



**UNIVERSITA' DEGLI STUDI DI PADOVA**

**DIPARTIMENTO DI SCIENZE ECONOMICHE ED AZIENDALI  
"M. FANNO"**

**CORSO DI LAUREA MAGISTRALE IN  
BUSINESS ADMINISTRATION**

**TESI DI LAUREA**

**"How government guarantees impact on the public finance?  
The case of the Italian response to COVID-19 crisis."**

**RELATORE:**

**CH.MO PROF. Luciano Giovanni Greco**

**LAUREANDO/A: Federica Bassato**

**MATRICOLA N. 1207276**

**ANNO ACCADEMICO 2020 – 2021**

Il candidato dichiara che il presente lavoro è originale e non è già stato sottoposto, in tutto o in parte, per il conseguimento di un titolo accademico in altre Università italiane o straniere.

Il candidato dichiara altresì che tutti i materiali utilizzati durante la preparazione dell'elaborato sono stati indicati nel testo e nella sezione "Riferimenti bibliografici" e che le eventuali citazioni testuali sono individuabili attraverso l'esplicito richiamo alla pubblicazione originale.

*The candidate declares that the present work is original and has not already been submitted, totally or in part, for the purposes of attaining an academic degree in other Italian or foreign universities. The candidate also declares that all the materials used during the preparation of the thesis have been explicitly indicated in the text and in the section "Bibliographical references" and that any textual citations can be identified through an explicit reference to the original publication.*

Federico Bamato

**How government guarantees impact on the public finance?  
The case of the Italian response to COVID-19 crisis.**

**Summary**

<b>Summary</b>	<b>3</b>
<b>Introduction</b>	<b>4</b>
<b>1. Measures adopted by European Member States in contrasting the COVID-19 crisis</b>	<b>6</b>
1.1 Temporary framework for state aid measures to support the economy in the current covid-19 outbreak	6
1.2 European response in the pandemic Covid-19 crisis: the examples of guarantees schemes in Germany, France and Spain	12
1.3 The Italian response to the COVID-19 crisis	16
<b>2. Government guarantees on loans</b>	<b>21</b>
2.1 Government loan guarantees as credit access instrument	21
2.2 Benefits and risks related to guarantees supported by the literature	24
2.3 Accounting treatment of government guarantees	32
2.4 Debt composition and guarantees impact	41
<b>3. Analysis on the “Garanzia Italia” scheme</b>	<b>49</b>
3.1 Methodologic approach for financial resources requirement estimation	49
3.2 Model hypothesis and implementation	50
3.3 Exposition of the results	57
<b>Conclusions</b>	<b>60</b>
References	62
Sitography	66
<b>Appendix</b>	<b>67</b>

## Introduction

The COVID-19 pandemic has challenged the majority of the world economies through the necessity of drastic interventions of social distancing. Shutdowns, lockdowns and restrictions have become necessary measures to prevent the diffusion of the virus and avoid the collapse of the healthcare system. These measures had a direct effect on the 2020 GDP <sup>1</sup>, where all the major economies of the world faced a recession, except for China, Turkey, Chile and South Korea (Figure 1.1). As it can be noticed, Euro area countries encountered on average a decrease of 6.03% in GDP, while the effect on Italy was even more severe (-7.94%).

		→ Variable	Gross domestic product, nominal value, growth		
		→ Frequency	Annual		
		→ Time	2018	2019	2020
			▲ ▼	▲ ▼	▲ ▼
→ Country	Unit				
Australia	Percentage		5.11	4.97	-3.58
Austria	Percentage		4.24	3.16	-7.39
Belgium	Percentage		3.47	3.43	-6.86
Canada	Percentage		3.86	3.60	-5.50
Chile	Percentage		6.47	3.66	0.28
Denmark	Percentage		2.76	3.62	-2.71
Finland	Percentage		3.42	2.95	-1.64
France	Percentage		2.78	2.73	-6.81
Germany	Percentage		2.99	2.80	-4.19
Greece	Percentage		1.45	2.05	-10.49
Hungary	Percentage		10.48	9.61	-2.95
Ireland	Percentage		9.61	8.76	-0.97
Italy	Percentage		1.86	1.05	-7.94
Japan	Percentage		0.17	1.26	-4.40
Korea	Percentage		3.40	1.10	0.10
Mexico	Percentage		7.25	3.03	-6.82
Netherlands	Percentage		4.81	4.63	-2.30
New Zealand	Percentage		4.41	4.53	-2.42
Norway	Percentage		7.84	0.41	-4.75
Portugal	Percentage		4.71	3.96	-5.71
Spain	Percentage		3.65	3.37	-10.84
Sweden	Percentage		4.46	4.08	-1.83
Switzerland	Percentage		3.77	1.04	-4.89
Turkey	Percentage		19.93	14.95	11.30
United Kingdom	Percentage		3.53	3.39	-5.99
United States	Percentage		5.47	3.98	-2.60
Euro area (17 countries)	Percentage		3.30	2.99	-6.03
OECD - Total	Percentage, 2015		4.88	3.87	-3.57
Non-OECD Economies	Percentage, 2015		9.61	6.81	-6.22
Non-OECD Economies/Argentina	Percentage		36.42	47.48	20.93
Brazil	Percentage		4.65	5.34	-2.25
China (People's Republic of)	Percentage		10.49	7.79	2.67
India	Percentage		10.95	7.21	-8.50
Russia	Percentage		13.92	5.18	-7.93
South Africa	Percentage		4.08	4.31	-4.34

Figure 1.1. Source: OECD, 2020.

<sup>1</sup> OECD, 2020. Economic outlook No. 108. December 2020. Available at: <https://stats.oecd.org/Index.aspx?DataSetCode=EO>

The restrictive measures simultaneously hit enterprises through many channels: supply shock, demand shock, uncertainty and unavailability of finance. SMEs have demonstrated even more vulnerable to these effects for three principal reasons. First, SMEs are more prevalent in countries and sectors that have been the most affected by the crisis. Second, SMEs are more subject to the channels of impacts of the pandemic than larger firms. Finally, SMEs have fewer resources to properly weather the COVID-19 outbreak, such as availability of liquidity from external financing or profits from previous years (Adian et al., 2020). To try to mitigate the negative effects carried by these interventions, authorities supported firms through eight main measures: debt finance, employment support, tax, business costs, other finance, demand, business climate and business advice. This thesis will focus on debt finance measures and, in particular, on the path taken by many governments to make recourse to massive credit guarantee schemes to help enterprises dealing with the lack of liquidity from external sources, such as bank loans.

The elaborate is divided as follow: the first part analyses the measures put into action by the main European economies to respond to the crisis, starting from the more general “Temporary Framework” aid plan elaborated by the European Commission to the specific guarantee schemes issued by Germany, France, Spain, and, in particular, Italy. The second part is focused on loan guarantees, providing a more specific classification and a literature review about the effectiveness of these instruments and the risks that come with them. Finally, analysis on the accounting treatment and impact on the government debt are provided. The third part has the aim to estimate the impact of the “Garanzia Italia” scheme on the Italian public finance. With respect to this final part, it has been elaborated during an internship in Sogei - Funzione Modelli di Previsione e Analisi Statistiche in which I had the opportunity to participate in the government guarantee project of Ministero dell’Economia e delle Finanze - Dipartimento del Tesoro - Direzione Interventi Finanziari nell’Economia and Sogei, with the support of Pwc teams.

## **1. Measures adopted by European Member States in contrasting the COVID-19 crisis**

### **1.1 Temporary framework for state aid measures to support the economy in the current covid-19 outbreak**

The COVID-19 outbreak in Europe has required a coordinated economic response of Member States and EU institutions. The effect of the pandemic on economies are multiple: a demand shock caused by a lower consumer demand, a supply shock caused by the disruption of supply chains and difficulties faced by undertaking maintaining investment plans and dealing with liquidity constraints. The sectors that demonstrated to be the more affected are health, tourism, culture, retail and transports. The role played by banks and financial intermediaries during the COVID-19 pandemic crisis is crucial for the importance of maintaining the flow of credit to the overall economy (European Commission, 2020).

The spread of coronavirus has required drastic interventions, spacing from social distancing and restrictions to shutdowns and lockdowns. These containment measures have been particularly severe and prolonged in some States and shocked firms through several channels. The supply shock is determined by reduced labour supply, input unavailability and disruption of supply chains. The demand shock is influenced by the reduction of the demand of consumers constrained at home or laid off, as well as by a more widespread tendency of precautionary savings. Investors are also more cautious and prudent. For this reason, the demand shock has been particularly intense in sectors of “non-essential” goods and services. Furthermore, the uncertainty that characterizes the consumers’ behaviour during the outbreak has affected also firms, finding themselves in the situation of postponing expenses and investment in capital, skills and innovation (Adian et al., 2020).

Well-targeted public intervention is therefore essential to support the economic activity, ensuring sufficient available liquidity and countering the damage suffered by healthy undertaking. The main response needs to come from Member States’ national budgets (European Commission, 2020).

Temporary framework has been adopted on 19 March 2020 with Communication 2020/C 91 I/01, modified and integrated on 3 April 2020 with Communication C(2020) 2215 and finally modified and extended on 8 May with Communication C(2020) 3156 final). The EU Commissions adopted the third modification on 29 June 2020, allowing to grant aid also to micro and small enterprises that were already in difficulties on 30 December 2019. The Commission also adjusted the conditions for the recapitalization in the case of private investors contributing with capital injections (Camera dei Deputati, 2020).

On 13 October 2020 the Commission adopted the fourth modification (Communication C(2020)7127 final) which extended the Temporary Framework's provisions up to 30 June 2021, except for recapitalization provisions that are extended up to 30 September 2021. The aid typologies available for Member States are also increased, adding in the allowed scheme support for uncovered fixed costs due to the pandemic in companies that faced a decline in turnover of at least 30% (Camera dei Deputati, 2020).

The Temporary Framework communication lists the possibilities allowed by the European Commission to Member States with the scope of ensuring liquidity and access to finance for undertakings, in particular SMEs. A range of interventions outside the scope of EU state aid control may be put into place without Commission's involvement, covering wage subsidies, suspension of payments of corporate and value added taxes or social welfare contributions. Direct contributions to consumers for cancelled services or tickets not reimbursed are also included.

The principal aim of the Communication is to constitute a framework that allows Member States to manage the difficulties that undertakings are facing, while preserving the integrity of the EU Internal Market. Article 107 of the Treaty on the Functioning of the European Union<sup>2</sup> considers compatible with the internal market to take measures, for a limited period, that "aid to make good the damage caused by natural disasters or exceptional occurrences" (TFEU art. 107.2 (b)), "aid to promote the execution of an important project of common European interest or remedy a serious disturbance in the economy" (TFEU art. 107.3 (b)) and "aid to facilitate the development of certain economic activities or of certain economic areas, where such aid does not adversely affect trading conditions to an extent contrary to the common interest" (TFEU art. 107.3 (c)).

Temporary Framework represents an integration to other measures of public intervention already allowed by ordinary norms about State aid instruments.

The Commission identified five categories of State aid to facilitate access to liquidity and financing for undertakings: limited aid amount, aid in the form of guarantees on loans, aid in the form of subsidized interest rates on loans, aid granted as guarantees on loans channelled through credit or other financial institutions and short-term export credit insurance.

---

<sup>2</sup> Consolidated version of the Treaty on the Functioning of the European Union - PART THREE: UNION POLICIES AND INTERNAL ACTIONS - TITLE VII: COMMON RULES ON COMPETITION, TAXATION AND APPROXIMATION OF LAWS - Chapter 1: Rules on competition - Section 2: Aids granted by States - Article 107 (ex Article 87 TEC)

<https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:12008E107&from=EN>

### **1.1.1 Limited amount of aid allowed under the Communication**

The aid granted in compliance with the internal market shall meet simultaneously the following five conditions (European Commission, 2020):

a) the overall gross aid cannot exceed €800.000 per undertaking, and it can be allowed in the form of direct grants, tax and payment advantages, or other forms such as repayable advances, guarantees, loans and equity;

b) the aid is granted in accordance with the production of an estimated budget;

c) the aid can be granted only to undertakings that were not already in difficulty on 31 December 2019. Micro or small enterprises can be excluded from this requirement and can receive the aid even if they were already facing difficulties on 31 December 2019, given that they are not subject to collective insolvency procedure and have not received rescue or restructuring aid;

d) the aid cannot be granted later than 30 June 2021;

e) the aid granted to companies that process and market agricultural products is subordinated to not be partly or entirely passed on primary producers and is not calculated on the price or quantity purchased or sold.

For what concerns agriculture sector undertakings, the gross maximum aid amount cannot exceed € 100.000 per undertaking, while for fishery and aquaculture undertakings, the gross overall amount is fixed at € 120.000 per undertaking. The aid must not be fixed based on price or quantity of products put on the market.

### **1.1.2 Aid granted as guarantees on loans**

Many businesses in Europe rely on bank loans for external financing. Obtaining borrowings can be difficult for small and medium-sized enterprises, in particular when they lack collateral or their track record and credit history are too short. Guarantees can help compensate for lacking collateral and creditworthiness for reducing the banks' risk (European Commission, 2020).

Public guarantees on loans for a limited period of time and loan amount can represent an appropriate instrument for enterprises that are encountering liquidity shortages. Aid granted as guarantees on loans cannot be cumulated with aid in the form of subsidies interest rates for loans, but can be cumulated for different loans when the maximum amount conditions are respected.



Aid granted as guarantees on loans can be considered compatible with the EU internal market under art.107.3 (b) of the TFEU when the following conditions are met (European Commission, 2020).

First, a minimum guarantee premium per loan is set, increasing with the duration of the loan and allowing favourable conditions for SMEs, as in the following table:

<i>Type of recipient</i>	<i>For 1<sup>st</sup> year</i>	<i>For 2<sup>nd</sup>-3<sup>rd</sup> year</i>	<i>For 4<sup>th</sup> -6<sup>th</sup> years</i>
<i>SMEs</i>	<i>25bps</i>	<i>50bps</i>	<i>100bps</i>
<i>Large enterprises</i>	<i>50bps</i>	<i>100bps</i>	<i>200bps</i>

**Table 1.1.** *Source: European Commission, 2020.*

Member States may module guarantee duration, guarantee premiums and guarantee coverage for each loan principal, allowing, for instance, a lower guarantee coverage to offset a longer duration or to apply lower premiums. A flat premium is allowed for the entire duration of the guarantee in the case in which in the first year it is higher than the minimum premiums (European Commission, 2020).

The guarantee cannot be granted later than 30 June 2021. When the loan's maturity is beyond 30 June 2021, the maximum amount covered by the guarantee shall not exceed twice the annual cost for wages of the beneficiary for 2019 or the last year available, or 25% of the beneficiary's total turnover in 2019. With the predisposition of an appropriate justification, Member States can increase the loan amount to cover the liquidity needs from the moment of the granting for 18 and 12 months for SMEs and large enterprises respectively. When the guarantee's maturity is within 30 June 2021, the amount of the loan principal can be higher in the presence of appropriate justification when the proportionality of the aid is assured by the Member State (European Commission, 2020).

The guarantee can have a maximum duration of six years and the coverage cannot exceed 90% of the loan principal amount in the case in which the losses are attributed proportionally both to the State and the credit institution under the same conditions or 35% when the losses are sustained firstly by the State and only then by the credit institution. When the size of the loan decreases over time, the amount of the guarantee must decrease proportionally (European Commission, 2020).

The loan covered by the guarantee shall belong to investments or working capital of the beneficiary. The guarantee cannot be granted to undertakings that were already in difficulty on 31 December 2019, except for micro and small enterprises given that they are not subject to a collective insolvency procedure (European Commission, 2020).

### 1.1.3 Aid granted in the form of subsidized interest rates for loans

Subsidized interest rates for a limited period of time and loan amount can represent a targeted possibility to deal with the current circumstances. In addition, the use of subordinated debt may result appropriate, given that this instrument is less distortive than equity or hybrid capital since it cannot be automatically converted into equity when the company is a going concern.

The commission considers aid in the form of subsidies to public loans compatible with the internal market as in article 107.3 (b) when the following conditions are respected (European Commission, 2020).

The interest rates applied on loans must not be lower than the base rate, which is equal to the 1-year IBOR, or equivalent, set in accordance with the Communication from the Commission on the revision of the methods for setting the reference and discount rates, available either on 1 January 2020 or at the moment of the notification, to which it has to be added the credit risk margins, as in the following table:

<i>Type of recipient</i>	<i>Credit risk margin for 1<sup>st</sup> year</i>	<i>Credit risk margin for a 2<sup>nd</sup> -3<sup>rd</sup> year</i>	<i>Credit risk margin for 4<sup>th</sup>-6<sup>th</sup> year</i>
<i>SMEs</i>	<i>25bps<sup>33</sup></i>	<i>50bps<sup>34</sup></i>	<i>100bps</i>
<i>Large enterprises</i>	<i>50bps</i>	<i>100bps</i>	<i>200bps</i>

**Table 1.2.** Source: European Commission, 2020.

Alternatively, Member States can use the above values as a basis, allowing to modulate loan maturity and credit risk margins. A flat credit risk margin is permitted for the entire duration of the loan when it is higher than the minimum credit risk margin for the first year.

The loan contract cannot be signed later than 30 June 2021 and the maturity has to be at maximum 6 years (European Commission, 2020).

When the maturity is beyond 30 June 2021, the maximum amount per beneficiary cannot exceed double the annual cost of wage bill sustained in 2019 or in the last available year, or 25% the undertaking's total turnover in 2019. When an appropriate justification is provided by the Member State, the amount can exceed the above limits in order to satisfy liquidity needs for the following 18 months for SMEs and 12 months for large enterprises.

The maximum amounts set above can be increased, if provided appropriate justification, when the loan has maturity until 30 June 2021 (European Commission, 2020).

The loan for which the aid is granted has to relate to investment or working capital needs and undertakings that were already in difficulty on 31 December 2019 are exempted from the granting. In derogation, aid can be granted to micro or small enterprises that were already in

difficulty, proven they were not involved in collective insolvency procedure, and they have not already received rescue or restructuring aid (European Commission, 2020).

Debt instruments, given their subordination to ordinary creditors in case of insolvency, can be granted at reduced interest rates, equal to at least the base rate indicated above with the addition of 200 bps for large enterprises and 150 bps for SMEs. If the amount of subordinated debt exceeds two-thirds of the annual wage bill for large enterprises or the annual wage bill for SMEs, or 8.4% and 12.5% of the total 2019 turnover for large and SMEs respectively, the compatibility should be set as recapitalization measure (European Commission, 2020).

#### **1.1.4 Aid granted as guarantees on loans channelled through credit or other financial institutions**

Guarantees on loans in compliance with the Temporary Framework can be granted directly or through credit institutions or other financial institutions. In the latter case, the aid should not have the objective to preserve or restore the viability, liquidity or solvency of the credit institutions. It is in fact appropriate that safeguards are taken in order to reduce possible distortions to competition due by the aid. The purpose of financial institutions is to transfer, in the largest possible extent, the benefits of the public guarantees or subsidized interest rates to the beneficiary undertaking, being able to demonstrate that the operations taken are following this extent (European Commission, 2020).

#### **1.1.5 Short-term export credit insurance**

The Commission, analysed the lack of sufficient private insurance capacity for short-term export credits, considers all commercial and political risks associated with exports as temporarily non-marketable until 30 June 2021 (European Commission, 2020).

## **1.2 European response in the pandemic Covid-19 crisis: the examples of guarantees schemes in Germany, France and Spain**

During the most recent Covid-19 emergency, many Euro area countries decided to use loan guarantees schemes as a primary part of their packages to support the credit flow and stabilise the banking system (European Central Bank, 2020). The guarantees schemes are determined at national level, with size and eligibility criteria varying a lot across countries.

Loan guarantees are usually short-term (one year) but can rise up to six years. Generally, the pricing of guarantees starts at 25 basis points (bps) for one-year SMEs guarantees and 50 bps for one-year large corporates guarantees. This value reaches 100 bps and 200 bps respectively for four and six-year maturity. Usually, the guarantees cover maximum 90% of the loan principal, even though in some countries this value reaches a 100% loss absorption (European Central Bank, 2020).

The aim of the schemes is to reduce losses incurred by banks on corporate loans by transferring part of the risk to the government. Doing so, banks will more easily allow funds to companies that will be able to increase their cash buffers and extend the horizon of their liabilities. Estimates that consider four scenarios taking into account economic growth and corporate cash flows, indicate that the full deployment of loan schemes can reduce loan losses between 15% and 20% with respect to losses without the schemes. About one-third of the remaining losses could be sustained by the government through the guarantee activation (European Central Bank, 2020). The benefits arising in terms of avoiding loan losses are increasingly more significant as larger is the overall size of the scheme. Another condition having effects on the loss avoiding of the scheme is the initial cash and solvency position of the beneficiary determining the share of eligible firms. The demand for guarantees aid is assumed to be higher in Member States in which the pandemic outbreak has determined large economic contractions, where SMEs represent a significant share of the economy, where companies have a high dependence on short-term bank financing, and the corporate sector is facing a higher indebtedness. Banks may meet an operational challenge in the creditworthiness assessment of a large number of applications where the demands may coincide with applications for debt moratoria (European Central Bank, 2020).

In Europe, public guarantee schemes issued in response to the COVID-19 pandemic are 47, of which 43 come from EU Member States while 4 from EEA (European Banking Authority, 2020).

## 1.2.1 Germany

Germany issued guarantee schemes in response to the COVID-19 outbreak in 2020 for a total amount of 19.6% of GDP. Table 1.1 below resumes the principal measures in terms of commitment.

<b>Guarantee scheme</b>	<b>Details</b>	<b>Amount</b>
<b>Financing guarantees provided to companies by the Economic Stabilisation Fund</b>	Stabilisation of enterprises by helping them overcome liquidity shortfalls and by creating a framework to strengthen the capital base of enterprises whose insolvency would have significant effects on the economy, technological sovereignty, security of supply, critical infrastructure or the labour market. The maximum maturity of the loan is five years.	€ 400 billion (12.1% of GDP)
<b>KfW special programme</b>	Guarantees on loans from the state-owned promotional bank KfW for companies facing financial difficulties due to the coronavirus crisis. The coverage ranges from 80% to 100% depending on the respective KfW Corona-loan programme.	€ 150 billion (4.5% of GDP)
<b>Increase in the guarantee framework of the <i>Länder</i></b>	Additional measures by the <i>Länder</i> to ensure credit and liquidity protection for industry.	€ 72.7 billion (2.1% of GDP)
<b>Guarantees for credit insurers</b>	Indemnification payments from trade credit insurers.	€ 30 billion (0.9% of GDP)
<b>Guarantee banks</b>	Increase of the risk share in guarantee banks by 10% in order to more easily shoulder risks that are difficult to assess in times of crisis. The upper limit of 35% of operating resources for guarantee banks' total exposure has been increased to 50%. Banks have the freedom to take guarantee decisions	Unlimited

	involving amounts of up to €250,000 independently and within three days.	
<b>Guarantee programme</b>	Parallel guarantees from the federal government and the <i>Länder</i> (50%-50%). It was previously addressed to enterprises based in structurally weak regions and has now been opened up to enterprises in other regions. It covers operating and investment loans up to 90%.	Unlimited
<b>Guarantees for liquidity protection loans from the <i>Landwirtschaftliche Rentenbank</i></b>	Coverage for the <i>Landwirtschaftliche Rentenbank</i> to provide guarantees to stabilise the liquidity positions of agricultural enterprises.	€ 150 million

**Table 1.1.** Guarantee schemes in Germany. *Source: own elaboration (data from German Draft Budgetary Plan 2021<sup>3</sup>).*

## 1.2.2 France

The guarantees issued by the French government in 2020 amount to € 327.5 billion, which represent 14.2% of GDP. Table 1.2 below shows the principal obligations in terms of commitment.

<b>Guarantee scheme</b>	<b>Details</b>	<b>Amount</b>
<b>Extraordinary government guarantee scheme for loans to businesses</b>	For all new loans granted by banks between 16 March and 31 December 2020 to businesses registered in France The cover percentage ranges from 70% to 90%, depending on the company's turnover: up to €1.5 billion allows a 90% coverage, from €1.5 to 5 billion 80% and over €5 billions 70%.	€ 300 billion (13.5% of GDP)

<sup>3</sup> FEDERAL MINISTRY OF FINANCE, 2020. German Draft Budgetary Plan 2021. Available at: [https://ec.europa.eu/info/sites/info/files/economy-finance/2021\\_dbp\\_de\\_en.pdf](https://ec.europa.eu/info/sites/info/files/economy-finance/2021_dbp_de_en.pdf)

<b>Activation of a government reinsurance guarantee to cover outstanding credit insurance</b>	To provide companies with the continued credit insurance cover they need to maintain their business activity with their French SME and mid-tier company customers.	€ 10 billion (0.4% of GDP)
<b>Introduction of reinsurance for short-term export credits</b>	Extension of the “Cap Franceexport” government re-insurance scheme, which was unveiled in October 2018, with the doubling of the cap on outstanding amounts able to be reinsured by the government and extended to other countries of destination.	€ 5 billion (0.2% of GDP)

**Table 1.2.** Guarantee scheme in France. *Source: own elaboration (data from French Draft Budgetary Plan 2021 <sup>4</sup>).*

### 1.2.3 Spain

Spain announced in 2020 guarantees for 14.4% of the GDP. Table 1.3 below resumes the principal schemes in terms of commitment.

<b>Guarantee scheme</b>	<b>Details</b>	<b>Amount</b>
<b>Bank guarantees</b>	Guarantee scheme provided by Istituto de Credito Oficial (ICO) to provide liquidity to firms and counter-guaranteed by the government. The guarantee covers 70% of general credit and 80% for SMEs and self-employed persons.	€ 100 billion (9.0% of GDP)
<b>Bank guarantees for investments</b>	Guarantees provided by ICO for the financing new investment projects. The guarantee covers 70% of general credit and 80% for SMEs and self-employed persons.	€ 40 billion (3.6% of GDP)

<sup>4</sup> REPUBLIQUE FRANCAISE, 2020. Draft Budgetary Plan 2021. Available at: [https://ec.europa.eu/info/sites/info/files/economy-finance/2021\\_dbp\\_fr\\_en.pdf](https://ec.europa.eu/info/sites/info/files/economy-finance/2021_dbp_fr_en.pdf)

<b>Fund sustaining strategic companies</b>	The Fund operates through the granting of participating loans, subordinated debt, shares subscription and other capital instruments.	€ 10 billion (0.9% of GDP)
<b>SURE (Support to mitigate Unemployment Risks in an Emergency) guarantees</b>	Creation of a line of credit against internationalization risk provided by CESCE as insurance collateral for the financing of working capital of SMEs and not-listed companies with export activities.	€ 2 billion (0.2% of GDP)
<b>Guarantees via CERSA</b>	Increase of CERSA Fund, from € 1 billion to € 2 billion in extraordinary coverage of credit risk of SMEs.	€ 1 billion (0.1% of GDP)
<b>Strengthening of the Fund for tourism sector and other activities affected by COVID-19</b>	Ampliation of the “Thomas Cook” line of credit through ICO from € 200 million to € 400 million, with a 50% guarantee from the Industry, Tourism and Commerce Ministry.	€ 200 million

**Table 1.3.** Guarantee schemes in Spain. *Source: own elaboration (data from Spanish Draft Budgetary Plan 2021 <sup>5</sup>).*

### 1.3 The Italian response to the COVID-19 crisis

This paragraph focuses on the measures taken by the Italian government in contrasting the COVID-19 outbreak.

The first part analyses the measures put into force to provide liquidity to undertakings as established in the government Decree “Decreto Legge 8 Aprile 2020, n. 23”, in articles 1 and 13. The second part is focused on other guarantees regulated into the government Decree “Decreto Legge 17 Marzo 2020, n. 18”, article 56, “Decreto Legge 8 Aprile 2020, n. 23”, article 2 and “Decreto Legge 8 Aprile 2020, n. 23” article 14-bis.

<sup>5</sup> REINO DE ESPAÑA. Plan presupuestario 2021. Available at: [https://ec.europa.eu/info/sites/info/files/economy-finance/2021\\_dbp\\_es\\_es.pdf](https://ec.europa.eu/info/sites/info/files/economy-finance/2021_dbp_es_es.pdf)



### **1.3.1 D.L. 8 Aprile 2020, n. 23 (“Decreto Liquidità”)**

The recovery interventions that pursue their scope through the use of guarantees are regulated under article 1 (SACE’s guarantees for all undertakings facing liquidity difficulties) and article 13 (Fondo Centrale di Garanzia’s guarantees for SMEs) of the government Decree “Decreto Legge 8 Aprile 2020, n. 23” converted, with modifications, into Law “Legge 5 Giugno 2020, n. 40”.

The guarantees of the “Garanzia Italia” scheme regulated by article 1 are provided by SACE S.p.a and counter-guaranteed by the Italian government. They cannot exceed the total amount of € 200 billion, of which € 30 billion should be addressed to SMEs, self-employed persons and professional associations of workers.

The guarantee of the scheme shall meet the following conditions:

- a) the guarantee is granted within 31 December 2020 for loans with maturity of maximum 6 years, with the possibility of 36 months of pre-amortisation;
- b) on 31 December 2019 the beneficiary undertaking was not in difficulty and on 29 February 2020 was not registered into the non-performing loan in the Italian Banking System;
- c) the maximum amount covered by the guarantee cannot exceed the highest between 25% of the 2019 turnover or double the annual cost for wage bill sustained in 2019;
- d) the guarantee covers 90% for undertakings with less than 5000 employees and turnover up to € 1.5 billion, 80% for undertakings with turnover between € 1.5 and 5 billion, and 70% for undertakings with turnover higher than € 5 billion;
- e) annual fees that undertakings pay for the guarantee’s grant are 25 basis point for the first year, 50 for the second and third year and 100 for the fourth, fifth and sixth year for SMEs, while 50 basis point for the first year, 100 for the second and third year and 200 for the fourth, fifth and sixth year for undertakings different from SMEs;
- f) the guarantee is at first-request, unconditional and irrevocable;
- g) the guarantee only covers new loans granted later than the entrance into effect of the present Law;
- h) fees need to be limited to recovery costs and the cost of funding has to be lower than the cost that would be required to the same undertaking without the benefit of the guarantee;
- i) the beneficiary of the guarantee takes the commitment to not distribute dividends or repurchase dividends during the year 2020;
- l) the beneficiary of the guarantee takes the commitment to manage the level of employment through union agreements;

m) the lender must demonstrate that the amount of funding granted with the presence of the guarantee is higher than it would have been without;

n) the loan must relate to employees wage costs, rents, investments or working capital employed in production plants and business activities located in Italy.

The Italian government has established a Fund with an initial dotation of € 1 billion for year 2020.

The guarantees regulated by article 13 concerns the aid provided to SMEs by “Fondo Centrale di Garanzia” and counter-guaranteed by the Italian government.

The guarantees of the scheme shall meet the following conditions:

a) the guarantee is granted for free;

b) the maximum guaranteed amount for single undertaking is € 5 million and the guarantee is addressed to undertakings with no more than 499 employees;

c) the direct guarantee covers 90% of the loan with maturity up to 72 months. The maximum amount cannot exceed double the wage bill costs for 2019, 25% of the undertaking’s turnover for 2019 or the need for capital and investment costs for the following 18 and 12 months for SMEs and other firms with employees’ number not greater than 499 respectively;

d) for loans that respect the amounts and maturity set above, the percentage of coverage for re-insurance is increased to 100%, also through Fund’s special sections, of the amount guaranteed by Credit consortia, other guarantee Funds or cooperative societies. The condition to be respected is that the maximum coverage provided by these entities is 90% and there is no payment of a premium for the remuneration of the credit risk. For operations not respecting the conditions set above the percentage of coverage is increased to 80% for direct guarantees and to 90% for re-insurance, even for maturity longer than 10 years. The guarantee can be cumulated with another additional guarantee provided by Credit consortia or other authorised entities;

e) operations of debt renegotiation are admitted to the Fund’s guarantee in the measure of 80% for direct guarantee and 90% for re-insurance of the amount guaranteed by Credit consortia or other guarantee Funds, on the condition that the maximum coverage provided by these entities is 80%. The new financing must grant at least 10% of the amount of the original debt object of renegotiation and 25% for financing after the approval of the present Law;

f) for operations for which banks of financial intermediaries have established the suspension of the amortization payments or of the principal amount on operations covered by the Fund, the maturity of the guarantee is extended as consequence;

g) the Fund allows the participation of final beneficiaries that present unlikely to pay or expired positions, but if present before 31 January 2020 the measures regulated in e) are excluded. Firms that present non-performing loans are excluded in any case;

h) the commission for the processing operation is not due;

i) for real estate investment operations in the tourism and hospitality sector, with minimum maturity of 10 years and amount above € 500,000 the guarantee can be cumulated with other forms of guarantees on loans;

l) guarantees on loans on particular financing portfolios dedicated to firms damaged by the COVID-19 outbreak, the junior tranche covered by the Fund may be increased by 50%, to which an additional 20% may be provided in case of intervention of other guarantors;

m) new loans are admitted to the Fund with 100%, both through direct guarantees and re-insurance, for amount of maximum € 30,000 and given that the reimbursement of the principal amount is not scheduled before than 24 months from the loan's disbursement. The maturity cannot be greater than 120 months and the amount must follow the conditions set in c). The guarantee is free and does not require the firm's creditworthiness assessment for the approval. The Fund allows the participation of final beneficiaries that present unlikely to pay or expired positions, but if present before 31 January 2020 the measures regulated in e) are excluded. Firms that present non-performing loans are excluded in any case;

n) beneficiaries with turnover up to € 3,200,000 damaged by the COVID-19 outbreak may cumulate guarantee granted in compliance with point c) with an additional guarantee granted by Credit consortia, up to 100% coverage for a maximum amount of € 800,000;

o) all the deadlines for administrative fulfilments are deferred of 3 months;

p) the Fund's guarantee can be required also on operations that have already been concluded in the previous 3 months, provided that later than 31 January 2020.

