POLITECNICO DI TORINO

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Master's Degree Thesis

How Firm Characteristics Affect Credit Rationing among Small and Medium-sized Enterprises in the Euro Area

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Contents

1 Introduction

Access to finance is critical for businesses since it allows them to expand operations, upgrade equipment, or launch new projects, thereby assisting in their development and increasing their competitiveness. Access to finance, on the other hand, is typically correlated with firm size, implying that the smaller the company, the more difficult is to access external financing options. Small and medium-sized enterprises (SMEs) face greater challenges than large firms. Additionally, smaller firms are more dependent on external funding due to their limited equity and internal funds, they may, thus, be more vulnerable if adequate funds are not available.

Bank financing is one of the most important external sources of funding for SMEs. They may, however, face credit rationing (CR) in the bank loan markets. Banks may refuse credit to businesses in varying degrees, either completely rejecting a loan application or only providing a limited amount. Some studies suggest that SMEs experience a higher rate of credit rationing than larger firms (Kundid and Ercegovac, 2011; Balogun, Nazeem and Agumba, 2016). This could be due to a variety of factors, including information asymmetry between SMEs and banks, or, in a more narrow sense, specific attributes such as firm characteristics which may cause this informational gap. However, any barriers to the bank loan process will have a significant negative impact on the growth and survival of smaller businesses and, ultimately, the entire economy.

Credit rationing is a worldwide phenomenon that exists in almost every banking system. (Drakos and Giannakopoulos, 2011) report the presence of credit rationing in Eastern European countries, showing that credit rationing is different between firms; it is less likely for larger and more profitable firms. Another study looked at the effect of a firm's age, size, and ownership structure in 80 developed and developing countries, and the results show that older, larger, and foreign-owned businesses have a lower likelihood to be credit rationed (Beck *et al.*, 2006).

Furthermore, firms that decide not to apply for bank loans because they are afraid of being rejected should not be overlooked, as this group of discouraged borrowers is

considered credit rationed in literature. The study of (Chakravarty and Xiang, 2013) examines drivers of discouraged borrowers globally, and their findings show that the existence of discouraged borrowers also varies by country and firm characteristics.

Hence, in this thesis, a comprehensive review of the credit rationing literature is conducted in order to collect credit rationing determinants. In fact, the goal is to investigate the determinants of credit rationing in eurozone SMEs and assess how these factors contribute to different forms of credit rationing. Two steps are taken here to investigate credit rationing more precisely. First, empirical data are analyzed to determine the trends of different forms of credit rationing for SMEs in the euro area over time, and then a multinomial logistic regression (MRL) is run to gain a more in-depth understanding of the relationship of determinants, including firm characteristics, with each form of credit rationing separately. The database used is microdata from Survey on the Access to Finance of Enterprises (SAFE) conducted by the European Central Bank (ECB) from 2009 to 2022.

The research is organized as follows. The following parts (up to section 4) discuss the relevant credit rationing literature. In section 5, determinants of credit rationing are extracted from literature. After an introduction on SMEs in Europe (section 6), the dataset is described in section 7 and, in line with that, the credit rationing situation of SMEs in the eurozone is analyzed. Section 8 presents the results of multinomial logistic regression. The conclusion follows in section 9.

2 Credit Rationing Theory

2.1 Credit Rationing Definition

Firms should be able to obtain funds in a perfect capital market if they have investment projects with a positive net present value. However, this is not always the case, and some borrowers are subjected to credit rationing by lenders.

Credit rationing, as an example of market failure, is broadly defined as a situation in which, the demand for loans exceeds the supply at the market prevailing interest rate at the equilibrium point. And, lenders (lenders are referred to as banks) decide not to grant credit to some borrowers. In other words, some borrowers who would be qualified for obtaining loans in a perfect capital market are unable to receive their desired fund, while others to whom are otherwise identical are able.

In fact, credit rationing may not be a result of a shortage of funds; rather, it is a risk mitigation/elimination strategy employed by banks to avoid choosing risky borrowers while maximizing their profits (Kundid and Ercegovac, 2011); Some potential borrowers are willing to receive funds at current interest rates (or even higher), but a funding shortage occurs when a rational bank is unwilling to fully meet loan demands, either by lending additional funds or raising the rate of interest.

It is worth noting that one of the earliest definitions of credit rationing is based on determining the optimal level of interest rate to maximize the expected return of a bank. Later studies, however, show that raising interest rates above a certain point is irrational. A high interest rate may cause a higher level of uncertainty related to the loan repayment ability by borrowers. This causes the borrower´s default risk to increase and consequently reduces the expected profit of banks.

Besides, banks usually know less than borrowers about the payoff of borrowers´ projects. Borrowers who receive loans with higher interest rates are more likely to report lower returns on their projects and claim they are unable to repay their debts. As a result of this information gap, named “information asymmetry” banks are required to monitor firms, acquiring the necessary information about them both before and after making

credit decisions. Therefore, the higher interest rate raises the monitoring costs of banks as well.

In addition, an increase in interest rates may attract riskier borrowers while driving out the least risky borrowers, a phenomenon known as "adverse selection". And once the loan is granted to borrowers, higher levels of interest rates may lead borrowers to select higher-risk projects in order to maximize their returns on investments, which refers to “moral hazard” (E.Stiglitz and Weiss, 1981). In a lending process, therefore, there are no competitive forces to raise interest rates to the point where demand and supply of credit are equalized, to put it another way, a profit-maximizing bank induces to select among borrowers and ration credit rather than fulfilling all loan demands by raising the interest rate.

2.2 The Evolution of Credit Rationing Theory

The concept of credit rationing emerged as a result of a limited supply of credit. In the early 1950s, in the years following Second World War, (Wilson, 1954) argued that credit rationing occurs when there is a limit on the amount of bank credit that is given to the demanded loans at the current interest rate. This limited amount of loan may be imposed on potential borrowers by monetary authorities or by banks themselves. Authorities may apply control of credit by “requesting that certain loans be not made at all, or that they should be kept to a minimum” in consequence of a policy related to “qualitative control (necessarily with quantitative implications)”. It is also possible that a bank will refuse to lend to a sector because it already has a sense of overlending to that sector due to uncertainty about the sector's future. Also, when a bank's desired level of liquidity is jeopardized. This early definition of credit rationing is mentioned as disequilibrium CR. And, it focuses mostly on the problem of credit availability, which is related to the “availability doctrine.”

