Sectoral Interlinkages in Chile: An Implementation of National Accounts by Institutional Sector

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N.° 97 May 2013
BANCO CENTRAL DE CHILE
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Sectoral Interlinkages in Chile: 
An implementation of National Accounts by Institutional Sector*

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Abstract  
This paper presents the methodology for measuring the sectoral interlinkages or from-whom-to-whom matrices for deposits and loans covering the period 2008-2012. In addition, the results are presented as networks which allow relationships to be analyzed between different sectors. These matrices indicate which institutional sector has initiated a transaction (outstanding amount or financial transaction) and identifies the counterparty sector. The results highlight the importance of the relationship of Deposit-taking corporations with Households and Non-financial corporations, both for deposits and loans, as well as the important structural differences that arise when comparing the relationship between the institutional sectors in Chile and the Eurozone.

Resumen  
En este trabajo se presenta la metodología de medición de las exposiciones intersectoriales o matrices de quién a quién -para depósitos y préstamos- para el periodo 2008-2012, y además, se muestran los resultados en visualizaciones de redes, que permiten analizar las relaciones entre los distintos sectores. Estas matrices indican qué sector institucional ha realizado una transacción (saldo u operación financiera) y cuál ha sido el sector de contrapartida. En los resultados se destaca la importante relación de Bancos y cooperativas con Hogares y con Empresas no financieras, tanto para depósitos como para préstamos, y también, las importantes diferencias estructurales que surgen al comparar las relaciones entre los sectores institucionales de Chile y de la Eurozona.

* The views contained in this document are the sole responsibility of the author and do not necessarily represent those of the Central Bank of Chile. I am very grateful for the comments and suggestions received. E-mail: ifernandez@bcentral.cl.
I. Introduction

The global financial crisis that erupted in 2008 revealed the importance of monitoring the financial market, the financial instruments traded and the actors involved, among other factors. In this context the information from the National Accounts by Institutional Sector (NA-IS) provide the background for the analysis of these variables, under the integrated and unified framework that comprises the System of National Accounts (SNA).

A variety of literature explains the importance of these records, from its early developments within the U.S. Federal Reserve Board in the 1940s until today. By way of example, Copeland (1949) explained the importance of knowing where money comes from and where it is going to explain the birth of these accounts. The Board of Governors of the Federal Reserve System (1993) prepared a Flow of Funds manual, which addressed in detail the organization and uses of these accounts in the United States. Teplin (2001) highlighted the usefulness of these accounts in the same country for the study of the relationships between real and nominal developments. Finally, Be Duc and Le Breton (2009) presented a flow of funds analysis for the European Central Bank (ECB), explaining its uses in monetary analysis, in financial stability, and in projections or scenario analysis.

More recently, the ECB has published various articles on the uses or applications of these figures, and Kobayakawa and Okuma (2012) of the Bank of Japan have published the main features and improvements that are being implemented in flow of funds measurement and analysis.

In Chile, literature on the subject is based on publications of the Central Bank of Chile (CBCh). In 1967, in conjunction with Chile’s National Planning Office (Odeplan), the CBCh published background material to analyze the forms of financing in the economy and the development of the financial system, through the compilation of accounts that tracked sources and uses of financial funds for the years 1960-1964. Later, the Central Bank of Chile (1995) published the financial accounts of the Chilean economy for the years 1986-1990, which have subsequently been published every year. Recently the Central Bank of Chile (2011) began publishing the methodology and the results of the NA-IS on a quarterly basis.

From the basic information used to compile these accounts, or from the estimates used in their construction, it is possible to identify not only the types of financial instruments used in balance sheets, but also, the counterparty institutional sector of those transactions, specifically from which institutional sector a certain financial instrument was acquired or sold. This type of reporting is referred to as “from-whom-to-whom matrices”.

These matrices provide information on the channels of funding between institutional sectors and the possible contamination that may arise from problems in a particular sector. Therefore, they allow identifying receivable or payable positions at the end of a period for a particular sector in comparison to other sectors of the economy or the Rest of the world. The Financial Stability Board

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1 The NA-IS were published for the first time in July 2011 on a quarterly basis, covering the period 2005-2011 consistent with the 2003 benchmark compilation, which was valid until then.
(FSB) recommends the capture and development of this type of information (FSB, 2011) which allows the analysis of exposures across sectors, and that Shrestha, Mink and Fassler (2012) of the International Monetary Fund (IMF) and the European Central Bank (ECB) promote the compilation and publication of the same.

However, these matrices have been published in only a few countries, due to restrictions in available information. Countries or organizations that currently publish such information include Japan, the ECB and some countries of the European Community such as Austria and Spain, among others.

In Chile, the National Accounts by Institutional Sector incorporate a from-whom-to-whom basis within financial flows, which is updated quarterly and referenced in this paper to loans and deposits.

In this context, the purpose of this paper is to disseminate the methodology and measurement of the from-whom-to-whom matrices and explain the content and scope of this new data. Simultaneously with the publication of this study, matrices of financial transactions and outstanding amounts will be distributed to the statistical database of the Central Bank of Chile.4

The presentation of the results is accompanied by a networking visualization tool, which allows the examination of interrelationships using charts that summarize the information contained in the matrices. These graphs are obtained using the Pajek program, whose operation is explained in annex 2 of this paper. This display form that facilitates data analysis has been used in publications by Austria5 and Japan,6 for example.