The Fund has been refinanced through art. 64 of the Law Decree "Decreto Legge 14 Agosto 2020, n. 104" by € 3,100 million for 2023, € 2,635 million for 2024 and € 1,600 million for 2025.

### **1.3.2 Other guarantees activated for the COVID-19 crisis**

Article 56 of the government Decree "Decreto Legge 17 Marzo 2020, n. 18", converted into Law "Legge 24 Aprile 2020, n. 27" and further modified by the government Decree "Decreto Legge 14 Agosto 2020, n. 104", covers the exposures of SMEs subject to legislative moratoria. Specifically, it establishes the possibility for firms to benefit of the prohibition of withdrawal, the extension and the suspension of existing loans. In particular:

a) withdrawal prohibition: for credit opening operations and for loans in the face of credit anticipations existing as of 17 March 2020, all the funding negotiated, both for the employed and not-employed part, are not revocable;

b) extension: for non-instalment loans with maturity previous than 31 January 2021, loan contracts are extended until that date;

c) suspension: for mortgages and other forms of financing that include instalments, the payment of instalments and leasing with deadline previous than 31 January 2021 is suspended until that date. Furthermore, the reimbursement of instalments and leasing is deferred with modalities that assure the absence of new or higher financial charges for both the parties.

The measures are addressed to micro enterprises and SMEs that cannot present non-performing loans as of 17 March 2020. The Fund's special section, with a capacity of € 1,730 million, guarantees 33% of the amount interest by the operations described above in points a), b) and c). The guarantees, provided by "Fondo Centrale di Garanzia" and counter-guaranteed by the Central government, are conditional and do not require the firm's creditworthiness assessment. As support to the internationalisation of the production system, with article 2 of the government Decree "Decreto Legge 8 Aprile 2020, n. 23" converted, with modifications, into Law "Legge 5 Giugno 2020, n. 40", a new Fund for the Integrated Promotion towards Foreign Markets has been created. Furthermore, the existing Fund providing subsidised loans for the internationalisation of firms has been refinanced. A co-insurance system addressed to relevant sectors for the Italian economy in terms of occupational levels and repercussions on the economic system has been introduced, whereby the commitments deriving from SACE's insurance and guarantees businesses are assumed by the State for 90% and by the company itself for the remaining 10%. This measure will allow to free up to € 200 billion of resources to be allocated to the expansion of exports.

Another guarantee scheme is represented by "Garanzie a Mercato" scheme, regulated by article 14-bis of Decree "Decreto Legge 8 Aprile 2020, n. 23" converted into Law "Legge 5 Giugno 2020, n. 40".

The guarantees, issued by SACE S.p.a., are at first-request and at market conditions, in compliance with the European Legislation. They are addressed to credit consortia in the form of counter-guarantees, to banks and both national and international credit institutions and other institutions qualified in credit financing. The guarantees cover financial exposures in any form of firms located in Italy and will become.

The ceiling of the scheme is set to € 200 billion.

## **2. Government guarantees on loans**

### **2.1 Government loan guarantees as credit access instrument**

Government interventions to assist financial institutions can be divided into two categories: direct interventions, such as loans to financial institutions, recapitalization and asset restructuring measures, which cause an immediate increase in the government's financing need, and off-balance sheet contingent guarantees, which do not determine any direct impact on debt but will be recognized in the case the government has to make a payment or assume a debt (Singh, Gómez-Puig, Sosvilla-Rivero, 2019).

A government guarantee on loans is “an arrangement in which a government entity undertakes payment of a debt or performance of an obligation in the event of a default by the primary creditor” (Heald, Hodges, 2018, p. 783). A government guarantee legally binds a government to take on an obligation if, and only if, a clearly specified event occurs (International Monetary Fund, 2006). Many States governments, usually at central government level but also at state or local level, provide guarantees on the borrowing of certain corporations or other entities, both in public and private sectors (Eurostat, 2019). Governments provide a wide variety of loan guarantees (e.g. to farmers, small businesses, home buyers, and students) and other financial guarantees, such as trade and exchange rate guarantees, income, profit and rate of return guarantees, and minimum pension guarantees.

The actors who take part in a guarantee agreement are the borrower, the lender and the guarantor, which is required to make payments if the borrower defaults. Allowing to cover the primary borrower's debt, the guarantor assumes many different risks that concern with the guarantee activation (International Monetary Fund, 2014):

- a) commercial risk or financial performance risk of the borrower;
- b) market risk, correlated to drastic adverse movements in exchange rates and interest rates;
- c) political risk, which includes currency inconvertibility risk and non-transferability of payments (transfer risk), expropriation and political violence;
- d) regulatory or policy risk, critical when implementing laws and regulations may affect the debtor's financial performance.

Also, the guarantor typically has to manage four parameters when granting a guarantee (Riding, Madill, Haines, 2007):

- a) the degree of discretion in credit decision, which in some jurisdictions is decided by the credit institution, while in others the government reviews each application;

b) the level of the guarantee, which is the percentage of the debt which is covered by the granted guarantee and varies in every jurisdiction and even within the jurisdiction;

c) fees, which may be used both as an attempt of sustaining possible future defaults and to preserve the integrity of the reserve of capital that in some jurisdictions lies behind guarantees;

d) eligibility criteria, which set the purpose of borrowing allowing for the grant of the guarantee.

These parameters vary according to the setting and purpose. Objectives can range over availability of financing to small businesses, in some cases allowing the loan only when the SMEs have failed to meet other sources of financing or when turned down by commercial lenders, and prevention of failure of companies that would otherwise go under.

Guarantees and other contingent liabilities are characterized by the uncertainty about whether the government will have to pay and, if so, about the timing and amount, representing one of the less certain government obligations (International Monetary Fund, 2006).

Public guarantee schemes (PGSs) have the purpose of supporting the firm's access to bank's credit by providing publicly funded collateral. Typically, PGSs are addressed to small and medium enterprises, which are the most likely to suffer from credit constraints (Banca d'Italia, 2017). The most common support arrangement of this type is a Credit Guarantee Scheme (CGS) which typically provides a partial guarantee for SMEs' bank credit to in case of primary debtor default (OECD, 2017).

When granting a guarantee, the payment of fees is required by the guarantor to prevent the risk of losses related to the probability of default of the borrower. Fees also have the scope of covering administrative costs and expenses that arise as consequences of the guarantee. Net fees are calculated as fees receivables plus fees supplement less administration and other costs (Eurostat, 2013). When a guarantee covers a multi-year period, the fee may be payable annually or up-front. At the moment the guarantee is given, the fee represents the amount of charges earned each year in which the guarantee holds, with the value of the liability decreasing as the remaining period gets shorter (Eurostat, 2013).

The private value of a guarantee is the amount that a private sector agent would willingly exchange for the rights on the guarantee in the future. The value considers the time pattern and risk characteristics of the cash flow, including any contingent claims (Baldwin, Lessard, Mason, 1983).

### **2.1.1 Characteristics and attributes: guarantees classification**

The source of this paragraph is an internal documentation in the Italian Government guarantees project prepared by Ministero dell'Economia e delle Finanze, Dipartimento del Tesoro and Sogei in 2020.

Government guarantees can be classified under five characteristics: subsidiarity, autonomy, cost, intervention typology and operativity.

Under the subsidiarity attribute, guarantees can be distinguished as conditional and unconditional (or “first-request”) guarantees.

Conditional guarantees need actual proof of default or damage, and the activation needs the conclusion of the coercive credit collection procedures. The guaranteed lender must finish and present all the credit recovery actions about the amount due by the borrower and assess the definitive loss. Unconditional guarantees, instead, do not need the proof of the legitimising assumptions for the payment request. These guarantees imply that the guarantor assumes the obligation to pay the guaranteed lender when the borrower fails to perform it, renouncing in proposing exceptions to the guarantee relationship.

For what concerns the autonomy attribute, guarantees can be distinguished in autonomous and accessory. Autonomous guarantees are completely free from the principal obligation since the constraint regards the guarantor and the debtor. Usually, autonomous guarantees are associated with first-request guarantees. Accessory guarantees are valid as the principal obligation is valid, from which they derive their validity date. This typology of guarantees extends the obligation to accessory charges and expenses of the principal obligation.

For what concerns cost, guarantees can be divided into costly and free. The first usually require the payment of a premium proportional to the risk faced by the guarantor. The latter does not require any form of remunerative premium but have to respect limits and conditions imposed by the European normative about State aid.

The typology of intervention allows to classify government guarantees under three categories. Direct guarantees require the guarantee to be issued directly by the guarantor in favour of the debtor. Eventually, the guarantee can be issued by the government through a third party that forwards it to the debtor without taking any obligation.

Instead, counter-guarantees are issued from a third party in favour of the principal guarantor, in the case in which both the debtor and the first guarantor demonstrate themselves unable to fulfil the obligation.

Co-guarantees finally allow the concession of guarantees directly in favour of the lender and jointly with other subjects authorised to issue guarantees.

Operativity allows to distinguish between operative and non-operative guarantees. Operative guarantees are, at the considered date, active and their capacity is not exhausted. Non-operative

guarantees have never been activated, or are going to be disabled for not receiving anymore or enough requests, or have reached the maximum available capacity.

## **2.2 Benefits and risks related to guarantees supported by the literature**

In order to evaluate the overall benefits produced by guarantee programmes, it is needed to compare performance in terms of effectiveness to the potential costs attached to the use of these instruments. For this purpose, periodical evaluations are important, especially helping policymakers improve elements of these programmes.

The budget process represents an essential source of information about the evaluation of projects and programmes and the relative trade-off among them, as well as a limit to total expenditures. Therefore, it is important that the budget process provides consistent measures for the calculation of the costs of programmes and their impacts on present and future expenditures. Furthermore, defaults on previously-granted guarantees expose budgets to large random shocks, that may create disruptions in their planning functions or problems with the respect of budgetary ceilings. Whenever the government gives an undertaking access to capital with favourable conditions, it transmits a subsidy to that undertaking. In the case of a guarantee, the implicit subsidy is proportional to the amount guaranteed and the probability that the firm will default, making necessary the guarantee's activation (Baldwin, Lessard, Mason, 1983).

Generally, the presence of a guarantee allows the beneficiary to borrow at a lower interest rate, as it results in a credit enhancement. Rating agencies in fact tend to attribute to the debt the rating of the guarantor, if higher than the borrower's one. In some cases, the use of the guarantee is even necessary in order to have access to borrowing markets (Eurostat, 2019). Many guarantees on loans and other payments usually also improve the maturity structure of the borrowing (International Monetary Fund, 2014). The literature shows that credit guarantees are an effective instrument, particularly for small and medium-sized enterprises, for financial additionality, accessing to debt finance, increasing credit availability and reducing costs (OECD, 2017). PGSs may in fact allow to constrained firms to access credit and to risky but-creditworthy firms to get larger funds at a lower cost. Banks may also benefit from PGSs as they help share credit risk when very high and when the bank's capital requirements are increasing, permitting savings on regulatory capital (Banca d'Italia, 2017). Due to the restrictions on the supply of bank credit to firms, PGSs are considered a cost-effective public intervention to spur credit creation (OECD, 2017).

Guarantee arrangements exist for different types of financial claims, often addressing specific financial policy objectives, including safeguarding the stability of the financial system, the



protection of consumers and investors and addressing market failures that impede a correct allocation of resources (Schich, Kim, 2011). Credit guarantee programmes may also have the purpose of overcoming the lack of collaterals that small and medium-sized enterprises encounter when accessing to finance (OECD, 2017).

However, this instrument may meet adverse selection and moral hazard problems, since the limited liability mechanism may increase the granting of risky and bad loans by banks. Also, guarantees that cover loans that would have been given anyway do not improve the private sector access to credit. Under these circumstances, the scheme will result in a highly costly but not worthy program for the public finances (Banca d'Italia, 2017). The limited degree of scrutiny at which guarantees are subject with respect to regular spending may cause different problems (International Monetary Fund, 2006):

a) it is not easy to verify the appropriateness and efficiency of the guarantees with respect to other fiscal policy instruments to meet a particular objective;

b) guarantees may be used as an instrument to bypass fiscal constraints;

c) allowance in the budget is usually not made to cover the costs of called guarantees;

d) a “guarantee culture” may arise, leading the private sector to prefer guarantees instead of managing the risks themselves;

e) good governance may be put at risk since guarantees are valuable for beneficiaries and given at the government’s discretion.

Budgeting only for expected cash cost and the absence of any immediate impact on the budget determine a visible advantage in the use of guarantees with respect to direct expenses or loans, even in cases where these would lead to more efficient and effective results. Ex ante estimations of the lifetime cost of the guarantee and the disclosure of relevant information ex post the granting can help the excessive use of guarantees as a financing instrument. When achieving this objective, the government should set up a reserve fund out of which future calls on guarantees would be made (International Monetary Fund, 2006). In fact, guarantees can be used to defer expenditures, increasing the number of subsidies today, without increasing their current expenditures (Baldwin, Lessard, Mason, 1983).

A central risk assumed by governments when granting a guarantee, as mentioned before, is the risk of moral hazard, which is constituted by the incentive of one party of the agreement, particularly the financial institution that lends funds, to assume unusual risks to earn extra profits before the contract settles. A study conducted by Gropp, Gruendl and Guettler (2010) for the European Central Bank demonstrated the effect of moral hazard associated with public guarantees. Following the German Government’s decision to remove guarantees for saving banks in 2001, they studied the effect of this lawsuit on banks’ risk assumption and credit

portfolio choices considering the period 1996-2006. The decision to remove guarantees on loans came from the European Court of Justice that believed that government guarantees caused a significant competitive advantage for saving banks with respect to commercial banks, which are in competition between each other for retail and commercial customers. The first results showed that the removal of the guarantees brought banks to cut off the riskiest borrowers from credit. In fact, lending standards were tightened, improving the credit quality of existing borrowers and in a significantly larger way of new borrowers. Banks also shifted their liabilities from risk-sensitive debt instruments towards insured deposits and equity. A second result regarded the observed increase in interest rates on the remaining borrowers and a reduction in the average loan size. The effects observed in the years from 2001 afterwards were economically large: the Z-score of average borrowers increased by 7.5%, suggesting a lower risk associated with borrowers, the average loan size declined by 17.2% while the interest rates carried to the remaining borrowers, despite the higher quality, were 46 basis point higher. A final important result concerns the increase in credit risk on a control group of German banks that were not directly affected by the lawsuit introduction. This is consistent with a deterioration in overall borrower quality in Germany in the period following 2001 consequent to the guarantees' removal.

Riding, Madill and Haines (2007) studied the effectiveness of loan guarantees schemes in terms of incrementality (or additionality). Their study focused on SMEs enterprises involved in the Canada Small Business Financing program. If a loan guarantee scheme results to be effective, there should be a significant number of firms which are obtaining financing through the scheme that would otherwise not. Identified as turndowns the additional loans that the scheme allowed and defining them as a measure of additionality, they set a logistic regression-based model. Their findings estimated additionality as  $74.8 \pm 9.0\%$  with 95% of confidence. They found out that many variables have an effect on the probability of the loan to be refused in traditional forms of financing. Their study suggests that financing real assets or working capital is less likely to result in a turndown, as well as an higher productivity or a bigger number of employees, suggesting a big company. On the other side, an owner younger than 35 years old or an higher capacity are factors that make more likely the loan to result in a turndown.

An OECD research conducted by Schich, Cariboni, Naszodi and Maccaferri (2017) analysed 23 evaluation studies on the effects of credit guarantee schemes (CGS) in many OECD countries. The study focused on financial additionality, taking into account, even if in a minor measure, financial sustainability and economic additionality. They classified policy interventions under the Maryland Scientific Methods Scale, which ranks them from level 1 (least robust) to level 5 (most robust). In order to avoid the selection-into-treatment bias and

therefore construct a valid counterfactual, which should take into account a sample of randomly selected SMEs, they considered only levels 3 and 4, which represent quasi-randomisation or at least construction of a valid counterfactual. The results of 8 studies showed that the amount of bank debt was positively affected by the CGS intervention, given that the presence of the guarantee tends to increase the debt of the beneficiary. In comparison 2 studies found out no related effects. The cost of credit is associated with 5 studies confirming a positive effect, 1 underlining a negative effect and 2 no effect. Employment maintained or created by the CGS is found out to be positive in 6 studies, negative in 4 studies and not significant in 2 studies. An highlighting should be made in relation to the impact of the guarantees on the probability of default of the beneficiary, where 5 studies out of 6 suggested a positive relation. The most common explanation is the adverse selection effect that may distort banks' incentives and lead to moral hazard problems.

These results are coherent with the Bank of Italy's studies made by De Blasio, De Mitri, D'Ignazio, Finaldi Russo and Stoppani (2017) about the effectiveness of "Fondo di Garanzia" (FG), Italian PGS that guaranteed € 54 billion loans during the period 2009-2014. The research suggests that the program resulted in a positive effect on the amount of bank loans to firms, but led no effects on the interest rates charged by banks. Through an 80% guarantee loan coverage, the FG aimed to counterbalance the effect of a credit crunch in a contest of increasing credit risk, particularly significant for small firms that suffered from a stronger rise in interest rates with respect to medium-big enterprises. The studies also underlined how the extra-finance made available through the scheme has been used by firms mostly as working capital financing, with no significant effects on firms' investments and sales.

Figure 2.1 shows the main results of their research. Using a parametric analysis, Panels A and B present growth rates in credit flows equal to 4.9% and 3.8%, respectively for loans disbursed and granted. When estimating with non-parametric methods, the value obtained are 3.0% and 3.8% respectively, remaining highly significant. Panel C refers to the two-year variations in the interest rates charged by the banks, suggesting no relevant variation in the cost of credit. Panel D underlines an increase of firms with bad loans attributable to the scheme estimated to be equal to 3.2% and 3.0%, for parametric and non-parametric analysis respectively.

**Table 4. The impact of FG on the main outcomes**

Parametric analysis			Non-parametric analysis	
ITT (1)	LATE (2)	F-test (3)	ITT (4)	LATE (5)
<i>A. Disbursed loans</i>				
0.0495** (0.0247)	0.563* (0.300)	9.746	0.0303* (0.0180)	0.457* (0.275)
N=57632 <i>polynomial degree: 3</i>				
<i>B. Granted loans</i>				
0.0381* (0.0190)	0.551* (0.314)	9.632	0.0377** (0.0149)	0.560** (0.229)
N=57912 <i>polynomial degree: 3</i>				
<i>C. Interest rate</i>				
0.0621 (0.132)	0.855 (1.840)	8.029	0.0335 (0.115)	0.478826 (1.643)
N=51001 <i>polynomial degree: 3</i>				
<i>D. Probability of bad loans</i>				
0.0325*** (0.0125)	0.503** (0.254)	9.527	0.0302** (0.0125)	0.479** (0.205)
N=57502 <i>polynomial degree: 3</i>				

Notes: columns (1) to (3) report parametric estimates. Columns (4) and (5) report non-parametric estimates. The optimal bandwidth for non-parametric estimates has been retrieved by Imbens and Kalyanaraman (2012) procedure with triangular Kernel. Outliers below 5 or above 95 percentile were dropped. Standard errors in brackets.

**Figure 2.1.** Source: De Blasio, De Mitri, D'Ignazio, Finaldi Russo, Stoppani, 2017.

D'Ignazio and Menon (2013) conducted a study on the effectiveness of a credit guarantee regional program in Italy that started operating in 2008, with an endowment of approximately €20 million per year. They found out that the policy resulted effective in improving the financial conditions of the beneficiary firms. Although the total amount of bank debt was unaffected, a significant increase was shown on the share of long-term debt over the total bank debt. Carried interest rates marked a substantial decrease, while, on the other hand, the program affected the risk of moral hazard with the probability of default of treated firms being larger than identical untreated firms for the two following years. The impact on the probability of default became negligible when a longer period is considered. Even in this case, the effect on investments and trade debts was minimal, and significant only in the first year following the intervention.

Vogel and Adams (1997) identified the presence of a market imperfection or distortion, such as information externalities or asymmetries, as a necessary but not sufficient condition for the implementation of an effective loan guarantee program. They identified two situations in which loan guarantees schemes may represent an effective solution: first, when risk premium or fixed costs are too high, and second, when lenders require the presence of collaterals. They underlined three categories of costs related to loan guarantee schemes: set-up costs, transaction costs, especially when involving small and short-term loans, and program subsidies, including guarantee funds and other additional grants or government transfers. The main benefit identified is represented by additionality to the targeted group, even if results are difficult to evaluate due to counterfactual, which would have been the effects without the presence of the guarantees. Substitution effects further complicate the estimation, through both intra-portfolio and inter-lender substitution. Vogel and Adams stated that these obstacles in the estimations might result in a major additionality observation than what it would actually be without the guarantee.

Riding and Haines (2001) found a positive correlation between the use of guaranteed as aid instrument and job creations, highlighting an average cost-per-job much lower than other aid measures. The guarantees under the terms of the Canadian Small Business Loans Act analysed in their study resulted an extraordinary assistance measure for SMEs to survive and grow.

Singh, Gómez-Puig and Sosvilla-Rivero (2019) studied the different effects of aid measures on sovereign risk profile. Even though both direct intervention and contingent guarantee are temporary measures, the first represents a more expensive instrument and, at the same time, the use of guarantees does not significantly affect sovereign risk. This is possibly caused by the absence of an immediate increase of funding requirements and by the fact that they influence both bank and sovereign risk, which affect each other.

In their study, they used a sample of European countries to study the relationship between government intervention and sovereign yield, represented by the 10-year benchmark government bond. They started with a regression using sovereign yield as the dependent variable, including separately direct assistance and contingent guarantees, finding out an increase of 6 and 2.9 basis points respectively. In order to find more precise results and determine if the results are correlated with sample composition, size and asset concentration in financial sector, country characteristics, uncertainty and market sentiment, they added other variables to the regression. In the combined analysis they found out that while an additional percentage increase in GDP as direct assistance increases the sovereign yield by 6.2 basis point, the additional percentage increase in GDP as contingent guarantees has no relevant effect. Country size, perceived government effectiveness and better economic sentiments negatively affect the sovereign yield. On the other hand, unemployment, inflation and uncertainty affect

positively sovereign yield. Also, belonging to the Euro area has a negative effect of roughly 85 basis points. The results of their studies are resumed in Figure 2.2.

	<i>Dependent variable: SovYield</i>		
	(1)	(2)	(3)
GovLiabExclFinAsst	0.027** (0.013)	0.025*** (0.007)	0.028*** (0.007)
DirectAssistance	0.065* (0.035)	0.049*** (0.016)	0.062*** (0.015)
ContingentGuarantee	0.003 (0.007)	-0.003 (0.004)	-0.003 (0.003)
SizeFI		-0.008 (0.134)	-0.077 (0.138)
ShareTop5CI		0.009 (0.008)	0.010 (0.007)
log(GDP)		-0.588*** (0.201)	-0.548*** (0.184)
Inflation		0.119* (0.062)	0.123* (0.066)
Unemployment		0.139** (0.055)	0.149*** (0.050)
Government Effectiveness		-0.891*** (0.221)	-0.701*** (0.219)
WUI		2.194** (0.855)	1.353* (0.767)
ESI		-0.088** (0.036)	-0.101*** (0.034)
EUROAREA			-0.853** (0.335)
Year FE	Yes	Yes	Yes
Observations	230	194	194
R <sup>2</sup>	0.195	0.658	0.675
Adjusted R <sup>2</sup>	0.151	0.618	0.635

*Note:* \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

**Figure 2.2.** *Source: Singh, Gómez-Puig, Sosvilla-Rivero, 2019.*

## **2.2 Guarantees classification: financial derivatives, standardised guarantees and “one-off” guarantees**

A government can provide guarantees in three different forms:

- a) in the form of derivatives, which fall under the normal treatment of derivatives and do not require specific provisions for such government transactions;
- b) in the form of standardised guarantees (introduced in 2008 SNA and ESA 2010);
- c) in the form of ‘one-off’ guarantees (Eurostat, 2019).

### **2.2.1 Financial derivatives guarantees**

Guarantees that meet the definition of financial derivatives are actively traded on financial markets, such as credit default swaps. The derivative is based on the risk of default of a reference instrument and is not actually linked to an individual loan or bond. For this reason, they do not affect the net lending or borrowing of the government (European Commission, International Monetary Fund, Organization for Economic Co-operation and Development, United Nations, World Bank, 2009). Guarantees classified as financial derivatives protect the lender against certain types of risk arising from a credit relationship by paying the guarantor a fee for a specified period of time. The characteristics of the guarantees covered allow the guarantor to apply standard master legal agreements or to make a reasonable estimate of the probability of default of the borrower, thus allowing to calculate suitable terms for the financial derivatives (International Monetary Fund, 2014).

### **2.2.2 Standardised guarantees**

Standardised guarantees are issued in large numbers, usually for fairly small amounts, along identical lines. Either the borrower or the lender may contract with the guarantor to repay the lender if the borrower defaults. Examples of these guarantees are student loans, real estate loans to households and export credit (Eurostat, 2013).

Guarantees in this form are characterised by often-repeated transactions with similar features and pooling of risks, allowing guarantors to estimate the average loss using a probability-weighted risk of call (Eurostat, 2013). Even though the degree of probability of a single standardised guarantee being called is uncertain, in fact, the high number of guarantees with similar features allows a reliable statistical estimate of the future number of calls under

guarantee. Therefore, standardised guarantees are assumed to give rise to financial assets instead of contingent assets (Eurostat, 2013).

### **2.2.3 One-off guarantees**

On the contrary, guarantors are not able to make a reliable estimate of the risk of calls for one-off guarantees due to the uniqueness of the case. The granting of a one-off guarantee is therefore a contingency and not recorded (Eurostat, 2013). One-off guarantees are included in contingent liabilities and therefore considered off-balance sheet of which the disclosed is however required. IAS 17 in paragraph 14 states that when a contingent liability is considered to be more likely to require an outflow of resources than not, contingent liabilities are required to be shown on balance-sheet as provisions, given that a present obligation is present at the reporting date and a reliable estimate of the amount can be made. One-off guarantees are used where the conditions of the loan or the security are so particular that it is not possible for the degree of risk associated with the loan to be calculated with any degree of accuracy.

## **2.3 Accounting treatment of government guarantees**

Obligations in public sector accounting can be divided into three categories (Lequiller, 2015):

- a) liabilities: present obligations arising from past events expected to result in an outflow of resources;
- b) provisions;
- c) contingent liabilities.



**Figure 9.1 Overview of Liabilities and Contingent Liabilities in Macroeconomic Statistics**



**Figure 2.3.** Source: International Monetary Fund, 2014.

A provision is defined in International Accounting Standards (IAS) 37 (paragraph 10) as “a liability of uncertain timing or amount”. The liability can be legal or constructive, through which the entity declared the acceptance of certain responsibilities, therefore creating expectations about the discharge. If the outflow of cash or other economic resources is believed to be probable, the provision is recognised. The provision is measured as the present value of the amount that the entity will rationally pay or transfer to a third party at the end of the reporting period, including possible risks and uncertainties. If the outflow is not probable, it is treated as a contingent liability.

Many statisticians consider provisions as ambiguous for two reasons: the differences that may arise when analysing the same liability from the point of view of two different agents, often on

the opposite side of the transaction, and the lack of reliability that many times may arise in the moment of the recognition (Lequiller, 2015).

A contingent liability is classified in IAS 37 (paragraph 10) as “a possible obligation that arises from past events and whose existence will be confirmed by the occurrence or non-occurrence of one or more uncertain future events not wholly within the control of the entity” or a present obligation not recognised either because its amount cannot be measured with sufficient reliability or because the outflow of resources is not probable. IAS 37 states that a contingent liability is not recognised in the statement of financial position. However, unless the possibility of an outflow of economic resources is remote, contingent liabilities are disclosed in the notes. In the probability estimation, IAS 37 defines in paragraph 23 “an outflow of resources or other events is regarded as probable if the event is more likely to occur than not to occur”.

Even if the no definition of “remote” is provided, the intention is to avoid disclosure of obscure potential obligations that would lead to misleading reporting (Heald, Hodges, 2018).

Contingent liabilities are distinguished between explicit and implicit. Explicit contingent liabilities are defined as legal or contractual financial arrangements that require payments of economic values if one or more established conditions arise. Guarantees are the most common form, but the category includes also:

- a) potential legal claims, which are claims stemming from pending court cases;
- b) indemnities, which are commitments to accept the risk of losses or damages that a third party may suffer;
- c) uncalled capital, which is an obligation to provide additional capital to an entity to which the government is a shareholder (International Monetary Fund, 2014).

Implicit contingent liabilities, on the contrary, do not arise from a legal or contractual source, but enter into force when a condition or event is realised. They can often be considered political or moral obligations that arise from the expectation that the government will intervene in cases of exceptionally crisis or disaster, in particular when the impact is considered not affordable (International Monetary Fund, 2014).

Table 1. Government reporting preferences ladder for guarantees.

Recognized in financial statements	Disclosed within notes but not recognized	Neither recognized nor disclosed
	Remote unquantifiable contingent liability <sup>a</sup>	No government obligation
	Unquantifiable contingent liability	Remote quantifiable or unquantifiable contingent liability <sup>b</sup>
	Remote quantifiable contingent liability <sup>a</sup>	
	Quantifiable contingent liability	
Liability		

Figure 2.4. Source: Heald, Hodges, 2018

Heald and Hodges (2018) underlined how a government might account for guarantees under four different accounting modes: accounting standards-based financial reporting, statistical accounting, government budgeting and fiscal sustainability projections. They studied how different way of recognising for guarantees may have effects on the promotion or hindering of fiscal transparency, defined by the International Monetary Fund <sup>6</sup> as “comprehensiveness, clarity, reliability, timeliness, and relevance of public reporting on the past, present, and future state of public finances”.

Following the financial reporting mode, which is performed by accountants and auditors, the accounting of guarantees under IFRS 37 and IPSAS 19 is recognised as provisions or disclosed as contingent liabilities. In some cases, guarantees arrangements are disclosed as financial instruments or insurance contracts.

The issue correlated with financial reporting is that off-balance-sheet obligations lead to an increase in risks which is not counterbalanced by expenditures since the initial recognition as contingent liabilities involves little or no recognised expenditure. Any provision of financial guarantee liabilities measured at fair value is considered to be matched by the value of future revenues represented by guarantees fees (Heald, Hodges, 2018).

In the context of statistical accounting, guarantees are normally recognised as government liabilities only if it is clear that it will require government funding. Under this approach, it is required to distinguish between the three types of guarantees as in ESA 10.

One-off guarantees have the advantage of not being recognised as public expenditure since they are regarded as contingent liabilities. The complexity and lack of transparency of such instruments determine the long time required to unravel and the possibilities that may arise for governments that move policy objective to the right or upwards. In fact, arbitrage opportunities

<sup>6</sup> International Monetary Fund (2018). <https://www.imf.org/external/np/fad/trans/>

may arise from the choice of allocating guarantees obligations within the general government and public corporation that may reveal not viable without even charging fees. Furthermore, fees are treated as government revenues instead of being disclosed as a form of coverage for future liabilities that may arise under those guarantees (Heald, Hodges, 2018).

For this reason, some safeguards have been put into action. First, regulations in ESA10 and Eurostat Manual on Government Deficit and Debt have innovated the category of standardised guarantees, that can be estimated at the expected cost through a provision for calls under standardised guarantees, and the enforcement of the “three calls rules”. Second, the positioning of national statistical offices and Eurostat within the government information perimeter gives them complete access to source documents. For EU Member States, the Council Directive 2011/85/EU requires the disclosure of contingent liabilities that may cause large effects in public budgets (Heald, Hodges, 2018).

Under government budgeting, performed by public servants, guarantees shown in budgetary documents depends on the adopted measurement basis, the coverage of budgetary documents and the degree of aggregation of the budget documents.

Finally, using fiscal sustainability projections, constructed on a cash basis to assess sustainability by economists working in finance ministries, central banks and international and supranational agencies, are subject to the risk of large improbable future calls. This risk represents a potential threat to sustainability itself (Heald, Hodges, 2018).

Independently of the basis of accounting followed, information for each guarantee or guarantee scheme should include annually (International Monetary Fund, 2006):

- a) brief description of intended purpose, nature, beneficiaries and expected duration;
- b) the government’s gross financial exposure and, if possible, an estimation of the fiscal cost of called guarantees;
- c) payments made, reimbursements, recoveries, financial claims against beneficiaries, and any waivers;
- d) guarantee fees or other forms of revenues received.