Availability doctrine arises in the 1950s, by studying the role of monetary control policies on banks’ liquidity. Roosa was the first to develop the availability doctrine (1951). Scott (1957) provided a useful explanation of this doctrine. He discussed that the availability doctrine refers to “a restrictive monetary policy may cause a reduction

in the quantity of credit supplied to private borrowers by private lenders irrespective of the elasticity of demand for borrowed funds." This theory, in the context of credit rationing, considers the supply-side and it does not take into account demand elements and their characteristics.

Between the 1960s and 1970s, studies were conducted to determine whether a bank should meet borrowers' loan demands by raising interest rates. "Credit risk and credit rationing" by Hodgman (1960) is one of the first to address this issue. Hodgman (1960) refuted the notion that the rate of interest can rise to cover the lender's risk feature of the loan. A borrower may always gain funds in this manner unless the proposed interest rate is significantly higher than his/her interest rate. The potential borrower will decline the credit at that cost. As a result, this is not a credit rationing situation, but rather "traditional interest rationing." Rather, Hodgman argued that potential borrowers' ability to repay matters and is limited, effectively limiting loan size beyond some level regardless of interest rate. This model was testing whether "credit risk" could be used to justify bank "credit rationing." The lender's decision to fund a potential borrower is influenced by the loan's expected value of payoff and loss. The bank calculates the probability distribution of a potential borrower's ability to repay (credit rating), and the bank will not make a loan that exceeds the borrower's promise to pay. As a result of this point of view, there is also a disparity in available funds for potential borrowers based on their credit ratings. The optimality of this payoff/loss ratio as a criterion for a bank's decision-making has been debated by (Chase, 1961; Miller, 1962; Ryder, 1962).

(Miller, 1962) considered bankruptcy costs to the lender´s return function. He discussed that the lender`s reluctance to incur the costs associated with the bankruptcy and thus, the lender´s reluctance to bankrupt borrowers. The model was then presented in greater detail by (Freimer and Gordon, 1965). They proposed that a profit-maximizing bank will increase the amount of loan with an increase in interest rate, with the exception of lending to "fixed-size investments," for which the bank will ration credit beyond a certain amount.

Previously, studies argued about the supply side of credit rationing, but (Jaffee and Modigliani, 1969) did not consider this point of view sufficient to derive credit rationing

implications. They proposed credit rationing models that take into account both the supply and demand sides, as well as the determinants of commercial loan rates as a third component. According to this framework, banks seek a way to maximize their expected profits in the long-run and, as a result, determine an optimal loan rate to achieve this goal. Even though the demand and supply curves intersect at the optimal interest rate, credit ratioing, known as equilibrium credit rationing, continues to exist.

In 1976, Jaffee & Russell studied the role of imperfect information and uncertainty in credit rationing in loan markets where potential borrowers have more information about the probability of default than lenders. Furthermore, lenders are unable to differentiate between "honest"[1] and "dishonest" groups of borrowers. This theory was further developed by a notable study by (Stiglitz & Weiss, 1981) which discussed how credit rationing occurs in markets where risk-neutral borrowers and lenders have imperfect information about the risk of a project. In this situation, banks need to differentiate the likelihood of borrowers' repayment in order to maximize the expected returns on loans. As a result, interest rates are used as a "screening device" to identify "good borrowers."

Stiglitz and Weiss stated that credit rationing may happen in equilibrium. In normal markets, the assumption is that equilibrium exists when demand and supply are equal, and thus no rationing occurs. Furthermore, once the market has moved away from the equilibrium point, the price (or interest rate) fluctuates until the market reaches a new equilibrium. Stiglitz and Weiss, on the other hand, demonstrated that credit rationing exists in the loan market even when it is in equilibrium and the optimal interest rate does not necessarily change to equate supply and demand for loans.

It is discussed that banks limit the supply of additional credit to borrowers even when the borrowers are willing to pay the market interest rate (or more). In other words, banks will not raise interest rates in the presence of excess loan demand since it reduces the bank's expected return due to the adverse selection effect and a higher risk of default. When interest rates rise, good potential borrowers who will repay the loan leave the

[1] "Honest" borrowers accept a loan contract only if they can repay it, whereas "dishonest" borrowers may default on loans whenever the cost of default is sufficiently low (Jaffee & Russell, 1976).

market, causing the adverse selection effect. A higher interest rate may induce a borrower to choose riskier projects with lower chances of success but higher payoffs in case of being successful. Therefore, a bank sets a limit on the rate of interest. The bank's expected return is maximized at point r*, which is referred to as the "bank-optimal rate." If supply exceeds demand at this point, no rational bank has an incentive to charge borrowers more than r* because the bank is already maximizing its profits; instead, the bank reduces loan demand through credit rationing. This is also true in terms of the amount of collateral. Increasing the amount of collateral may reduce the return to the bank in the same way that an increase in interest rates does. As a result, when a bank has an excess demand for credit, it may not be profitable to raise interest rates or collateral.

Table 1- A summary of Key Papers that Attempted to Define Credit Rationing Theory

Author(s)	Aim of study	Credit rationing definition	Key findings
Wilson (1954)	How credit rationing affects potential bank borrowers.	Credit rating occurs as a limited amount of bank credit at the current interest rates imposed by monetary policies or by banks themselves. And, a banker is likely to lend "all or nothing" of the requested credit.	- Credit rationing is mostly caused by a lack of available credit. - A credit rationed borrower has two options: A rationed borrower has to use his/her own resources, or he/she is forced to seek alternatives options.
Scott (1957)	Analyzing the impact of monetary policy on credit availability and credit rationing.	Credit rationing occurs when a borrower is unable to borrow the full amount desired at the current interest rate due to a restrictive monetary policy.	Monetary policy is a tool for influencing credit availability, regardless of the elasticity of demand for borrowed funds. A restrictive monetary policy causes a supply constraint of funds.
Hodgman (1960)	Providing a model to analyze if "credit risk" can provide a rationale for "credit rationing" by banks.	Considering borrower´s default risk as a factor determining credit rationing.	When deciding whether to lend money to a potential borrower, banks consider the borrower's ability to repay. A bank will not make a loan that exceeds the borrower's promise to pay regardless of the interest rate.
Freimer & Gordon (1965)	Is credit rationing rational for a profit-maximizing bank?	Two types of CR: weak credit rationing and strict credit rationing.	A banker will not increase the loan amount for a fixed-sized investment if the rate rises above a certain point.
Jaffee & Modigliani (1969)	Examining the rationality of non-price credit rationing and methods for measuring it	Credit rationing arises when demand for commercial loans exceeds supply at the loan rates quoted by banks.	They proposed credit rationing models that take into account both the supply and demand sides, as well as the determinants of commercial loan rates as a third component.
Jaffee & Russell (1976)	Analyzing credit rationing in the presence of imperfect information and uncertainty	Credit rationing occurs when lenders quote an interest rate on a loan and then proceed to provide a smaller loan size than the borrower requested.	The government should intervene to solve credit rationing by chartering monopoly power. A monopolist may offer a larger loan size than a competitive industry, but at a higher cost, and honest borrowers prefer the competitive contract.
Stiglitz & Weiss (1981)	To show how the bank loan market in equilibrium may be characterized by credit rationing.	Among identical borrowers, some receive loans while others do not, and rejected applicants are unable to obtain credit even if a higher interest rate is offered; even though they would be able to with a larger supply of credit.	- Banks limit the amount of credit they extend as higher interest rates and higher collateral requirements attract riskier borrowers, resulting in an adverse selection and higher default risks. As a result, the bank's expected return can be maximized at interest rates lower than those required to clear the market. - Monetary policy can increase the supply of funds by increasing credit availability rather than through the interest rate mechanism.