This paper is divided into four sections: section II provides a brief description of the conceptual framework, focusing on the System of National Accounts and its structure. Section III explains the methodology for measuring the from-whom-to-whom matrices. Finally, section IV discusses the results using network visualization.

II. Conceptual framework

This section describes the conceptual framework of the National Accounts by Institutional Sector, and contains three aspects: a synthesis of the structure of the System of National Accounts; a conceptualization of the Financial Account and Flow of Funds; and a description of the uses of the flow of funds.

A. The System of National Accounts

The objective of the national accounts is to measure the processes of creation, distribution and ownership of value, referring to a country, a group of countries or a region, through transactions of goods and/or instruments between agents.

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5 By way of example, see Oesterreichische Nationalbank (2011) at: <http://www.oenb.at/en/img/shst_2010_june_sector_accounts_tcm16-236095.pdf>
The compilation of these statistics is referenced to the System of National Accounts (SNA)\(^7\), which provides recommendations for the accounting standards needed for their development and representation. Accordingly, international comparisons can be made of the economic performance of different countries, a macroeconomic analysis of these figures, and subsequent monitoring the behavior of the economy.

The accounts that make up the SNA are instruments that measure employment and resources or variations of positions of assets and liabilities of the economy at any given moment. Therefore, concepts are used for their measurement that respond to different questions enabling an economic analysis of the figures: units and institutional sectors (who?), transactions and other flows (what?), assets and liabilities (what positions?), products and production units (other aspects of who and what?), and purposes (why?).

According to the SNA 2008\(^8\), the core of the national accounts is comprised of two basic components: the “sequence of accounts” within the framework of integrated economic accounts (which include institutional sectors, transactions, and assets and liabilities), and “goods and services accounts” which include industries and products, where each component responds to a specific purpose.

The integrated economic accounts register, for example, the use of income, the saving, and the outstanding amounts of assets and liabilities for an accounting period. They are composed of three parts: the Current Accounts, Accumulation Accounts and Balance Sheets. In addition, these accounts are recorded by institutional sector and for the Rest of the world, which it is shown in a simplified presentation in table 1\(^9\).

\begin{table}[h!]
\centering
\begin{tabular}{|c|c|c|c|c|c|c|c|c|c|c|}
\hline
 & Good and Services & Rest of the World & Total Economy & Institutional Sectors & Transactions & Balancing items & Institutional Sectors & Total Economy & Rest of the World & Good and Services \\
\hline
\textbf{Current accounts} & & & & & Assets & and liabilities & & & & \\
Uses & & & & & Resources & & & & & \\
\hline
\textbf{Accumulation accounts} & & & & & & & & & & \\
Changes in assets & & & & & & & Changes in liabilities and net worth & & & \\
\hline
\textbf{Balance sheets} & & & & & & & & & & \\
Assets & & & & & & & Liabilities and net worth & & & \\
\hline
\end{tabular}
\end{table}

Table 1. National Accounts by Institutional Sector (simplified presentation).

The goods and services accounts are made up of the supply and use tables, which allow for the development of macroeconomic aggregates focusing on production, income and expenditure, additionally being the source from which the input-output tables are built.

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\(^7\) In Chile, the National Accounts are based on the SNA 1993, and the implementation of the SNA 2008 is being studied. For further background, see at: <http://unstats.un.org/unsd/discussion/Sna.asp>.

\(^8\) A similar description is given in the SNA 1993, which identifies a central framework divided into 5 parts (in the SNA 2008 these are all included within the two components mentioned above).

\(^9\) In Chile, this first part is measured in the NA-IS.
B. Financial account and flow of funds

This paper focuses on the financial account and flow of funds, which records transactions of financial assets and liabilities that take place between institutional sectors, and between these and the Rest of the world (in conjunction with the capital account, shaping the accumulation account presented in table 1). In the SNA 1993\(^\text{10}\), assets are classified into seven categories sorted by their degree of liquidity, as seen in table 2.

<table>
<thead>
<tr>
<th>Changes in assets</th>
<th>Changes in liabilities and net worth</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>F.1 Monetary gold and SDRs</td>
<td>F.2 Currency and deposits</td>
</tr>
<tr>
<td>F.2 Currency and deposits</td>
<td>F.3 Securities other than shares</td>
</tr>
<tr>
<td>F.3 Securities other than shares</td>
<td>F.4 Loans</td>
</tr>
<tr>
<td>F.4 Loans</td>
<td>F.5 Shares and other equity</td>
</tr>
<tr>
<td>F.5 Shares and other equity</td>
<td>F.6 Insurance and technical reserves</td>
</tr>
<tr>
<td>F.6 Insurance and technical reserves</td>
<td>F.7 Other accounts receivable</td>
</tr>
<tr>
<td>F.7 Other accounts receivable</td>
<td>B.9 Net lending (+)/Net borrowing (-)</td>
</tr>
</tbody>
</table>

Source: Author’s elaboration based on diagram 2.1 of SNA 1993.

The financial account registers by type of instrument the acquisitions or disposals of financial assets and liabilities. The accounting balance is the net lending or net borrowing; a net lending arises when net savings and capital transfers are greater than the accumulation of non-financial assets (surplus), while net borrowing occurs when these variables are insufficient to do so (deficit).