In addition, budget documentation should provide:

- a) indication of the allowance made for expected calls and its form;
- b) a forecast of the new guarantees or guarantee schemes to be issued in the budget year.

During the year, the issue of new guarantees should be published, and fiscal reports should report new guarantees issued during the period, payments made on called guarantees and the status of claims on beneficiaries. Finally, a reconciliation between the stock of debt at the beginning and at the end of the period should be provided, showing that part of the change is attributable to the activation of guarantees. Annual budgets of government should include the

expected cost of called guarantees, assuring that such expenses are known when the budget is presented and do not cut off other spending or increase the fiscal deficit. Budget documents have to contain an explanation for the appropriation as well as an identification of the guarantees or guarantees programmes that are expected to result in calls. When necessary, the appropriation has to be increased within the year. On the contrary, any unused portion of the appropriation can be withdrawn when it becomes clear that it will not be subsequently required (International Monetary Fund, 2006).

### **2.3.1 Accounting treatment for one-off guarantees**

Generally, a government one-off guarantee is recorded solely as borrowing in the borrower's balance sheet and an asset in the lender's balance-sheet. In contrast, the guarantee is represented as a contingent liability for the government and thus not recorded in ESA balance-sheets until the guarantee is called (or activated) (Eurostat, 2019).

If the guarantee is called, whether for the full amount or part of it, the government takes over the amount of the borrower's called debt through a debt assumption, which will be recorded as a capital transfer from government to the borrower (Eurostat, 2019). A debt assumption is a trilateral agreement between a creditor, a former debtor and a new debtor. The new debtor becomes liable of the repayment of the former debtor's outstanding liability to the creditor. In the case in which the original debtor defaults on its debt obligations, which is the moment of the guarantee's activation, the creditor may invoke the contract conditions requesting the guarantor unit to either repay the debt or to assume the responsibility for the debt as the primary debtor. Therefore, the liability of the original debtor is extinguished and substituted by the new liability (International Monetary Fund, 2014).

This operation has an impact on the government's net lending/borrowing. The capital transfer is matched by the transfer of the financial liability from the borrower to the government. The government may, immediately or subsequently, repay the outstanding debt to the lender, including the interest accrued but not paid yet at the time of the assumption entering into a separate financial transaction. However, this financial transaction has no impact on net lending/borrowing (Eurostat, 2019).

A partial call (or cash call) of the guarantee occurs when the government pays one instalment. The government's actual payment made is recorded as a debt assumption and therefore as capital transfer expenditure, balanced by a decrease in currency and deposit. This is analysed as a debt assumption with government taking over part of the liability and as if there was a transfer of the financial liability to government that is followed by an immediate settlement of

this amount in order to extinguish the liability (Eurostat, 2019). The debt may carry the same terms as the original debt, or new terms may come into force because of the invocation of the guarantee (International Monetary Fund, 2014).

The general principle for the treatment of one-off guarantees states that they should be considered contingent assets or liabilities. Since contingent assets and liabilities do not give rise to unconditional obligations, they cannot be treated as financial assets and liabilities (Eurostat, 2013). Consequently, contingent liabilities are not recorded in the ESA balance-sheet and are not included in the government debt, and the granting of a guarantee is not considered a transaction in national accounts. The only recorded transactions are the recognition of the fees and the activation of the guarantee in the case in which the guarantor finds itself in the position of replacing the original borrower. Any call of the guarantee, whether full or partial, is equivalent to a debt assumption for the government (Eurostat, 2019).

In some cases, even if the corporation legally carries the debt, it is known with certainty that the government will have to take the obligation. This may happen both for newly issued or already existing debt that the government had started to guarantee (Eurostat, 2019).

In the most linear cases, evidence of the debt repayment is provided in legal documents or the liability is recognised in the public accounts or in similar documents, like in the budgetary documentation. In such cases, the debt is considered first issued by the corporation and then assumed by the government, operation that may happen even immediately if it obvious that the government will have to assume it. The operation is economically equivalent to the government borrowing directly from the creditor, with the proceeds used to fund the corporation. This transaction should be recorded as a distributive transaction (capital transfer) and affects government net lending/borrowing (Eurostat, 2019).

International accounting standards require government reporting to disclose information on contingent liabilities, including guarantees, on an accrual basis. Supplementary information disclosure can strengthen transparency required with respect to guarantees through budget documents, fiscal documents, and financial statements (International Monetary Fund, 2006).

In other cases, even if no documented evidence is provided, other indicators may underline the de facto assumption of the debt by the government.

Such indicators may be represented by:

a) repeated calls: in these cases, it can be noticed that the government is repaying the debt every year, either directly, through calls, or indirectly, through recurrent payments to the borrower. Such payments result in a provision for the amount necessary to repay the creditors, without formally activating the guarantee. In the case this support becomes a common

occurrence, it will be considered as an indirect (or disguised) call, triggering the government assumption of the debt;

b) a provision recorded in public accounts or similar documents showing that the repayment probability of the debt covered by the guarantee is very high: in these cases, the outstanding debt amount, or at least a relevant part of it, is treated in national accounts as assumed by the government (Eurostat, 2019).

If the government has to repay part of the debt for three consecutive calls (referred to as the “three calls rule”), then the debt is automatically assumed by the government itself. The amount for which the government is considered liable usually corresponds to the amount in its entirety, although a reduction can be applied if it can demonstrate that the government is liable only for a proportion of the debt amount. The date of record of the debt should be the one of the event that caused the assumption, such as the time of the third annual payment (Eurostat, 2019).

If the defaulting borrower’s financial performance subsequently improves to the point in which it is assumed to be capable of regular debt repayments, the corporation is considered obliged to assume the debt back from the government. This operation is recorded in public accounts as a capital transfer from the corporation to the government, offset by a financial transaction where the liability is transferred from the government to the corporation (Eurostat, 2019). The debt should be presented as a liability in the public accounts until the payments from the defaulting entity become real and evidence shows that they will continue also in the future. This prudence will avoid instability in government debt statistics, viewing the unit’s financial improvement as permanent (Eurostat, 2019).

The mechanism described above is schematised in Figure 2.5.

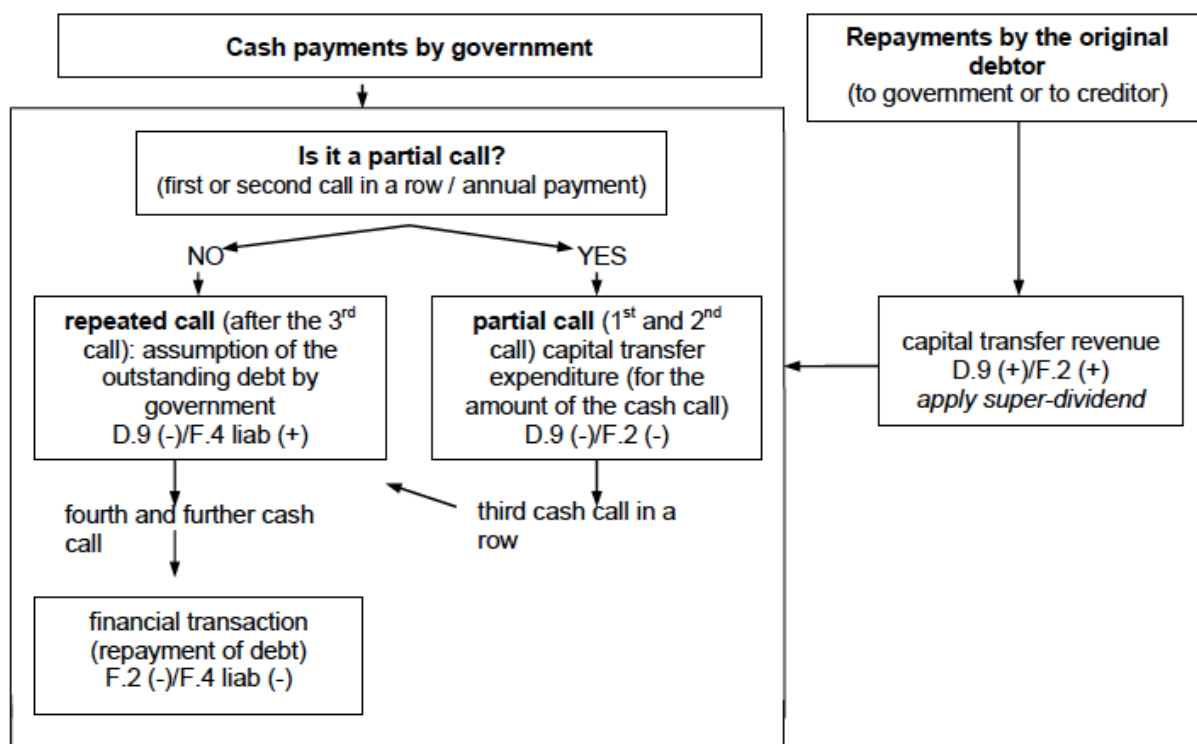


Figure 2.5. Source: Eurostat, 2019.

### 2.3.2 Accounting treatment for standardised guarantees

A government standardised guarantee is treated similarly as a non-life insurance, under the assumption that providing the guarantee has commercial purpose. However, the level of claims may be higher than expected, not being covered anymore by the size of income or premiums. Under a theoretical point of view the amount of fees required by government should be economically significant in covering most of the expected calls and administrative costs.

When the government grants a standardised guarantee, a liability named “provisions for call under standardised guarantees” is recorded in its balance sheet for an amount estimated from past experiences or forecasts in case of new activities. The counterpart of the liability is a cash payment equal to the fees received minus the value of calls of existing guarantees. In the case the government charges no fees, the counterpart would be represented by a nonfinancial transaction (transfer from the government) (Eurostat, 2019). Provisions for calls under standardised guarantees are financial claims that holders of standardised guarantees have against the institutional units providing them (Eurostat, 2013).

When a call on standardised guarantees is made, this operation has no impact on government net lending/borrowing since the provisions for call under standardised guarantees should cover the loan amount and may be just re-adjusted. The provision should represent, in fact, a reliable



estimate made by the government of the value of expected losses during the life of the guarantees (Eurostat, 2019).

In the case of a further increase of the risk of default, a revision of the liability and a new capital transfer are required if it is assumed that it will affect all the portfolio's existing loans. On the contrary, a decrease of the risk will lead to a revision downward of the value of the liability only if the recovery of the claim is assumed to be quite irreversible. Instead, a new capital transfer is recorded if the value of the provisions set in advance is not sufficient to cover the guarantees calls. The government will also have to reconstitute provisions for the remaining portfolio of loans guaranteed through a new capital transfer (Eurostat, 2019).

From an accounting perspective, two important conclusions emerge. First, guarantees are connected with an uncertain outcome, also strengthened by the use of multiple accounting standards and porous accounting boundaries. Second, standards tightening may encourage policy instruments designed to exclude obligations from balance-sheet numbers (Heald, Hodges, 2018).

#### **2.4 Debt composition and guarantees impact**

The Excessive Deficit Procedure provides a specific definition of the gross debt of the general government. The Maastricht debt is the “gross debt outstanding at the end of the year, consolidated at the general government level. It covers the following liabilities: currency and deposits, securities other than shares excluding financial derivatives and loans” (Bresciani, Cossaro, 2016, p.3). It excludes pension liabilities, insurance technical reserves and other account payables, such as trade credits and advances (Bresciani, Cossaro, 2016). Figure 2.6 shows the evolution of Maastricht debt in European States.

→ Variable		Gross public debt, Maastricht criterion as a percentage of GDP				
→ Frequency		Annual				
→ Time		2018	2019	2020	2021	2022
		▲ ▼	▲ ▼	▲ ▼	▲ ▼	▲ ▼
→ Country	Unit					
Austria	Percentage	74.05	70.57	86.81	91.95	92.21
Belgium	Percentage	99.76	98.06	116.31	118.65	120.17
Denmark	Percentage	34.03	33.35	44.12	40.09	40.88
Finland	Percentage	59.63	59.25	63.80	68.46	72.27
France	Percentage	97.99	98.07	115.65	116.85	118.50
Germany	Percentage	61.70	59.55	73.93	76.18	75.78
Greece	Percentage	186.24	180.50	213.71	207.63	194.63
Hungary	Percentage	69.12	65.41	74.49	77.52	77.71
Ireland	Percentage	62.91	57.33	66.19	73.00	74.46
Italy	Percentage	134.46	134.68	157.60	157.22	156.14
Netherlands	Percentage	52.40	48.71	55.89	63.05	67.27
Norway	Percentage	39.11	40.21	..	..	..
Portugal	Percentage	121.48	117.20	136.12	139.70	138.76
Spain	Percentage	97.43	95.51	117.26	120.50	122.43
Sweden	Percentage	38.90	35.04	38.33	38.28	38.48
United Kingdom	Percentage	85.78	85.40	113.36	125.49	128.55
Euro area (17 countries)	Percentage	87.72	85.90	101.82	104.50	105.14

**Figure 2.6.** Gross public debt. Maastricht criterion as percentage of GDP. *Source: OECD, 2020.*

Under ESA 2010, no definition of government debt is provided, but an equivalent concept is represented by total financial liabilities, value which includes more financial instruments than Maastricht debt. It covers “monetary gold and special drawing rights, currency and deposits, debt securities, loans, financial derivatives and other accounts payables. Equity and insurance, pension and standardized guarantees schemes are included only in few cases of specific units classified inside the government sector” (Bresciani, Cossaro, 2016, p.4).

The stock of government liabilities always excludes liabilities such as provisions for expected uncertain events arising from past events, and liabilities of entities considered as government subsidiaries in other accounting systems but regarded in national accounts as external to the general government. “Contingent liabilities, such as guarantees, public-private partnerships recorded off-balance-sheet of government, liabilities of government-controlled entities classified outside government and pension entitlement for under unfunded government defined benefit employer pension schemes or social security pension funds” are also excluded (Bresciani, Cossaro, 2016, p.4).

From an accounting point of view, unlike direct intervention measures, government guarantees have no immediate impact on government debt when they are issued. Figure 2.7 resumes the principal aid measures taken in contrast to the 2008-2015 financial crisis, classified based on if they give rise on any impact on asset and liabilities, or on fiscal balance.

Table 3.1 - Accounting framework for general government assistance to the financial sector, 2008-2015

	direct impact on assets and liabilities	direct impact on fiscal balance
<b>Financial transactions</b>		
Loans	✓	
Debt securities	✓	
Equity and investment fund shares/units at market price	✓	
Other assets and liabilities from entities reclassified from national sector to general government without transactions. Assets and liabilities of newly established government defeasance structures	✓	
<b>Capital transfers</b>		
Interest payable	✓	✓
Capital injections recorded as deficit-increasing (capital transfers)	✓	✓
Other capital transfers (e.g. asset purchase above market price)	✓	✓
Calls on guarantees	✓	✓
Debt assumption	✓	✓
<b>Indirect revenues</b>		
Guarantee fees receivable		✓
Interest receivable		✓
Dividends receivable		✓
<b>Contingent liabilities</b>		
Liabilities and assets outside general government under guarantee		
Securities issued under liquidity schemes		
Special purpose entities (1)		

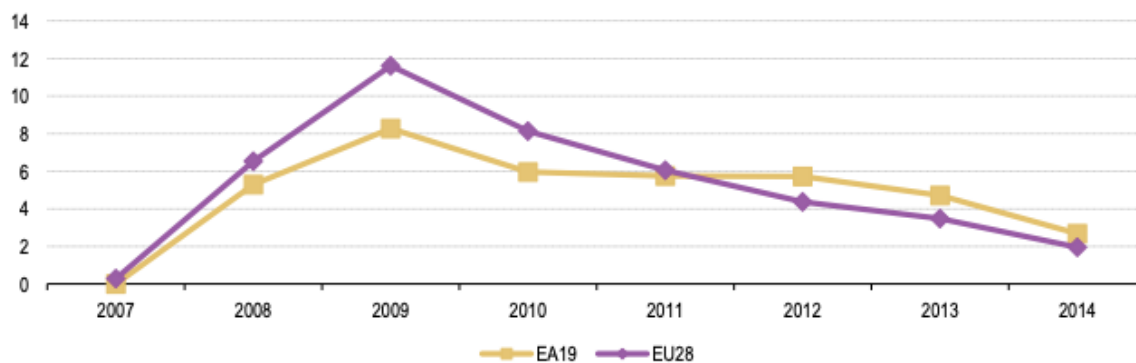
1). Special purpose entities included here are those where government has a significant role, including a guarantee, but which are classified outside the general government sector. Their liabilities are recorded outside the general government sector (as contingent liabilities of general government).

Figure 2.7. Source: Bresciani, Cossaro, 2016.

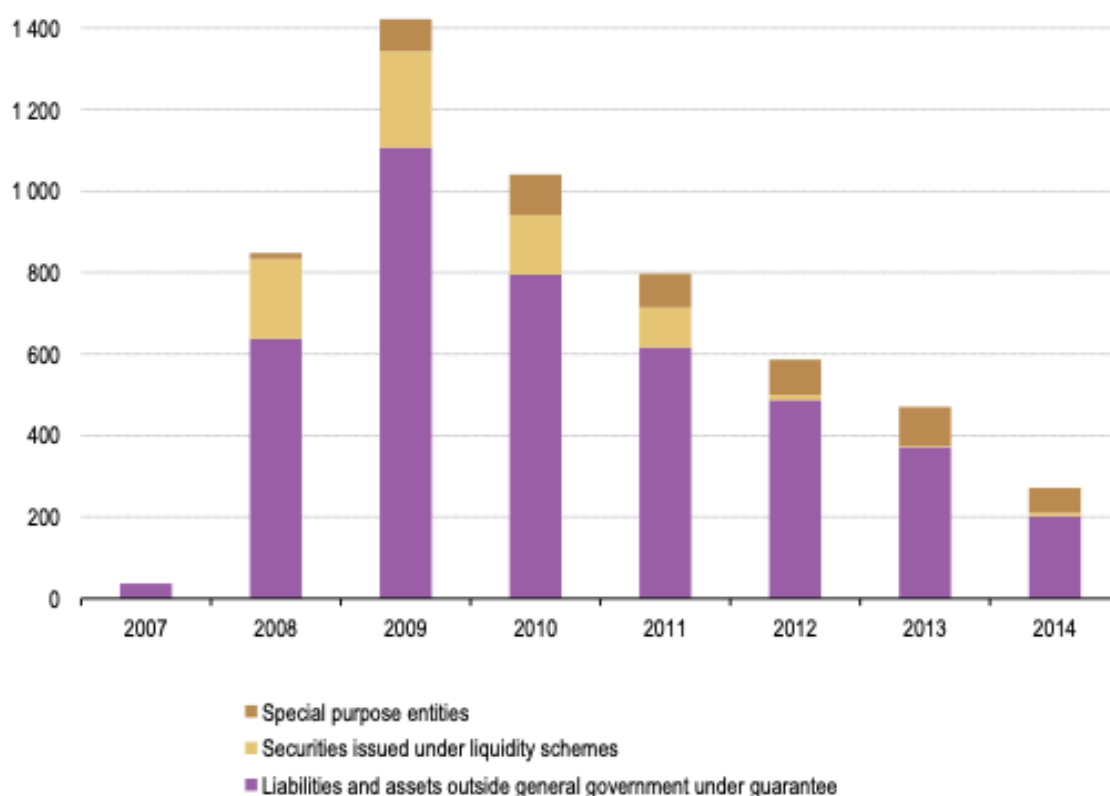
ESA 2010, paragraph 5.11, underlines the importance of the recognition of contingent liabilities: "Although contingent assets and contingent liabilities are not recorded in the accounts, they are important for policy and analysis, and information on them needs to be collected and presented as supplementary data. Even though no payments may turn out to be due for contingent assets and contingent liabilities, a high level of contingencies may indicate an undesirable level of risk on the part of those units offering them." (Eurostat, 2013, p. 126). Contingent liabilities have not any current effect on the debt level, but may contribute to government liabilities in the future, also with significant effects.

In fact, particularly in period of financial and economic crisis, governments made large use of contingent liabilities as instrument of response to the challenging situation. Figure 2.8 shows the increase in the quantity of contingent liabilities that European States have faced during the 2008-2015 financial crisis. Figure 2.9 shows the composition of contingent liabilities in the

considered period, demonstrating the large importance that guarantees on financial institutions' assets and/or liabilities assumed on the total.



**Figure 2.8.** Level of contingent liabilities in the Euro Area (EA19) and the EU28 as percentage of GDP. *Source: Eurostat, 2015.*



**Figure 2.9.** Structure of contingent liabilities, EU28 (billions of euro). *Source: Eurostat, 2015.*

Given the potential impact of government guarantees on the public finance, article 14(3) of the Council Directive 2011/85/EU of 8 November 2011 on requirements for budgetary framework

of the Member States establishes: "For all sub-sectors of general government, Member States shall publish relevant information on contingent liabilities with potentially large impacts on public budgets, including government guarantees, non-performing loans, and liabilities stemming from the operation of public corporations, including the extent thereof. Member States shall also publish information on the participation of general government in the capital of private and public corporations in respect of economically significant amounts".

As shown in the table in Table 2.1 <sup>7</sup>, in 2019 the European State with the highest amount of government guarantees as percentage of GDP were Finland (33.42%), Denmark (18.21%), Austria (16.07%), Germany (13.19%), France (11.64%) and Luxembourg (10.45%). In Italy the value was significantly lower (4.80%). Ireland faced the most relevant change in the period 2010-2019, from a value of 96% to 0% of GDP. A significant decrease can also be noticed in Belgium (from 17.17% to 8.49%) and in Austria (from 38.18% in 2012 to 16.07% in 2010). On the contrary, Finland shows the highest increase during the considered period.

Table 2.2 and Table 2.3 differentiate the stock of general government guarantees into one-off guarantees and standardised guarantees. Comparing data between the two tables, it can be noticed that a large percentage of government guarantees is represented by one-off guarantees in almost every State considered, reaching the totality in countries like Germany, Czechia, Ireland, Austria, Netherlands, Croatia, Slovakia, Slovenia, Sweden, Portugal and Spain. Estonia and Romania are the only countries with a larger share of standardized guarantees than one-off guarantees on the total.

---

<sup>7</sup> EUROSTAT Data Browser, 2020. Government guarantees. Available at: [https://ec.europa.eu/eurostat/databrowser/view/gov\\_cl\\_guar/settings\\_1/table?lang=en](https://ec.europa.eu/eurostat/databrowser/view/gov_cl_guar/settings_1/table?lang=en)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<b>Belgium</b>	17,17	15,09	17,53	13,76	11,47	9,64	10,72	9,87	9,32	8,49
<b>Bulgaria</b>	1,29	1,12	0,93	0,73	0,60	0,49	0,38	0,26	0,17	0,12
<b>Czechia</b>	0,53	0,47	0,5	0,58	0,48	0,34	0,28	0,23	0,19	0,16
<b>Denmark</b>	14,62	12,93	7,29	9,92	9,51	12,48	12,23	11,64	14,54	18,21
<b>Germany (until 1990 former territory of the FRG)</b>	20,27	18,74	17,34	16,65	15,42	15,28	14,34	13,40	12,84	13,19
<b>Estonia</b>	2,64	2,15	1,91	1,7	1,59	1,47	1,81	1,73	1,55	1,37
<b>Ireland</b>	96	79,75	65,75	31,07	12,88	4,3	1,47	0,09	0	0
<b>Greece</b>	25,50	36,28	31,47	31,11	28,32	28,00	6,51	4,36	4,16	4,09
<b>Spain</b>	12,74	14,91	20,98	18,83	12,88	9,55	7,77	6,68	5,58	4,94
<b>France</b>	11,82	11,10	10,71	11,63	11,34	11,81	11,95	12,02	11,97	11,64
<b>Croatia</b>	4,26	2,06	2,20	1,87	1,61	1,93	2,66	2,65	1,37	1,09
<b>Italy</b>	0,81	3,51	6,18	6,13	2,65	2,13	2,40	3,91	4,33	4,80
<b>Cyprus</b>	7,34	7,68	14,44	15,96	16,23	15,29	8,97	8,42	7,83	7,44
<b>Latvia</b>	2,91	3,01	2,91	2,34	1,17	1,96	1,40	1,34	1,38	1,43
<b>Lithuania</b>	1,47	1,08	0,93	0,91	0,87	0,85	0,95	1,01	0,91	0,84
<b>Luxembourg</b>	5,62	7,86	9,45	8,98	12,28	11,31	12,45	11,85	11,13	10,45
<b>Hungary</b>	8,61	7,91	7,64	6,57	5,73	6,11	5,79	4,99	5,09	7,39
<b>Malta</b>	11,43	12,57	16,18	15,09	15,26	14,07	13,28	9,19	8,57	7,40
<b>Netherlands</b>	10,12	9,31	7,27	6,54	3,52	3,76	3,56	3,44	3,20	3,03
<b>Austria</b>	nd	nd	38,18	33,39	19,14	18,76	17,18	16,29	16,33	16,07
<b>Poland</b>	1,41	1,42	1,33	1,72	1,65	1,53	1,65	1,40	1,28	1,18
<b>Portugal</b>	4,64	12,38	13,56	13,28	6,93	6,68	5,56	6,31	5,61	4,83
<b>Romania</b>	2,39	1,77	2,10	2,16	2,50	2,41	2,38	2,23	2,10	2,00
<b>Slovenia</b>	19,73	17,31	13,36	14,39	12,32	10,6	9,61	8,55	7,48	6,46
<b>Slovakia</b>	0,06	0,05	0,04	0,03	0,04	0,03	0,03	0,02	0,03	0,01
<b>Finland</b>	19,62	20,16	21,27	23,6	25,77	28,25	27,80	31,73	32,66	33,42
<b>Sweden</b>	16,79	13,88	11,94	11,42	10,25	10,95	10,48	9,76	10,00	9,99
<b>United Kingdom</b>	0,04	0,04	0,21	0,21	0,31	0,30	0,34	0,20	0,19	nd

**Table 2.1.** General government total stock of guarantees as percentage of Gross Domestic Product (GDP). *Source: own elaboration (data from Eurostat Data Browser, 2020).*

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<b>Belgium</b>	17,17	14,45	16,89	13,16	10,90	9,08	10,10	9,26	8,73	7,89
<b>Bulgaria</b>	1,28	1,10	0,90	0,68	0,54	0,42	0,31	0,19	0,10	0,06
<b>Czechia</b>	0,53	0,47	0,5	0,58	0,48	0,34	0,28	0,23	0,19	0,16
<b>Denmark</b>	14,52	12,83	7,21	9,84	9,45	12,43	12,19	11,61	11,77	11,15
<b>Germany (until 1990 former territory of the FRG)</b>	20,27	18,74	17,34	16,65	15,42	15,28	14,34	13,40	12,84	13,19
<b>Estonia</b>	0,02	0	0	0	0	0	0	0	0,01	0
<b>Ireland</b>	96	79,75	65,75	31,07	12,88	4,3	1,47	0,09	0	0
<b>Greece</b>	24,43	35,69	31,25	30,99	28,26	27,96	6,48	4,33	4,13	4,06
<b>Spain</b>	12,74	14,91	20,98	18,83	12,88	9,55	7,77	6,68	5,58	4,94
<b>France</b>	9,99	9,21	8,72	9,65	9,26	9,71	9,74	9,74	9,62	9,30
<b>Croatia</b>	4,26	2,06	2,20	1,87	1,61	1,93	2,66	2,65	1,37	1,09
<b>Italy</b>	0,37	3,00	5,65	5,44	1,80	1,16	1,23	2,48	2,63	2,93
<b>Cyprus</b>	7,34	7,68	14,44	15,96	15,62	15,00	8,71	8,19	7,83	7,44
<b>Latvia</b>	2,38	2,51	2,42	1,87	0,72	1,50	0,44	0,34	0,29	0,25
<b>Lithuania</b>	0,28	0,25	0,23	0,26	0,27	0,24	0,19	0,25	0,24	0,29
<b>Luxembourg</b>	4,84	7,09	8,67	8,23	11,49	10,52	11,62	10,99	10,26	9,56
<b>Hungary</b>	8,12	7,45	7,24	6,24	5,44	5,88	5,60	4,86	4,99	6,35
<b>Malta</b>	11,04	12,26	15,92	14,87	15,07	13,91	13,14	9,08	8,48	7,32
<b>Netherlands</b>	10,12	9,31	7,27	6,54	3,52	3,76	3,56	3,44	3,20	3,03
<b>Austria</b>	53,35	44,54	38,18	33,39	19,14	18,76	17,18	16,29	16,33	16,07
<b>Poland</b>	1,40	1,31	1,22	1,32	1,10	0,98	0,99	0,73	0,65	0,61
<b>Portugal</b>	4,64	12,38	13,56	13,28	6,93	6,68	5,56	6,31	5,61	4,83
<b>Romania</b>	1,26	0,93	0,97	0,81	0,96	0,63	0,51	0,40	0,35	0,34
<b>Slovenia</b>	19,73	17,31	13,36	14,39	12,32	10,6	9,61	8,55	7,48	6,46
<b>Slovakia</b>	0,06	0,05	0,04	0,03	0,04	0,03	0,03	0,02	0,03	0,01
<b>Finland</b>	18,89	19,43	20,51	22,8	24,91	27,3	26,73	30,52	31,21	31,76
<b>Sweden</b>	16,79	13,88	11,94	11,42	10,25	10,95	10,48	9,76	10,00	9,99
<b>United Kingdom</b>	0,04	0,04	0,21	0,21	0,26	0,21	0,23	0,09	0,09	0,08

**Table 2.2.** General government one-off guarantees as percentage of Gross Domestic Product (GDP). *Source: own elaboration (data from Eurostat Data Browser, 2020).*

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<b>Belgium</b>	nd	0,64	0,63	0,60	0,57	0,55	0,62	0,61	0,59	0,60
<b>Bulgaria</b>	0	0,01	0,03	0,04	0,06	0,07	0,07	0,07	0,07	0,06
<b>Czechia</b>	0	0	0	0	0	0	0	0	0	0
<b>Denmark</b>	0,1	0,09	0,09	0,07	0,06	0,05	0,04	0,03	2,77	7,06
<b>Germany (until 1990 former territory of the FRG)</b>	nd	nd	0	0	0	0	0	0	0	0
<b>Estonia</b>	2,63	2,15	1,91	1,69	1,59	1,47	1,81	1,73	1,54	1,37
<b>Ireland</b>	0	0	0	0	0	0	0	0	0	0
<b>Greece</b>	1,07	0,59	0,22	0,11	0,06	0,04	0,03	0,03	0,03	0,03
<b>Spain</b>	0	0	0	0	0	0	0	0	0	0
<b>France</b>	1,84	1,89	2,00	1,99	2,08	2,10	2,20	2,28	2,35	2,34
<b>Croatia</b>	0	0	0	0	0	0	0	0	0	0
<b>Italy</b>	0,44	0,51	0,52	0,69	0,85	0,97	1,17	1,43	1,70	1,86
<b>Cyprus</b>	0	0	0	0	0,61	0,29	0,26	0,22	0	0
<b>Latvia</b>	0,53	0,50	0,49	0,47	0,45	0,47	0,96	1,00	1,09	1,18
<b>Lithuania</b>	1,19	0,83	0,70	0,65	0,60	0,60	0,76	0,76	0,67	0,56
<b>Luxembourg</b>	0,78	0,77	0,78	0,75	0,79	0,79	0,83	0,86	0,88	0,89
<b>Hungary</b>	0,49	0,47	0,40	0,33	0,29	0,23	0,19	0,13	0,10	1,04
<b>Malta</b>	0,39	0,31	0,26	0,22	0,19	0,16	0,14	0,11	0,09	0,07
<b>Netherlands</b>	0	0	0	0	0	0	0	0	0	0
<b>Austria</b>	0	0	0	0	0	0	0	0	0	0
<b>Poland</b>	0,02	0,11	0,11	0,40	0,54	0,55	0,65	0,67	0,63	0,57
<b>Portugal</b>	0	0	0	0	0	0	0	0	0	0
<b>Romania</b>	1,13	0,84	1,13	1,35	1,54	1,78	1,87	1,83	1,75	1,66
<b>Slovenia</b>	0	0	0	0	0	0	0	0	0	0
<b>Slovakia</b>	0	0	0	0	0	0	0	0	0	0
<b>Finland</b>	0,73	0,73	0,76	0,8	0,86	0,95	1,07	1,21	1,46	1,65
<b>Sweden</b>	0	0	0	0	0	0	0	0	0	0
<b>United Kingdom</b>	0	0	0	0	0,04	0,08	0,11	0,11	0,11	nd

**Table 2.3.** General government standardised guarantees as percentage of Gross Domestic Product (GDP). *Source: own elaboration (data from Eurostat Data Browser, 2020).*



### 3. Analysis on the “Garanzia Italia” scheme

This chapter will focus on the estimation of the resource requirement necessary for the establishment of a Fund against the positions covered by the “Garanzia Italia” guarantee scheme. The normative reference of this scheme was presented in paragraph 1.3.1 of this elaborate.