2.3 Credit Rationing Classification

Researchers have proposed different classifications of credit rationing to define it. As previously noted, the concept of credit rationing evolves over time with various viewpoints. Therefore, some of the most important classifications are reviewed in this section.

In the (Freimer and Gordon, 1965) study, two types of credit rationing are presented, weak credit rationing and strict credit rationing. In the case of weak credit rationing, a lender will change the amount he is ready to loan a borrower with the interest rate up to a specified limit. After this point, he will refuse to extend credit, regardless of the rate of interest. And, in strict credit rationing, “a banker who sets an interest rate, lends a borrower whatever he wants up to a predetermined level at this rate and refuses to lend him more regardless of the rate.”

(Jaffee and Stiglitz, 1990) listed four types of credit ratioing. The first type named “interest rate (or price) rationing” indicates that the loan rate depends on the size of a loan. A borrower asks for a larger loan, he or she will be charged a higher interest rate since the probability of default goes up with respect to the size of a loan. The second type is “divergent view rationing.” In this case, a borrower may be credit-rationed at an interest rate that he or she believes is appropriate given the likelihood of default. The third type, "Redlining," which refers to the practice of removing certain observationally distinct groups from loan markets rather than offering them a contract with higher interest rates and collateral requirements. There is less information asymmetry in redlining, and credit rationing is not the outcome of adverse selection. Credit rationing happens when a bank realizes that a borrower will be unable to pay the bank's expected return on the project. “Pure credit rationing” as the fourth type states that “there may be instances in which some individuals obtain loans, while apparently identical individuals, who are wiling to borrow at precisely the same terms, do not.” In the case of pure credit rationing, which is mostly caused by information asymmetry, even if rejected applicants offer to pay a higher interest rate, they would be denied receiving a loan.

Later, in 2000, (Levenson & Willard) proposed a new definition of credit rationed firms, referring to "discouraged borrowers" who require a loan for their business but do not apply formally because they are afraid the bank will reject their requests. There are three reasons why businesses do not apply for credit or, as (Han, Fraser and Storey, 2009) stated, they practice "self-rationing mechanism". Firstly, smaller firms are more likely to be discouraged rather than older and larger firms. And time does matter. Firms that believe financing is a time-consuming process may not apply for credit, as investment opportunities evolve over time (Levenson and Willard, 2000). Secondly, (Han, Fraser and Storey, 2009) discovered that discouragement behavior is influenced by both the entrepreneur's and the business's demographics and besides, riskier borrowers are more likely to be discouraged. Thirdly, the greater the number of competitors a firm faces in obtaining funding, the more likely the firm will be discouraged. Relationships with banks are also important in a firm's self-rationing (Chakravarty and Xiang, 2013b).

In addition, two other forms of credit rationing are distinguished by (Ghosh, Mookherjee and Ray, 2000): Micro and Macro credit rationing. Micro credit rationing occurs when a potential borrower faces a credit limit on his/her request. The potential borrower, therefore, is not able to receive all necessary credit, while macro credit rationing is considered as a situation where a bank “randomly denies access to any credit to a fraction of borrowers.” In the case of macro credit rationing, which is a result of asymmetric information, the bank prevents from rising the level of interest rate excessively to meet all potential borrowers' demands.

2.4 Credit Markets with Asymmetric Information

The term credit market is used to describe “the place where investors with surplus capital provide their surplus capital to those who are in need of capital. This may be done directly, such as a person borrowing from a friend or relative or financial intermediaries such as banks, mutual funds, insurance companies may facilitate this process” (Hoque, Sultana and Thalil, 2016).

A competitive credit market operates under the influence of asymmetric information. Credit markets are distinct from standard competitive markets since they do not trade

homogeneous commodities and do not require full payment at the time of closing the deal. Credit, on the other hand, is exchanged for the promise of future repayment. That is why there is uncertainty in these markets. Repayment promises are dependent on borrowers, and there is a chance that a promise will be broken. Hence, an information gap, which is named information asymmetry, exists between lenders and borrowers; Borrowers have more information in comparison to lenders. This information asymmetry may result in credit rationing in loan markets, allowing lenders to increase their expected returns.

Jaffee & Russell (1976) provided the first explicit explanation of asymmetric information. They expressed that a lender cannot recognize ex-ante the difference between "honest" and "dishonest" borrowers (those who will accept a contract only if they are able to pay their loans back and those who will default in case that the cost of default is low enough, respectively). Borrowers frequently request bank credit with a variety of different default risks at the same time, with no distinguishable signals. Lenders, therefore, cannot obtain precise information about potential borrowers´ default risks and will be unable to separate trustworthy and untrustworthy borrowers. It means that the borrower is able to examine the expected return of a project, knowing his or her ability to repay the loan, whereas the bank has to pay monitoring costs to gain its necessary information. Thus, in this case, the information gap between the lender and the borrower occurs before the loan agreement is completed ("ex-ante asymmetric information"). This fact that different borrowers have different chances of repaying their loans also gives rise directly to the adverse selection effect.

There is also another type of information gap known as "ex-post asymmetric information." A paper discussing debt contracts with asymmetric information (Carlier and Renou, 2006) defined ex-post asymmetric information as a situation in which the opinions of a borrower and a lender are different regarding expected returns of an investment project. The lender may make an estimate of the return of the undertaken project based on private information that occurred in similar previous projects. Alternatively, the lender and the borrower may simply use different techniques to evaluate the project's return. Therefore, ex-ante refers to the pre-contractual phase,

whereas ex-post refers to the post-contractual phase, following the completion of loan contracts. During this phase, there is a risk of moral hazard since the borrower's behavior may alter in such a way that the lender will be at a disadvantage to the borrower. In a moral hazard situation, the borrower changes his or her behavior as they believe that there will be no penalties. They, therefore, may be tempted to choose riskier projects which give them higher profits.