Therefore, the financial account indicates the manner in which the surplus or net lender sectors assign their surpluses, acquiring financial assets or reducing liabilities, and the manner in which the deficit or net borrower sectors obtain the necessary resources incurring new liabilities or reducing assets.

This account records two basic types of information: the stocks or outstanding amounts (elements of the sectors’ balance sheets); and flows (changes in positions due to transactions, due to the effects of valuation changes and reclassifications).

Therefore, the financial account allows the analysis of the types of financial instruments used by institutional sectors to finance their deficits or allocate their surpluses. However, the sectoral information does not indicate the counterparty, essentially from which institutional sector the asset or the liability was acquired.

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\(^{10}\) The SNA 2008 changed the names “securities other than shares” to “debt securities” and “shares and other equity” to “equity and investment fund shares”. The category of financial derivatives previously introduced when the SNA 1993 was updated, has been extended to include employees’ stock options.
This type of information is captured by the flow of funds\textsuperscript{11} or from-whom-to-whom matrices, being a three dimensional representation of the financial account defining the two parties to the transaction—the debtor and the creditor—and defining the financial instrument involved.

This information allows identifying the financial relationships between institutional sectors, and thus it improves the understanding of the role of financial flows in the economy.

C. Uses of flow of funds or from-whom-to-whom matrices

When the information in these tables is sufficiently detailed and in combination with information from other accounts in the system, various analyses can be produced, such as describing financial structures, monetary analysis, economic analysis and sensitivity analysis. This document deals with the first point, namely the analysis of financial structures that enable an examination of the interrelationships between various market participants.

Monetary analysis can be used to study the liquidity of economic sectors (interdependencies between liquid assets and other financial instruments\textsuperscript{12}) using the financial accounts, and complemented by the from-whom-to-whom matrices. Furthermore, this data allows the monitoring of financial intermediation and understands the origin of resources within the financial market.

Likewise, these accounts can be useful in monitoring financial stability and macro-prudential analysis, since knowledge of the existing relationships between sectors enables the identification of potential contamination or risk exposure between financial institutions, or with non-financial institutions.

When used in economic analysis, this information can help supplement a descriptive review of activities or of economic sectors, or can be used in composition studies for the development of different policies.

In addition, the availability of long-term data can be used to examine the consistency of projected sectoral results and the implications for their stocks and flows. Similarly, it can be used to estimate the sensitivity of demand of certain financial instruments by institutional sector.

Finally, although the possible uses of these matrices are varied, their implementation will critically depend on the availability of information, because in practice it is difficult to obtain data to form all the financial relationships for each instrument and thus obtain a complete picture of the financial interrelationships within the economy. For this reason, official international publications of this data are influenced by the timeliness, quality and importance of the underlying information, in proportion to the development of the statistical system in each country.

\textsuperscript{11} In varied literature, the term flow of funds is interchangeable with financial account. In this paper these shall be differentiated, as in the System of National Accounts.

\textsuperscript{12} It is worth mentioning that there may be some differences in the definitions of money included in the financial account (based on the SNA) compared to those of monetary statistics (monetary aggregates).
III. Measurement of the from-whom-to-whom matrices in Chile

In Chile, the NA-IS measure current accounts, accumulation accounts and financial balance sheets. These statistics have been compiled every year since 1996, with a lag of 15 months in their publication. Their quarterly frequency began in 2008 with a lag of 115 days. Currently, there exists quarterly information since 2005.

The from-whom-to-whom matrices are implicitly generated during the elaboration of the NA-IS, and they are a tool in the balancing or reconciliation of the financial accounts. In this section the methodology and sources used to obtain the from-whom-to-whom matrices are explained, specifically for the case of deposit and loan instruments.

A. Methodology

The measurement of the financial account and flow of funds starts with the collection of individual financial statements, classified by institutional sector, which are then grouped into: Non-financial corporations, the Central Bank of Chile, Deposit-taking corporations\textsuperscript{14}, Other financial intermediaries and financial auxiliaries, Insurance companies, Pension funds, Households and non-profit institutions serving households (NPISHs), the General government, and the Rest of the world.

For two consecutive periods each item of financial assets and of equity within the financial statements is transformed into a national accounts concept, where the classification may differ from that used in business accounting. From these items, it is possible to identify “who” is awarded a financial instrument, and “who” is providing this instrument, being the counterparty.

The individual accounts of Financial corporations are measured using financial statements and supplementary information from regulatory agencies in some sub-sectors, which allow a more detailed breakdown of the available assets in their balance sheets.

Meanwhile, for Non-financial corporations' financial statements, supplementary information from regulatory agencies and tax records are used, subject to availability.

The financial accounts of Households and NPISHs are calculated from the variables of the counterparties across the remaining sectors, i.e. the amounts that other sectors acquire from or supply to Households.

The financial accounts of the General government sector and the Rest of the world are computed from information on the wealth of the state, the Balance of Payments and the International Investment Position statistics.

\textsuperscript{13} For more information, see: National Accounts by Institutional Sectors, NA-IS. Methodologies and Results 2005-2011q1” (CBCh, 2011), available at: <http://www.bccentral.cl/estudios/estudios-economicos-estadisticos/pdf/see87_Eng.pdf>

\textsuperscript{14} Corporations include those monitored by the Superintendence of Banks and Financial Institutions (SBIF).
Once the financial accounts have been compiled by institutional sector, an inter-sectoral balancing process begins with the aim of ensuring consistency throughout the system. This process is based on the quadruple entry accounting principle, meaning that a transaction between two agents generates income/liability entries and expense/asset entries for every economic agent involved\(^{15}\).