The following chapter has been developed during the internship at Sogei in which I had the opportunity to participate in the activities of the Sogei and Pwc working groups in the risk analysis of the “Garanzie di Stato” project. The definition and specification of the actuarial estimation models, on behalf of the “Dipartimento del Tesoro”, had the purpose of predicting the level of expected and unexpected outlays that may originate from exposition of the guarantees Funds managed by SACE S.p.a and counter-guaranteed by the Italian government. The model that will be presented has been developed by Sogei and Ministero dell’Economia e delle Finanze and proposes a possible method in the estimation of the impact of a guarantee scheme’s position on the public finance. Data about “Garanzia Italia” scheme for the implementation of the model have been gently provided by the Risk Management of SACE S.p.a., administrator of the Fund.

#### 3.1 Methodologic approach for financial resources requirement estimation

This paragraph shows the basic structure used for the implementation of the model (Ministero dell’Economia e delle Finanze, Sogei, 2020b).

The model estimates the resources requirement (“Fabbisogno di Risorse”, FR) defined as:

$$FR = \sum_{t=0.5,1}^N (E_t - P_t - R_t)$$

where N is the guarantee’s maturity in years,  $E_t$  are the outlays at time t,  $P_t$  are the premiums at time t, and  $R_t$  are the recoveries at time t. For estimation purposes, payments and recoveries are considered annual.

Outlays at time t ( $E_t$ ) are calculated as:

$$E_t = (QC_t + QI_t + O_t) \cdot PD_t^y$$

where:

a)  $QC_t$  is the principal payment at time  $t$ , defined in function of the initial debt ( $DI$ ) taking into account the years of pre-amortization  $n$  and the maturity of the guarantee  $N$ . Therefore, there will be a constant  $QC_t=QC$  defined as:

$$QC_t = QC = \begin{cases} 0, & t \leq n \leq 1 \\ \frac{DI}{N - n}, & n < t \leq N \end{cases}$$

b)  $QI_t$  is the interest payment at time  $t$ , determined as function of the interest rate  $i$  and the residual debt at the beginning of the period  $DR_t=DR_{t-1}-QC$ . Therefore:

$$QI_t = \begin{cases} DI \cdot i \cdot t, & t \leq n \leq 1 \\ DR_{t-1} \cdot i, & n < t \leq N \end{cases}$$

c)  $O_t$  are the charges at time  $t$ , calculated as:

$$O_t = \begin{cases} DI \cdot o_t \cdot t, & t \leq n \leq 1 \\ DR_{t-1} \cdot o_t, & n < t \leq N \end{cases}$$

where  $o_t$  is the rate charged for accessory charges.

d)  $PD_t^y$  is the cumulated default probability at time  $t$  with rating  $y$ .

Premiums at time  $t$  ( $P_t$ ) are determined as:

$$P_t = \begin{cases} DI \cdot AP_t \cdot t, & t \leq n \leq 1 \\ DR_{t-1} \cdot SP_{t-1}^y \cdot AP_t, & n < t \leq N \end{cases}$$

where  $S_{t-1}^y=1-PD_{t-1}^y$  and  $AP_t$  is premium rate at time  $t$ .

Recoveries ( $R_t$ ) are calculated with the hypothesis of a time deferral equal to  $z$  years.

Therefore:

$$R_t = \begin{cases} 0, & t \leq z \\ E_{t-z} \cdot RR_t, & z < t \leq N \end{cases}$$

where  $RR_t$  represents the recovery rate at time  $t$ . The valuation approach does not consider recoveries subsequent to the maturity of the guarantee.

### 3.2 Model hypothesis and implementation

The principal hypothesis of the model under the basis hypothesis for the large and SMEs aggregated estimation of resources are presented in the table below.

<b>Hypothesis</b>	<b>Basis scenario</b>	<b>Stress scenario</b>
Debt amount (billions €)	<b>18,485</b>	<b>18,485</b>
Pre-amortization (months)	<b>12,0</b>	<b>12,0</b>
Amortization (months)	<b>48,0</b>	<b>48,0</b>
Rating	<b>BB-</b>	<b>B+</b>
Interest rate	<b>2,95%</b>	<b>2,95%</b>
Accessory charges	<b>0,50%</b>	<b>0,50%</b>
Recovery rate (RR)	<b>45%</b>	<b>45%</b>
RR delay (years)	<b>3,0</b>	<b>3,0</b>
Flag RR after maturity	<b>NO</b>	<b>NO</b>

**Table 3.1.** *Source: own elaboration from the model implemented by Sogei and Ministero dell’Economia e delle Finanze.*

The pre-amortisation hypothesis considers on average 1 year. The interest is set with the disposition of Decree 8 April 2020, n. 23, in compliance with the Temporary Framework guidelines.

The transition from the BB- average rating of the basis scenario to the B+ of the stress scenario has been estimated following the Cerved Rating Agency (2020) studio, which considered, under the hard case scenario, an increase of 100% in the default probability of Italian non-financial corporates. It has been verified that an increase of 100% in the probability of default corresponds to a downgrading in one rating notch for the positions contained in the portfolio. The debt amount considered is € 18.485 billion (data provided by SACE), which represents the total exposition of the “Garanzia Italia” scheme on 28 December 2020. The recovery rate (RR) and the recovery rate delay are estimated together with SACE.

The flag recovery rate refers to the possibility of the recovers to continue after the end of the financing. As mentioned before under the model in question this option is not considered.

Following the presented hypothesis, the model has been implemented as follow, presenting first the application of the model under the basis scenario and second under the stress scenario.

The following part takes into account the basis scenario analysis.

YEAR	Residual debt	Post Default residual debt	Pre default			Post default		
			Principal payment	Interest payment	Accessory charges	Principal payment	Interest payment	Accessory charges
1	18,485	18,091	0,000	0,545	0,092	0,000	0,545	0,092
2	13,864	13,156	4,621	0,545	0,092	4,523	0,534	0,090
3	9,243	8,449	4,621	0,409	0,069	4,385	0,388	0,066
4	4,621	4,049	4,621	0,273	0,046	4,224	0,249	0,042
5	0,000	0,000	4,621	0,136	0,023	4,049	0,119	0,020
6	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
7	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
8	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
9	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
10	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
11	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
12	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
<b>Total</b>			<b>18,485</b>	<b>1,909</b>	<b>0,323</b>	<b>17,182</b>	<b>1,836</b>	<b>0,311</b>

**Table 3.2.** *Source: own elaboration from the model implemented by Sogei and Ministero dell'Economia e delle Finanze.*

As shown in Table 3.2, the principal amount has been equally divided into constant principal payments from year 2 to year 5, as the years of amortization. Year 1 is considered the year of pre-amortization, in which no principal amount is being reimbursed. The interest payments start to be paid since year 1 and are defined as the 2.95% interest rate multiplied by the residual debt. The post default residual debt has been calculated as the initial debt multiplied by the survival rate at the end of the period (EoP) that will be presented later in Table 3.3. The pre default section presents data for every year at the beginning of the 1-year period, while the post default section at the end of the 1-year period, taking into account the consequences deriving from the percentage of firms that are estimated to default during the year. Accessory charges are defined as 0.50% accessory charges rate multiplied by the residual debt in the pre default section and as 0.50% multiplied by the post default residual debt in the post default section.

As it can be noticed, the total post default values of principal payments, interest payments and accessory charges are lower than the pre default values, since the effect of defaulted firms not being able to honour their debt and requiring the activation of the guarantee.

YEAR	Residual debt	Post Default residual debt	Default Probability			
			Cumulated DP	Marginal DP	Survival BoP	Survival EoP
1	18,485	18,091	2,133%	2,133%	100,000%	97,867%
2	13,864	13,156	5,102%	2,968%	97,867%	94,898%
3	9,243	8,449	8,588%	3,487%	94,898%	91,412%
4	4,621	4,049	12,381%	3,793%	91,412%	87,619%
5	0,000	0,000	16,321%	3,939%	87,619%	83,679%
6	0,000	0,000	20,284%	3,964%	83,679%	79,716%
7	0,000	0,000	24,183%	3,899%	79,716%	75,817%
8	0,000	0,000	27,956%	3,772%	75,817%	72,044%
9	0,000	0,000	31,561%	3,606%	72,044%	68,439%
10	0,000	0,000	34,976%	3,415%	68,439%	65,024%
11	0,000	0,000	38,189%	3,213%	65,024%	61,811%
12	0,000	0,000	41,198%	3,008%	61,811%	58,802%
<b>Total</b>						

**Table 3.3.** *Source: own elaboration from the model implemented by Sogei and Ministero dell’Economia e delle Finanze.*

The survival end of period (EoP) rate shows for every year how many of the survival beginning of period (BoP) positions remain in life at the end of the 1-year period. The default probability is defined both as marginal, which represents the percentage of positions that are expected to default during the year, and cumulated, which represents the positions that have defaulted since the first year. Therefore, the survival EoP can be easily defined as the difference between the survival BoP and the cumulated default probability.

For what concerns the default probability associated to every ranking, it has required the use of transition matrixes of 1-year default probabilities derived from the “Average 1-Year Transition Rates For Global Corporates By Rating Modifier (1981-2018)” elaborated by S&P Global Ratings (2019). The matrix reports, for every rating class, the probability of downgrading to a different rating. The mentioned 18x19 matrix is reported in Table A.1 of the Appendix of this elaborate. This matrix does not define the transition probability from the 19<sup>th</sup> rating class (unrated - NR) to one of the other classes. In order to ensure that the sum of the default probability for every rating class is equal to 100%, the probabilities of the transition to the unrated class is proportionally reallocated to every rating class. In this way it can be obtained a squared 18x18 “modified” S&P transition matrix, reported in Table A.2 in the Appendix of this thesis. Therefore, the probability of passing from a rating  $i$  to a rating  $j$  is defined by:

$$p^*_{i,j} = p_{i,j} + p_{i,19} \frac{p_{i,j}}{1 - p_{i,19}}$$

where  $i,j = 1, \dots, 18$ .

The modified transition matrix represents the starting point for the construction of the PD matrix  $t \times k$ , that defines cumulated default probabilities at year  $t$  for each rating class  $k$ .

The first step requires to multiply every element of the “modified” S&P transition matrix for the rescaling factor ( $a$ ), so (Ministero dell’Economia e delle Finanze, Sogei, 2020a):

$${}_a p^{(1)}_{i,j} = p^{*(1)}_{i,j} * a$$

where  $i, j = 1, \dots, 18$  and  $a = 2.1$ .

The 2.1 rescaling factor ( $a$ ) is determined by the ratio between 3.8%, which is the average probability of default for large enterprises under the intermediate scenario (Cerved Rating Agency, 2020), and 1.81%, which is the average probability of default derived by S&P from an historical and global analysis. Therefore, it represents a country-specific adjustment, allowing to obtain a PD matrix suitable for the application to the Italian contest. The applicability of the average probability of default for large enterprises is considered suitable for the purpose of the estimation given the composition of the “Garanzia Italia” portfolio, which is constituted of SMEs for less than 1% of the total exposition.

The second step requires the development through the Markov-Chain method of the cumulated transition matrix defined for  $t = 30$  years, in which every element is defined as (Ministero dell’Economia e delle Finanze, Sogei, 2020a):

$${}_a p^{(t)}_{i,j} = \sum_{h=1}^{18} ({}_a p^{(t-1)}_{i,h} * a p^{*(1)}_{h,j})$$

where  $t = 1, \dots, 30$  and  $i, j = 1, \dots, 18$ . The formula represents the probability of transition from the rating class  $h$  to the rating class  $j$  during a 1-year time period, considered constant over the  $t$  time horizon.

Extracting from every  $t = 30$  transition matrices only the cumulated default probability for the 18 rating classes, represented by the 18<sup>th</sup> column ( $j = 18$ ), it can be obtained the  $i \times t$  (18x30) PIT 2.1 transition matrix.

The PIT 2.1 matrix is reported in Table A.3 of the Appendix. Tables from A.4 to A.33 of the Appendix report the underlying Markov-Chain process.

YEAR	Residual debt	Post Default residual debt	Outlays		Premiums		Recoveries	
			Total exposition	Potential outlays	Premium rate	Premium	Recovery rate	Recoveries
1	18,485	18,091	20,717	0,442	0,004	0,069	0,000	0,000
2	13,864	13,156	20,079	0,596	0,008	0,136	0,000	0,000
3	9,243	8,449	14,820	0,517	0,008	0,099	0,000	0,000
4	4,621	4,049	9,721	0,369	0,015	0,127	0,450	0,006
5	0,000	0,000	4,781	0,188	0,015	0,061	0,450	0,121
6	0,000	0,000	0,000	0,000	0,015	0,000	0,450	0,197
7	0,000	0,000	0,000	0,000	0,015	0,000	0,450	0,275
8	0,000	0,000	0,000	0,000	0,015	0,000	0,450	0,351
9	0,000	0,000	0,000	0,000	0,015	0,000	0,450	0,000
10	0,000	0,000	0,000	0,000	0,015	0,000	0,450	0,000
11	0,000	0,000	0,000	0,000	0,015	0,000	0,450	0,000
12	0,000	0,000	0,000	0,000	0,015	0,000	0,450	0,000
<b>Total</b>				<b>2,112</b>		<b>0,491</b>		<b>0,950</b>

**Table 3.4.** *Source: own elaboration from the model implemented by Sogei and Ministero dell'Economia e delle Finanze.*

Table 3.4 shows the estimates of outlays, premiums and recoveries under the implemented model. Total expositions represent the sum of the residual flows (principal payment plus interest payment plus accessory charges) in the year considered. Since the guarantees considered cover the total exposition, potential outlays are calculated multiplying the total exposition of the year for the marginal default probability. The total estimate of potential outlays is € 2.112 billion.

Premiums in year 1 are calculated as the residual debt multiplied by the premium rate, while for the following years are calculated as the previous year post default residual debt multiplied by the premium rate. Total premiums are estimated as € 0.491 billion.

Recoveries start in year 4 and end in year 8, since the recovery delay time is supposed to be 3 years and no recoveries are considered to take place after year 7, as established in the initial hypothesis. They are calculated as the outlays in  $t-z$ , with  $z = 3$ , defined as the product between the sum of capital payment, interest payment and accessory charges and the cumulated default probability in  $t-z$ , multiplied by the recovery rate in  $t$ .

The total estimation of recoveries amounts to € 0.950 billion.

For the analysis under the stress scenario, it has been implemented the same model using as average rating of the portfolio B+, result of the downgrading of one notch as presented in the initial hypothesis. The implementation of the model is reported in the following Tables, in coherence with the procedure adopted exposing the analysis of the basis scenario.

YEAR	Residual debt	After Default residual debt	Before default			After default		
			Principal payment	Interest payment	Accessory charges	Principal payment	Interest payment	Accessory charges
1	18,485	17,617	0,000	0,545	0,092	0,000	0,545	0,092
2	13,864	12,388	4,621	0,545	0,092	4,404	0,520	0,088
3	9,243	7,677	4,621	0,409	0,069	4,129	0,365	0,062
4	4,621	3,551	4,621	0,273	0,046	3,839	0,226	0,038
5	0,000	0,000	4,621	0,136	0,023	3,551	0,105	0,018
6	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
7	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
8	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
9	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
10	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
11	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
12	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
<b>Total</b>			<b>18,485</b>	<b>1,909</b>	<b>0,323</b>	<b>15,923</b>	<b>1,762</b>	<b>0,299</b>

**Table 3.5.** Source: own elaboration from the model implemented by Sogei and Ministero dell'Economia e delle Finanze.

YEAR	Residual debt	After Default residual debt	Default Probability			
			Cumulated DP	Marginal DP	Survival BoP	Survival EoP
1	18,485	17,617	4,696%	4,696%	100,000%	95,304%
2	13,864	12,388	10,646%	5,950%	95,304%	89,354%
3	9,243	7,677	16,935%	6,288%	89,354%	83,065%
4	4,621	3,551	23,153%	6,219%	83,065%	76,847%
5	0,000	0,000	29,086%	5,932%	76,847%	70,914%
6	0,000	0,000	34,616%	5,530%	70,914%	65,384%
7	0,000	0,000	39,692%	5,076%	65,384%	60,308%
8	0,000	0,000	44,303%	4,612%	60,308%	55,697%
9	0,000	0,000	48,466%	4,162%	55,697%	51,534%
10	0,000	0,000	52,207%	3,742%	51,534%	47,793%
11	0,000	0,000	55,563%	3,356%	47,793%	44,437%
12	0,000	0,000	58,572%	3,008%	44,437%	41,428%
<b>Total</b>						

**Table 3.6.** Source: own elaboration from the model implemented by Sogei and Ministero dell'Economia e delle Finanze.



YEAR	Residual debt	After Default residual debt	Outlays		Premiums		Recoveries	
			Total exposition	Potential outlays	Premium rate	Premium	Recovery rate	Recoveries
1	18,485	17,617	20,717	0,973	0,004	0,069	0,000	0,000
2	13,864	12,388	20,079	1,195	0,008	0,132	0,000	0,000
3	9,243	7,677	14,820	0,932	0,008	0,093	0,000	0,000
4	4,621	3,551	9,721	0,605	0,015	0,115	0,450	0,013
5	0,000	0,000	4,781	0,284	0,015	0,053	0,450	0,252
6	0,000	0,000	0,000	0,000	0,015	0,000	0,450	0,389
7	0,000	0,000	0,000	0,000	0,015	0,000	0,450	0,515
8	0,000	0,000	0,000	0,000	0,015	0,000	0,450	0,626
9	0,000	0,000	0,000	0,000	0,015	0,000	0,450	0,000
10	0,000	0,000	0,000	0,000	0,015	0,000	0,450	0,000
11	0,000	0,000	0,000	0,000	0,015	0,000	0,450	0,000
12	0,000	0,000	0,000	0,000	0,015	0,000	0,450	0,000
<b>Total</b>				<b>3,988</b>		<b>0,463</b>		<b>1,794</b>

**Table 3.7.** Source: own elaboration from the model implemented by Sogei and Ministero dell'Economia e delle Finanze.

### 3.3 Exposition of the results

Table 3.8 and Table 3.9 report the estimations of net outlays under the analysed basis and stress scenarios of the model, respectively.

YEAR	Residual debt	Post Default residual debt	Net outlays
1	18,485	18,091	0,373
2	13,864	13,156	0,460
3	9,243	8,449	0,418
4	4,621	4,049	0,236
5	0,000	0,000	0,007
6	0,000	0,000	-0,197
7	0,000	0,000	-0,275
8	0,000	0,000	-0,351
9	0,000	0,000	0,000
10	0,000	0,000	0,000
11	0,000	0,000	0,000
12	0,000	0,000	0,000
<b>Total</b>			<b>0,670</b>

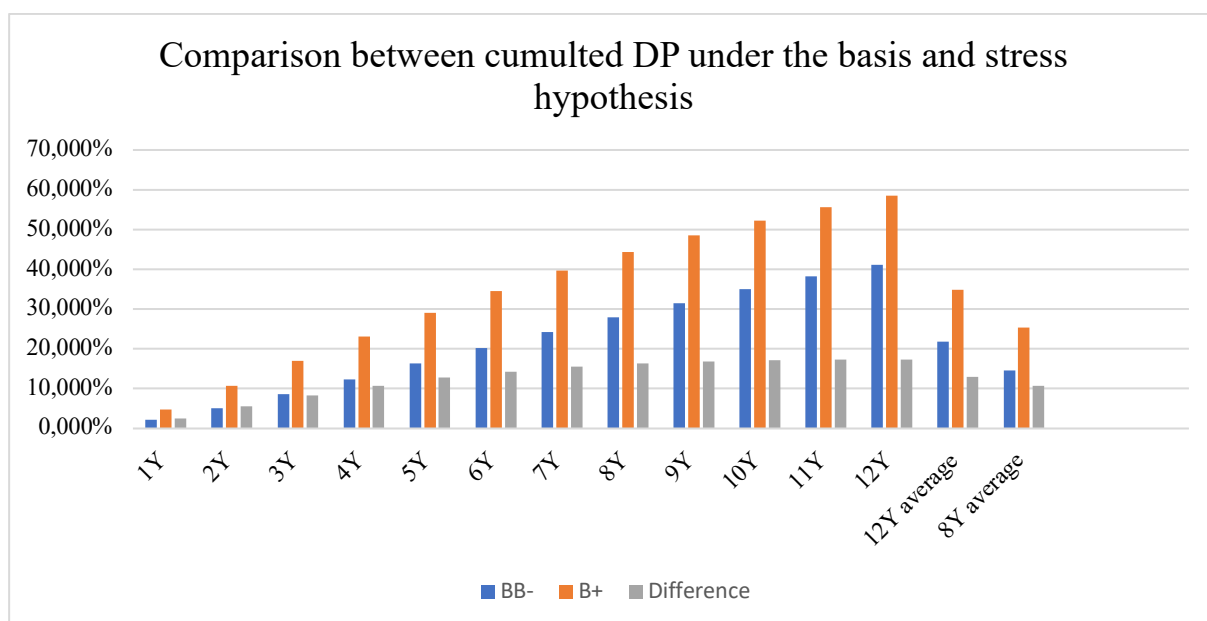
**Table 3.8.** Source: own elaboration from the model implemented by Sogei and Ministero dell'Economia e delle Finanze.

YEAR	Residual debt	Post Default residual debt	Net outlays
1	18,485	18,091	0,903
2	13,864	13,156	1,063
3	9,243	8,449	0,839
4	4,621	4,049	0,476
5	0,000	0,000	-0,022
6	0,000	0,000	-0,389
7	0,000	0,000	-0,515
8	0,000	0,000	-0,626
9	0,000	0,000	0,000
10	0,000	0,000	0,000
11	0,000	0,000	0,000
12	0,000	0,000	0,000
<b>Total</b>			<b>1,730</b>

**Table 3.9.** Source: own elaboration from the model implemented by Sogei and Ministero dell'Economia e delle Finanze.

It can be noticed how the rating hypothesis of the model influence significantly the results. The estimation of net outlays under the basis scenario result in € 0.670 billion, while under the stress scenario net outlays result to be equal to € 1.730 billion.

The different BB- and B+ ratings applied to the model result, during the 12-years period considered for the model, in an average 21.906% and 34.828% cumulated default probability respectively. Considering a more specific 8-years interval in which net outlays are not null, the average cumulated default probability is 14.619% and 25.391% respectively (Graph 3.1).



**Graph 3.1.** Source: own elaboration.

It can be concluded that, under the considered model, an increase of 10.772pp (+173.688%) in the average default probability in the 8-years interval results in an increase of € 1.060 billion (+250.209%) in estimated net outlays.

## Conclusions

The COVID-19 outbreak has required governments all around to take restrictive measures to restrain the spread of the virus. These measures had a direct effect on undertakings and the overall economy, requiring government to implement large public intervention plans in support to the economic activity.

Crisis periods like the current outbreak have seen governments to massively use government guarantees to sustain national firms that are facing a liquidity constraint. The European Commission has recognised the necessity for a regulation, with the purpose of allowing Member States to manage the difficulties that undertakings are facing, while preserving the integrity of the EU Internal Market. The Temporary Framework lists the possibilities of aid that Member States are allowed to implement without the necessity of approval, including limited amount of aid, guarantees on loans, subsidised interest rate on loans, guarantees on loans channelled through credit or other financial institutions, and short-term export credit insurance (European Commission, 2020). Particular attention should be addressed to the amount of contingent liabilities that Italy and other European Member States are granting: Italy during 2020 has issued guarantee schemes for about 30% of GDP, Germany for 19.6% of GDP, France for 14.2% of GDP, and Spain for 14.4% of GDP.

Government guarantees result an effective aid with respect to incrementality (Riding, Madill, Haines, 2007), loan maturity (D'Ignazio, Menon, 2013), and job creation (Riding, Haines, 2001). The results regarding the carried interest rates are more ambiguous (Banca D'Italia, 2017). At the same time, a central aspect to consider when issuing a guarantee is the risk of moral hazard (Gropp, Gruendl, Guettler, 2010)

From an accounting point of view, government guarantees, unlike other direct aid interventions, do not give rise to any direct impact on fiscal balance or on liabilities in the moment in which they are issued (Bresciani, Cossaro, 2016). At the same time, guarantee fees received for granting the guarantee have a direct positive impact on fiscal balance, leading to a potentially distortive situation, that governments may use to defer expenditures (Baldwin, Lessard, Mason, 1983). The structure of contingent liabilities is itself characterised by uncertainty, regarding both the timing and the amount (International Monetary Fund, 2006). Considering the risks and potential impacts of these instruments on public finance in the future, ESA 2010 has required the disclosure of contingent liabilities in budgetary documents.

In the third chapter of this thesis I provided an estimation of the impact on the public finance of the exposition at the end of 2020 of the “Garanzia Italia” scheme, elaborated during my internship at “Sogei - Funzione Modelli di Previsione e Analisi Statistiche”. The model has the

aim of estimating the level of outlays that may derive from the portfolio's exposition, examined under both a basis and a stress scenario. It is particularly important to notice that the presented model is strictly dependent on the supposed rating for the portfolio. Therefore, such hypothesis requires to be monitored during the following months, in order to confirm or, eventually, revise them, basing on a clearer framework, regarding both amounts and the economic situation of Italian firms.

## References

ADIAN, I., et al. (2020). *Small and Medium Enterprises in the Pandemic. Impact, Responses and the Role of Development Finance*. World Bank Group. Economics and Private Sector Development Vice Presidency, International Finance Corporation. Policy Research Working Paper 9414.

ALLEN, F., et al. (2015). *Moral Hazard and Government Guarantees in the Banking Industry*. Journal of Financial Regulation. 2015 (1), pp. 30-50.

BALDWIN C., LESSARD, D., MASON, S. (1983). *Budgetary Time Bombs: Controlling Government Loan Guarantees*. Canadian Public Policy. Vol. 9, No. 3 (Sep., 1983), pp. 338-346.

BANCA D'ITALIA (2017). *Public guarantees on loans to SMEs: an RDD evaluation*. Prepared by Guido de Blasio, Stefania De Mitri, Alessio D'Ignazio, Paolo Finaldi Russo and Lavina Stoppani. Working paper, No. 1111.

BLACK, J. R., HOELSCHER, S. A., STOCK, D. (2014). *Benefits of Government Bank Debt Guarantees: Evidence from the Debt Guarantee Program*. Michael F. Price College of Business, University of Oklahoma.

BRESCIANI, M. V., COSSARO, L. (2016). *A balance sheet approach to general government finance: the legacy of the crisis in selected Euro area countries*. Paper presented at the 13th Euroframe Conference on Economic Policy Issues in the European Union, Utrecht, The Netherlands.

CAMERA DEI DEPUTATI (2020). *Gli aiuti di Stato nell'attuale epidemia da COVID: il nuovo quadro UE*. Servizio Studi, XVIII Legislatura.

CERVED RATING AGENCY (2020). *Evolution and impacts of the COVID-19 pandemic emergency on Italian non-financial corporates*. Research study.

*Council Directive 2011/85/EU of 8 November 2011 on Requirements for Budgetary Framework of the Member States*.

D.L. 17 marzo 2020, n. 18 (“Decreto Legge Cura-Italia”) converted into L. 24 aprile 2020, n. 27.

D.L. 8 aprile 2020, n. 23 (“Decreto Legge Liquidità”) C converted into L. 5 giugno 2020, n. 40.

D’IGNAZIO, A., MENON, C. (2013). *The casual effect of credit guarantees for SMEs: evidence from Italy*. Banca d’Italia Working paper.

EUROPEAN COMMISSION (2020). *Temporary Framework for state aid measures to support the economy in the current Covid-19 outbreak. Consolidated version*. Communication from the Commission.

EUROSTAT (2013). *European system of accounts. ESA 2010*. Manual and guidelines. Luxemburg: Publications Office of the European Union, pp. 145-148.

EUROSTAT (2015). *Eurostat supplementary table for the financial crisis*. Background note (April 2015).

EUROSTAT (2019). *Manual on Government Deficit and Debt. Implementation of ESA 2010*. Manual and guidelines. Luxemburg: Publications Office of the European Union, pp. 309-342.

GROPP, R., GRUENDL, C., GUETTLER, A. (2010). *The impact of public guarantees on bank risk taking. Evidence from a natural experiment*. European Central Bank. Working paper series, No. 1272.

HEALD, D., HODGES, R. (2018). *Accounting for government guarantees: perspectives on fiscal transparency from four modes of accounting*. Accounting and Business Research, 48:7, pp. 782-804.

INTERNATIONAL ACCOUNTING STANDARDS BOARD (1998). *International Accounting Standard 37: Provisions, Contingent Liabilities and Contingent Assets*.

INTERNATIONAL MONETARY FUND (2006). *Public-Private Partnerships, Government Guarantees and Fiscal Risk*. Staff Team led by Richard Hemming. IMF Multimedia Services Division.

INTERNATIONAL MONETARY FUND (2014). *External debt statistics. Guide for compilers and users*. International Monetary Fund Publication Services.

LEQUILLER, F. (2015). *Towards convergence between government finance statistics and public sector accounting standards*. Eurostat Review on National Accounts and Macroeconomic Indicators. Luxemburg: Publications Office of the European Union.

MINISTERO DELL'ECONOMIA E DELLE FINANZE, SOGEI (2020a). *Nota sulla costruzione delle matrici PD per Garanzia Italia*. Internal document.

MINISTERO DELL'ECONOMIA E DELLE FINANZE, SOGEI (2020b). *Nota esplicativa dell'approccio metodologico utilizzato per la stima iniziale del fabbisogno di risorse per Garanzia Italia e Garanzie a Mercato*. Internal document.

OECD (2017). *Evaluating publicly supported credit guarantee programmes for SMEs*.

RIDING A., MADILL, J., HAINES, G. JR. (2007). *Incrementality of SME Loan Guarantees*. *Small Business Economics* (2007), 29:47–61.

RIDING, A., HAINES, G. JR. (2001). *Loan guarantees: costs of default and benefits to small firms*. *Journal of Business Venturing* 16, pp. 595–612.

S&P GLOBAL RATINGS (2019). *Annual global corporate default and rate transition study*.

SCHICH, S., KIM, B. (2011). *Guarantee arrangements for financial promises: how widely should the safety net be cast?* OECD Journal: Financial Market Trends. Volume 2011. Issue 1.

SINGH, M. K., GOMEZ-PUIG, M., SOSVILLA-RIVERO, S. (2019). *Increasing contingent guarantees: The asymmetrical effect on sovereign risk of different government interventions*. Research Institute of Applied Economics of Barcelona. Working Paper 2019/14, pp. 1-41.



Treaty on the Functioning of the European Union. Part three: Union policies and internal actions. Title VII: Common rules on competition, taxation and approximation of laws. Chapter 1: Rules on competition. Section 2: Aids granted by States. *Article 107 (ex article 87 TEC)*.

VOGEL, R. C., ADAMS, D. W. (1997). *The benefits and costs of loan guarantee programs*. The Financier, Vol. 4, No. 1 & 2, February/May 1997, pp. 22-29.

## Sitography

EUROPEAN BANKING AUTHORITY (2020). *EBA publishes overview of public guarantee schemes issued in response to the Covid-19 pandemic*. Available at:

< <https://eba.europa.eu/eba-publishes-overview-public-guarantee-schemes-issued-response-covid-19-pandemic> > [Access date: 15/12/2020].

EUROPEAN CENTRAL BANK (2020). *Potential impact of government loan guarantee schemes on bank losses*. Prepared by Ugo Albertazzi, Martin Bijsterbosch, Maciej Grodzicki, Julian Metzler and Aurea Ponte Marques. Part of the Financial Stability Review, May 2020. Available at: < [https://www.ecb.europa.eu/pub/financial-stability/fsr/focus/2020/html/ecb.fsrbox202005\\_04~42dd37a855.en.html](https://www.ecb.europa.eu/pub/financial-stability/fsr/focus/2020/html/ecb.fsrbox202005_04~42dd37a855.en.html) > [Access date: 17/11/2020].

EUROPEAN COMMISSION (2020). *Draft budgetary plans 2021*. Available at < [https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/stability-and-growth-pact/annual-draft-budgetary-plans-dbps-euro-area-countries/draft-budgetary-plans-2021\\_en#italy](https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/stability-and-growth-pact/annual-draft-budgetary-plans-dbps-euro-area-countries/draft-budgetary-plans-2021_en#italy) > [Access date: 05/01/2021].

EUROSTAT DATA BROWSER (2020). *Government guarantees*. Available at: < [https://ec.europa.eu/eurostat/databrowser/view/gov\\_cl\\_guar/settings\\_1/table?lang=en](https://ec.europa.eu/eurostat/databrowser/view/gov_cl_guar/settings_1/table?lang=en) > [Access date: 12/12/2020].

<https://www.fondidigaranzia.it>

INTERNATIONAL MONETARY FUND (2018). *Fiscal transparency*. Available at: < <https://www.imf.org/external/np/fad/trans/> > [Access date: 10/09/2020].

OECD (2020). *Economic Outlook No. 108. December 2020*. Available at: < <https://stats.oecd.org/Index.aspx?DataSetCode=EO#> > [Access date: 03/01/2021].