3 Traditional Lending Technologies

3.1 Introduction

Traditional debt funding extends credit primarily based on the firm's overall creditworthiness, and the lender considers the firm's expected future cash flow as the primary source of repayment as a mean of addressing the issue of information asymmetry between itself and the borrower. The lending techniques used to assess and monitor the firm's creditworthiness, on the other hand, can vary greatly.

Different lending technologies combine various sources of information about the borrower, screening and underwriting procedures, loan contract structure, monitoring strategies and mechanisms (Berger and Udell, 2006). The literature divides lending technologies into two types: transaction lending, which is based on ´hard´ information, and relationship lending, which is based on `soft´ information. According to the studies, relationship lending is more associated with lowering credit rationing rates among firms, hence, an overview is presented in this thesis.

3.2 Relationship lending

Lenders must obtain information about the creditworthiness of borrowers who apply for credit. There are several methods for gathering this information, but a well-suited one is the development of long-term relationships between a lender and a borrower.

‘Relationship lending’ is one of the most effective lending technologies to alleviate information asymmetry between the lender and the borrower, as well as facilitate monitoring and screening for banks. Relationship lending, in particular, has evolved as a method of gathering information from smaller firms since large firms are typically more transparent. Over time, continuous and frequent bank-firm relationships can help banks gather a variety of valuable information about the firm´s financial prospects and utilize that information to make decisions about extending credit to the firm. Studies provide support for the important role that a bank-firm relationship play to increase credit availability and consequently decrease credit rationing for smaller firms (Petersen and Rajan, 1994; Cole, 1998; Cenni *et al.*, 2015; Kysucky and Norden, 2016).

lending relationship is typically associated more with production of “soft” and “private” information rather than “hard” and “public” information. Information related to the lending process are divided into two major categories “hard” and “soft” and can be further separated by information source: “public” and “private” (Yosano and Nakaoka, 2019). As this segmentation of information has a key role in this context, it is necessary to clarify the distinction between soft and hard information (Liberti and Petersen, 2019).

Hard information is quantifiable either obtained through public sources or private sources. This includes data such as financial statements, the number of employees or patents, personal assets owned by a company’s manager. Since hard data is measurable, it can be easily gathered, stored, and transmitted even across distance. To collect hard information is only needed to have access to the source of information and it may be collected at any time and everywhere. This means that its collection process is independent of the context and personal interpretation. Individuals or businesses are no longer required to participate in the collection process to be able to make decisions based on that information. The important advantage of being independent of people is that the information has greater durability. Hard information is still accessible if people who collected the data are not expected to be around in the future, making the decision process free from constraints of space and time.

Soft information, on the other hand, is qualitative. It includes more subjective information such as opinions, ideas, managerial competencies, internal assets and skills, employee morale. This type of information is collected through personal interactions between lenders and borrowers over time and requires professional knowledge and expertise to collect and process. Hence, acquiring soft information takes more time rather than hard information and it may be difficult to encode, verify, and communicate cross distance without loss of content. But the point is that soft information plays an important role in lending relationship, especially in case of SMEs. Since there is little reliable hard information about them as they have no track record and as they are frequently active in new businesses. Ultimately, banks are able to achieve better lending performance by strategically collect and use soft information (Yosano and Nakaoka, 2019).

In the following, the focus is on the duration of the bank-borrower relationship, multiple banking, and the scope of the relationship as measures of strength of this relationship (Kysucky and Norden, 2016).

3.2.1 The Duration of Banking Relationship

It is reasonable to assume that the longer a borrower and a lender have a relationship, the more information flows between them and the more important the relationship becomes. However, the empirical evidence on this topic is mixed.

The result of some studies indicated that as the duration of the relationship increases more credit is available to firms and consequently the credit rationing decreases (Petersen and Rajan, 1994; Berger and Udell, 1995; Cenni *et al.*, 2015; Kirschenmann, 2016; Brighi and Venturelli, 2017). A bank can develop more soft and private information about the firm in a longer relationship through repeated transactions with the firm. This information lowers the bank's initial screening costs while also addressing the issue of asymmetric information, making the lending relationship a worthwhile tool for the bank. It collects private information in order to better estimate the company's ability to repay its debt, and indeed the relationship's importance grows over time. Therefore, the lending relationship allows the bank to offer its reliable customers a greater amount of credit, which also makes competing banks´ offers less appealing.

Despite the fact that (Cole, 1998) found a lender is more willing to provide credit if it already has a relationship with a borrower, he claimed that the length of the relationship is unimportant for relationships lasting longer than one year. The reason for this is that the bank is able to quickly generate the necessary private information about the firm and thus the value of both public and private information declines over time as the relationship evolves, due to changes in the relationship such as merger or the development of a relationship with another source of funding. As a result, while he showed that the rate of denied credit is high among “zero length of relationship firms,” he also underlined that the value of information diminishes over time.

3.2.2 Exclusivity of Banking Relationship

The extent to which a firm concentrates its borrowings on a single lender is referred to as exclusivity. From a theoretical standpoint, an exclusive banking relationship can have both benefits and drawbacks to firms, both are related to the fact that the relationship allows a bank to obtain private information on the borrowing firm.

The more exclusive a bank relationship is, the more comprehensive, accurate, and easy to interpret information may be. An exclusive relationship encourages the development of soft and private information about the firm and helps in resolving the asymmetric information problem. In contrast, when the firm deals with several sources of financial services, the information a lender generates about the firm is less valuable. Firms with multiple lending relationships are also riskier since their leverage and share of unsecured bank debt are higher. An exclusive bank relationship, therefore, is linked to increased credit available to firms, mitigating credit rationing (Petersen and Rajan, 1994; Cole, 1998; Harhoff and Körting, 1998; Kysucky and Norden, 2016).

The study of Petersen and Rajan (1994) indicated that borrowing is highly concentrated. Despite the fact that borrowing concentration decreases with firm size, firms diversify their financial sources as they grow larger. Their results suggested that “on average, the smallest firms tend to have just over one lender while the largest firms have about three lenders.” Moreover, based on another study titled "Lending relationships in Germany–Empirical evidence from survey data" by (Harhoff and Körting, 1998), the largest firms receive roughly two-thirds of total credit volume from a single financial institution. And approximately half of all firms with fewer than ten employees receive external finance from only one institution.