The balancing process uses from-whom-to-whom matrices that emanate from compiling accounts by institutional sector\(^{16}\). However, these matrices are usually incomplete due to missing data or discrepancies in information between institutional sectors. These situations are resolved through an arbitration process based on rules associated with the hierarchical structure of the sources of information, according to their degree of robustness. These criteria are defined for each transaction between two agents following the principle of quadruple entry and maintaining the following identities:

\[
\text{Debit} = \text{Credit} \\
B_t = B_{t-1} + F_t + V_t,
\]

where \(B_t\) is the balance sheet (stock or outstanding amount) of financial instruments at the end of period \(t\), \(B_{t-1}\) is the balance sheet at the end of the previous period, \(F_t\) are the transactions (flows) of the financial account in the period \(t\), and \(V_t\) are other changes caused by variations in the volume of assets and by gains in nominal holdings of instruments.

The reconciliation of the flows and stocks within the financial account is based upon the information from the counterparty of each account for each institutional group. For example, the information about an asset purchased by a given sector is compared with the information regarding the liability within the sector that sold that asset, when the data is available.

This process is broken down to reach 10 institutional sectors and 16 financial instruments. The matrices presented in this paper refer only to deposits and loan instruments. The first matrices address deposits\(^{17}\) and other deposits\(^{18}\), while the second matrices incorporate short-term loans\(^{19}\) and long-term loans\(^{20}\).

\(^{15}\) This process is required because the accounting for a transaction between agents may differ in value and/or timing.

\(^{16}\) The balancing process is performed for all accounts, and it is separated into stages: the first corresponds to the financial account and balance sheets, and the second involves the current account and the capital accumulation account (CBCh, 2011)

\(^{17}\) “These include deposits held by resident and non-resident agents in current accounts at commercial banks and in the Central Bank of Chile, and the current account deposits held by resident agents in non-resident financial institutions” (CBCh, 2011).

\(^{18}\) “These include all financial deposits from monetary institutions and other financial institutions, other than the transferable deposits that are represented by deposit certificates, such as on demand and time deposits with commercial banks and deposits in domestic and foreign currency at the Central Bank of Chile, and accounts of collections received by commercial banks for deposit with the Central Bank of Chile, among others” (CBCh, 2011).

\(^{19}\) “This includes loans whose initial maturity is one year or less. All loans payable on demand have been classified as short-term, even when they are expected to continue for more than a year” (CBCh, 2011). Note that the debt on cards with trading houses is not included, as this is defined as trade credit.

\(^{20}\) “Loans with a maturity of more than a year, for example mortgage loans” (CBCh, 2011).
The overall process can be summarized in five steps:

1. Identify assets in stocks or financial transactions for institutional sectors by financial instrument.
2. Identify liabilities in stocks or financial transactions for institutional sectors by financial instrument.
3. Compare information regarding assets and liabilities for each instrument, based on validation and hierarchy rules (selection of higher priority information).
4. Equalize information on data not selected compared to data with a higher priority.
5. Create reconciliation data to maintain the allocations in point 4, avoiding imbalances in the financial account for that sector and for the rest of the accounts (thereby preserving the net lending or net borrowing of the institutional sectors).

Table 3 illustrates these steps with information in the case of deposits. The cells in dark gray in this figure indicate the amount of deposits from Deposit-taking corporations held by the Central Bank of Chile (CBCh), and information regarding the deposits received by this institution from Deposit-taking corporations, as reflected on the liabilities side of its financial statements (step 2).

When a comparison was performed between these two sources of information, a difference arose (step 3), which was resolved by prioritizing the information of the CBCh over that from the Deposit-taking corporations (step 4). In the reconciliation process that followed an adjustment vector was created which preserved a balance in the system of accounts (step 5, which in table 3 corresponds to the difference between the initial amount and the highlighted cell). When the process had been completed, total assets remained equal to total liabilities.

A similar process took place with the foreign deposit information of Deposit-taking corporations when compared to foreign deposit information recorded in the Balance of Payments. As the information from the Balance of Payments was more extensive, this was given a higher priority over that received from Deposit-taking corporations, generating an adjustment, and thereby reducing the amount initially recorded (cells in light gray).
Table 3. From-whom-to-whom matrices for deposits (trillion pesos). Example of the balancing process.

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Non-fin. corpor.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A Central Bank</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>2.2</td>
</tr>
<tr>
<td>s Deposit-taking corpor.</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>10.3</td>
</tr>
<tr>
<td>s Other financial interm.</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>12.2</td>
</tr>
<tr>
<td>t Insurance corporations</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>0.8</td>
</tr>
<tr>
<td>t Pension funds</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>2.9</td>
</tr>
<tr>
<td>General government</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>76.5</td>
</tr>
<tr>
<td>Households</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>11.2</td>
</tr>
<tr>
<td>Rest of the world</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>91.7</td>
</tr>
<tr>
<td>Total assets</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>11.2</td>
</tr>
</tbody>
</table>

Source: Author’s elaboration based on NA-IS information.