## Appendix

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D	NR
AAA	87.03%	5.89%	2.51%	0.69%	0.16%	0.24%	0.13%	0.00%	0.05%	0.00%	0.03%	0.05%	0.03%	0.00%	0.03%	0.00%	0.05%	0.00%	3.12%
AA+	2.31%	78.94%	10.91%	3.54%	0.71%	0.33%	0.19%	0.05%	0.09%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.88%
AA	0.42%	1.31%	80.76%	8.53%	2.72%	1.15%	0.36%	0.39%	0.13%	0.08%	0.05%	0.03%	0.02%	0.00%	0.00%	0.02%	0.05%	0.02%	3.96%
AA-	0.04%	0.11%	3.77%	78.80%	9.68%	2.19%	0.60%	0.25%	0.15%	0.07%	0.03%	0.00%	0.00%	0.03%	0.08%	0.00%	0.00%	0.03%	4.18%
A+	0.00%	0.06%	0.44%	4.44%	78.38%	8.73%	2.15%	0.61%	0.34%	0.09%	0.06%	0.09%	0.01%	0.07%	0.03%	0.00%	0.00%	0.05%	4.45%
A	0.03%	0.04%	0.22%	0.41%	5.32%	78.88%	6.74%	2.38%	0.86%	0.27%	0.10%	0.10%	0.06%	0.08%	0.02%	0.00%	0.01%	0.05%	4.42%
A-	0.04%	0.01%	0.06%	0.15%	0.42%	6.49%	78.12%	7.23%	1.98%	0.57%	0.13%	0.13%	0.11%	0.10%	0.02%	0.01%	0.03%	0.06%	4.34%
BBB+	0.00%	0.01%	0.05%	0.06%	0.20%	0.74%	7.13%	75.83%	7.98%	1.56%	0.36%	0.29%	0.13%	0.15%	0.10%	0.02%	0.06%	0.10%	5.23%
BBB	0.01%	0.01%	0.04%	0.03%	0.10%	0.31%	1.00%	7.73%	76.00%	6.11%	1.34%	0.58%	0.27%	0.22%	0.11%	0.03%	0.05%	0.16%	5.90%
BBB-	0.01%	0.01%	0.02%	0.04%	0.06%	0.14%	0.25%	1.17%	9.31%	72.40%	5.47%	2.08%	0.83%	0.36%	0.27%	0.16%	0.21%	0.25%	7.00%
BB+	0.04%	0.00%	0.00%	0.03%	0.03%	0.08%	0.08%	0.41%	1.59%	11.33%	65.29%	7.42%	2.61%	0.85%	0.53%	0.24%	0.36%	0.31%	8.70%
BB	0.00%	0.00%	0.03%	0.01%	0.00%	0.06%	0.05%	0.16%	0.47%	2.00%	9.44%	65.41%	8.46%	2.22%	1.02%	0.31%	0.52%	0.51%	9.33%
BB-	0.00%	0.00%	0.00%	0.01%	0.01%	0.01%	0.05%	0.09%	0.23%	0.35%	1.69%	9.57%	63.71%	8.42%	3.04%	0.81%	0.66%	0.91%	10.42%
B+	0.00%	0.01%	0.00%	0.03%	0.00%	0.03%	0.06%	0.04%	0.05%	0.10%	0.31%	1.42%	8.17%	62.91%	9.20%	2.51%	1.71%	1.98%	11.45%
B	0.00%	0.00%	0.01%	0.01%	0.00%	0.03%	0.04%	0.02%	0.05%	0.03%	0.11%	0.23%	1.09%	7.38%	62.00%	9.32%	3.85%	3.20%	12.63%
B-	0.00%	0.00%	0.00%	0.00%	0.02%	0.03%	0.00%	0.06%	0.05%	0.10%	0.08%	0.13%	0.46%	2.18%	10.06%	54.63%	11.70%	6.49%	14.02%
CCC/C	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.08%	0.05%	0.08%	0.05%	0.03%	0.16%	0.40%	0.98%	2.57%	9.41%	43.64%	27.08%	15.45%
D	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%

**Table A.1.** Average 1-Year Transition Rates For Global Corporates By Rating Modifier (1981-2018). *Source: Ministero dell'Economia e delle Finanze and Sogei elaboration from S&P Rating Agency, 2019.*

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB-	B+	B	B-	CCC/C	D
AAA	89.83%	6.08%	2.59%	0.71%	0.17%	0.25%	0.13%	0.00%	0.05%	0.00%	0.03%	0.05%	0.00%	0.03%	0.00%	0.05%	0.00%
AA+	2.38%	81.28%	11.23%	3.64%	0.73%	0.34%	0.20%	0.05%	0.09%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
AA	0.44%	1.36%	84.09%	8.88%	2.83%	1.20%	0.37%	0.41%	0.14%	0.08%	0.05%	0.03%	0.02%	0.00%	0.02%	0.05%	0.02%
AA-	0.04%	0.11%	3.93%	82.24%	10.10%	2.29%	0.63%	0.26%	0.16%	0.07%	0.03%	0.00%	0.00%	0.08%	0.00%	0.00%	0.03%
A+	0.00%	0.06%	0.46%	4.65%	82.03%	9.14%	2.25%	0.64%	0.36%	0.09%	0.06%	0.09%	0.07%	0.03%	0.00%	0.00%	0.05%
A	0.03%	0.04%	0.23%	0.43%	5.57%	82.53%	7.05%	2.49%	0.90%	0.28%	0.10%	0.10%	0.08%	0.02%	0.00%	0.01%	0.05%
A-	0.04%	0.01%	0.06%	0.16%	0.44%	6.78%	81.66%	7.56%	2.07%	0.60%	0.14%	0.14%	0.10%	0.02%	0.01%	0.03%	0.06%
BBB+	0.00%	0.01%	0.05%	0.06%	0.21%	0.78%	7.52%	80.01%	8.42%	1.65%	0.38%	0.31%	0.16%	0.11%	0.02%	0.06%	0.11%
BBB	0.01%	0.01%	0.04%	0.03%	0.11%	0.33%	1.06%	1.26%	10.01%	6.49%	1.42%	0.62%	0.23%	0.12%	0.03%	0.05%	0.17%
BBB-	0.01%	0.01%	0.02%	0.04%	0.06%	0.15%	0.27%	1.26%	10.01%	7.78%	5.88%	2.24%	0.39%	0.24%	0.17%	0.23%	0.27%
BB+	0.04%	0.00%	0.00%	0.03%	0.03%	0.09%	0.09%	0.45%	1.74%	12.41%	71.51%	8.13%	1.04%	0.58%	0.26%	0.39%	0.34%
BB	0.00%	0.00%	0.03%	0.01%	0.00%	0.07%	0.06%	0.18%	0.52%	2.21%	10.41%	72.14%	2.45%	1.12%	0.34%	0.57%	0.56%
BB-	0.00%	0.00%	0.00%	0.01%	0.01%	0.01%	0.06%	0.10%	0.26%	0.39%	1.89%	10.68%	9.40%	3.39%	0.90%	0.74%	1.02%
B+	0.00%	0.01%	0.00%	0.03%	0.00%	0.03%	0.07%	0.05%	0.06%	0.11%	0.35%	1.60%	71.04%	10.39%	2.83%	1.93%	2.24%
B	0.00%	0.00%	0.01%	0.01%	0.00%	0.03%	0.05%	0.02%	0.06%	0.03%	0.13%	0.26%	8.45%	70.96%	10.67%	4.41%	3.66%
B-	0.00%	0.00%	0.00%	0.00%	0.02%	0.03%	0.00%	0.07%	0.06%	0.12%	0.09%	0.15%	2.54%	11.70%	63.54%	13.61%	7.55%
CCC/C	0.00%	0.00%	0.00%	0.00%	0.04%	0.00%	0.09%	0.06%	0.09%	0.06%	0.04%	0.19%	1.16%	3.04%	11.13%	51.61%	32.03%
D	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%

**Table A.2.** “Modified” S&P transition matrix. *Source: Ministero dell’Economia e delle Finanze and Sogei elaboration from S&P Rating Agency, 2019.*

	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	11V	12V	13V	14V	15V	16V	17V	18V	19V	20V	21V	22V	23V	24V	25V	26V	27V	28V	29V	30V	
AAA	0.00%	0.04%	0.10%	0.16%	0.23%	0.31%	0.40%	0.50%	0.60%	0.72%	0.84%	0.97%	1.12%	1.27%	1.43%	1.60%	1.78%	1.98%	2.18%	2.40%	2.63%	2.87%	3.13%	3.39%	3.67%	3.96%	4.27%	4.59%	4.93%	5.26%	
AA	0.00%	0.01%	0.03%	0.07%	0.13%	0.20%	0.28%	0.38%	0.49%	0.61%	0.75%	0.91%	1.07%	1.25%	1.43%	1.66%	1.89%	2.13%	2.38%	2.66%	2.94%	3.25%	3.56%	3.90%	4.25%	4.63%	5.00%	5.39%	5.80%	6.23%	
AA	0.04%	0.13%	0.24%	0.36%	0.49%	0.62%	0.77%	0.93%	1.11%	1.29%	1.49%	1.71%	1.94%	2.18%	2.44%	2.71%	3.01%	3.31%	3.64%	3.98%	4.33%	4.70%	5.09%	5.50%	5.92%	6.35%	6.80%	7.27%	7.75%	8.25%	
AA	0.07%	0.15%	0.24%	0.36%	0.49%	0.64%	0.81%	0.99%	1.19%	1.40%	1.63%	1.87%	2.14%	2.41%	2.71%	3.02%	3.35%	3.71%	4.07%	4.45%	4.85%	5.28%	5.73%	6.17%	6.63%	7.13%	7.64%	8.16%	8.69%	9.24%	
A+	0.11%	0.21%	0.36%	0.50%	0.67%	0.85%	1.06%	1.28%	1.53%	1.80%	2.08%	2.39%	2.72%	3.08%	3.45%	3.84%	4.25%	4.69%	5.15%	5.62%	6.12%	6.63%	7.16%	7.70%	8.27%	8.85%	9.44%	10.05%	10.67%	11.30%	
A	0.13%	0.31%	0.49%	0.58%	0.79%	1.02%	1.29%	1.58%	1.89%	2.24%	2.61%	3.01%	3.44%	3.89%	4.37%	4.87%	5.39%	5.94%	6.50%	7.09%	7.69%	8.32%	8.96%	9.62%	10.30%	10.97%	11.67%	12.38%	13.10%	13.83%	
A	0.13%	0.31%	0.52%	0.77%	1.05%	1.37%	1.73%	2.12%	2.54%	3.00%	3.49%	4.01%	4.56%	5.14%	5.75%	6.39%	7.04%	7.72%	8.42%	9.14%	9.88%	10.64%	11.40%	12.18%	12.98%	13.78%	14.59%	15.41%	16.24%	17.07%	
BBB+	0.22%	0.32%	0.52%	0.87%	1.27%	1.71%	2.20%	2.74%	3.31%	3.93%	4.58%	5.27%	6.00%	6.75%	7.54%	8.35%	9.18%	10.04%	10.91%	11.80%	12.70%	13.62%	14.54%	15.47%	16.40%	17.34%	18.29%	19.24%	20.17%	21.11%	22.05%
BBB	0.36%	0.79%	1.25%	1.85%	2.49%	3.19%	3.95%	4.77%	5.64%	6.55%	7.50%	8.49%	9.50%	10.55%	11.61%	12.69%	13.78%	14.88%	15.99%	17.09%	18.20%	19.31%	20.41%	21.51%	22.59%	23.67%	24.74%	25.79%	26.84%	27.87%	
BBB-	0.56%	1.44%	2.25%	3.25%	4.33%	5.49%	6.72%	8.00%	9.33%	10.70%	12.10%	13.51%	14.94%	16.37%	17.81%	19.23%	20.65%	22.05%	23.43%	24.79%	26.12%	27.43%	28.72%	29.97%	31.20%	32.40%	33.58%	34.72%	35.84%	36.93%	
BB+	0.71%	1.85%	3.24%	4.80%	6.49%	8.30%	10.18%	12.12%	14.09%	16.08%	18.06%	20.02%	21.96%	23.87%	25.72%	27.53%	29.29%	31.00%	32.64%	34.24%	35.77%	37.25%	38.68%	40.05%	41.37%	42.65%	43.87%	45.05%	46.19%	47.28%	
BB-	1.18%	2.85%	5.05%	7.40%	9.92%	12.56%	15.26%	18.00%	20.72%	23.40%	26.02%	28.58%	31.01%	33.36%	35.60%	37.75%	39.78%	41.72%	43.55%	45.29%	46.94%	48.51%	49.99%	51.39%	52.72%	53.99%	55.19%	56.33%	57.41%	58.44%	
B+	1.70%	4.05%	7.15%	10.95%	15.32%	20.24%	24.88%	29.96%	34.95%	39.98%	44.94%	49.84%	54.66%	59.41%	64.09%	68.71%	73.28%	77.81%	82.30%	86.75%	91.16%	95.53%	99.86%	104.15%	108.40%	112.61%	116.78%	120.91%	124.99%	129.03%	
B	4.70%	10.55%	18.93%	29.15%	39.15%	49.00%	59.69%	70.99%	82.47%	93.91%	105.16%	116.27%	127.17%	137.88%	148.41%	158.76%	168.94%	178.96%	188.83%	198.56%	208.15%	217.60%	226.91%	236.08%	245.12%	254.03%	262.81%	271.46%	279.98%	288.38%	
B-	7.69%	17.95%	31.81%	48.46%	66.86%	86.99%	108.76%	132.07%	156.83%	182.96%	209.47%	236.37%	263.66%	291.35%	319.45%	347.96%	376.88%	406.21%	435.95%	466.10%	496.66%	527.64%	559.04%	590.86%	623.09%	655.73%	688.78%	722.14%	755.81%	789.80%	
B	15.85%	34.99%	61.37%	88.45%	116.95%	146.60%	177.23%	208.78%	241.28%	274.75%	309.11%	344.28%	380.28%	417.12%	454.81%	493.36%	532.78%	573.07%	614.24%	656.29%	699.24%	743.09%	787.84%	833.49%	880.05%	927.52%	975.90%	1025.19%	1075.39%	1126.50%	
CCC/C	62.06%	84.07%	96.55%	99.28%	99.98%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	
D	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	

Table A.3. PIT 2.1 matrix. Source: own elaboration during the internship at Sogei.

Tables A.4-A.33. Markov-Chain method underlying the PIT 2.1 matrix construction.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	89,82%	6,08%	2,59%	0,71%	0,17%	0,25%	0,13%	0,00%	0,05%	0,00%	0,03%	0,05%	0,03%	0,00%	0,03%	0,00%	0,05%	0,00%
AA+	2,38%	81,28%	11,23%	3,64%	0,73%	0,34%	0,20%	0,05%	0,09%	0,05%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%
AA	0,44%	1,36%	84,05%	8,88%	2,83%	1,20%	0,37%	0,41%	0,14%	0,08%	0,05%	0,03%	0,02%	0,02%	0,00%	0,02%	0,05%	0,04%
AA-	0,04%	0,11%	3,93%	82,20%	10,10%	2,28%	0,63%	0,26%	0,16%	0,07%	0,03%	0,00%	0,00%	0,03%	0,08%	0,00%	0,00%	0,07%
A+	0,00%	0,06%	0,46%	4,64%	81,98%	9,13%	2,25%	0,64%	0,36%	0,09%	0,06%	0,09%	0,01%	0,07%	0,03%	0,00%	0,00%	0,11%
A	0,03%	0,04%	0,23%	0,43%	5,56%	82,49%	7,05%	2,49%	0,90%	0,28%	0,10%	0,10%	0,06%	0,08%	0,02%	0,00%	0,01%	0,11%
A-	0,04%	0,01%	0,06%	0,16%	0,44%	6,78%	81,61%	7,55%	2,07%	0,60%	0,14%	0,14%	0,11%	0,10%	0,02%	0,01%	0,03%	0,13%
BBB+	0,00%	0,01%	0,05%	0,06%	0,21%	0,78%	7,51%	79,92%	8,41%	1,64%	0,38%	0,31%	0,14%	0,16%	0,11%	0,02%	0,06%	0,22%
BBB	0,01%	0,01%	0,04%	0,03%	0,11%	0,33%	1,06%	8,20%	80,61%	6,48%	1,42%	0,62%	0,29%	0,23%	0,12%	0,03%	0,05%	0,36%
BBB-	0,01%	0,01%	0,02%	0,04%	0,06%	0,15%	0,27%	1,25%	9,98%	77,63%	5,86%	2,23%	0,89%	0,39%	0,24%	0,17%	0,23%	0,56%
BB+	0,04%	0,00%	0,00%	0,03%	0,09%	0,09%	0,45%	1,73%	12,36%	71,24%	8,10%	2,85%	1,04%	0,58%	0,26%	0,39%	0,71%	
BB	0,00%	0,00%	0,03%	0,01%	0,00%	0,07%	0,05%	0,18%	0,52%	2,19%	10,35%	71,69%	9,27%	2,43%	1,12%	0,34%	0,57%	1,18%
BB-	0,00%	0,00%	0,00%	0,01%	0,01%	0,01%	0,06%	0,10%	0,25%	0,39%	1,87%	10,56%	70,33%	9,30%	3,36%	0,89%	0,73%	2,13%
B+	0,00%	0,01%	0,00%	0,03%	0,00%	0,03%	0,07%	0,04%	0,06%	0,11%	0,34%	1,56%	9,00%	69,27%	10,13%	2,76%	1,88%	4,70%
B	0,00%	0,00%	0,01%	0,01%	0,00%	0,03%	0,04%	0,02%	0,05%	0,12%	0,25%	1,20%	8,09%	67,99%	10,22%	4,22%	7,69%	
B-	0,00%	0,00%	0,00%	0,00%	0,02%	0,03%	0,00%	0,06%	0,05%	0,11%	0,08%	0,14%	0,49%	2,31%	10,65%	57,82%	12,38%	15,85%
CCC/C	0,00%	0,00%	0,00%	0,00%	0,02%	0,00%	0,05%	0,03%	0,05%	0,03%	0,02%	0,09%	0,23%	0,56%	1,46%	5,36%	24,86%	67,26%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

Table A.4. Markov-Chain method, Year 1. Source: own elaboration during the internship at Sogei.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	80,84%	10,44%	5,22%	1,69%	0,49%	0,52%	0,28%	0,04%	0,10%	0,02%	0,06%	0,09%	0,06%	0,01%	0,05%	0,01%	0,06%	0,04%
AA+	4,12%	66,37%	18,78%	7,01%	1,90%	0,86%	0,43%	0,17%	0,19%	0,10%	0,01%	0,01%	0,00%	0,00%	0,00%	0,00%	0,01%	0,01%
AA	0,80%	2,29%	71,18%	14,95%	5,68%	2,49%	0,86%	0,78%	0,31%	0,17%	0,10%	0,06%	0,04%	0,04%	0,02%	0,03%	0,06%	0,13%
AA-	0,09%	0,25%	6,60%	68,40%	16,82%	4,78%	1,45%	0,62%	0,36%	0,16%	0,07%	0,02%	0,01%	0,07%	0,13%	0,01%	0,01%	0,15%
A+	0,01%	0,12%	0,98%	7,71%	68,21%	15,29%	4,41%	1,47%	0,78%	0,24%	0,13%	0,17%	0,04%	0,13%	0,06%	0,01%	0,01%	0,23%
A	0,06%	0,08%	0,44%	1,00%	9,24%	69,07%	11,89%	4,69%	1,87%	0,61%	0,23%	0,21%	0,13%	0,16%	0,05%	0,01%	0,02%	0,24%
A-	0,07%	0,02%	0,13%	0,32%	1,13%	11,24%	67,68%	12,55%	4,12%	1,25%	0,32%	0,29%	0,23%	0,20%	0,06%	0,03%	0,05%	0,31%
BBB+	0,01%	0,02%	0,10%	0,14%	0,44%	1,83%	12,29%	65,18%	13,84%	3,24%	0,84%	0,61%	0,31%	0,30%	0,20%	0,06%	0,09%	0,52%
BBB	0,02%	0,02%	0,08%	0,07%	0,22%	0,69%	2,38%	13,34%	66,88%	10,59%	2,64%	1,26%	0,62%	0,46%	0,25%	0,09%	0,10%	0,79%
BBB-	0,02%	0,02%	0,04%	0,08%	0,13%	0,32%	0,65%	2,85%	16,02%	61,71%	9,13%	3,97%	1,76%	0,81%	0,51%	0,31%	0,32%	1,34%
BB+	0,07%	0,00%	0,01%	0,06%	0,07%	0,18%	0,23%	1,00%	3,96%	18,72%	52,40%	12,18%	5,00%	2,03%	1,16%	0,52%	0,55%	1,85%
BB	0,00%	0,00%	0,05%	0,03%	0,01%	0,12%	0,13%	0,40%	1,23%	4,63%	15,11%	53,31%	13,72%	4,51%	2,23%	0,77%	0,80%	2,95%
BB-	0,00%	0,00%	0,00%	0,02%	0,02%	0,04%	0,11%	0,21%	0,53%	1,06%	3,80%	15,32%	51,39%	13,55%	5,82%	1,83%	1,19%	5,10%
B+	0,00%	0,02%	0,00%	0,05%	0,01%	0,06%	0,12%	0,10%	0,14%	0,28%	0,83%	3,22%	12,85%	49,76%	14,55%	4,74%	2,62%	10,65%
B	0,00%	0,00%	0,02%	0,02%	0,01%	0,06%	0,08%	0,05%	0,11%	0,10%	0,26%	0,63%	2,47%	11,49%	48,25%	13,32%	5,35%	17,79%
B-	0,00%	0,00%	0,00%	0,00%	0,03%	0,05%	0,02%	0,10%	0,17%	0,16%	0,31%	1,00%	3,91%	13,83%	35,26%	10,74%	34,29%	
CCC/C	0,00%	0,00%	0,00%	0,00%	0,02%	0,01%	0,05%	0,04%	0,06%	0,04%	0,04%	0,13%	0,32%	0,79%	2,00%	4,60%	6,92%	84,97%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

Table A.5. Markov-Chain method, Year 2. Source: own elaboration during the internship at Sogei.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	72,88%	13,47%	7,72%	2,83%	0,96%	0,83%	0,44%	0,11%	0,16%	0,04%	0,08%	0,12%	0,08%	0,02%	0,07%	0,02%	0,06%	0,10%
AA+	5,37%	54,46%	23,64%	9,97%	3,34%	1,54%	0,72%	0,35%	0,30%	0,16%	0,04%	0,02%	0,01%	0,01%	0,01%	0,01%	0,02%	0,03%
AA	1,09%	2,90%	60,73%	18,97%	8,34%	3,84%	1,43%	1,14%	0,52%	0,27%	0,15%	0,10%	0,06%	0,07%	0,04%	0,04%	0,06%	0,24%
AA-	0,15%	0,39%	8,36%	57,63%	21,16%	7,22%	2,40%	1,07%	0,61%	0,26%	0,11%	0,06%	0,03%	0,10%	0,16%	0,02%	0,02%	0,24%
A+	0,03%	0,17%	1,49%	9,67%	57,61%	19,34%	6,38%	2,42%	1,26%	0,42%	0,21%	0,24%	0,09%	0,18%	0,10%	0,02%	0,01%	0,36%
A	0,08%	0,11%	0,63%	1,61%	11,59%	58,69%	15,16%	6,59%	2,87%	0,98%	0,36%	0,32%	0,21%	0,22%	0,09%	0,02%	0,03%	0,40%
A-	0,10%	0,04%	0,21%	0,49%	1,92%	14,08%	57,04%	15,79%	6,01%	1,92%	0,55%	0,46%	0,34%	0,29%	0,12%	0,05%	0,06%	0,52%
BBB+	0,01%	0,03%	0,15%	0,22%	0,68%	2,95%	15,23%	54,25%	17,25%	4,68%	1,32%	0,92%	0,50%	0,44%	0,29%	0,10%	0,11%	0,87%
BBB	0,03%	0,03%	0,12%	0,12%	0,35%	1,10%	3,74%	16,45%	55,80%	13,11%	3,64%	1,88%	0,98%	0,67%	0,39%	0,15%	0,15%	1,29%
BBB-	0,03%	0,03%	0,07%	0,12%	0,20%	0,50%	1,12%	4,47%	19,52%	50,22%	10,81%	5,27%	2,55%	1,25%	0,79%	0,44%	0,38%	2,25%
BB+	0,09%	0,01%	0,02%	0,09%	0,11%	0,28%	0,43%	1,64%	6,14%	21,57%	39,85%	13,98%	6,52%	2,90%	1,72%	0,76%	0,65%	3,24%
BB	0,01%	0,00%	0,07%	0,04%	0,03%	0,18%	0,23%	0,67%	2,06%	6,78%	16,85%	41,08%	15,51%	6,08%	3,22%	1,19%	0,95%	5,06%
BB-	0,00%	0,00%	0,01%	0,04%	0,03%	0,07%	0,17%	0,34%	0,84%	1,89%	5,38%	16,98%	38,98%	15,10%	7,46%	2,61%	1,50%	8,59%
B+	0,00%	0,02%	0,01%	0,07%	0,02%	0,09%	0,16%	0,15%	0,26%	0,52%	1,38%	4,56%	14,05%	37,06%	15,95%	5,87%	2,90%	16,93%
B	0,00%	0,00%	0,02%	0,03%	0,02%	0,08%	0,11%	0,09%	0,16%	0,18%	0,41%	1,06%	3,49%	12,45%	35,56%	13,26%	5,26%	27,81%
B-	0,00%	0,00%	0,00%	0,01%	0,04%	0,07%	0,04%	0,13%	0,15%	0,22%	0,24%	0,50%	1,46%	4,81%	13,75%	22,50%	7,70%	48,37%
CCC/C	0,00%	0,00%	0,00%	0,00%	0,02%	0,01%	0,05%	0,05%	0,07%	0,06%	0,06%	0,17%	0,37%	0,89%	2,04%	3,26%	2,39%	90,55%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

Table A.6. Markov-Chain method, Year 3. Source: own elaboration during the internship at Sogei.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	65,82%	15,49%	10,01%	4,07%	1,56%	1,19%	0,62%	0,21%	0,23%	0,08%	0,11%	0,15%	0,10%	0,04%	0,08%	0,02%	0,06%	0,16%
AA+	6,22%	44,93%	26,54%	12,48%	4,91%	2,33%	1,07%	0,57%	0,43%	0,22%	0,06%	0,04%	0,03%	0,03%	0,02%	0,01%	0,02%	0,07%
AA	1,32%	3,28%	52,19%	21,51%	10,72%	5,21%	2,07%	1,51%	0,75%	0,38%	0,19%	0,14%	0,09%	0,10%	0,07%	0,05%	0,06%	0,36%
AA-	0,21%	0,52%	9,46%	49,15%	23,82%	9,48%	3,43%	1,59%	0,90%	0,38%	0,16%	0,10%	0,06%	0,14%	0,19%	0,04%	0,02%	0,36%
A+	0,05%	0,22%	1,97%	10,86%	49,36%	21,91%	8,13%	3,41%	1,80%	0,63%	0,30%	0,31%	0,15%	0,23%	0,13%	0,03%	0,02%	0,50%
A	0,11%	0,14%	0,81%	2,21%	13,04%	50,61%	17,31%	8,21%	3,86%	1,38%	0,51%	0,44%	0,29%	0,29%	0,13%	0,04%	0,04%	0,58%
A-	0,12%	0,06%	0,29%	0,68%	2,70%	15,82%	48,85%	17,81%	7,69%	2,60%	0,80%	0,64%	0,46%	0,38%	0,18%	0,07%	0,08%	0,77%
BBB+	0,02%	0,04%	0,19%	0,30%	0,95%	4,02%	16,93%	46,07%	19,31%	5,93%	1,80%	1,23%	0,70%	0,58%	0,38%	0,14%	0,13%	1,27%
BBB	0,04%	0,04%	0,15%	0,17%	0,48%	1,53%	5,01%	18,22%	47,84%	14,59%	4,44%	2,45%	1,34%	0,89%	0,54%	0,22%	0,19%	1,85%
BBB-	0,04%	0,03%	0,09%	0,15%	0,28%	0,70%	1,64%	5,97%	21,38%	41,79%	11,54%	6,20%	3,22%	1,67%	1,07%	0,55%	0,42%	3,25%
BB+	0,10%	0,02%	0,04%	0,11%	0,16%	0,38%	0,67%	2,34%	8,03%	22,44%	31,33%	14,52%	7,52%	3,63%	2,22%	0,98%	0,72%	4,80%
BB	0,02%	0,01%	0,07%	0,06%	0,06%	0,24%	0,34%	0,98%	2,95%	8,46%	17,00%	32,73%	15,86%	7,15%	4,04%	1,57%	1,06%	7,40%
BB-	0,01%	0,00%	0,02%	0,05%	0,04%	0,11%	0,23%	0,48%	1,19%	2,74%	6,50%	17,04%	30,63%	15,24%	8,44%	3,20%	1,70%	12,38%
B+	0,00%	0,02%	0,02%	0,07%	0,03%	0,12%	0,20%	0,22%	0,39%	0,80%	1,90%	5,51%	13,91%	28,55%	15,80%	6,35%	2,96%	23,15%
B	0,00%	0,00%	0,02%	0,04%	0,03%	0,10%	0,13%	0,13%	0,21%	0,28%	0,58%	1,48%	4,19%	12,19%	27,06%	11,97%	4,72%	36,86%
B-	0,00%	0,00%	0,01%	0,01%	0,05%	0,08%	0,07%	0,15%	0,19%	0,27%	0,32%	0,69%	1,80%	5,16%	12,40%	14,98%	5,39%	58,45%
CCC/C	0,00%	0,00%	0,00%	0,00%	0,02%	0,02%	0,05%	0,05%	0,07%	0,07%	0,08%	0,19%	0,41%	0,91%	1,87%	2,25%	1,11%	92,89%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

Table A.7. Markov-Chain method, Year 4. Source: own elaboration during the internship at Sogei.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	59,54%	16,73%	12,03%	5,35%	2,26%	1,59%	0,82%	0,33%	0,31%	0,13%	0,13%	0,17%	0,12%	0,05%	0,09%	0,03%	0,07%	0,23%
AA+	6,78%	37,28%	28,03%	14,54%	6,51%	3,22%	1,47%	0,83%	0,58%	0,29%	0,10%	0,07%	0,04%	0,04%	0,04%	0,02%	0,03%	0,13%
AA	1,51%	3,50%	45,18%	22,97%	12,77%	6,56%	2,76%	1,90%	1,01%	0,49%	0,24%	0,18%	0,12%	0,09%	0,05%	0,06%	0,06%	0,49%
AA-	0,26%	0,64%	10,08%	42,41%	25,31%	11,49%	4,48%	2,16%	1,23%	0,51%	0,22%	0,15%	0,09%	0,17%	0,20%	0,05%	0,03%	0,49%
A+	0,07%	0,26%	2,39%	11,51%	42,88%	23,44%	9,64%	4,39%	2,37%	0,88%	0,39%	0,38%	0,21%	0,27%	0,16%	0,05%	0,03%	0,67%
A	0,13%	0,17%	0,98%	2,75%	13,85%	44,25%	18,67%	9,56%	4,82%	1,79%	0,67%	0,56%	0,38%	0,35%	0,18%	0,06%	0,05%	0,79%
A-	0,14%	0,08%	0,38%	0,87%	3,44%	16,80%	42,47%	19,01%	9,14%	3,27%	1,06%	0,82%	0,58%	0,47%	0,24%	0,10%	0,09%	1,05%
BBB+	0,03%	0,05%	0,24%	0,39%	1,24%	5,00%	17,81%	39,87%	20,46%	6,98%	2,25%	1,53%	0,91%	0,71%	0,47%	0,19%	0,16%	1,71%
BBB	0,05%	0,05%	0,18%	0,23%	0,62%	1,98%	6,13%	19,12%	41,77%	15,37%	5,06%	2,96%	1,68%	1,10%	0,70%	0,30%	0,23%	2,49%
BBB-	0,05%	0,04%	0,12%	0,19%	0,36%	0,91%	2,20%	7,26%	22,19%	35,52%	11,71%	6,84%	3,78%	2,05%	1,33%	0,66%	0,46%	4,33%
BB+	0,11%	0,03%	0,06%	0,13%	0,20%	0,50%	0,94%	3,05%	9,57%	22,21%	25,42%	14,36%	8,11%	4,21%	2,65%	1,17%	0,78%	6,49%
BB	0,03%	0,01%	0,08%	0,08%	0,09%	0,30%	0,47%	1,32%	3,83%	9,67%	16,36%	26,85%	15,46%	7,81%	4,68%	1,89%	1,15%	9,92%
BB-	0,01%	0,01%	0,03%	0,06%	0,06%	0,15%	0,30%	0,64%	1,57%	3,53%	7,21%	16,31%	24,83%	14,67%	8,91%	3,58%	1,82%	16,32%
B+	0,00%	0,02%	0,02%	0,08%	0,05%	0,14%	0,23%	0,29%	0,55%	1,11%	2,36%	6,09%	13,15%	22,67%	14,90%	6,38%	2,87%	29,09%
B	0,00%	0,01%	0,03%	0,04%	0,04%	0,12%	0,15%	0,17%	0,27%	0,39%	0,75%	1,84%	4,59%	11,37%	21,14%	10,32%	4,07%	44,70%
B-	0,00%	0,00%	0,01%	0,02%	0,05%	0,09%	0,09%	0,17%	0,23%	0,31%	0,40%	0,86%	2,04%	5,14%	10,70%	10,38%	3,83%	65,69%
CCC/C	0,00%	0,00%	0,00%	0,01%	0,02%	0,02%	0,05%	0,06%	0,08%	0,08%	0,10%	0,21%	0,42%	0,88%	1,64%	1,58%	0,65%	94,19%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