However, while having a single banking relationship over multiple ones can be advantageous to the bank since it allows the bank to have lower overall monitoring and transaction costs, it can be detrimental to the firm due to the "hold-up problem"; in this case, the bank may misuse its monopolistic power and capture future rents over the firm (Sharpe, 1990). Firms with an exclusive banking relationship are also more reliant on the bank for additional credit. The bank may refuse to provide additional credit if the firm's quality has been revealed to be bad or if the bank itself is experiencing liquidity

issues (Shikimi, 2013). Therefore, anticipating these kind of problems, firms may choose to engage in multiple banking relationships to ensure stable access to finance, but firms are at the risk of be rationed when they obtain loans from several banks (Petersen and Rajan, 1994).

3.2.3 Scope of Banking Relationship

A firm-bank relationship may include more than just providing credit to borrowers. As a representative element of the breadth of the firm-bank relationship, “scope” refers to all of a bank's financial services to a customer. This can include non-credit bank services such as cash management and services that allow the bank to grant multiple loans at once, all of which can create significant informational synergy for the bank (Degryse and Van Cayseele, 2000; Kysucky and Norden, 2016). Selling more bank services to the customer can give the bank a unique advantage in customer monitoring, resulting in an increase in the volume of information available to the bank. It also saves both the bank and the customer money by lowering the shared expenses of multiple services.

Besides, some researchers believe that private information gathered by banks while providing multiple services to the same customer may be useful in lending process. Checking and deposit accounts, for example, can help a bank determine a company's ability to repay a loan. As a result, the scope of the relationship may influence the amount of credit available to customers (Kysucky and Norden, 2016). In empirical studies, however, the scope of the banking relationship is rarely viewed as an effective determinant of the strength of firm-bank relationship in comparison to duration or an exclusive banking relationship.

3.2.4 The Effect of Competition in Banking Industry

So far, it has been stated that a longer and more exclusive relationship lending and the scope may result in more credit being available to businesses and hence less credit rationing in loan markets. These advantages are particularly obvious in countries where banks compete fiercely, as the higher level of competition in the banking sector drives banks to use relationship lending to outperform competitors and differentiate

themselves; To discourage borrowers from switching to competitors, banks invest in producing borrower-specific information and rewarding borrowers with more credit.

Kysucky and Norden (2016) analysed "the benefits of relationship lending in a cross-country context." Their findings revealed that in countries with a competitive banking market, borrowers are 33% more likely to benefit from all stated lending relationship dimensions. And, when there is a high level of competition, borrowers benefit from 76% of all effects. The following (Figure 1) provided detailed information about the situation of countries under consideration; It depicts the relationship between banking competition and average relationship benefits by country. According to the study, the two variables have a meaningful and positive linear relationship. Borrowers in the United States, Argentina, and Taiwan can benefit the most from the fierce competition among banks. However, Borrowers in Europe, particularly in countries where bank competition is low such as Portugal and Finland, can benefit from the lending relationship at the lower levels. This result does not imply that relationship lending is less common in these regions, but rather that the benefits for borrowers are, on average, lower in these countries.

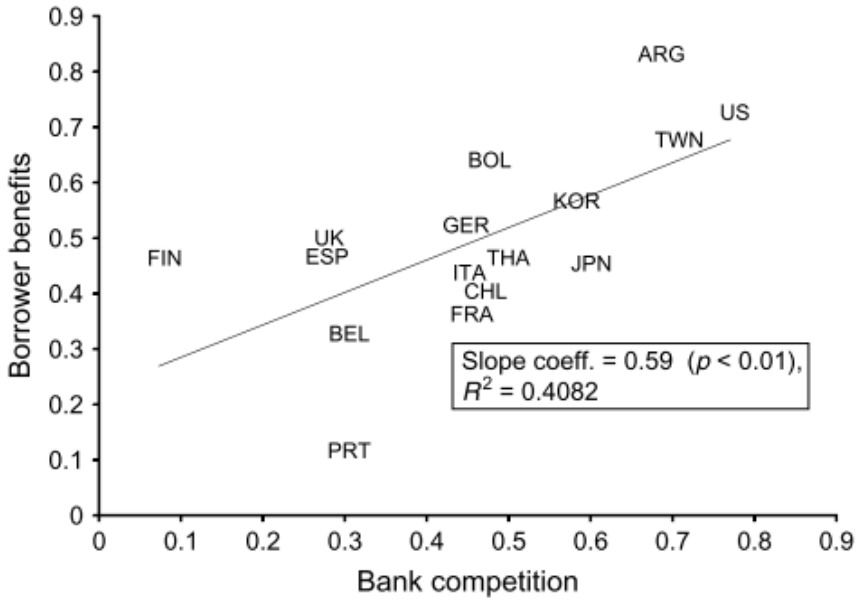

Figure 1- Relationship Lending Benefits and Bank Competition

Notes. "This figure shows the means of bank competition (0 = perfect monopoly; 1 = perfect competition) and borrower benefits measured by one-tail p-values (0 = significant adverse effect for the borrower; 1 = significant

beneficial effect for the borrower). The means are calculated as equal-weighted averages of observations per country over the sample period within each study. Effect sizes from multicounty studies are excluded. Countries: ARG, Argentina; BEL, Belgium; BOL, Bolivia; CHL, Chile; GER, Germany; ESP, Spain; FIN, Finland; FRA, France; ITA, Italy; JPN, Japan; KOR, South Korea; PRT, Portugal; THA, Thailand; TWN, Taiwan; UK, United Kingdom; US, United States".
Source- "The Benefits of Relationship Lending in a Cross-Country Context: A Meta-Analysis" by (Kysucky and Norden, 2016).

4 Credit Risk Mitigation

4.1 Introduction

Traditional bank lending to SMEs faces more challenges than lending to large firms due to a higher level of asymmetric information. This asymmetric information is caused by a variety of factors. In general, however, large corporations, as previously stated, are more transparent and publish more public information, such as annual financial reports, whereas SMEs do not. Furthermore, the profitability of SMEs may be more volatile from year to year. As a result, financial institutions use a variety of methods to mitigate risks in the lending process to smaller firms and align incentives between themselves and borrowers. The collateral requirement is one of the most commonly used methods which led to secures debt repayment in the event of borrower default. Therefore, it can assist SMEs in obtaining bank loans. The following section discusses how collateral requirements can affect credit rationing.

4.2 Collateral Requirements

Collateral is one of the most important non-price terms of loan contracts and it is widely used in credit markets. According to (Leeth and Scott, 1989) about 60% of firms with commercial bank loans provide collateral as a security for the loan agreement. Berger and Udell (1990) also stated that collateral has a significant role in bank lending in the United States, as indicated by the fact that almost 70% of all commercial and industrial loans are secured.