The same process is presented in table 4 for the case of loans. By way of example, note that information on the account of the Rest of the world regarding foreign loans obtained by Deposit-taking corporations was compiled from the Balance of Payments, which was compared to the same information that Deposit-taking corporations recorded as liabilities in their balance sheets. The information compiled from the Balance of Payments had a higher priority than that received from Deposit-taking corporations, therefore, a higher value was allocated to the loans in this sector (light-gray cell).

Table 4. From-whom-to-whom matrices for loans (trillion pesos). Example of the balancing process.

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-fin. corpor.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A Central Bank</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>1.7</td>
</tr>
<tr>
<td>s Deposit-taking corpor.</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>90.6</td>
</tr>
<tr>
<td>s Other financial interm.</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>2.3</td>
</tr>
<tr>
<td>t Insurance corporations</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>3.8</td>
</tr>
<tr>
<td>t Pension funds</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>1.8</td>
</tr>
<tr>
<td>General government</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>25.3</td>
</tr>
<tr>
<td>Households</td>
<td>XX</td>
<td>8.04</td>
<td>XX</td>
<td>XX</td>
<td>126.2</td>
</tr>
<tr>
<td>Total liabilities</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
<td>126.2</td>
</tr>
</tbody>
</table>

Source: Author’s elaboration based on NA-IS information.
In the same way, the amount of loans granted by Other financial intermediaries to Households was incorporated into the account of Households, because direct data is not available on loans that Householders receive from Other financial intermediaries.

In a nutshell, the reconciliation process of the matrices for each instrument can give rise to one of three situations:

- The data is maintained because it comes from a source of information more robust than the data of the counterparty.
- The data is partially adjusted to match other information from the counterparty sector with a higher priority.
- The data is fully imputed as this information is not available. The imputation is based on information from the counterparty sector or from a balance within other entries. An example of this situation can be found in the Household sector.

When any differences arising have been processed and adjusted, consistency is achieved within the system of national accounts, and the from-whom-to-whom matrices can be extracted. This information will be disseminated together with this paper for deposit and loan instruments in the statistical database of the Central Bank of Chile, and thereafter in accordance with the pre-established NA-IS publication schedules.

B. **Sources**

The sources of information may vary depending on the institutional sector being measured. Mostly the information is made up of accounting statements of statistical units and supplementary data obtained from monitoring institutions. These sources are:

- Non-financial Corporations: Information from the Superintendence of Banks and Financial Institutions (SBIF), the Securities and Insurance Supervisor (SVS), and the Internal Revenue Service (SII).
- Deposit-taking Corporations: Principally data from the SBIF.
- Other Financial Intermediaries and Financial Auxiliaries: Information from the SBIF, the SVS, and the Pensions Supervisor (SP).
- Insurance Companies: Data from the SVS and the Superintendence of Health.
- Pension Funds: Information from the Pensions Supervisor.

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21 The account of Households includes Households and NPISHs.
- Rest of the World: Data from the Balance of Payments and the International Investment Position, and the Central Bank of Chile.

IV. Results

In this section the results of the from-whom-to-whom matrices are analyzed. First, the sectoral interlinkages of deposits and loans are shown through “risk or network maps”, and secondly, the results obtained are compared with information from the Eurozone published by the European Central Bank (ECB).

A. Sectoral interlinkages

Deposits are financial savings instruments that can be classified as either demand deposits (where entities are custodians of the money, and the funds can be withdrawn at any time) or time deposits (where the parties agree on conditions beforehand) both involve a very low risk for the depositor. Deposit-taking corporations use this money to finance their own activities. It is understood that deposits reflect the saving capacity of depositors and their fluctuations will be linked to the solvency and liquidity that savers wish to maintain.

An analysis of the information of deposits by institutional sector reveals that all maintain deposits within their assets, as shown in chart 1. The principal holders are Non-financial corporations and Households, followed by Deposit-taking corporations, and Other intermediaries and financial auxiliaries. Also, there is an increase in deposits when comparing extremes of the series, noting an increase in Non-financial corporations at 8.5 percent points (pp.), from 19.4% of GDP to 27.9% of GDP, and in Deposit-taking corporations at 4.3 pp., from 6.8% of GDP to 11.1% of GDP.

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22 The tables of from-whom-to-whom matrices are presented in annex 1.
23 Annex 2 explains the program used to view the information using networks.
Besides, by plotting the from-whom-to-whom matrices the relationships between institutional sectors can be drawn. Chart 2 illustrates that deposits are received mainly by Deposit-taking corporations\(^{24}\), and secondly, by the Rest of the world (see the direction of the arrows). Similarly, the graph illustrates that Non-financial corporations and Households are the principal “depositors” (size of the arrows).

In addition, within the relationships illustrated in graph 2 (arrows between circles), the relationship between Deposit-taking corporations and the Central Bank of Chile stands out, as this shows the measures adopted to maintain market liquidity through “liquidity deposits”. Together the diagrams show that there are intra-sector deposits, specifically between Deposit-taking corporations (ellipse over the net balance of sector deposits).

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\(^{24}\) All Deposit-taking Corporations are grouped together, regardless of whether the deposits or the loans have been made only in banks.
Chart 2. Sectoral interlinkages for Deposits. Outstanding amounts at December 2007 and 2012. (percentage of annual GDP)

Source: Author’s elaboration based on NA-IS data.