Table A.8. Markov-Chain method, Year 5. Source: own elaboration during the internship at Sogei.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	53,93%	17,39%	13,76%	6,61%	3,05%	2,05%	1,05%	0,48%	0,41%	0,18%	0,16%	0,19%	0,13%	0,07%	0,11%	0,04%	0,07%	0,31%
AA+	7,11%	31,12%	28,54%	16,17%	8,07%	4,17%	1,92%	1,12%	0,75%	0,37%	0,14%	0,10%	0,06%	0,06%	0,03%	0,03%	0,03%	0,20%
AA	1,65%	3,59%	39,39%	23,66%	14,48%	7,87%	3,48%	2,31%	1,29%	0,62%	0,29%	0,22%	0,15%	0,15%	0,12%	0,06%	0,06%	0,62%
AA-	0,32%	0,75%	10,37%	37,02%	25,99%	13,20%	5,51%	2,78%	1,60%	0,67%	0,28%	0,21%	0,13%	0,21%	0,22%	0,06%	0,04%	0,64%
A+	0,10%	0,30%	2,76%	11,80%	37,75%	24,24%	10,92%	5,34%	2,96%	1,14%	0,50%	0,46%	0,27%	0,32%	0,20%	0,06%	0,04%	0,85%
A	0,15%	0,19%	1,14%	3,22%	14,23%	39,20%	19,46%	10,67%	5,72%	2,21%	0,83%	0,69%	0,46%	0,42%	0,23%	0,08%	0,07%	1,02%
A-	0,15%	0,09%	0,46%	1,07%	4,09%	17,26%	37,47%	19,64%	10,36%	3,90%	1,32%	1,01%	0,70%	0,56%	0,31%	0,13%	0,11%	1,37%
BBB+	0,05%	0,06%	0,28%	0,49%	1,53%	5,85%	18,15%	35,13%	21,02%	7,84%	2,66%	1,82%	1,12%	0,84%	0,57%	0,23%	0,18%	2,20%
BBB	0,06%	0,05%	0,21%	0,29%	0,77%	2,43%	7,09%	19,44%	37,07%	15,69%	5,53%	3,40%	2,00%	1,30%	0,85%	0,37%	0,26%	3,19%
BBB-	0,06%	0,05%	0,14%	0,22%	0,45%	1,14%	2,77%	8,33%	22,35%	30,76%	11,56%	7,24%	4,22%	2,39%	1,58%	0,75%	0,50%	5,49%
BB+	0,11%	0,03%	0,08%	0,16%	0,25%	0,62%	1,24%	3,74%	10,76%	21,41%	21,22%	13,85%	8,41%	4,64%	3,01%	1,34%	0,83%	8,30%
BB	0,03%	0,01%	0,09%	0,10%	0,13%	0,37%	0,62%	1,67%	4,64%	10,46%	15,39%	22,59%	14,70%	8,15%	5,13%	2,14%	1,22%	12,56%
BB-	0,01%	0,01%	0,03%	0,07%	0,08%	0,20%	0,38%	0,81%	1,97%	4,22%	7,58%	15,25%	20,67%	13,77%	9,02%	3,79%	1,86%	20,28%
B+	0,01%	0,02%	0,03%	0,08%	0,06%	0,17%	0,27%	0,36%	0,71%	1,42%	2,73%	6,38%	12,15%	18,47%	13,67%	6,14%	2,70%	34,62%
B	0,00%	0,01%	0,03%	0,05%	0,05%	0,13%	0,17%	0,20%	0,34%	0,51%	0,91%	2,12%	4,76%	10,33%	16,87%	8,71%	3,44%	51,36%
B-	0,00%	0,00%	0,01%	0,02%	0,05%	0,09%	0,11%	0,18%	0,27%	0,36%	0,47%	1,00%	2,18%	4,91%	9,04%	7,47%	2,81%	71,04%
CCC/C	0,00%	0,00%	0,00%	0,01%	0,02%	0,03%	0,05%	0,06%	0,08%	0,09%	0,11%	0,23%	0,43%	0,83%	1,40%	1,15%	0,45%	95,06%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

Table A.9. Markov-Chain method, Year 6. Source: own elaboration during the internship at Sogei.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	48,92%	17,61%	15,20%	7,83%	3,89%	2,56%	1,31%	0,65%	0,51%	0,24%	0,19%	0,21%	0,15%	0,09%	0,12%	0,04%	0,07%	0,40%
AA+	7,26%	26,14%	28,35%	17,40%	9,54%	5,16%	2,41%	1,43%	0,94%	0,45%	0,18%	0,13%	0,08%	0,09%	0,07%	0,03%	0,04%	0,28%
AA	1,75%	3,59%	34,57%	23,80%	15,86%	9,10%	4,22%	2,74%	1,59%	0,75%	0,35%	0,27%	0,18%	0,24%	0,24%	0,07%	0,05%	0,81%
AA-	0,37%	0,83%	10,42%	32,65%	26,11%	14,64%	6,51%	3,41%	1,99%	0,84%	0,35%	0,27%	0,18%	0,24%	0,24%	0,07%	0,05%	0,81%
A+	0,12%	0,34%	3,06%	11,83%	33,63%	24,54%	11,99%	6,24%	3,56%	1,42%	0,61%	0,54%	0,34%	0,36%	0,23%	0,08%	0,05%	1,06%
A	0,16%	0,21%	1,29%	3,63%	14,32%	35,15%	19,86%	11,58%	6,56%	2,63%	1,00%	0,81%	0,55%	0,48%	0,28%	0,10%	0,08%	1,29%
A-	0,17%	0,11%	0,54%	1,26%	4,65%	17,38%	33,49%	19,89%	11,37%	4,49%	1,59%	1,20%	0,82%	0,65%	0,38%	0,16%	0,12%	1,73%
BBB+	0,06%	0,06%	0,33%	0,59%	1,82%	6,57%	18,15%	31,44%	21,17%	8,52%	3,03%	2,10%	1,32%	0,97%	0,66%	0,28%	0,20%	2,74%
BBB	0,06%	0,06%	0,24%	0,35%	0,93%	2,87%	7,88%	19,41%	33,38%	15,72%	5,87%	3,77%	2,29%	1,50%	0,99%	0,44%	0,30%	3,95%
BBB-	0,07%	0,05%	0,16%	0,26%	0,53%	1,38%	3,31%	9,19%	22,11%	27,09%	11,23%	7,47%	4,56%	2,68%	1,80%	0,85%	0,53%	6,72%
BB+	0,12%	0,04%	0,10%	0,18%	0,31%	0,75%	1,55%	4,38%	11,62%	20,36%	18,15%	13,18%	8,49%	4,95%	3,30%	1,47%	0,87%	10,18%
BB	0,04%	0,02%	0,10%	0,12%	0,16%	0,44%	0,78%	2,04%	5,38%	10,92%	14,30%	19,41%	13,79%	8,25%	5,43%	2,32%	1,26%	15,26%
BB-	0,02%	0,01%	0,04%	0,08%	0,10%	0,25%	0,46%	0,99%	2,37%	4,80%	7,71%	14,09%	17,58%	12,76%	8,88%	3,86%	1,85%	24,18%
B+	0,01%	0,02%	0,04%	0,09%	0,08%	0,19%	0,30%	0,44%	0,89%	1,71%	3,01%	6,45%	11,09%	15,38%	12,36%	5,74%	2,50%	39,69%
B	0,00%	0,01%	0,03%	0,05%	0,06%	0,14%	0,19%	0,24%	0,41%	0,63%	1,06%	2,33%	4,76%	9,25%	13,68%	7,28%	2,89%	56,98%
B-	0,00%	0,00%	0,01%	0,02%	0,05%	0,10%	0,12%	0,20%	0,30%	0,41%	0,54%	1,11%	2,24%	4,55%	7,57%	5,55%	2,12%	75,10%
CCC/C	0,00%	0,00%	0,00%	0,01%	0,02%	0,03%	0,05%	0,07%	0,09%	0,10%	0,12%	0,24%	0,43%	0,73%	1,18%	0,86%	0,33%	95,71%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

Table A.10. Markov-Chain method, Year 7. Source: own elaboration during the internship at Sogei.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	44,43%	17,51%	16,35%	8,97%	4,77%	3,10%	1,60%	0,85%	0,64%	0,30%	0,21%	0,23%	0,17%	0,11%	0,13%	0,05%	0,07%	0,50%
AA+	7,28%	22,10%	27,70%	18,30%	10,89%	6,15%	2,94%	1,78%	1,15%	0,55%	0,23%	0,17%	0,11%	0,11%	0,09%	0,04%	0,04%	0,38%
AA	1,82%	3,54%	30,54%	23,56%	16,95%	10,24%	4,95%	3,18%	1,91%	0,89%	0,41%	0,32%	0,21%	0,22%	0,17%	0,08%	0,06%	0,93%
AA-	0,42%	0,90%	10,31%	29,09%	25,86%	15,81%	7,46%	4,05%	2,41%	1,02%	0,43%	0,34%	0,22%	0,28%	0,25%	0,09%	0,05%	0,99%
A+	0,15%	0,37%	3,30%	11,70%	30,29%	24,50%	12,87%	7,08%	4,16%	1,71%	0,72%	0,63%	0,40%	0,41%	0,27%	0,09%	0,06%	1,28%
A	0,18%	0,23%	1,42%	3,96%	14,22%	31,87%	19,99%	12,31%	7,34%	3,03%	1,18%	0,94%	0,65%	0,55%	0,33%	0,13%	0,09%	1,58%
A-	0,18%	0,13%	0,62%	1,45%	5,13%	17,27%	30,30%	19,90%	12,19%	5,03%	1,84%	1,38%	0,95%	0,73%	0,45%	0,19%	0,14%	2,12%
BBB+	0,07%	0,07%	0,37%	0,69%	2,10%	7,16%	17,94%	28,54%	21,07%	9,06%	3,36%	2,36%	1,51%	1,10%	0,75%	0,32%	0,22%	3,31%
BBB	0,07%	0,07%	0,27%	0,41%	1,09%	3,29%	8,52%	19,16%	30,43%	15,56%	6,10%	4,08%	2,55%	1,67%	1,13%	0,50%	0,33%	4,77%
BBB-	0,08%	0,06%	0,18%	0,30%	0,62%	1,62%	3,83%	9,85%	21,63%	24,21%	10,82%	7,57%	4,81%	2,92%	2,00%	0,93%	0,56%	8,00%
BB+	0,12%	0,05%	0,12%	0,20%	0,36%	0,89%	1,87%	4,96%	12,22%	19,22%	15,86%	12,45%	8,43%	5,15%	3,52%	1,58%	0,89%	12,12%
BB	0,05%	0,02%	0,10%	0,14%	0,20%	0,51%	0,95%	2,39%	6,01%	11,13%	13,21%	16,96%	12,84%	8,17%	5,59%	2,44%	1,28%	18,00%
BB-	0,02%	0,01%	0,05%	0,09%	0,12%	0,29%	0,54%	1,17%	2,75%	5,25%	7,65%	12,93%	15,22%	11,74%	8,58%	3,82%	1,80%	27,96%
B+	0,01%	0,02%	0,04%	0,09%	0,09%	0,22%	0,34%	0,53%	1,07%	1,98%	3,21%	6,37%	10,07%	13,03%	11,08%	5,28%	2,28%	44,30%
B	0,00%	0,01%	0,03%	0,05%	0,07%	0,15%	0,21%	0,28%	0,48%	0,74%	1,18%	2,47%	4,64%	8,21%	11,25%	6,08%	2,43%	61,71%
B-	0,00%	0,00%	0,01%	0,03%	0,06%	0,11%	0,14%	0,22%	0,33%	0,45%	0,60%	1,18%	2,23%	4,15%	6,32%	4,25%	1,65%	78,27%
CCC/C	0,00%	0,00%	0,00%	0,01%	0,02%	0,03%	0,05%	0,07%	0,09%	0,11%	0,13%	0,25%	0,41%	0,69%	1,00%	0,66%	0,26%	96,21%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

Table A.11. Markov-Chain method, Year 8. Source: own elaboration during the internship at Sogei.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	40,41%	17,17%	17,25%	10,02%	5,66%	3,68%	1,92%	1,06%	0,77%	0,38%	0,24%	0,26%	0,18%	0,13%	0,14%	0,06%	0,07%	0,60%
AA+	7,19%	18,82%	26,74%	18,90%	12,09%	7,13%	3,50%	2,14%	1,38%	0,66%	0,28%	0,21%	0,14%	0,14%	0,11%	0,05%	0,05%	0,49%
AA	1,87%	3,45%	27,15%	23,06%	17,77%	11,29%	5,68%	3,64%	2,24%	1,05%	0,47%	0,37%	0,25%	0,25%	0,20%	0,08%	0,07%	1,11%
AA-	0,47%	0,96%	10,08%	26,15%	25,36%	16,74%	8,34%	4,69%	2,85%	1,22%	0,51%	0,41%	0,28%	0,32%	0,27%	0,10%	0,06%	1,19%
A+	0,18%	0,40%	3,49%	11,47%	27,55%	24,23%	13,58%	7,84%	4,76%	2,00%	0,84%	0,72%	0,47%	0,45%	0,30%	0,11%	0,07%	1,53%
A	0,20%	0,25%	1,54%	4,23%	14,00%	29,18%	19,92%	12,90%	8,04%	3,43%	1,35%	1,07%	0,74%	0,61%	0,38%	0,15%	0,11%	1,89%
A-	0,19%	0,14%	0,70%	1,64%	5,52%	17,01%	27,72%	19,73%	12,85%	5,52%	2,08%	1,57%	1,07%	0,82%	0,52%	0,22%	0,15%	2,54%
BBB+	0,08%	0,08%	0,41%	0,79%	2,37%	7,65%	17,60%	26,22%	20,81%	9,47%	3,64%	2,59%	1,69%	1,22%	0,84%	0,37%	0,24%	3,93%
BBB	0,08%	0,07%	0,30%	0,47%	1,25%	3,69%	9,03%	18,78%	28,04%	15,29%	6,26%	4,32%	2,78%	1,84%	1,26%	0,56%	0,36%	5,64%
BBB-	0,08%	0,06%	0,21%	0,33%	0,72%	1,86%	4,31%	10,36%	21,02%	21,92%	10,37%	7,58%	4,98%	3,12%	2,16%	1,00%	0,59%	9,33%
BB+	0,12%	0,05%	0,14%	0,23%	0,42%	1,03%	2,18%	5,48%	12,60%	18,08%	14,09%	11,71%	8,26%	5,26%	3,68%	1,66%	0,91%	14,09%
BB	0,05%	0,02%	0,11%	0,16%	0,24%	0,60%	1,13%	2,74%	6,54%	11,14%	12,19%	15,03%	11,92%	7,98%	5,64%	2,51%	1,28%	20,72%
BB-	0,02%	0,01%	0,06%	0,10%	0,14%	0,34%	0,63%	1,36%	3,10%	5,58%	7,48%	11,85%	13,36%	10,76%	8,17%	3,72%	1,73%	31,56%
B+	0,01%	0,02%	0,05%	0,10%	0,11%	0,24%	0,38%	0,61%	1,24%	2,22%	3,33%	6,18%	9,12%	11,19%	9,88%	4,79%	2,06%	48,47%
B	0,00%	0,01%	0,03%	0,06%	0,07%	0,17%	0,23%	0,32%	0,55%	0,85%	1,28%	2,55%	4,44%	7,26%	9,36%	5,08%	2,04%	65,70%
B-	0,00%	0,00%	0,01%	0,03%	0,06%	0,11%	0,15%	0,23%	0,37%	0,50%	0,65%	1,23%	2,17%	3,74%	5,29%	3,33%	1,31%	80,81%
CCC/C	0,00%	0,00%	0,00%	0,01%	0,02%	0,03%	0,05%	0,07%	0,10%	0,12%	0,14%	0,25%	0,40%	0,63%	0,84%	0,52%	0,21%	96,61%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

Table A.12. Markov-Chain method, Year 9. Source: own elaboration during the internship at Sogei.



	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	36,78%	16,67%	17,90%	10,96%	6,55%	4,29%	2,26%	1,30%	0,93%	0,45%	0,28%	0,28%	0,20%	0,15%	0,15%	0,06%	0,07%	0,72%
AA+	7,04%	16,13%	25,59%	19,24%	13,15%	8,08%	4,07%	2,52%	1,63%	0,77%	0,33%	0,26%	0,17%	0,17%	0,14%	0,06%	0,05%	0,61%
AA	1,90%	3,33%	24,28%	22,39%	18,36%	12,22%	6,38%	4,10%	2,59%	1,21%	0,54%	0,43%	0,29%	0,29%	0,22%	0,09%	0,07%	1,29%
AA-	0,51%	1,00%	9,79%	23,69%	24,71%	17,46%	9,15%	5,32%	3,29%	1,43%	0,60%	0,49%	0,33%	0,36%	0,29%	0,11%	0,07%	1,40%
A+	0,20%	0,43%	3,63%	11,16%	25,28%	23,81%	14,14%	8,54%	5,33%	2,30%	0,97%	0,81%	0,55%	0,50%	0,34%	0,13%	0,09%	1,80%
A	0,21%	0,27%	1,65%	4,45%	13,70%	26,95%	19,73%	13,36%	8,67%	3,81%	1,52%	1,21%	0,83%	0,68%	0,43%	0,18%	0,12%	2,24%
A-	0,19%	0,15%	0,77%	1,81%	5,84%	16,67%	25,59%	19,47%	13,37%	5,96%	2,31%	1,74%	1,20%	0,91%	0,59%	0,25%	0,17%	3,00%
BBB+	0,09%	0,09%	0,45%	0,89%	2,62%	8,03%	17,18%	24,34%	20,45%	9,78%	3,89%	2,81%	1,86%	1,33%	0,92%	0,41%	0,26%	4,58%
BBB	0,09%	0,08%	0,32%	0,54%	1,41%	4,05%	9,42%	18,32%	26,08%	14,94%	6,35%	4,52%	2,97%	1,99%	1,38%	0,62%	0,38%	6,55%
BBB-	0,09%	0,06%	0,23%	0,37%	0,81%	2,10%	4,75%	10,72%	20,35%	20,05%	9,91%	7,51%	5,09%	3,28%	2,30%	1,06%	0,61%	10,70%
BB+	0,12%	0,06%	0,16%	0,26%	0,48%	1,18%	2,49%	5,93%	12,81%	17,00%	12,69%	11,01%	8,04%	5,29%	3,78%	1,72%	0,92%	16,08%
BB	0,05%	0,03%	0,12%	0,17%	0,28%	0,68%	1,31%	3,07%	6,97%	11,02%	11,26%	13,46%	11,05%	7,72%	5,61%	2,53%	1,27%	23,40%
BB-	0,02%	0,02%	0,06%	0,11%	0,16%	0,39%	0,73%	1,55%	3,43%	5,82%	7,23%	10,86%	11,86%	9,85%	7,71%	3,57%	1,65%	34,98%
B+	0,01%	0,02%	0,05%	0,10%	0,12%	0,27%	0,42%	0,70%	1,41%	2,42%	3,39%	5,93%	8,26%	9,72%	8,80%	4,32%	1,85%	52,21%
B	0,00%	0,01%	0,03%	0,06%	0,08%	0,18%	0,25%	0,35%	0,62%	0,95%	1,36%	2,57%	4,20%	6,41%	7,86%	4,25%	1,72%	69,08%
B-	0,00%	0,00%	0,02%	0,03%	0,06%	0,12%	0,16%	0,25%	0,40%	0,54%	0,69%	1,26%	2,09%	3,34%	4,44%	2,67%	1,06%	82,87%
CCC/C	0,00%	0,00%	0,00%	0,01%	0,02%	0,04%	0,06%	0,07%	0,11%	0,13%	0,15%	0,25%	0,38%	0,56%	0,71%	0,42%	0,17%	96,94%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

Table A.13. Markov-Chain method, Year 10. Source: own elaboration during the internship at Sogei.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	33,52%	16,05%	18,35%	11,80%	7,42%	4,92%	2,62%	1,55%	1,09%	0,54%	0,31%	0,31%	0,22%	0,17%	0,17%	0,07%	0,07%	0,84%
AA+	6,83%	13,92%	24,35%	19,38%	14,05%	8,98%	4,65%	2,91%	1,90%	0,90%	0,39%	0,30%	0,20%	0,20%	0,16%	0,07%	0,06%	0,75%
AA	1,91%	3,20%	21,83%	21,62%	18,75%	13,05%	7,07%	4,57%	2,95%	1,38%	0,61%	0,49%	0,34%	0,32%	0,25%	0,10%	0,07%	1,49%
AA-	0,54%	1,03%	9,45%	21,63%	23,96%	18,00%	9,88%	5,93%	3,74%	1,65%	0,70%	0,57%	0,39%	0,40%	0,31%	0,12%	0,08%	1,63%
A+	0,23%	0,45%	3,73%	10,82%	23,37%	23,30%	14,58%	9,16%	5,89%	2,60%	1,09%	0,90%	0,62%	0,55%	0,37%	0,15%	0,10%	2,08%
A	0,22%	0,28%	1,75%	4,61%	13,36%	25,08%	19,45%	13,71%	9,24%	4,17%	1,69%	1,34%	0,93%	0,74%	0,48%	0,20%	0,13%	2,61%
A-	0,20%	0,17%	0,84%	1,96%	6,10%	16,28%	23,83%	19,14%	13,77%	6,35%	2,52%	1,91%	1,32%	0,99%	0,66%	0,29%	0,19%	3,49%
BBB+	0,10%	0,10%	0,49%	0,99%	2,86%	8,34%	16,73%	22,80%	20,04%	10,00%	4,09%	3,00%	2,02%	1,44%	1,00%	0,45%	0,28%	5,27%
BBB	0,09%	0,08%	0,35%	0,60%	1,56%	4,39%	9,72%	17,83%	24,43%	14,56%	6,39%	4,67%	3,14%	2,12%	1,48%	0,67%	0,40%	7,50%
BBB-	0,09%	0,07%	0,25%	0,41%	0,91%	2,34%	5,14%	10,97%	19,66%	18,51%	9,46%	7,40%	5,15%	3,39%	2,42%	1,11%	0,63%	12,10%
BB+	0,12%	0,06%	0,17%	0,28%	0,55%	1,33%	2,78%	6,31%	12,89%	15,99%	11,56%	10,34%	7,77%	5,27%	3,83%	1,75%	0,92%	18,06%
BB	0,06%	0,03%	0,13%	0,19%	0,32%	0,77%	1,49%	3,37%	7,32%	10,81%	10,42%	12,17%	10,24%	7,40%	5,51%	2,51%	1,24%	26,02%
BB-	0,03%	0,02%	0,07%	0,12%	0,19%	0,45%	0,82%	1,73%	3,72%	5,97%	6,94%	9,96%	10,62%	9,02%	7,23%	3,38%	1,56%	38,19%
B+	0,01%	0,02%	0,06%	0,10%	0,14%	0,29%	0,46%	0,79%	1,57%	2,58%	3,40%	5,65%	7,49%	8,52%	7,82%	3,87%	1,66%	55,56%
B	0,01%	0,01%	0,04%	0,06%	0,09%	0,19%	0,27%	0,39%	0,69%	1,04%	1,42%	2,55%	3,94%	5,66%	6,65%	3,58%	1,46%	71,96%
B-	0,00%	0,00%	0,02%	0,03%	0,06%	0,13%	0,18%	0,27%	0,43%	0,58%	0,72%	1,26%	1,98%	2,98%	3,75%	2,17%	0,87%	84,57%
CCC/C	0,00%	0,00%	0,00%	0,01%	0,02%	0,04%	0,06%	0,08%	0,11%	0,13%	0,15%	0,24%	0,36%	0,50%	0,60%	0,35%	0,14%	97,21%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

Table A.14. Markov-Chain method, Year 11. Source: own elaboration during the internship at Sogei.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	30,58%	15,35%	18,60%	12,52%	8,26%	5,56%	3,00%	1,82%	1,27%	0,63%	0,35%	0,33%	0,24%	0,19%	0,18%	0,07%	0,07%	0,97%
AA+	6,59%	12,10%	23,06%	19,35%	14,81%	9,84%	5,24%	3,32%	2,18%	1,03%	0,45%	0,36%	0,24%	0,23%	0,18%	0,07%	0,06%	0,91%
AA	1,90%	3,06%	19,73%	20,78%	18,97%	13,78%	7,71%	5,04%	3,31%	1,56%	0,69%	0,56%	0,38%	0,36%	0,27%	0,11%	0,08%	1,71%
AA-	0,57%	1,05%	9,08%	19,87%	23,17%	18,38%	10,54%	6,51%	4,20%	1,88%	0,80%	0,65%	0,44%	0,44%	0,34%	0,13%	0,08%	1,87%
A+	0,25%	0,47%	3,80%	10,46%	21,75%	22,73%	14,91%	9,72%	6,42%	2,89%	1,22%	1,00%	0,69%	0,60%	0,41%	0,17%	0,11%	2,39%
A	0,23%	0,30%	1,83%	4,73%	12,99%	23,50%	19,12%	13,98%	9,74%	4,51%	1,86%	1,46%	1,02%	0,81%	0,54%	0,23%	0,15%	3,01%
A-	0,21%	0,18%	0,91%	2,11%	6,29%	15,87%	22,36%	18,77%	14,06%	6,69%	2,72%	2,07%	1,44%	1,07%	0,72%	0,32%	0,20%	4,01%
BBB+	0,11%	0,11%	0,53%	1,08%	3,07%	8,57%	16,28%	21,51%	19,60%	10,14%	4,26%	3,17%	2,16%	1,54%	1,08%	0,49%	0,30%	6,00%
BBB	0,10%	0,09%	0,38%	0,67%	1,71%	4,69%	9,93%	17,34%	23,04%	14,16%	6,39%	4,79%	3,27%	2,23%	1,58%	0,72%	0,42%	8,49%
BBB-	0,10%	0,07%	0,27%	0,45%	1,01%	2,57%	5,49%	11,13%	18,97%	17,22%	9,03%	7,25%	5,16%	3,47%	2,51%	1,15%	0,64%	13,51%
BB+	0,12%	0,07%	0,19%	0,31%	0,61%	1,48%	3,06%	6,63%	12,87%	15,07%	10,63%	9,73%	7,47%	5,21%	3,84%	1,77%	0,92%	20,02%
BB	0,06%	0,04%	0,14%	0,21%	0,36%	0,86%	1,67%	3,65%	7,58%	10,54%	9,66%	11,08%	9,50%	7,06%	5,36%	2,47%	1,21%	28,56%
BB-	0,03%	0,02%	0,08%	0,13%	0,21%	0,50%	0,92%	1,90%	3,97%	6,04%	6,63%	9,15%	9,57%	8,25%	6,74%	3,19%	1,46%	41,20%
B+	0,02%	0,02%	0,06%	0,11%	0,15%	0,32%	0,50%	0,88%	1,72%	2,71%	3,36%	5,35%	6,80%	7,52%	6,96%	3,46%	1,49%	58,57%
B	0,01%	0,01%	0,04%	0,07%	0,10%	0,20%	0,29%	0,43%	0,76%	1,12%	1,45%	2,50%	3,67%	5,00%	5,67%	3,04%	1,25%	74,42%
B-	0,00%	0,00%	0,02%	0,04%	0,07%	0,13%	0,19%	0,28%	0,46%	0,62%	0,74%	1,25%	1,86%	2,65%	3,18%	1,79%	0,73%	85,99%
CCC/C	0,00%	0,00%	0,00%	0,01%	0,02%	0,04%	0,06%	0,08%	0,12%	0,14%	0,15%	0,24%	0,33%	0,45%	0,52%	0,29%	0,12%	97,44%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

Table A.15. Markov-Chain method, Year 12. Source: own elaboration during the internship at Sogei.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	27,92%	14,61%	18,70%	13,14%	9,05%	6,20%	3,40%	2,10%	1,47%	0,73%	0,39%	0,36%	0,26%	0,21%	0,19%	0,08%	0,07%	1,12%
AA+	6,32%	10,58%	21,77%	19,18%	15,43%	10,63%	5,82%	3,73%	2,48%	1,17%	0,51%	0,41%	0,28%	0,26%	0,20%	0,08%	0,07%	1,07%
AA	1,88%	2,91%	17,93%	19,92%	19,05%	14,40%	8,32%	5,51%	3,68%	1,74%	0,77%	0,62%	0,43%	0,40%	0,30%	0,13%	0,08%	1,94%
AA-	0,60%	1,06%	8,71%	18,36%	22,35%	18,63%	11,12%	7,07%	4,65%	2,11%	0,90%	0,73%	0,51%	0,48%	0,36%	0,14%	0,09%	2,14%
A+	0,27%	0,49%	3,83%	10,10%	20,36%	22,14%	15,15%	10,21%	6,92%	3,18%	1,35%	1,10%	0,77%	0,65%	0,45%	0,18%	0,12%	2,72%
A	0,25%	0,31%	1,90%	4,81%	12,62%	22,15%	18,76%	14,17%	10,19%	4,82%	2,01%	1,59%	1,11%	0,87%	0,59%	0,25%	0,16%	3,44%
A-	0,21%	0,19%	0,97%	2,24%	6,44%	15,45%	21,10%	18,39%	14,28%	6,99%	2,90%	2,22%	1,55%	1,15%	0,79%	0,35%	0,22%	4,56%
BBB+	0,12%	0,12%	0,57%	1,17%	3,27%	8,74%	15,83%	20,42%	19,14%	10,23%	4,40%	3,32%	2,29%	1,64%	1,16%	0,52%	0,31%	6,75%
BBB	0,11%	0,09%	0,41%	0,73%	1,86%	4,96%	10,08%	16,85%	21,85%	13,76%	6,36%	4,87%	3,38%	2,33%	1,67%	0,76%	0,44%	9,50%
BBB-	0,10%	0,08%	0,29%	0,49%	1,11%	2,79%	5,79%	11,22%	18,30%	16,12%	8,63%	7,09%	5,14%	3,53%	2,57%	1,19%	0,65%	14,94%
BB+	0,12%	0,07%	0,21%	0,34%	0,68%	1,63%	3,32%	6,90%	12,78%	14,23%	9,84%	9,16%	7,17%	5,11%	3,82%	1,77%	0,90%	21,96%
BB	0,06%	0,04%	0,14%	0,23%	0,40%	0,95%	1,84%	3,90%	7,77%	10,23%	8,98%	10,16%	8,82%	6,71%	5,18%	2,40%	1,17%	31,01%
BB-	0,03%	0,02%	0,08%	0,14%	0,24%	0,55%	1,02%	2,07%	4,19%	6,06%	6,31%	8,43%	8,68%	7,56%	6,26%	2,98%	1,36%	44,00%
B+	0,02%	0,02%	0,06%	0,11%	0,16%	0,34%	0,55%	0,96%	1,86%	2,81%	3,30%	5,04%	6,19%	6,67%	6,20%	3,09%	1,34%	61,27%
B	0,01%	0,01%	0,04%	0,07%	0,10%	0,21%	0,30%	0,47%	0,82%	1,19%	1,47%	2,43%	3,40%	4,42%	4,87%	2,59%	1,07%	76,54%
B-	0,00%	0,00%	0,02%	0,04%	0,07%	0,14%	0,20%	0,30%	0,49%	0,65%	0,75%	1,22%	1,74%	2,35%	2,72%	1,50%	0,61%	87,20%
CCC/C	0,00%	0,00%	0,00%	0,01%	0,02%	0,04%	0,06%	0,08%	0,12%	0,14%	0,15%	0,23%	0,31%	0,40%	0,44%	0,24%	0,10%	97,64%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