Collateral is a pledge of a property by a borrower to lenders to guarantee repayment of a loan under a credit agreement. It is defined more precisely by (Jaffee & Stiglitz, 1990) as follows: “Collateral consists of financial and tangible capital assets that are pledged by the borrower to guarantee at least partial, if not complete, loan repayment. If a loan defaults, then the collateral is used to supplement the proceeds available to the lender (up to the repayment amount).”

A bank is faced with a pool of identical borrowers divided into two groups: low-risk and high-risk, with the unknown proportion of each group. Furthermore, as previously

stated, there is asymmetric information between the bank and the borrower both ex-ante and ex-post. By deciding on different terms of a loan contract (price and non-price terms) such as loan interest rate and collateral amount, the bank attempts to secure the lending process and maximize its profit.

In fact, collateral can be used as a screening or an incentive device in credit markets under asymmetric information. The bank is able to influence borrowers and their actions since the pledged collateral is an additional asset that may be lost if the loan will default. Collateral, therefore, has the ability to alleviate information asymmetry, which is thought to be the primary cause of credit rationing. As a result, it is plausible that collateral can help reduce credit rationing.

There have been extensive empirical studies on collateral and its role in reducing credit rationing. Previous studies can be divided into two groups. In the first study path, collateral is investigated as a remedy for informational asymmetries between the borrower and the lender. In the second study path, collateral is looked into as a way to increase the availability of credit while reducing the risk of being credit rationed. In fact, the indirect impact of collateral on credit rationing is explored in the first path, while its direct impact is investigated in the second one (Steijvers and Voordeckers, 2009).

4.2.1 Collateral as a Remedy for Credit Rationing

In this regard, collateral plays a role in reducing both ex-ante and ex-post information asymmetries, thereby reducing adverse selection and moral hazard effects.

Collateral plays a “signaling” role to the bank when it comes to decreasing ex-ante information asymmetry. The borrower selects the optimal amount of collateral based on the project's creditworthiness and return. On the other hand, the amount of collateral conveys to the bank the borrower's evaluation of the quality of the project to be funded. Thus, the borrower's willingness to pledge collateral informs the bank about the real quality of the project. As a result of this model, banks propose different contracts to borrowers in order to sort out types of borrowers, with the collateral and interest rate being inversely related; borrowers will benefit from a lower loan rate by providing more

collateral. Therefore, low-risk borrowers are eager to pledge more collateral and pay a lower interest rate while high-risk borrowers choose to pledge less collateral and pay a higher interest rate (Chan and Kanatas, 1985; Besanko and Thakor, 1987).

The second set of theories regards collateral as an incentive device that helps to reduce moral hazard. Once credit is granted, the collateral can influence borrowers' behavior, and resolving the moral hazard problem. Boot and Thakor (1994) demonstrated there is a direct relationship between collateral and its effect on moral hazard. They proved that collateral acts as a tax on the borrower early on, which can be removed once the borrower achieves its first success in an environment with repeated credit market interaction. A long-term bank–borrower relationship allows the bank to tax and subsidize the borrower more efficiently over time, reducing the need for collateral for high-quality borrowers. A loan contract of a low-quality borrower, on the other hand, always includes a collateral clause to avoid moral hazard. (Bellier, Sayeh and Serve, 2012) also stated that with high collateral, default is costly for the borrower, therefore the borrower is motivated to reduce the risk of the project, accelerate the project's implementation, and report the real revenues of the investment to the bank. To sum up, this viewpoint claims that collateral is used to prevent the borrower from switching from a lower-risk to a higher-risk project after the loan has been granted. Hence, contrary to the previous statement, high-risk borrowers pledge more collateral than low-risk borrowers and the possibility of losing the pledged collateral would discourage the high-risk borrower from changing his or her risk-taking behavior after receiving the loan.

4.2.2 Collateral as a Tool to Expand Credit Availability

Increasing the amount of collateral is expected to increase the supply of bank credit. Thus, collateral can directly result in lower credit rationing. A study conducted in South Africa found that collateral is an important determinant of credit accessibility to bank credit among construction SMEs (Balogun, Nazeem and Agumba, 2016). According to Fatoki and Asah`s research (2011) SMEs with no collateral will have a difficult time obtaining debt financing from commercial banks. Thus, owners of SMEs must have either business or personal assets that can be used as collateral when applying for credit from commercial banks.

In addition, Ogawa and Suzuki (2000) studied the role of collateral in the credit availability in Japan, focusing primarily on land and capital stock as collateral. Their findings indicated that the land asset is a significant factor in determining credit availability and it can expand bank credit even more strongly than capital stock. For independent firms, a 1-yen[2] increase in land value reduces borrowing constraints by 0.68 yen and 1.30 yen for group firms while in case if capital stock a 1-yen increase reduces borrowing constraint by 0.15 and 0.39, respectively, for independent and group firms.

[2] The yen is the official currency of Japan

5 Credit Rationing Determinants

5.1 Firm´s Characteristics and Credit Rationing

Five firm characteristics have been examined as potential determinants of credit rationing in the empirical literature, both for credit rationing from the bank side (complete CR and partial CR) and from the borrower side (self CR). These characteristics include firm's age, size, ownership and credit history, as well as its business plan.

5.1.1 Age

The age of firms plays an important role in being credit rationed. Studies reveal that young firms as borrowers are less favorable and trustable to the financial institutions due to a higher level of information asymmetry between financial institutions and young firms (Beck *et al.*, 2006). Banks have difficulty monitoring young firms to assess their creditworthiness, thereby making it challenging for young firms to obtain credit. According to the study of (Hoque, Sultana and Thalil, 2016), there is a positive significant relationship between being credit rationed and the age of firms for those young firms within the age of 1 to 5 years.

5.1.2 Size

Banks behave differently depending on the size of firms, empirically demonstrating that the firm size has a direct impact on the probability of being rationed (Levenson and Willard, 2000). As a result, SMEs are being rationed more strongly than larger firms (Beck *et al.*, 2006), especially in the case of undertaking investment in highly-innovative projects rather than the more traditional projects (Freel, 2007). Lending to smaller firms may be riskier for banks due to the higher failure probability of those firms (Brighi and Venturelli, 2017).

5.1.3 Ownership

Studies imply that ownership structure of firms can affect their ability to access credit, with applicants who intend to remain the only owner of the company appear to be at a

higher risk of credit rationing. Banks are slightly more likely to reject their request for funds because they are less likely to fully recover the debt from a single owner in the event of bankruptcy. Multiple ownership, on the other hand, may signal to banks that the potential borrower is more reliable. According to the research of (Blumberg and Letterie, 2008), multiple ownership is more appealing to banks, and banks are unconcerned about the increased complexity of the agency problem in the multi-ownership case. Furthermore, they discovered that single ownership reduces the likelihood of applying for a loan.

