*1,4*
Net worth	105417	100,0	174019	100,0	*188600*	*100,0*	*269700*	*100,0*

According to the adjusted figures, the average net worth of the Portuguese households in 2000 would have been almost 175 thousand euros. In terms of its composition, the tangible assets were clearly predominant and the principal residence was by far the main asset. The financial assets were mainly

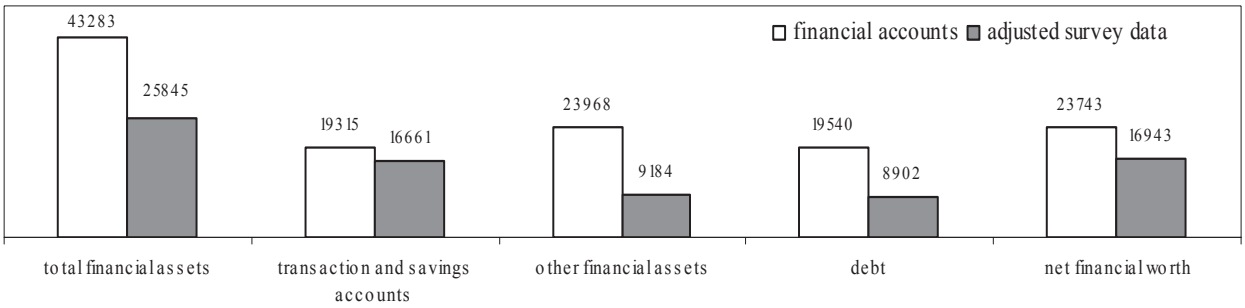
[6] For a survey on these methods see for example Kalton and Flores-Cervantes, 2003.
[7] Data from Banco de Portugal central of credits register, which has information on all loans granted by credit institutions and includes several characteristics on each debtor, namely its location.
[8] To facilitate this general comparison, the same terminology was adopted.

composed by deposits. These results should be taken with caution given the significant statistical limitations associated to the adjustment method. In particular, the experience with the IPEF, suggests an underestimation of both "Other financial assets" and "Debt", even after the adjustment. On the contrary, "Other real estate" might be overestimated.

Chart 2 compares the adjusted survey data and Financial Accounts (FA)[9]. As it can be seen, both in terms of assets and of liabilities the figures obtained from the survey are smaller. The main differences occur in the "Other financial assets" (bonds, shares and other equity, investment trust units) and in the "Debt", which might indicate that the adjustments made in the IPEF original data, although very considerable, still underestimate the population values. The difference in net financial worth is less pronounced.

Unfortunately, unlike financial wealth, there is no information on total real assets of households. However, in a recent study by Cardoso and Cunha (2005), using the perpetual inventory method, the housing wealth was estimated to be almost 50 thousand euros per household, in 2000. Nevertheless, according to the survey, the unadjusted average value of the principal residence is, by itself, larger than that figure. This discrepancy may in part reflect different valuation criteria, but its magnitude suggests the need for further work in the estimation of the stock of capital attributed to households. This is an important insight coming from the survey, since the stock of capital is a key variable in most macroeconomic structural models.

Chart 2 -Average financial position of households in 2000 (in euro)



V. Concluding remarks

In conclusion, the following remarks deserve to be mentioned: (i) the survey micro data, even without any kind of extrapolation is useful for macroeconomic analysis, as the example of the households debt burden has shown; (ii) although affected by under representation of wealthy households, it is possible, using some population benchmarks, to moderate the impact of this problem on the survey results; (iii) the adjustment exercise pointed to an average net worth of Portuguese households of near 175 thousand euros in 2000, although this value should be taken with caution given the limitations of such exercise; (iv) in fact, despite the adjustment made, the households average financial wealth continues to be downward biased comparing with FA; (v) finally, in the case of real estate, the survey results point to a possible underestimation of the Portuguese households capital stock.

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[9] In order to render the comparison more accurate some adjustments were made in FA (e.g. emigrants deposits were excluded).