Table A.16. Markov-Chain method, Year 13. Source: own elaboration during the internship at Sogei.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	25,52%	13,85%	18,66%	13,64%	9,80%	6,83%	3,81%	2,40%	1,67%	0,83%	0,43%	0,39%	0,29%	0,24%	0,21%	0,09%	0,08%	1,27%
AA+	6,04%	9,32%	20,51%	18,91%	15,92%	11,36%	6,39%	4,15%	2,78%	1,32%	0,58%	0,47%	0,32%	0,29%	0,23%	0,09%	0,07%	1,25%
AA	1,86%	2,77%	16,36%	19,05%	19,01%	14,92%	8,90%	5,96%	4,05%	1,93%	0,85%	0,69%	0,48%	0,43%	0,33%	0,14%	0,09%	2,18%
AA-	0,62%	1,06%	8,34%	17,05%	21,54%	18,77%	11,63%	7,59%	5,09%	2,35%	1,00%	0,81%	0,57%	0,52%	0,39%	0,16%	0,10%	2,41%
A+	0,29%	0,50%	3,85%	9,74%	19,15%	21,54%	15,31%	10,65%	7,40%	3,46%	1,48%	1,20%	0,84%	0,70%	0,49%	0,20%	0,13%	3,08%
A	0,26%	0,32%	1,96%	4,86%	12,25%	20,99%	18,38%	14,30%	10,57%	5,12%	2,16%	1,71%	1,20%	0,93%	0,64%	0,28%	0,17%	3,89%
A-	0,22%	0,20%	1,02%	2,35%	6,55%	15,03%	20,03%	18,01%	14,43%	7,25%	3,06%	2,36%	1,66%	1,23%	0,85%	0,38%	0,23%	5,14%
BBB+	0,13%	0,12%	0,61%	1,26%	3,44%	8,86%	15,39%	19,49%	18,69%	10,27%	4,51%	3,45%	2,41%	1,72%	1,23%	0,55%	0,33%	7,54%
BBB	0,11%	0,10%	0,43%	0,79%	2,00%	5,20%	10,17%	16,37%	20,81%	13,36%	6,31%	4,92%	3,47%	2,42%	1,74%	0,80%	0,45%	10,55%
BBB-	0,11%	0,08%	0,31%	0,53%	1,20%	3,00%	6,05%	11,24%	17,66%	15,18%	8,25%	6,90%	5,09%	3,55%	2,62%	1,21%	0,65%	16,37%
BB+	0,12%	0,07%	0,22%	0,36%	0,74%	1,78%	3,55%	7,11%	12,63%	13,47%	9,16%	8,64%	6,87%	4,99%	3,77%	1,75%	0,89%	23,87%
BB	0,06%	0,04%	0,15%	0,24%	0,45%	1,05%	2,01%	4,12%	7,90%	9,91%	8,38%	9,36%	8,20%	6,35%	4,97%	2,32%	1,12%	33,36%
BB-	0,03%	0,02%	0,09%	0,15%	0,26%	0,61%	1,12%	2,22%	4,36%	6,03%	5,99%	7,78%	7,91%	6,94%	5,81%	2,78%	1,27%	46,62%
B+	0,02%	0,02%	0,07%	0,12%	0,18%	0,37%	0,59%	1,04%	1,99%	2,88%	3,22%	4,74%	5,64%	5,95%	5,54%	2,77%	1,20%	63,69%
B	0,01%	0,01%	0,04%	0,07%	0,11%	0,22%	0,32%	0,50%	0,88%	1,24%	1,47%	2,34%	3,14%	3,92%	4,20%	2,22%	0,92%	78,38%
B-	0,00%	0,00%	0,02%	0,04%	0,07%	0,14%	0,21%	0,32%	0,52%	0,67%	0,75%	1,19%	1,62%	2,09%	2,33%	1,26%	0,52%	88,23%
CCC/C	0,00%	0,00%	0,00%	0,01%	0,02%	0,04%	0,06%	0,09%	0,13%	0,15%	0,15%	0,22%	0,29%	0,35%	0,38%	0,21%	0,09%	97,81%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

Table A.17. Markov-Chain method, Year 14. Source: own elaboration during the internship at Sogei.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	23,35%	13,09%	18,50%	14,05%	10,48%	7,46%	4,23%	2,71%	1,89%	0,94%	0,48%	0,43%	0,31%	0,26%	0,22%	0,09%	0,08%	1,43%
AA+	5,75%	8,26%	19,29%	18,55%	16,29%	12,03%	6,94%	4,57%	3,10%	1,48%	0,65%	0,52%	0,36%	0,33%	0,25%	0,10%	0,08%	1,45%
AA	1,82%	2,63%	14,99%	18,19%	18,89%	15,36%	9,43%	6,41%	4,22%	2,13%	0,94%	0,76%	0,53%	0,47%	0,35%	0,15%	0,10%	2,44%
AA-	0,64%	1,06%	7,97%	15,91%	20,75%	18,81%	12,07%	8,08%	5,53%	2,59%	1,11%	0,90%	0,63%	0,56%	0,41%	0,17%	0,11%	2,71%
A+	0,31%	0,52%	3,84%	9,38%	18,10%	20,94%	15,41%	11,02%	7,84%	3,74%	1,61%	1,30%	0,92%	0,75%	0,53%	0,22%	0,14%	3,45%
A	0,26%	0,33%	2,02%	4,89%	11,88%	19,97%	18,00%	14,39%	10,91%	5,39%	2,31%	1,83%	1,29%	1,00%	0,69%	0,30%	0,18%	4,37%
A-	0,22%	0,21%	1,08%	2,45%	6,62%	14,63%	19,11%	17,62%	14,52%	7,47%	3,21%	2,49%	1,76%	1,30%	0,91%	0,41%	0,24%	5,75%
BBB+	0,13%	0,13%	0,65%	1,34%	3,60%	8,94%	14,97%	18,68%	18,25%	10,27%	4,60%	3,56%	2,51%	1,80%	1,29%	0,59%	0,34%	8,35%
BBB	0,12%	0,11%	0,46%	0,85%	2,14%	5,42%	10,22%	15,91%	19,90%	12,97%	6,24%	4,94%	3,53%	2,49%	1,81%	0,83%	0,46%	11,61%
BBB-	0,11%	0,09%	0,33%	0,57%	1,30%	3,19%	6,27%	11,22%	17,05%	14,36%	7,90%	6,71%	5,03%	3,56%	2,64%	1,23%	0,65%	17,81%
BB+	0,12%	0,08%	0,24%	0,39%	0,81%	1,92%	3,77%	7,27%	12,44%	12,78%	8,58%	8,16%	6,57%	4,85%	3,71%	1,73%	0,87%	25,22%
BB	0,07%	0,04%	0,16%	0,26%	0,49%	1,14%	2,17%	4,32%	7,98%	9,57%	7,83%	8,65%	7,64%	6,01%	4,75%	2,24%	1,07%	35,60%
BB-	0,04%	0,03%	0,10%	0,16%	0,29%	0,66%	1,21%	2,37%	4,51%	5,96%	5,68%	7,20%	7,24%	6,37%	5,37%	2,59%	1,18%	49,04%
B+	0,02%	0,02%	0,07%	0,12%	0,19%	0,39%	0,64%	1,12%	2,10%	2,92%	3,12%	4,45%	5,15%	5,33%	4,95%	2,48%	1,08%	65,87%
B	0,01%	0,01%	0,04%	0,07%	0,12%	0,23%	0,34%	0,54%	0,94%	1,29%	1,45%	2,24%	2,90%	3,49%	3,65%	1,91%	0,80%	79,97%
B-	0,00%	0,01%	0,02%	0,04%	0,07%	0,15%	0,22%	0,33%	0,55%	0,69%	0,75%	1,14%	1,50%	1,86%	2,01%	1,08%	0,45%	89,12%
CCC/C	0,00%	0,00%	0,01%	0,01%	0,02%	0,04%	0,06%	0,09%	0,13%	0,15%	0,15%	0,21%	0,27%	0,32%	0,33%	0,18%	0,07%	97,96%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

Table A.18. Markov-Chain method, Year 15. Source: own elaboration during the internship at Sogei.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	21,37%	12,34%	18,25%	14,37%	11,11%	8,07%	4,65%	3,02%	2,12%	1,05%	0,47%	0,34%	0,28%	0,24%	0,10%	0,08%	1,60%	
AA+	5,46%	7,37%	18,13%	18,12%	16,56%	12,63%	7,47%	4,99%	3,42%	1,64%	0,72%	0,58%	0,41%	0,36%	0,28%	0,11%	0,08%	1,66%
AA	1,78%	2,49%	13,79%	17,36%	18,68%	15,71%	9,91%	6,84%	4,79%	2,32%	1,03%	0,83%	0,59%	0,36%	0,28%	0,16%	0,10%	2,71%
AA-	0,65%	1,05%	7,61%	14,90%	19,97%	18,78%	12,45%	8,54%	5,95%	2,82%	1,22%	0,99%	0,69%	0,60%	0,44%	0,18%	0,11%	3,02%
A+	0,33%	0,53%	3,81%	9,04%	17,16%	20,35%	15,46%	11,35%	8,25%	4,00%	1,73%	1,40%	0,99%	0,80%	0,57%	0,24%	0,15%	3,84%
A	0,27%	0,34%	2,06%	4,89%	11,53%	19,08%	17,62%	14,43%	11,20%	5,64%	2,44%	1,38%	1,06%	0,74%	0,32%	0,20%	0,20%	4,87%
A-	0,23%	0,22%	1,12%	2,54%	6,66%	14,24%	18,30%	17,25%	14,56%	7,65%	3,34%	2,62%	1,85%	1,37%	0,97%	0,43%	0,26%	6,39%
BBB+	0,14%	0,14%	0,68%	1,42%	3,73%	8,98%	14,57%	17,97%	17,82%	10,24%	4,67%	3,66%	2,60%	1,88%	1,35%	0,61%	0,35%	9,18%
BBB	0,12%	0,11%	0,48%	0,91%	2,26%	5,60%	10,23%	15,48%	19,09%	12,60%	6,16%	4,95%	3,58%	2,54%	1,86%	0,85%	0,47%	12,69%
BBB-	0,11%	0,09%	0,35%	0,61%	1,39%	3,37%	6,45%	11,17%	16,47%	13,63%	7,58%	6,52%	4,94%	3,55%	2,66%	1,23%	0,65%	19,23%
BB+	0,12%	0,08%	0,25%	0,42%	0,87%	2,06%	3,97%	7,40%	12,23%	12,15%	8,06%	7,72%	6,28%	4,70%	3,62%	1,70%	0,85%	27,53%
BB	0,07%	0,05%	0,17%	0,28%	0,53%	1,23%	2,32%	4,48%	8,02%	9,23%	7,34%	8,04%	7,13%	5,67%	4,53%	2,14%	1,02%	37,75%
BB-	0,04%	0,03%	0,10%	0,17%	0,32%	0,72%	1,31%	2,50%	4,63%	5,87%	5,38%	6,67%	6,64%	5,86%	4,97%	2,40%	1,09%	51,30%
B+	0,02%	0,02%	0,07%	0,12%	0,20%	0,42%	0,68%	1,20%	2,19%	2,94%	3,01%	4,17%	4,71%	4,80%	4,44%	2,22%	0,97%	67,83%
B	0,01%	0,01%	0,04%	0,07%	0,12%	0,24%	0,36%	0,57%	0,99%	1,32%	1,43%	2,13%	2,67%	3,11%	3,19%	1,66%	0,70%	81,37%
B-	0,00%	0,01%	0,02%	0,04%	0,08%	0,15%	0,23%	0,35%	0,57%	0,71%	0,74%	1,09%	1,39%	1,66%	1,75%	0,93%	0,39%	89,90%
CCC/C	0,00%	0,00%	0,01%	0,01%	0,02%	0,04%	0,06%	0,09%	0,13%	0,15%	0,15%	0,20%	0,25%	0,28%	0,29%	0,15%	0,06%	98,09%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

Table A.19. Markov-Chain method, Year 16. Source: own elaboration during the internship at Sogei.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	19,58%	11,61%	17,92%	14,59%	11,68%	8,66%	5,08%	3,35%	2,36%	1,18%	0,57%	0,51%	0,37%	0,31%	0,26%	0,11%	0,08%	1,78%
AA+	5,17%	6,60%	17,04%	17,66%	16,73%	13,16%	7,98%	5,40%	3,75%	1,81%	0,80%	0,65%	0,45%	0,40%	0,30%	0,13%	0,09%	1,89%
AA	1,74%	2,36%	12,74%	16,55%	18,42%	15,99%	10,36%	7,26%	5,15%	2,52%	1,12%	0,91%	0,64%	0,55%	0,41%	0,17%	0,11%	3,01%
AA-	0,66%	1,04%	7,27%	14,00%	19,23%	18,69%	12,77%	8,96%	6,36%	3,06%	1,33%	1,07%	0,76%	0,65%	0,47%	0,20%	0,12%	3,36%
A+	0,34%	0,53%	3,77%	8,71%	16,33%	19,78%	15,46%	11,63%	8,63%	4,25%	1,85%	1,50%	1,06%	0,86%	0,60%	0,26%	0,16%	4,26%
A	0,28%	0,35%	2,09%	4,88%	11,19%	18,28%	17,25%	14,44%	11,45%	5,87%	2,57%	2,05%	1,46%	1,12%	0,78%	0,35%	0,21%	5,39%
A-	0,23%	0,23%	1,17%	2,62%	6,68%	13,86%	17,58%	16,89%	14,57%	7,80%	3,46%	2,73%	1,94%	1,44%	1,02%	0,46%	0,27%	7,04%
BBB+	0,15%	0,14%	0,72%	1,49%	3,85%	9,00%	14,20%	17,33%	17,41%	10,19%	4,71%	3,73%	2,68%	1,94%	1,41%	0,64%	0,36%	10,04%
BBB	0,13%	0,11%	0,51%	0,97%	2,38%	5,76%	10,21%	15,07%	18,37%	12,24%	6,07%	4,94%	3,61%	2,59%	1,90%	0,88%	0,48%	13,78%
BBB-	0,11%	0,09%	0,36%	0,65%	1,48%	3,54%	6,61%	11,08%	15,93%	12,99%	7,27%	6,33%	4,85%	3,52%	2,66%	1,24%	0,65%	20,65%
BB+	0,12%	0,08%	0,27%	0,44%	0,94%	2,20%	4,15%	7,49%	12,00%	11,57%	7,60%	7,31%	5,99%	4,54%	3,53%	1,66%	0,82%	29,29%
BB	0,07%	0,05%	0,18%	0,29%	0,58%	1,32%	2,46%	4,63%	8,02%	8,90%	6,90%	7,49%	6,66%	5,35%	4,31%	2,04%	0,97%	39,78%
BB-	0,04%	0,03%	0,11%	0,19%	0,34%	0,77%	1,40%	2,62%	4,71%	5,75%	5,10%	6,20%	6,12%	5,40%	4,60%	2,23%	1,02%	53,39%
B+	0,02%	0,02%	0,07%	0,13%	0,22%	0,44%	0,72%	1,27%	2,27%	2,94%	2,90%	3,90%	4,32%	4,33%	3,99%	1,99%	0,87%	69,59%
B	0,01%	0,01%	0,04%	0,08%	0,13%	0,25%	0,38%	0,61%	1,04%	1,34%	1,40%	2,02%	2,46%	2,78%	2,80%	1,45%	0,61%	82,60%
B-	0,01%	0,01%	0,02%	0,04%	0,08%	0,16%	0,24%	0,37%	0,59%	0,72%	0,73%	1,04%	1,28%	1,48%	1,53%	0,80%	0,34%	90,57%
CCC/C	0,00%	0,00%	0,01%	0,01%	0,02%	0,04%	0,06%	0,09%	0,14%	0,15%	0,14%	0,19%	0,23%	0,25%	0,26%	0,13%	0,06%	98,20%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

Table A.20. Markov-Chain method, Year 17. Source: own elaboration during the internship at Sogei.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	17,95%	10,90%	17,53%	14,74%	12,19%	9,23%	5,51%	3,68%	2,61%	1,30%	0,63%	0,55%	0,40%	0,33%	0,27%	0,12%	0,09%	1,98%
AA+	4,89%	5,95%	16,01%	17,16%	16,82%	13,62%	8,46%	5,81%	4,08%	1,99%	0,88%	0,71%	0,50%	0,43%	0,33%	0,14%	0,09%	2,13%
AA	1,69%	2,24%	11,80%	15,78%	18,11%	16,19%	10,76%	7,66%	5,51%	2,72%	1,21%	0,98%	0,70%	0,59%	0,44%	0,19%	0,12%	3,31%
AA-	0,67%	1,02%	6,94%	13,20%	18,52%	18,55%	13,04%	9,35%	6,75%	3,29%	1,43%	1,16%	0,82%	0,69%	0,50%	0,21%	0,13%	3,71%
A+	0,35%	0,54%	3,72%	8,40%	15,59%	19,23%	15,43%	11,87%	8,98%	4,49%	1,97%	1,59%	1,14%	0,91%	0,64%	0,28%	0,17%	4,69%
A	0,29%	0,35%	2,11%	4,85%	10,87%	17,58%	16,88%	14,42%	11,67%	6,08%	2,69%	2,15%	1,54%	1,17%	0,83%	0,37%	0,22%	5,94%
A-	0,23%	0,23%	1,21%	2,69%	6,68%	13,51%	16,95%	16,54%	14,54%	7,93%	3,56%	2,83%	2,03%	1,50%	1,07%	0,48%	0,28%	7,72%
BBB+	0,15%	0,15%	0,75%	1,56%	3,96%	9,00%	13,84%	16,77%	17,01%	10,12%	4,75%	3,80%	2,75%	2,00%	1,46%	0,66%	0,37%	10,91%
BBB	0,13%	0,12%	0,53%	1,02%	2,49%	5,90%	10,18%	14,68%	17,71%	11,90%	5,97%	4,92%	3,63%	2,62%	1,94%	0,90%	0,49%	14,88%
BBB-	0,12%	0,10%	0,38%	0,69%	1,57%	3,70%	6,73%	10,98%	15,42%	12,61%	6,99%	6,14%	4,75%	3,48%	2,64%	1,23%	0,64%	22,05%
BB+	0,12%	0,08%	0,28%	0,47%	1,00%	2,32%	4,30%	7,54%	11,76%	11,05%	7,19%	6,94%	5,73%	4,38%	3,43%	1,61%	0,80%	31,00%
BB	0,07%	0,05%	0,19%	0,31%	0,62%	1,41%	2,60%	4,75%	7,99%	8,58%	6,50%	6,99%	6,23%	5,04%	4,09%	1,94%	0,92%	41,72%
BB-	0,04%	0,03%	0,11%	0,20%	0,37%	0,83%	1,48%	2,72%	4,77%	5,63%	4,83%	5,77%	5,65%	4,98%	4,25%	2,06%	0,94%	55,33%
B+	0,02%	0,02%	0,08%	0,13%	0,23%	0,47%	0,77%	1,33%	2,34%	2,93%	2,78%	3,66%	3,97%	3,92%	3,59%	1,79%	0,79%	71,19%
B	0,01%	0,01%	0,04%	0,08%	0,13%	0,26%	0,40%	0,64%	1,08%	1,35%	1,36%	1,92%	2,27%	2,49%	2,46%	1,27%	0,54%	83,69%
B-	0,01%	0,01%	0,02%	0,04%	0,08%	0,16%	0,25%	0,38%	0,61%	0,72%	0,71%	0,99%	1,19%	1,33%	1,34%	0,70%	0,30%	91,16%
CCC/C	0,00%	0,00%	0,01%	0,01%	0,02%	0,04%	0,07%	0,09%	0,14%	0,15%	0,14%	0,18%	0,21%	0,23%	0,23%	0,12%	0,05%	98,30%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

Table A.21. Markov-Chain method, Year 18. Source: own elaboration during the internship at Sogei.

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	16,48%	10,22%	17,09%	14,82%	12,64%	9,77%	5,93%	4,01%	2,86%	1,43%	0,68%	0,59%	0,43%	0,36%	0,29%	0,12%	0,09%	2,18%
AA+	4,62%	5,39%	15,04%	16,63%	16,84%	14,03%	8,92%	6,21%	4,41%	2,16%	0,96%	0,78%	0,55%	0,47%	0,35%	0,15%	0,10%	2,38%
AA	1,64%	2,12%	10,97%	15,05%	17,77%	16,34%	11,13%	8,04%	5,86%	2,92%	1,30%	1,06%	0,75%	0,63%	0,47%	0,20%	0,12%	3,64%
AA-	0,67%	1,00%	6,63%	12,48%	17,84%	18,37%	13,27%	9,71%	7,12%	3,51%	1,54%	1,25%	0,89%	0,74%	0,54%	0,23%	0,14%	4,07%
A+	0,37%	0,54%	3,67%	8,10%	14,91%	18,71%	15,37%	12,08%	9,30%	4,72%	2,09%	1,69%	1,21%	0,96%	0,68%	0,30%	0,18%	5,15%
A	0,29%	0,36%	2,13%	4,82%	10,57%	16,94%	16,53%	14,38%	11,84%	6,26%	2,80%	2,25%	1,62%	1,23%	0,88%	0,39%	0,23%	6,50%
A-	0,24%	0,24%	1,24%	2,74%	6,67%	13,18%	16,38%	16,21%	14,49%	8,03%	3,65%	2,92%	2,10%	1,56%	1,12%	0,51%	0,29%	8,42%
BBB+	0,16%	0,16%	0,78%	1,62%	4,05%	8,98%	13,51%	16,26%	16,63%	10,03%	4,76%	3,85%	2,80%	2,05%	1,50%	0,69%	0,38%	11,80%
BBB	0,14%	0,12%	0,56%	1,07%	2,60%	6,01%	10,12%	14,31%	17,12%	11,57%	5,87%	4,88%	3,64%	2,64%	1,97%	0,91%	0,49%	15,99%
BBB-	0,12%	0,10%	0,40%	0,72%	1,65%	3,84%	6,83%	10,86%	14,94%	11,89%	6,72%	5,95%	4,64%	3,43%	2,62%	1,22%	0,63%	23,43%
BB+	0,12%	0,08%	0,29%	0,50%	1,07%	2,44%	4,44%	7,58%	11,51%	10,57%	6,82%	6,59%	5,47%	4,22%	3,32%	1,56%	0,77%	32,64%
BB	0,07%	0,05%	0,19%	0,33%	0,66%	1,50%	2,72%	4,85%	7,94%	8,26%	6,13%	6,55%	5,84%	4,76%	3,87%	1,85%	0,88%	43,55%
BB-	0,04%	0,03%	0,12%	0,21%	0,40%	0,88%	1,57%	2,82%	4,81%	5,49%	4,58%	5,38%	5,22%	4,60%	3,93%	1,91%	0,87%	57,13%
B+	0,02%	0,02%	0,08%	0,14%	0,24%	0,50%	0,81%	1,39%	2,39%	2,90%	2,67%	3,42%	3,65%	3,56%	3,24%	1,61%	0,71%	72,64%
B	0,01%	0,01%	0,04%	0,08%	0,14%	0,27%	0,42%	0,67%	1,11%	1,36%	1,32%	1,81%	2,09%	2,24%	2,18%	1,12%	0,48%	84,65%
B-	0,01%	0,01%	0,02%	0,05%	0,09%	0,17%	0,25%	0,39%	0,62%	0,73%	0,69%	0,94%	1,10%	1,19%	1,18%	0,61%	0,26%	91,69%
CCC/C	0,00%	0,00%	0,01%	0,01%	0,02%	0,05%	0,07%	0,10%	0,14%	0,15%	0,13%	0,17%	0,20%	0,21%	0,20%	0,10%	0,04%	98,39%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

**Table A.22.** Markov-Chain method, Year 19. *Source: own elaboration during the internship at Sogei.*

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	15,13%	9,57%	16,61%	14,83%	13,03%	10,28%	6,35%	4,35%	3,12%	1,57%	0,74%	0,64%	0,46%	0,39%	0,31%	0,13%	0,09%	2,40%
AA+	4,36%	4,91%	14,15%	16,10%	16,80%	14,37%	9,34%	6,59%	4,74%	2,34%	1,04%	0,85%	0,60%	0,51%	0,38%	0,16%	0,10%	2,66%
AA	1,59%	2,01%	10,23%	14,36%	17,40%	16,43%	11,45%	8,39%	6,21%	3,11%	1,39%	1,13%	0,81%	0,67%	0,50%	0,21%	0,13%	3,98%
AA-	0,68%	0,98%	6,34%	11,83%	17,19%	18,16%	13,45%	10,03%	7,48%	3,73%	1,65%	1,34%	0,95%	0,78%	0,57%	0,24%	0,15%	4,46%
A+	0,38%	0,54%	3,60%	7,82%	14,30%	18,20%	15,29%	12,25%	9,59%	4,93%	2,20%	1,78%	1,28%	1,01%	0,72%	0,32%	0,19%	5,62%
A	0,30%	0,36%	2,14%	4,77%	10,28%	16,36%	16,19%	14,32%	11,99%	6,43%	2,90%	2,34%	1,69%	1,28%	0,92%	0,41%	0,24%	7,09%
A-	0,24%	0,24%	1,27%	2,79%	6,64%	12,86%	15,87%	15,89%	14,42%	8,11%	3,73%	3,00%	2,17%	1,61%	1,17%	0,53%	0,30%	9,14%
BBB+	0,16%	0,16%	0,81%	1,68%	4,13%	8,95%	13,20%	15,79%	16,26%	9,93%	4,77%	3,88%	2,85%	2,09%	1,54%	0,71%	0,39%	12,70%
BBB	0,14%	0,13%	0,58%	1,12%	2,69%	6,11%	10,05%	13,96%	16,57%	11,26%	5,77%	4,84%	3,63%	2,66%	1,99%	0,92%	0,49%	17,09%
BBB-	0,12%	0,10%	0,41%	0,76%	1,73%	3,97%	6,91%	10,73%	14,49%	11,42%	6,47%	5,77%	4,53%	3,38%	2,59%	1,21%	0,62%	24,79%
BB+	0,12%	0,09%	0,30%	0,52%	1,13%	2,56%	4,56%	7,59%	11,26%	10,13%	6,49%	6,27%	5,22%	4,06%	3,21%	1,51%	0,75%	34,24%
BB	0,07%	0,05%	0,20%	0,35%	0,71%	1,58%	2,83%	4,92%	7,86%	7,96%	5,80%	6,15%	5,48%	4,48%	3,66%	1,75%	0,83%	45,29%
BB-	0,04%	0,03%	0,12%	0,22%	0,42%	0,93%	1,64%	2,90%	4,83%	5,34%	4,34%	5,03%	4,85%	4,26%	3,64%	1,77%	0,81%	58,81%
B+	0,02%	0,02%	0,08%	0,14%	0,26%	0,52%	0,85%	1,45%	2,44%	2,86%	2,55%	3,21%	3,36%	3,24%	2,93%	1,46%	0,65%	73,96%
B	0,01%	0,01%	0,05%	0,08%	0,15%	0,28%	0,43%	0,69%	1,14%	1,36%	1,28%	1,71%	1,93%	2,02%	1,94%	0,99%	0,43%	85,52%
B-	0,01%	0,01%	0,03%	0,05%	0,09%	0,18%	0,26%	0,41%	0,64%	0,73%	0,67%	0,89%	1,01%	1,08%	1,05%	0,54%	0,23%	92,16%
CCC/C	0,00%	0,00%	0,01%	0,01%	0,02%	0,05%	0,07%	0,10%	0,14%	0,15%	0,13%	0,17%	0,18%	0,19%	0,18%	0,09%	0,04%	98,47%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

**Table A.23.** Markov-Chain method, Year 20. *Source: own elaboration during the internship at Sogei.*

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	13,90%	8,96%	16,10%	14,78%	13,35%	10,75%	6,76%	4,69%	3,39%	1,71%	0,80%	0,68%	0,50%	0,42%	0,33%	0,14%	0,10%	2,63%
AA+	4,11%	4,48%	13,31%	15,57%	16,70%	14,66%	9,74%	6,97%	5,07%	2,52%	1,12%	0,92%	0,65%	0,55%	0,41%	0,17%	0,11%	2,94%
AA	1,54%	1,91%	9,56%	13,70%	17,01%	16,47%	11,73%	8,73%	6,54%	3,31%	1,48%	1,21%	0,87%	0,71%	0,52%	0,23%	0,14%	4,33%
AA-	0,68%	0,96%	6,06%	11,23%	16,58%	17,92%	13,59%	10,32%	7,81%	3,95%	1,75%	1,42%	1,02%	0,83%	0,60%	0,26%	0,15%	4,86%
A+	0,38%	0,54%	3,54%	7,55%	13,74%	17,72%	15,18%	12,39%	9,85%	5,13%	2,30%	1,87%	1,35%	1,05%	0,76%	0,33%	0,20%	6,12%
A	0,30%	0,37%	2,14%	4,72%	10,00%	15,83%	15,86%	14,25%	12,11%	6,58%	3,00%	2,42%	1,76%	1,33%	0,96%	0,43%	0,25%	7,69%
A-	0,24%	0,25%	1,30%	2,82%	6,61%	12,56%	15,41%	15,58%	14,33%	8,17%	3,80%	3,07%	2,24%	1,66%	1,21%	0,55%	0,31%	9,88%
BBB+	0,17%	0,17%	0,83%	1,73%	4,19%	8,90%	12,90%	15,37%	15,91%	9,82%	4,77%	3,91%	2,89%	2,12%	1,57%	0,72%	0,40%	13,62%
BBB	0,14%	0,13%	0,60%	1,17%	2,78%	6,19%	9,97%	13,63%	16,07%	10,96%	5,66%	4,79%	3,62%	2,66%	2,00%	0,93%	0,49%	18,20%
BBB-	0,12%	0,10%	0,43%	0,80%	1,81%	4,08%	6,97%	10,59%	14,07%	10,98%	6,24%	5,59%	4,41%	3,32%	2,55%	1,20%	0,61%	26,12%
BB+	0,12%	0,09%	0,32%	0,55%	1,19%	2,66%	4,67%	7,58%	11,02%	9,72%	6,18%	5,98%	4,99%	3,90%	3,09%	1,46%	0,72%	35,77%
BB	0,07%	0,06%	0,21%	0,36%	0,75%	1,66%	2,93%	4,99%	7,78%	7,68%	5,50%	5,79%	5,15%	4,23%	3,46%	1,66%	0,79%	46,94%
BB-	0,04%	0,03%	0,13%	0,23%	0,45%	0,98%	1,71%	2,97%	4,84%	5,20%	4,12%	4,71%	4,50%	3,95%	3,37%	1,64%	0,75%	60,36%
B+	0,02%	0,02%	0,08%	0,15%	0,27%	0,55%	0,89%	1,49%	2,47%	2,81%	2,44%	3,01%	3,11%	2,96%	2,66%	1,32%	0,59%	92,16%
B	0,01%	0,01%	0,05%	0,08%	0,15%	0,30%	0,45%	0,72%	1,16%	1,35%	1,23%	1,61%	1,78%	1,82%	1,73%	0,88%	0,38%	86,29%
B-	0,01%	0,01%	0,03%	0,05%	0,09%	0,18%	0,27%	0,42%	0,65%	0,72%	0,65%	0,84%	0,94%	0,97%	0,93%	0,48%	0,21%	92,57%
CCC/C	0,00%	0,00%	0,01%	0,01%	0,02%	0,05%	0,07%	0,10%	0,14%	0,15%	0,13%	0,16%	0,17%	0,17%	0,16%	0,08%	0,04%	98,55%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

**Table A.24.** Markov-Chain method, Year 21. *Source: own elaboration during the internship at Sogei.*

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	12,78%	8,38%	15,58%	14,69%	13,63%	11,20%	7,16%	5,02%	3,66%	1,85%	0,87%	0,73%	0,53%	0,45%	0,35%	0,15%	0,10%	2,87%
AA+	3,88%	4,11%	12,53%	15,03%	16,56%	14,89%	10,10%	7,33%	5,39%	2,70%	1,21%	0,98%	0,70%	0,59%	0,43%	0,19%	0,12%	3,25%
AA	1,49%	1,81%	8,96%	13,08%	16,61%	16,47%	11,98%	9,05%	6,86%	3,50%	1,57%	1,28%	0,92%	0,75%	0,53%	0,24%	0,14%	4,70%
AA-	0,68%	0,94%	5,80%	10,69%	15,99%	17,67%	13,69%	10,58%	8,13%	4,16%	1,85%	1,51%	1,08%	0,87%	0,63%	0,28%	0,16%	5,28%
A+	0,39%	0,54%	3,47%	7,29%	13,22%	17,26%	15,07%	12,50%	10,09%	5,32%	2,40%	1,95%	1,41%	1,10%	0,79%	0,35%	0,20%	6,63%
A	0,31%	0,37%	2,14%	4,66%	9,74%	15,35%	15,55%	14,16%	12,20%	6,71%	3,08%	2,50%	1,82%	1,38%	1,00%	0,45%	0,26%	8,32%
A-	0,25%	0,25%	1,33%	2,85%	6,56%	12,28%	14,99%	15,29%	14,23%	8,21%	3,85%	3,13%	2,30%	1,71%	1,25%	0,57%	0,32%	10,64%
BBB+	0,17%	0,17%	0,86%	1,78%	4,25%	12,63%	14,97%	15,58%	9,71%	4,76%	3,93%	2,92%	2,16%	1,60%	1,07%	0,40%	0,25%	14,54%
BBB	0,15%	0,13%	0,62%	1,21%	2,86%	6,26%	9,88%	13,32%	15,61%	10,68%	5,55%	4,73%	3,60%	2,66%	2,01%	0,93%	0,49%	19,31%
BBB-	0,13%	0,11%	0,45%	0,83%	1,88%	4,19%	7,01%	10,44%	13,67%	10,58%	6,02%	5,42%	4,30%	3,25%	2,51%	1,18%	0,60%	27,43%
BB+	0,12%	0,09%	0,33%	0,58%	1,24%	2,76%	4,76%	7,56%	10,77%	9,34%	5,90%	5,70%	4,77%	3,75%	2,98%	1,41%	0,69%	37,25%
BB	0,07%	0,06%	0,22%	0,38%	0,79%	1,74%	3,02%	5,03%	7,68%	7,40%	5,22%	5,46%	4,85%	3,99%	3,28%	1,57%	0,74%	48,51%
BB-	0,05%	0,03%	0,14%	0,24%	0,47%	1,03%	1,78%	3,03%	4,83%	5,05%	3,92%	4,42%	4,19%	3,67%	3,13%	1,52%	0,70%	61,81%
B+	0,03%	0,02%	0,09%	0,15%	0,28%	0,57%	0,93%	1,54%	2,49%	2,76%	2,33%	2,82%	2,87%	2,70%	2,42%	1,20%	0,54%	76,26%
B	0,01%	0,01%	0,05%	0,08%	0,16%	0,31%	0,47%	0,74%	1,18%	1,34%	1,19%	1,52%	1,64%	1,65%	1,55%	0,78%	0,34%	86,98%
B-	0,01%	0,01%	0,03%	0,05%	0,09%	0,19%	0,28%	0,43%	0,66%	0,72%	0,62%	0,80%	0,86%	0,88%	0,83%	0,42%	0,18%	92,95%
CCC/C	0,00%	0,00%	0,01%	0,01%	0,02%	0,05%	0,07%	0,10%	0,15%	0,15%	0,12%	0,15%	0,16%	0,15%	0,14%	0,07%	0,03%	98,61%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