5.1.4 Credit History

Credit availability for SMEs is thought to be hindered by a lack of credit history (Levenson and Willard, 2000). In other words, potential borrowers with no credit history may have difficulty obtaining bank financing. A company's credit history reflects its ability to repay debts and its responsibility in doing so. The credit history of the borrower, therefore, can be used by banks to determine the firm's level of risk, determining whether or not to extend credit to them. The results of study conducted by (Mutezo, 2013) proved the relationship between credit history and credit ratioing among SMEs in South Africa.

5.1.5 Business Plan

Banks use business plans of firms to assess firms current and future performance. By analyzing a firm's capital structure, a bank can learn about the status of the loan interest and principal. Furthermore, the bank uses the business plan to determine whether grant or extend credit to the borrower. Inadequate information leads to information asymmetry, which can jeopardize access to credit. As a result, there is a positive relationship between business plan of a firm and its access to credit (Balogun, Nazeem and Agumba, 2016).

5.2 Managers' Characteristics and Credit Rationing

Academics have become increasingly interested in the impact of entrepreneurial characteristics on the availability of bank funds to small and medium-sized businesses in recent years. A manager who is also the owner is common in small businesses. According to research, when a company seeks funding, banks look for owner-manager characteristics, which are defined as personal characteristics that are unique to the firm's owner/manager. The characteristics include the owner's gender, race, and educational level.

5.2.1 Gender

Studies suggest the existence of gender discrimination within SMEs credit market (Hoque, Sultana and Thalil, 2016) although the number of women-led businesses is increasing. Mijid & Bernasek, (2013) stated that "If capital is rationed more for women and minority business owners than it is for white male business owners, it has been argued that capital rationing is a form of discrimination". Some evidence suggests that women-led companies have higher loan refusal rates (de Andrés, Gimeno and Mateos de Cabo, 2021), lower loan application rates (de Andrés, Gimeno and Mateos de Cabo, 2021), and they receive smaller loans than men-led companies when loans are approved. However, there are different arguments about how gender may affect credit rationing. Mijid & Bernasek, (2013) and de Andrés, Gimeno and Mateos de Cabo (2021) proposed that the higher denial rate of women-led firms mostly is due to the other characteristics related to the business rather than the result of the bank´s gender discriminatory lending system. For instance, loan denial occurs since women-owned companies usually are active in competitive industries and less profitable ones as well as they are smaller and younger firms. It turns out that women-led companies that apply for a loan in the early years of the firm´s activity are less likely to receive loans, however, this credit access gap will disappear in the next years. They also found that women appear to ration themselves rather than being discriminated against by banks (de Andrés, Gimeno and Mateos de Cabo, 2021).

5.2.2 Race

According to the literature related to SMEs, various owner characteristics such as race are relevant for credit rationing. Discrimination in credit markets would take the form of different loan approval rates or interest rates charged to groups with otherwise equal repayment ability. Furthermore, as a result of different perceived probability of approval, race impacts may be present in different application rates. The findings of (Henderson *et al.*, 2015) showed that credit scores for business startups differ depending on the owner race in a way that firms with Asian and white owners, on average, have higher credit scores than those with African American and Latino primary owners.

5.2.3 Education

It is expected that there will be a positive correlation between loan availability and managers' education levels, and thus a negative correlation between CR. A highly educated manager is assumed to reduce information asymmetry by providing their banks with more clear and more comprehensive financial information and business plans than managers with lower levels of education.

Despite this, empirical research has shown inconsistent results. Chakravarty and Xiang (2013) found that firms with more educated owners are less likely to be discouraged. However, according to a study conducted among Bangladeshis SMEs (Hoque, Sultana and Thalil, 2016), there is no link between education and credit rationing.

6 An Introduction to SMEs in the EU

6.1 The Role of SMEs in the Euro Economic

Small and medium businesses are important drivers of economic development, having a critical role in most economies around the world and Europe's economy as well. In 2020, SMEs accounted for almost 99.8% of all enterprises in the European Union (EU27). They were also responsible for approximately 65% of employment and 53% of total value added in the non-financial business economy. To put it another way, the number of SMEs in the EU27 was around 22.6 million and they provided 82.4 million jobs, resulting in a higher added value of 3.3 trillion euros to the European economy (European Commission, 2021).

The SME population is divided into three categories: micro-enterprises, small enterprises, and medium-sized enterprises. According to the definition of SMEs by European Commission, three main elements are used to differentiate them: number of employments, turnover, and balance sheet size, (see Table 2).

Table 2- SMEs Classification

Enterprise category	Employees	Turn over	Balance sheet total
Micro SME	0 to < 10	< €2 million	< €2 million
Small SME	10 to < 50	< €10 million	< €10 million
Medium-sized SME	50 to <250	< €50 million	< €43 million

Source (European Commission, 2021)

Among the SME categories, micro-sized businesses have the greatest impact on the EU SMEs performance. In 2020, the vast majority of the SME population was related to micro-sized firms with 21 million businesses (93.3%) while small SMEs accounted for only 1.2 million (5.7%), and medium-sized SMEs accounted for 0.19 million (0.9%), Figure 2. From 2008 to 2020, the proportion remained stable. However, not only the number of micro businesses was higher, but also the contribution of SMEs to the economy was driven by micro SMEs in terms of the value added and the number of employees (Figure 3 and Figure 4). Nonetheless, the difference between the SME categories regarding the value added is small. In 2020, for instance, the value added

was approximately 1.17, 1.07, and 1.08 trillion euros for micro, small, and medium-sized firms, respectively.

Furthermore, SMEs play an important role in EU innovation. Innovation is at the heart of economic growth, and since young small businesses are flexible and able to make quick decisions, they can turn new ideas into successful innovations. The EU share of innovating SMEs was 49.5% from 2014 to 2016, the most recent period for which data are available, even though the share of innovative SMEs and innovative large enterprises remains significant (77.4% of large enterprise engaged in some innovation activities) (European Commission, 2019).

As a result, statistics show that SMEs are an important part of the EU27 economic system, as they contribute significantly to job creation, poverty reduction, and overall economic growth.