Note: The magnitude of the lines indicates the intensity of the relationship; the arrows are pointing to the “depositories”. The size of the circle indicates the net balance of deposits held by institutional sectors at the end of the period (deposits in assets minus deposits in liabilities). Red circles indicate sectors with more deposits received than invested; and blue circles indicate sectors with more deposits invested than received, or where only deposits are invested. The lines in the range -0.1 % to 0.1 % of GDP have been purged to simplify the graph.

On the other hand, the structures of sectoral interlinkages for deposits at December of 2007 and 2012 show no major differences. However, when intercepting both structures\(^\text{25}\) (chart 3) a decrease in the deposits of Pension funds by 6.5% of GDP is revealed particularly in relation to those investing with Deposit-taking corporations due to the changes applied during this period to foreign investment limits. In addition, there is an increase in deposits by Households by 1.8% of GDP, and Non-financial corporations by 8.5% of GDP, which may be linked to the turbulence of external markets in the period, that encourage these sectors to prefer deposits over other financial instruments.

\(^{25}\) In the Pajek program, the estimation of differences in balances is done by intercepting both matrices. In this case, the figure is made by subtracting the fourth quarter of 2012 from the fourth quarter of 2007.
Chart 3. Sectoral interlinkages for Deposits. Differences in outstanding amounts at 2012 – 2007. (percentage of annual GDP)

Source: Author’s elaboration based on NA-IS data.

Note: The magnitude of the lines indicates the intensity of the relationship, the arrows indicate the “depositories”, and the dotted lines show a negative difference. The size of the circles indicates the magnitude of the net deposit balances maintained in the institutional sectors at the end of the period, and the colors reflect the differences in positive balances (blue) and the differences in negative balances (red).

In the same way, chart 4 shows the flows or financial transactions that occurred during 2012. Here it is especially prominent the positive deposit flows from Households and from Non-financial corporations to Deposit-taking corporations. The Central Bank has experienced a negative flow of deposits to the Rest of the world, in contrast with the positive flow from Non-financial corporations.


Source: Author’s elaboration based on NA-IS data.

Note: The magnitude of the lines indicates the intensity of the relationship, the arrows indicate the “depositories”, and the dotted lines show a negative difference. The size of the circles indicates the magnitude of the net deposit flows maintained with the institutional sectors at the end of the period, and the colors reflect positive flows in blue and negative flows in red.
The loans are financial instruments by which a financial institution delivers funds to a borrower, who acquires the obligation to repay the capital within the agreed timescales, for the agreed amounts, including the agreed commission and interest. Therefore, these credits are linked to the solvency of agents or institutional sectors, and the risk involved if these amounts vary sharply over time.

Looking at the breakdown of loans by institutional sector, there has been an increase in loan stocks between December 2007 and December 2012 (chart 5). The sectors that have intensified their credits the most are Non-financial corporations (at 10.0 pp. in the period) and Households (at 6.1 pp. in the period).

![Chart 5. Loans by institutional sector (percentage of annual GDP).](image)

Source: Author’s elaboration based on NA-IS data.

In terms of the sectoral interlinkages, Deposit-taking corporations are at the center of loan operations (chart 6). This follows from the financial intermediation role that these institutions perform; this sector is intensively receiving deposits and making loans.

The sectors to which Deposit-taking corporations are most exposed in the event of failure in their loan obligations are shown by lines routed to those sectors. This credit risk is generated in the intermediation process that this sector performs due to possible failures in loans granted to economic agents by the borrowers.

In this same context, at the level of structures of sectoral interlinkages, the main channels of funding by Deposit-taking corporations can be identified to both Households and Non-financial corporations. The Deposit-taking corporations in conjunction with the Rest of the world are the largest “lenders”.

Source: Author’s elaboration based on NA-IS data.

Note: The magnitude of the lines indicates the intensity of the relationship; the arrows are pointing to the “lenders”. The size of the circles indicates the loans maintained by the institutional sectors at the end of the period (loans granted minus loans received). Blue circles indicate sectors that provide more loans than are received (more assets than liabilities of the same instrument) and red circles indicate those that receive more loans than provided or that do not grant loans (more liabilities than assets of the same instrument). The lines in the range -0.1% to 0.1% of GDP have been purged to simplify the graph.

In general, significant changes in the structure between these two periods are not apparent. However, a comparison of these figures to identify structural changes (see chart 7) reveals that loans financed by Deposit-taking corporations to Households has increased by 6.2 pp. (magnitude of the line).

Chart 7. Sectoral interlinkages for Loans. Differences in outstanding amounts at 2012 – 2007 (percentage of annual GDP).

Source: Author’s elaboration based on NA-IS data.

Note: The magnitude of the lines indicates the intensity of the relationship; the arrows indicate the “lenders”, and the dotted lines show negative differences. The size of the circles indicates the magnitude of the differences in loans between two periods, and the colors reflect differences in positive stocks in blue and differences in negative stocks in red.
Also the chart above highlights the increasing participation in lending by Deposit-taking corporations at 12.2 pp. (size of the circle), and the increase in funding of Non-financial corporations by the Rest of the world at 7.8 pp., as well as the Rest of the world by Deposit-taking corporations at 4.7 pp. (magnitude of lines).

An analysis of the flow of loans during 2012 in figure 8 shows the increase in the liabilities of Non-financial corporations by 9.9% of GDP, and an increase in the obligations of Households by 4.0% of GDP, these loans have been obtained from Deposit-taking corporations. Furthermore, the credit operations between Non-financial corporations and the Rest of the world have increased to represent 5.6% of GDP.