**Table A.25.** Markov-Chain method, Year 22. *Source: own elaboration during the internship at Sogei.*

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	11,76%	7,83%	15,04%	14,55%	13,85%	11,60%	7,54%	5,36%	3,94%	2,00%	0,93%	0,79%	0,57%	0,48%	0,37%	0,16%	0,11%	3,13%
AA+	3,65%	3,79%	11,81%	14,50%	16,38%	15,08%	10,44%	7,67%	5,71%	2,88%	1,29%	1,06%	0,75%	0,62%	0,46%	0,20%	0,12%	3,56%
AA	1,43%	1,72%	8,42%	12,50%	16,21%	16,43%	12,20%	9,34%	7,17%	3,69%	1,67%	1,36%	0,98%	0,80%	0,58%	0,25%	0,15%	5,09%
AA-	0,67%	0,92%	5,55%	10,20%	15,44%	17,40%	13,77%	10,82%	8,43%	4,35%	1,95%	1,59%	1,15%	0,92%	0,67%	0,29%	0,17%	5,72%
A+	0,40%	0,54%	3,40%	7,05%	12,75%	16,82%	14,93%	12,58%	10,30%	5,50%	2,50%	2,03%	1,48%	1,15%	0,83%	0,37%	0,21%	7,16%
A	0,31%	0,37%	2,14%	4,59%	9,49%	14,91%	15,24%	14,06%	12,28%	6,83%	3,16%	2,58%	1,88%	1,43%	1,04%	0,47%	0,27%	8,96%
A-	0,25%	0,26%	1,35%	2,87%	6,51%	12,01%	14,60%	15,01%	14,12%	8,24%	3,90%	3,19%	2,35%	1,75%	1,28%	0,59%	0,33%	11,40%
BBB+	0,18%	0,18%	0,88%	1,83%	4,29%	8,78%	12,37%	14,61%	15,26%	9,59%	4,74%	3,94%	2,94%	2,18%	1,62%	0,75%	0,41%	15,47%
BBB	0,15%	0,14%	0,64%	1,25%	2,93%	6,31%	9,79%	13,02%	15,17%	10,41%	5,45%	4,67%	3,57%	2,65%	2,01%	0,93%	0,49%	20,41%
BBB-	0,13%	0,11%	0,46%	0,86%	1,95%	4,28%	7,04%	10,29%	13,29%	10,22%	5,82%	5,25%	4,19%	3,18%	2,47%	1,16%	0,59%	28,72%
BB+	0,12%	0,09%	0,34%	0,60%	1,30%	2,85%	4,83%	7,53%	10,53%	8,99%	5,64%	5,45%	4,57%	3,60%	2,87%	1,36%	0,67%	38,68%
BB	0,07%	0,06%	0,23%	0,40%	0,83%	1,81%	3,10%	5,06%	7,57%	7,14%	4,96%	5,16%	4,57%	3,77%	3,10%	1,48%	0,70%	49,99%
BB-	0,05%	0,04%	0,14%	0,25%	0,50%	1,08%	1,84%	3,08%	4,80%	4,90%	3,72%	4,15%	3,91%	3,41%	2,91%	1,41%	0,65%	63,16%
B+	0,03%	0,02%	0,09%	0,15%	0,29%	0,59%	0,96%	1,58%	2,50%	2,70%	2,22%	2,65%	2,66%	2,48%	2,21%	1,09%	0,49%	77,27%
B	0,01%	0,01%	0,05%	0,09%	0,16%	0,32%	0,49%	0,76%	1,20%	1,32%	1,14%	1,43%	1,52%	1,50%	1,39%	0,70%	0,31%	87,61%
B-	0,01%	0,01%	0,03%	0,05%	0,10%	0,19%	0,29%	0,44%	0,66%	0,71%	0,60%	0,75%	0,80%	0,80%	0,75%	0,38%	0,17%	93,28%
CCC/C	0,00%	0,00%	0,01%	0,01%	0,03%	0,05%	0,07%	0,10%	0,15%	0,15%	0,12%	0,14%	0,14%	0,14%	0,13%	0,07%	0,03%	98,67%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

**Table A.26.** Markov-Chain method, Year 23. *Source: own elaboration during the internship at Sogei.*

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	10,83%	7,32%	14,50%	14,38%	14,02%	11,97%	7,92%	5,69%	4,21%	2,15%	1,00%	0,84%	0,61%	0,51%	0,39%	0,17%	0,11%	3,39%
AA+	3,44%	3,50%	11,14%	13,99%	16,17%	15,22%	10,75%	8,00%	6,02%	3,06%	1,38%	1,13%	0,81%	0,66%	0,49%	0,21%	0,13%	3,90%
AA	1,38%	1,64%	7,93%	11,95%	15,80%	16,36%	12,39%	9,61%	7,46%	3,88%	1,76%	1,44%	1,04%	0,84%	0,61%	0,27%	0,16%	5,50%
AA-	0,67%	0,90%	5,32%	9,74%	14,92%	17,12%	13,81%	11,03%	8,71%	4,54%	2,05%	1,67%	1,21%	0,96%	0,70%	0,31%	0,18%	6,17%
A+	0,40%	0,54%	3,32%	6,82%	12,31%	16,40%	14,79%	12,65%	10,49%	5,66%	2,59%	2,11%	1,54%	1,19%	0,86%	0,38%	0,22%	7,70%
A	0,31%	0,37%	2,13%	4,53%	9,25%	14,49%	14,95%	13,96%	12,33%	6,93%	3,24%	2,65%	1,94%	1,47%	1,07%	0,48%	0,27%	9,62%
A-	0,25%	0,26%	1,36%	2,89%	6,45%	11,76%	14,24%	14,74%	14,00%	8,25%	3,94%	3,24%	2,39%	1,79%	1,32%	0,60%	0,33%	12,18%
BBB+	0,18%	0,18%	0,90%	1,86%	4,33%	8,72%	12,12%	14,27%	14,96%	9,46%	4,71%	3,94%	2,96%	2,20%	1,64%	0,76%	0,41%	16,40%
BBB	0,15%	0,14%	0,66%	1,29%	2,99%	6,35%	9,69%	12,74%	14,77%	10,15%	5,34%	4,60%	3,54%	2,64%	2,01%	0,93%	0,49%	21,51%
BBB-	0,13%	0,11%	0,48%	0,89%	2,01%	4,36%	7,05%	10,14%	12,94%	9,87%	5,62%	5,10%	4,07%	3,11%	2,42%	1,14%	0,58%	29,97%
BB+	0,11%	0,09%	0,35%	0,62%	1,35%	2,93%	4,89%	7,48%	10,29%	8,66%	5,40%	5,21%	4,37%	3,46%	2,76%	1,31%	0,64%	40,05%
BB	0,08%	0,06%	0,23%	0,41%	0,86%	1,88%	3,18%	5,08%	7,45%	6,89%	4,72%	4,88%	4,32%	3,56%	2,93%	1,40%	0,67%	51,39%
BB-	0,05%	0,04%	0,15%	0,26%	0,52%	1,12%	1,90%	3,11%	4,77%	4,75%	3,54%	3,91%	3,66%	3,17%	2,70%	1,31%	0,61%	64,42%
B+	0,03%	0,02%	0,09%	0,16%	0,30%	0,62%	0,99%	1,61%	2,51%	2,64%	2,12%	2,49%	2,47%	2,28%	2,02%	1,00%	0,45%	78,19%
B	0,01%	0,01%	0,05%	0,09%	0,17%	0,33%	0,50%	0,78%	1,21%	1,30%	1,09%	1,35%	1,40%	1,37%	1,26%	0,63%	0,28%	88,18%
B-	0,01%	0,01%	0,03%	0,05%	0,10%	0,20%	0,29%	0,45%	0,67%	0,70%	0,58%	0,71%	0,74%	0,73%	0,67%	0,34%	0,15%	93,59%
CCC/C	0,00%	0,00%	0,01%	0,01%	0,03%	0,05%	0,07%	0,10%	0,15%	0,14%	0,11%	0,13%	0,13%	0,13%	0,12%	0,06%	0,03%	98,72%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

**Table A.27.** Markov-Chain method, Year 24. *Source: own elaboration during the internship at Sogei.*

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D	
AAA	9.98%	6.84%	13.96%	14.17%	14.15%	12.31%	8.27%	6.01%	4.49%	2.30%	1.07%	0.89%	0.65%	0.54%	0.41%	0.18%	0.11%	3.67%	
AA+	3.24%	3.24%	10.52%	13.48%	15.94%	15.33%	11.02%	8.31%	6.32%	3.24%	1.46%	1.20%	0.86%	0.70%	0.52%	0.22%	0.14%	4.25%	
AA	1.33%	1.56%	7.48%	11.43%	15.40%	16.27%	12.54%	9.86%	7.74%	4.06%	1.84%	1.51%	1.09%	0.88%	0.64%	0.28%	0.17%	5.92%	
AA-	0.66%	0.87%	5.10%	9.31%	14.42%	16.84%	13.84%	11.21%	8.96%	4.73%	2.15%	1.75%	1.27%	1.00%	0.73%	0.32%	0.19%	6.65%	
A+	0.40%	0.53%	3.25%	6.61%	11.90%	16.00%	14.64%	12.69%	10.66%	5.81%	2.68%	2.19%	1.60%	1.23%	0.90%	0.40%	0.23%	8.27%	
A	0.32%	0.37%	2.12%	4.46%	9.02%	14.11%	14.68%	13.84%	12.37%	7.02%	3.30%	2.71%	1.99%	1.51%	1.10%	0.50%	0.28%	10.29%	
A-	0.25%	0.26%	1.38%	2.90%	6.39%	11.52%	13.90%	14.48%	13.87%	8.25%	3.97%	3.28%	2.44%	1.82%	1.35%	0.62%	0.34%	12.98%	
BBB+	0.18%	0.18%	0.92%	1.90%	4.35%	8.64%	11.88%	13.95%	14.66%	9.34%	4.68%	3.94%	2.97%	2.21%	1.66%	0.77%	0.41%	17.34%	
BBB	0.15%	0.14%	0.67%	1.33%	3.05%	6.38%	9.59%	12.48%	14.39%	9.91%	5.23%	4.53%	3.50%	2.62%	2.00%	0.93%	0.49%	22.59%	
BBB-	0.13%	0.11%	0.49%	0.92%	2.07%	4.43%	7.06%	9.99%	12.60%	9.56%	5.44%	4.94%	3.96%	3.04%	2.37%	1.11%	0.56%	31.20%	
BB+	0.11%	0.09%	0.36%	0.65%	1.40%	3.01%	4.95%	7.43%	10.06%	8.36%	5.18%	4.99%	4.19%	3.32%	2.66%	1.26%	0.62%	41.37%	
BB	0.08%	0.06%	0.24%	0.43%	0.90%	1.94%	3.24%	5.09%	7.33%	6.66%	4.50%	4.62%	4.08%	3.37%	2.77%	1.33%	0.63%	52.72%	
BB-	0.05%	0.04%	0.15%	0.27%	0.55%	1.17%	1.95%	3.15%	4.73%	4.61%	3.37%	3.68%	3.42%	2.96%	2.52%	1.22%	0.57%	65.60%	
B+	0.03%	0.02%	0.09%	0.16%	0.32%	0.64%	1.03%	1.64%	2.51%	2.58%	2.03%	2.34%	2.30%	2.10%	1.85%	0.91%	0.41%	79.04%	
B	0.01%	0.01%	0.05%	0.09%	0.17%	0.34%	0.52%	0.80%	1.21%	1.28%	1.05%	1.27%	1.30%	1.25%	1.14%	0.57%	0.25%	88.69%	
B-	0.01%	0.01%	0.03%	0.05%	0.10%	0.20%	0.30%	0.45%	0.67%	0.69%	0.56%	0.67%	0.69%	0.67%	0.61%	0.30%	0.14%	93.86%	
CCC/C	0.00%	0.00%	0.01%	0.01%	0.03%	0.05%	0.07%	0.10%	0.15%	0.14%	0.11%	0.13%	0.13%	0.13%	0.12%	0.11%	0.05%	0.02%	98.77%
D	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	

**Table A.28.** Markov-Chain method, Year 25. *Source: own elaboration during the internship at Sogei.*

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	9.20%	6.39%	13.42%	13.94%	14.23%	12.61%	8.61%	6.33%	4.76%	2.45%	1.14%	0.95%	0.69%	0.57%	0.43%	0.19%	0.12%	3.96%
AA+	3.05%	3.01%	9.95%	12.99%	15.68%	15.39%	11.27%	8.61%	6.62%	3.42%	1.55%	1.27%	0.91%	0.74%	0.55%	0.24%	0.14%	4.61%
AA	1.29%	1.48%	7.07%	10.94%	14.99%	16.15%	12.67%	10.09%	8.01%	4.23%	1.93%	1.58%	1.15%	0.92%	0.67%	0.30%	0.17%	6.35%
AA-	0.66%	0.85%	4.89%	8.92%	13.95%	16.55%	13.84%	11.37%	9.20%	4.90%	2.24%	1.83%	1.33%	1.05%	0.76%	0.34%	0.20%	7.13%
A+	0.41%	0.53%	3.17%	6.40%	11.52%	15.62%	14.49%	12.72%	10.81%	5.95%	2.76%	2.26%	1.66%	1.28%	0.93%	0.42%	0.24%	8.85%
A	0.32%	0.37%	2.11%	4.39%	8.81%	13.75%	14.41%	13.73%	12.38%	7.10%	3.36%	2.77%	2.04%	1.55%	1.14%	0.52%	0.29%	10.97%
A-	0.25%	0.27%	1.39%	2.91%	6.33%	11.29%	13.59%	14.23%	13.74%	8.24%	4.00%	3.31%	2.47%	1.85%	1.37%	0.63%	0.35%	13.78%
BBB+	0.19%	0.19%	0.94%	1.93%	4.38%	8.57%	11.66%	13.65%	14.38%	9.21%	4.65%	3.93%	2.98%	2.22%	1.67%	0.77%	0.41%	18.29%
BBB	0.16%	0.15%	0.69%	1.36%	3.10%	6.40%	9.48%	12.22%	14.04%	9.67%	5.13%	4.46%	3.46%	2.60%	1.99%	0.93%	0.48%	23.67%
BBB-	0.13%	0.12%	0.50%	0.95%	2.13%	4.50%	7.05%	9.84%	12.28%	9.26%	5.27%	4.80%	3.86%	2.97%	2.32%	1.09%	0.55%	32.40%
BB+	0.11%	0.09%	0.37%	0.67%	1.45%	3.08%	4.99%	7.37%	9.84%	8.08%	4.97%	4.78%	4.01%	3.19%	2.55%	1.21%	0.59%	42.65%
BB	0.08%	0.06%	0.25%	0.44%	0.94%	2.00%	3.30%	5.09%	7.21%	6.43%	4.30%	4.39%	3.86%	3.19%	2.62%	1.26%	0.60%	53.99%
BB-	0.05%	0.04%	0.15%	0.28%	0.57%	1.21%	2.00%	3.17%	4.68%	4.47%	3.22%	3.48%	3.21%	2.77%	2.34%	1.14%	0.53%	66.70%
B+	0.03%	0.02%	0.09%	0.17%	0.33%	0.66%	1.05%	1.66%	2.50%	2.51%	1.93%	2.21%	2.14%	1.94%	1.70%	0.84%	0.38%	79.83%
B	0.01%	0.01%	0.05%	0.09%	0.18%	0.35%	0.53%	0.81%	1.22%	1.25%	1.01%	1.19%	1.21%	1.15%	1.04%	0.51%	0.23%	89.16%
B-	0.01%	0.01%	0.03%	0.05%	0.11%	0.21%	0.31%	0.46%	0.67%	0.67%	0.53%	0.63%	0.64%	0.61%	0.55%	0.28%	0.12%	94.12%
CCC/C	0.00%	0.00%	0.01%	0.01%	0.03%	0.05%	0.07%	0.11%	0.15%	0.14%	0.10%	0.12%	0.12%	0.11%	0.10%	0.05%	0.02%	98.82%
D	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%

**Table A.29.** Markov-Chain method, Year 26. *Source: own elaboration during the internship at Sogei.*

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	8.49%	5.97%	12.89%	13.68%	14.28%	12.88%	8.94%	6.63%	5.04%	2.61%	1.21%	1.01%	0.73%	0.60%	0.46%	0.20%	0.12%	4.27%
AA+	2.87%	2.80%	9.41%	12.51%	15.41%	15.42%	11.50%	8.89%	6.90%	3.59%	1.63%	1.34%	0.97%	0.78%	0.58%	0.25%	0.15%	5.00%
AA	1.24%	1.41%	6.70%	10.48%	14.60%	16.00%	12.77%	10.30%	8.26%	4.40%	2.02%	1.66%	1.21%	0.96%	0.70%	0.31%	0.18%	6.80%
AA-	0.65%	0.83%	4.70%	8.56%	13.50%	16.26%	13.82%	11.51%	9.42%	5.06%	2.32%	1.90%	1.39%	1.09%	0.79%	0.35%	0.20%	7.64%
A+	0.41%	0.52%	3.10%	6.21%	11.16%	15.25%	14.33%	12.73%	10.94%	6.08%	2.83%	2.33%	1.71%	1.31%	0.96%	0.43%	0.25%	9.44%
A	0.32%	0.37%	2.09%	4.32%	8.61%	13.42%	14.15%	13.61%	12.39%	7.16%	3.41%	2.82%	2.09%	1.58%	1.17%	0.53%	0.29%	11.67%
A-	0.25%	0.27%	1.40%	2.91%	6.26%	11.07%	13.30%	13.99%	13.60%	8.23%	4.01%	3.34%	2.50%	1.88%	1.40%	0.64%	0.35%	14.59%
BBB+	0.19%	0.19%	0.95%	1.96%	4.39%	8.49%	11.45%	13.37%	14.11%	9.08%	4.61%	3.91%	2.97%	2.23%	1.68%	0.78%	0.42%	19.23%
BBB	0.16%	0.15%	0.71%	1.40%	3.15%	6.41%	9.38%	11.98%	13.70%	9.45%	5.03%	4.39%	3.41%	2.58%	1.98%	0.92%	0.48%	24.74%
BBB-	0.13%	0.12%	0.51%	0.98%	2.18%	4.55%	7.03%	9.69%	11.98%	8.98%	5.11%	4.66%	3.75%	2.89%	2.26%	1.07%	0.54%	33.58%
BB+	0.11%	0.09%	0.38%	0.69%	1.49%	3.14%	5.02%	7.30%	9.62%	7.81%	4.78%	4.59%	3.85%	3.06%	2.46%	1.17%	0.57%	43.87%
BB	0.08%	0.06%	0.25%	0.46%	0.97%	2.05%	3.34%	5.08%	7.08%	6.22%	4.11%	4.17%	3.66%	3.02%	2.48%	1.19%	0.57%	55.19%
BB-	0.05%	0.04%	0.16%	0.29%	0.59%	1.25%	2.04%	3.19%	4.63%	4.33%	3.07%	3.29%	3.02%	2.59%	2.19%	1.06%	0.49%	67.74%
B+	0.03%	0.02%	0.10%	0.17%	0.34%	0.68%	1.08%	1.68%	2.49%	2.45%	1.85%	2.08%	2.00%	1.80%	1.57%	0.77%	0.35%	80.55%
B	0.01%	0.01%	0.05%	0.09%	0.18%	0.35%	0.54%	0.82%	1.22%	1.23%	0.96%	1.13%	1.13%	1.05%	0.94%	0.47%	0.21%	89.59%
B-	0.01%	0.01%	0.03%	0.05%	0.11%	0.21%	0.31%	0.46%	0.67%	0.66%	0.51%	0.60%	0.60%	0.56%	0.50%	0.25%	0.11%	94.35%
CCC/C	0.00%	0.00%	0.01%	0.01%	0.03%	0.05%	0.08%	0.11%	0.14%	0.13%	0.10%	0.11%	0.11%	0.10%	0.09%	0.04%	0.02%	98.86%
D	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%

**Table A.30.** Markov-Chain method, Year 27. *Source: own elaboration during the internship at Sogei.*

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	7,84%	5,57%	12,37%	13,41%	14,29%	13,12%	9,24%	6,93%	5,31%	2,76%	1,28%	1,07%	0,78%	0,63%	0,48%	0,21%	0,13%	4,59%
AA+	2,70%	2,61%	8,91%	12,05%	15,13%	15,42%	11,69%	9,15%	7,18%	3,76%	1,72%	1,41%	1,02%	0,82%	0,60%	0,26%	0,16%	5,39%
AA	1,19%	1,35%	6,36%	10,05%	14,21%	15,85%	12,85%	10,49%	8,50%	4,56%	2,10%	1,73%	1,26%	1,00%	0,73%	0,32%	0,19%	7,27%
AA-	0,64%	0,81%	4,51%	8,23%	13,08%	15,97%	13,78%	11,63%	9,63%	5,22%	2,41%	1,98%	1,45%	1,13%	0,82%	0,37%	0,21%	8,16%
A+	0,41%	0,52%	3,03%	6,02%	10,82%	14,90%	14,17%	12,73%	11,05%	6,19%	2,90%	2,39%	1,76%	1,35%	0,99%	0,45%	0,25%	10,05%
A	0,32%	0,37%	2,07%	4,25%	8,41%	13,10%	13,90%	13,48%	12,38%	7,22%	3,46%	2,87%	2,13%	1,61%	1,19%	0,54%	0,30%	12,38%
A-	0,26%	0,27%	1,41%	2,90%	6,20%	10,87%	13,03%	13,76%	13,46%	8,20%	4,02%	3,37%	2,53%	1,90%	1,42%	0,65%	0,35%	15,41%
BBB+	0,19%	0,19%	0,97%	1,98%	4,40%	8,41%	11,24%	13,10%	13,85%	8,95%	4,56%	3,89%	2,97%	2,23%	1,69%	0,78%	0,42%	20,17%
BBB	0,16%	0,15%	0,72%	1,42%	3,19%	6,42%	9,27%	11,75%	13,38%	9,23%	4,93%	4,31%	3,37%	2,55%	1,96%	0,91%	0,48%	25,79%
BBB-	0,13%	0,12%	0,53%	1,01%	2,23%	4,60%	7,01%	9,54%	11,69%	8,72%	4,95%	4,52%	3,65%	2,82%	2,21%	1,04%	0,53%	34,72%
BB+	0,11%	0,10%	0,39%	0,71%	1,54%	3,20%	5,04%	7,22%	9,41%	7,56%	4,60%	4,41%	3,70%	2,94%	2,36%	1,12%	0,55%	45,05%
BB	0,08%	0,06%	0,26%	0,47%	1,00%	2,10%	3,38%	5,06%	6,96%	6,02%	3,94%	3,97%	3,48%	2,86%	2,35%	1,13%	0,54%	56,33%
BB-	0,05%	0,04%	0,16%	0,29%	0,61%	1,28%	2,08%	3,19%	4,57%	4,20%	2,93%	3,11%	2,84%	2,43%	2,05%	0,99%	0,46%	68,70%
B+	0,03%	0,02%	0,10%	0,18%	0,35%	0,70%	1,10%	1,69%	2,47%	2,38%	1,77%	1,96%	1,87%	1,67%	1,45%	0,71%	0,32%	81,22%
B	0,01%	0,01%	0,05%	0,10%	0,19%	0,36%	0,55%	0,83%	1,22%	1,20%	0,92%	1,06%	1,05%	0,97%	0,86%	0,43%	0,19%	89,99%
B-	0,01%	0,01%	0,03%	0,06%	0,11%	0,21%	0,32%	0,47%	0,67%	0,64%	0,49%	0,56%	0,56%	0,52%	0,46%	0,23%	0,10%	94,56%
CCC/C	0,00%	0,00%	0,01%	0,01%	0,03%	0,05%	0,08%	0,11%	0,14%	0,13%	0,10%	0,11%	0,10%	0,09%	0,08%	0,04%	0,02%	98,90%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

**Table A.31.** Markov-Chain method, Year 28. *Source: own elaboration during the internship at Sogei.*

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	7,25%	5,21%	11,86%	13,12%	14,26%	13,32%	9,53%	7,22%	5,57%	2,92%	1,35%	1,12%	0,82%	0,67%	0,50%	0,22%	0,14%	4,92%
AA+	2,54%	2,44%	8,45%	11,61%	14,83%	15,40%	11,86%	9,39%	7,44%	3,93%	1,80%	1,48%	1,07%	0,86%	0,63%	0,28%	0,16%	5,80%
AA	1,15%	1,28%	6,04%	9,64%	13,83%	15,67%	12,91%	10,66%	8,73%	4,71%	2,18%	1,79%	1,31%	1,03%	0,76%	0,34%	0,19%	7,75%
AA-	0,63%	0,78%	4,34%	7,90%	12,68%	15,69%	13,74%	11,73%	9,81%	5,36%	2,49%	2,04%	1,50%	1,17%	0,85%	0,38%	0,22%	8,69%
A+	0,41%	0,51%	2,96%	5,85%	10,51%	14,57%	14,00%	12,72%	11,15%	6,30%	2,97%	2,45%	1,81%	1,39%	1,02%	0,46%	0,26%	10,67%
A	0,32%	0,37%	2,05%	4,18%	8,22%	12,81%	13,67%	13,35%	12,36%	7,26%	3,50%	2,91%	2,17%	1,64%	1,22%	0,56%	0,31%	13,10%
A-	0,26%	0,27%	1,41%	2,90%	6,13%	10,67%	12,77%	13,54%	13,32%	8,17%	4,03%	3,38%	2,55%	1,92%	1,43%	0,66%	0,36%	16,24%
BBB+	0,19%	0,20%	0,98%	2,00%	4,40%	8,33%	11,05%	12,84%	13,60%	8,82%	4,52%	3,87%	2,96%	2,23%	1,69%	0,78%	0,42%	21,11%
BBB	0,16%	0,15%	0,73%	1,45%	3,23%	6,41%	9,16%	11,52%	13,08%	9,03%	4,83%	4,24%	3,32%	2,52%	1,94%	0,91%	0,47%	26,84%
BBB-	0,13%	0,12%	0,54%	1,03%	2,27%	4,64%	6,98%	9,39%	11,41%	8,47%	4,81%	4,39%	3,55%	2,75%	2,16%	1,02%	0,51%	35,84%
BB+	0,11%	0,10%	0,40%	0,73%	1,57%	3,25%	5,05%	7,15%	9,20%	7,32%	4,43%	4,24%	3,55%	2,83%	2,27%	1,08%	0,53%	46,19%
BB	0,08%	0,06%	0,27%	0,49%	1,03%	2,15%	3,42%	5,04%	6,83%	5,83%	3,77%	3,79%	3,30%	2,72%	2,23%	1,07%	0,51%	57,41%
BB-	0,05%	0,04%	0,17%	0,30%	0,63%	1,32%	2,11%	3,20%	4,50%	4,07%	2,80%	2,95%	2,68%	2,28%	1,92%	0,93%	0,43%	69,62%
B+	0,03%	0,02%	0,10%	0,18%	0,36%	0,72%	1,12%	1,70%	2,45%	2,32%	1,69%	1,86%	1,75%	1,55%	1,34%	0,65%	0,30%	81,85%
B	0,01%	0,01%	0,05%	0,10%	0,19%	0,37%	0,56%	0,84%	1,21%	1,17%	0,88%	1,00%	0,98%	0,89%	0,79%	0,39%	0,18%	90,36%
B-	0,01%	0,01%	0,03%	0,06%	0,11%	0,22%	0,32%	0,47%	0,67%	0,63%	0,47%	0,53%	0,52%	0,48%	0,42%	0,21%	0,09%	94,75%
CCC/C	0,00%	0,00%	0,01%	0,01%	0,03%	0,05%	0,08%	0,11%	0,14%	0,13%	0,09%	0,10%	0,10%	0,09%	0,08%	0,04%	0,02%	98,93%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

**Table A.32.** Markov-Chain method, Year 29. *Source: own elaboration during the internship at Sogei.*

	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC/C	D
AAA	6,70%	4,87%	11,37%	12,82%	14,21%	13,50%	9,79%	7,50%	5,84%	3,07%	1,42%	1,18%	0,86%	0,70%	0,53%	0,23%	0,14%	5,26%
AA+	2,40%	2,29%	8,02%	11,19%	14,54%	15,35%	12,01%	9,62%	7,69%	4,09%	1,88%	1,55%	1,13%	0,90%	0,66%	0,29%	0,17%	6,23%
AA	1,10%	1,23%	5,75%	9,26%	13,46%	15,49%	12,95%	10,82%	8,94%	4,86%	2,26%	1,86%	1,37%	1,07%	0,79%	0,35%	0,20%	8,25%
AA-	0,62%	0,76%	4,18%	7,61%	12,29%	15,40%	13,67%	11,81%	9,98%	5,50%	2,56%	2,11%	1,55%	1,20%	0,88%	0,40%	0,23%	9,24%
A+	0,41%	0,51%	2,89%	5,68%	10,21%	14,25%	13,84%	12,69%	11,23%	6,39%	3,03%	2,51%	1,86%	1,42%	1,05%	0,47%	0,27%	11,30%
A	0,32%	0,37%	2,03%	4,11%	8,05%	12,53%	13,44%	13,22%	12,33%	7,30%	3,53%	2,95%	2,21%	1,67%	1,24%	0,57%	0,31%	13,83%
A-	0,26%	0,27%	1,41%	2,89%	6,06%	10,48%	12,52%	13,33%	13,18%	8,13%	4,03%	3,40%	2,57%	1,94%	1,45%	0,67%	0,36%	17,07%
BBB+	0,19%	0,20%	0,99%	2,02%	4,40%	8,25%	10,86%	12,60%	13,35%	8,70%	4,47%	3,84%	2,95%	2,23%	1,69%	0,79%	0,42%	22,05%
BBB	0,16%	0,16%	0,75%	1,48%	3,26%	6,40%	9,05%	11,31%	12,80%	8,83%	4,74%	4,17%	3,27%	2,49%	1,92%	0,90%	0,46%	27,87%
BBB-	0,13%	0,12%	0,55%	1,05%	2,31%	4,67%	6,94%	9,24%	11,15%	8,24%	4,67%	4,27%	3,45%	2,68%	2,10%	0,99%	0,50%	36,93%
BB+	0,11%	0,10%	0,40%	0,75%	1,61%	3,30%	5,06%	7,07%	9,00%	7,10%	4,27%	4,08%	3,41%	2,72%	2,18%	1,04%	0,51%	47,28%
BB	0,08%	0,07%	0,27%	0,50%	1,06%	2,19%	3,45%	5,01%	6,70%	5,64%	3,62%	3,62%	3,14%	2,58%	2,12%	1,01%	0,49%	58,44%
BB-	0,05%	0,04%	0,17%	0,31%	0,65%	1,35%	2,14%	3,20%	4,44%	3,95%	2,68%	2,80%	2,53%	2,14%	1,80%	0,87%	0,41%	70,47%
B+	0,03%	0,02%	0,10%	0,18%	0,37%	0,74%	1,14%	1,71%	2,43%	2,26%	1,61%	1,76%	1,64%	1,44%	1,24%	0,61%	0,28%	82,43%
B	0,01%	0,01%	0,05%	0,10%	0,20%	0,38%	0,57%	0,85%	1,20%	1,14%	0,85%	0,95%	0,91%	0,83%	0,73%	0,36%	0,16%	90,69%
B-	0,01%	0,01%	0,03%	0,06%	0,11%	0,22%	0,33%	0,47%	0,66%	0,62%	0,45%	0,50%	0,49%	0,44%	0,39%	0,19%	0,09%	94,93%
CCC/C	0,00%	0,00%	0,01%	0,01%	0,03%	0,05%	0,08%	0,11%	0,14%	0,13%	0,09%	0,10%	0,09%	0,08%	0,07%	0,03%	0,02%	98,97%
D	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%

**Table A.33.** Markov-Chain method, Year 30. *Source: own elaboration during the internship at Sogei.*