Source: Author’s elaboration based on NA-1S data.
Note: The magnitude of the lines indicates the intensity of the relationship; the arrows indicate the “lenders”. The size of the circle indicates the net flow of loans (loans in assets minus loans in liabilities).

Finally, it is possible to analyze the financial exposure of net balances, that is, deposits minus loans between institutional sectors (chart 9). The net position between these two instruments illustrates the debtor position of Non-financial corporations and Households (considering deposits and loans).

Source: Author’s elaboration based on NA-IS data.

Note: The magnitude of the lines indicates the intensity of the relationship, the arrows indicate “from whom” the instruments were obtained, and the dotted lines show negative differences. The size of the circles indicates the magnitude of the net balances in the institutional sectors, and the colors reflect differences in positive balances in blue and differences in negative balances in red. We have purged the lines in the range -0.1 % to 0.1 % of GDP to simplify the graph.

It is visually apparent that the two structures are similar but there are differences where they intercept (chart 10). The principal changes in structure are seen in the Pension funds and the CBCh where there are fewer deposits in stocks, in Deposit-taking corporations where the increase in loans granted is partially offset by an increase in deposits received, and in the Rest of the world by an increase in loans granted and a reduction in deposits received.


Source: Author’s elaboration based on NA-IS data.

Note: The magnitude of the lines indicates the intensity of the relationship, the arrows indicate “from whom” the instruments were obtained, and the dotted lines show negative differences. The size of the circles indicates the proportion of GDP that institutional sectors net balances represent, and the colors reflect differences in positive net balances in blue and differences in negative net balances in red.
In terms of financial operations, chart 11 summarizes the flows between the institutional sectors during the second quarter of 2012. In this figure, it is possible to observe that the debtor position of Non-financial corporations has increased due to a greater flow of loans.


Source: Author’s elaboration based on NA-IS data.
Note: The magnitude of the lines indicates the intensity of the relationship; the arrows indicate “from whom” the instruments were obtained. The size of the circles indicates the flow experienced by the institutional sectors during the period, and the colors reflect differences in positive net balances in blue and differences in negative net balances in red.

B. International comparison

The structure of the financial relationships between institutional sectors should differ between countries, mainly due to varying degree of development within financial markets and differing characteristics of funding between sectors.

To compare the structures of financial statements of the NA-IS and of other markets, the from-whom-to-whom matrices published by the ECB have been used, whose information covers the Eurozone. These matrices are published for deposits, short-term loans, and long-term loans, covering both outstanding amounts and flows.

In the case of deposits, the main depositories are the Deposit-taking corporations both in Chile and in the Eurozone, followed by the Rest of the world (chart 12). However, the structure reveals significant differences in terms of percentage of GDP (the Eurozone comprises more than twice the share of GDP compared to Chile in deposit stocks by Deposit-taking corporations), and in terms of

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27 The annual financial accounts of the European Community have been published since 2002 and with quarterly frequency since 2007.

28 Due to the number of sectors available in the ECB’s information, seven sectors have been selected from the third quarter of 2012 (latest data available from the ECB at the publication date of this document).
intensity of the relationships, which may be due to the differences in the development of financial markets and their relationships with the Rest of the world.

Moreover, the relationships between Households and Deposit-taking corporations show differences in the magnitude of exposure, possibly due to the retirement savings, which in Chile are managed by Pension funds, while in Europe part of these savings is associated with direct deposits by Households with the banks.

Chart 12. Sectoral interlinkages for deposits in Chile (left) and the Eurozone (right), at September 2012 (percentage of annual GDP).

Source: Author’s elaboration based on NA-IS data.
Note: The magnitude of the lines indicates the intensity of the relationship; the arrows are pointing to the “depositories”. The size of the circle indicates the stock of deposits held by institutional sectors at the end of the period. Deposit-taking Corporations include the Central Bank.

Comparing the structures of sectoral interlinkages for loans in chart 13, they differ in the sectoral participation (both intensity and alternative relationships), in the share of these sectors, and in interaction at the intra-sector level.

Relationships within the Eurozone are greater in number between the institutional sectors. For example, Deposit-taking corporations are the main lenders, but the financing channel also includes Other financial intermediaries, and to a lesser extent Insurance companies and pension funds. In addition, in the Eurozone structure there are relationships that are not present in the Chilean graph, as in the Rest of the world with Other financial intermediaries, likewise General government with Other financial intermediaries.

The intra-sectoral interaction (ellipses over the circles) within the Eurozone shows relationships not only in Deposit-taking corporations as in Chile, but also in General government, in the Other financial intermediaries, in Non-financial corporations, and in Insurance companies and pension funds.

Finally, there are important differences in the proportion of these instruments within GDP. Eurozone loans from Deposit-taking corporations are almost three times the proportion of those in
Chile, which may be due to the depth of their financial markets, and to the economic conditions experienced by the European Community during the study period.

Chart 13. Sectoral interlinkages for deposits in Chile (left) and the Eurozone (right), at September 2012 (percentage of annual GDP).

Source: Author’s elaboration based on NA-IS data.
Note: The magnitude of the lines indicates the intensity of the relationship; the arrows are pointing to the “lenders”. The size of the circle indicates the stock of loans held by institutional sectors at the end of the period. Deposit-taking Corporations include the Central Bank.

V. Conclusions

This paper presents the measurement methodology and the results of the from-whom-to-whom matrices for deposit and loan instruments. These matrices will shortly begin to be regularly published by the Central Bank of Chile.

The from-whom-to-whom matrices or flow of funds present data that allows the analysis of financial instruments, which together with institutional sector statistics, provides information on sectoral interlinkages, indicating funding channels and systemic risks. Specifically, these matrices permit the study of structural changes in the balances of these instruments, and the cyclical changes in their flows over time, illustrating the relationships between different sectors.

One of the advantages of this information is that it is calculated within a unified and uniform system, this being the SNA 1993 in Chile. Furthermore, these matrices are comprehensive and include all sectors of the economy in addition to relationships with the Rest of the world, allowing the analysis of both financing flows and their fluctuations over time.

However, it is worth remembering in this first stage that this information also exhibits some limitations in its use, due primarily to the fact that its publication covers only two financial instruments, namely deposits and loans, to the exclusion of the remaining instruments, precluding a complete understanding of the inter-sectoral linkages of the economy. In addition, to achieve an in-depth analysis it would be necessary to supplement the published data for these aggregated
classifications of instruments and sectors with additional information; for example, through the complementary use of data from Household surveys which could facilitate an intra-sector analysis.

In spite of the above restrictions that are inherent in all aggregate statistics in general, it should be recognized that this measurement is an improvement in the understanding of statements from different institutional sectors, with regard to deposits and loans.

In conclusion, it will be necessary in future to continue to develop these matrices through the inclusion of more instruments, which will enable to represent the dynamics of savings and investment, investment and financing flows, and changes in investment portfolios between different sectors.

Bibliography


## Annex 1: Tables

### Deposits by counterparty sector, outstanding amounts (billions of Chilenian pesos)

#### Table 1: Loans to various sectors (billions of Chilenian pesos)

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#### Table 2: Loans to various sectors (billions of Chilenian pesos)

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Loans by counterparty sector, outstanding amounts (billions of Chilean pesos)

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Loans by counterparty sector, financial transactions (billions of Chilean pesos)

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Note: The table includes data from various financial institutions and sectors, including Central Bank, deposit-taking corporations, other intermediaries and financial auxiliaries, rest of the world, insurance corporations, and non-financial corporations, as well as both liabilities and assets for each sector.
Annex 2: Pajek, a visualization tool for networks

I. Introduction

The from-whom-to-whom matrices contain the relationships between institutional sectors by financial instruments. The concept of visualizing social networks is used to analyze this information in a simple and schematic form.

The Pajek program was used in the construction of the graphs presented in this paper, as it is freely available and easy to use. This annex seeks to concisely explain the program and how to use it.

II. Program

Pajek is a program developed in Slovenia for use on the MS-Windows operating system. Its name means spider and its development started in 1996 (several versions exist). Its main purpose is the analysis and visualization of social networks. These networks are defined as complex structures of relationships between members of a system in different dimensions.

The objectives of this program are to break down large networks, provide a tool for displaying them, and implement algorithms to analyze them.

Therefore, this tool can be used to analyze data networks of all kinds, such as chemical structures, biological interactions, organizational studies and economic relationships, among many others (see examples of complex networks displayed in diagram 1).

Diagram 1. Examples of displays using Pajek. On the left is global trade and on the right a mathematical model.

Source: Examples drawn from the data contained in the Pajek program and in the manual.

This program contains six elements which together define the displays:

---

29 For more information see “Pajek, reference manual”, available at <http://vlado.fmf.uni-lj.si/pub/networks/pajek/>

30 The graph on the left represents global trade: the lines indicate imports between countries, the size of the vertices reflects the GDP in 1995, and the colors of the vertices show the continents. The chart on the right shows a mathematical model where the lines show the relationships between vectors.
- **Networks**: These are the objects under examination: They need to be prepared in flat file format (.net), where the vertices or nodes and relationships or lines are defined (in the program called arches or edges). These relationships can be defined one at a time, incorporating them as matrices, but also in other formats.

- **Partitions**: Defines the separation of vertices into groups.

- **Permutations**: Permits the vertices to be reordered.

- **Cluster**: Allows subsets of vertices.

- **Hierarchies**: Permits the vertices to be hierarchically sequenced.

- **Vectors**: Defines at each vertex specific numerical characteristics.

Each element generates a separate file, which is then merged with the others to draw the relationships. Additionally, various calculations can be performed with each element to simplify or facilitate network analysis. For example, various operations such as the addition or subtraction of relationships from two different networks, or transform the data by removing relationships or creating new ones.

For an overview of the program, diagram 2 shows the interface for version 3.05 (August 2012). For non-commercial purposes access is free, and can be obtained in different versions from [http://mrvar.fdv.uni-lj.si/pajek/](http://mrvar.fdv.uni-lj.si/pajek/).

![Diagram 2. Pajek Program Interface.](image)

Source: Author’s elaboration (program interface image).

In general terms, the creation of a display starts with a file (.net) that is loaded onto the networks element. In this paper the vertices were defined as the institutional sectors and relationships were then generated creating the from-whom-to-whom matrices.

Next the partitions could be defined in the program, which in this paper was the differentiation between sectors by positive or negative results. At the third step the vectors are created, and in this case values were entered that represent the vertices and dimensions.
Finally, the figures are displayed in the window “Draw”, where the properties can be modified, and the resulting drawing exported in various formats.
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