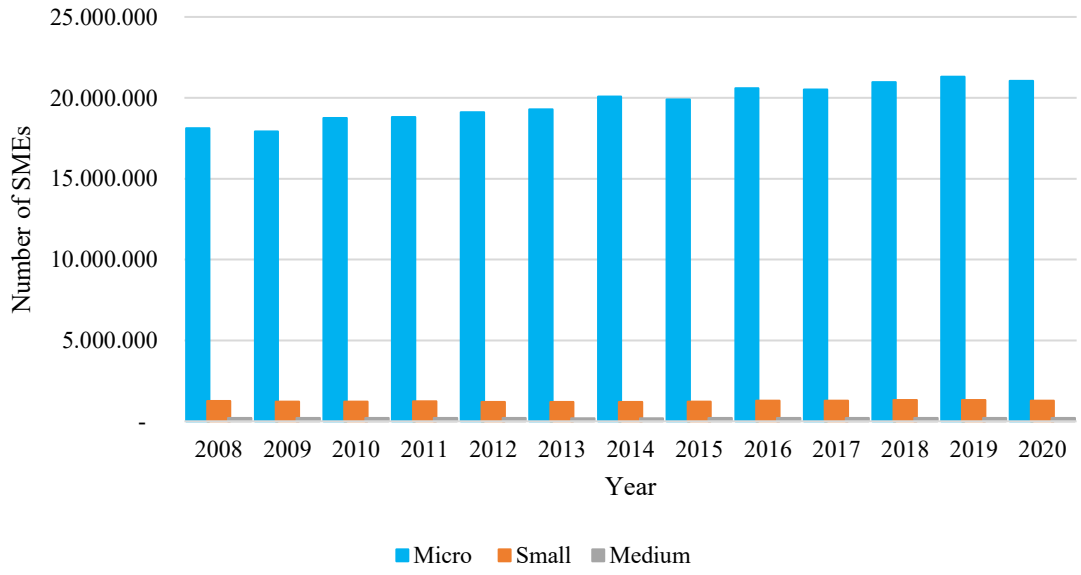

Figure 2- Number of SMEs in the European Union (EU 27) during 2008-2020
Source- European Commission- SME Performance Review 2008-2021

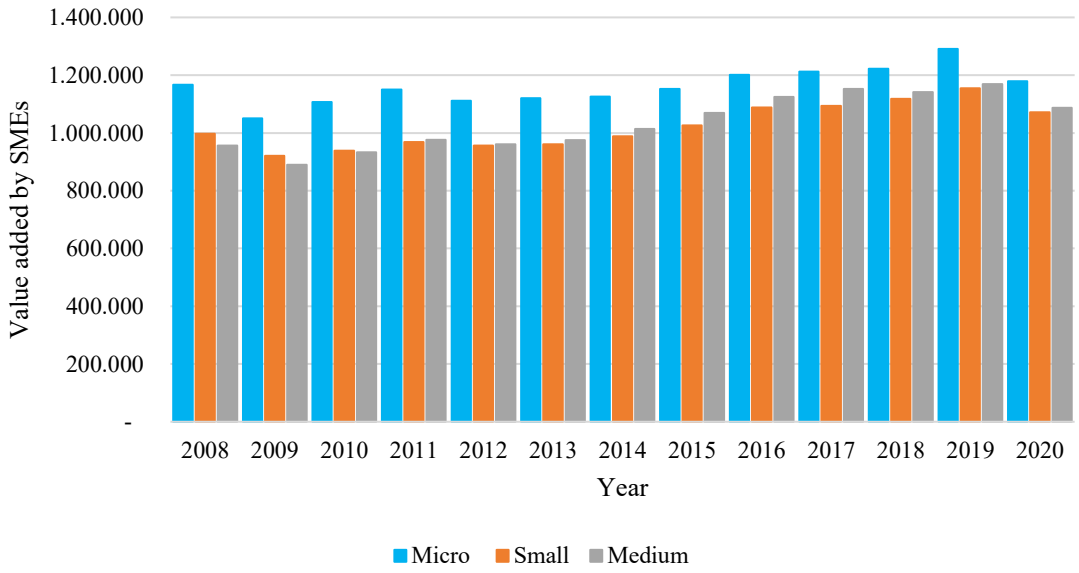

Figure 3- Value added (in million Euro) by SMEs in the European Union (EU27) 2008-2021
Source- European Commission- SME Performance Review 2008-2021

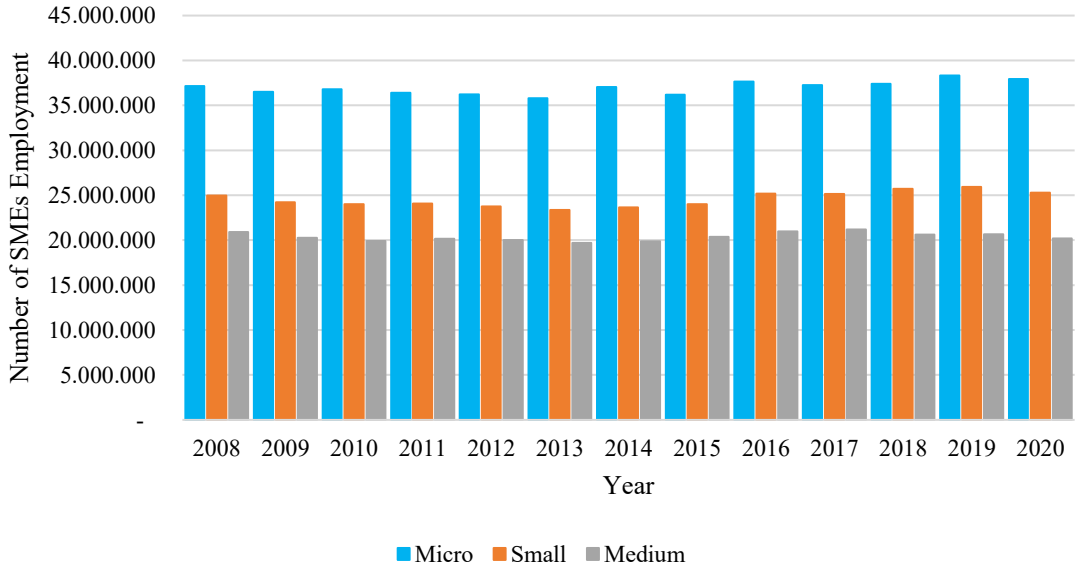

Figure 4- SMEs employment in the European Union (E27) 2008-2021
Source- European Commission- SME Performance Review 2008-2021

7 SMEs Credit Rationing in the Euro Area

7.1 Introduction

This section investigates the situation of SMEs in the euro area in terms of external funding availability and compares their situation to that of large firms. In fact, it has made an effort to properly understand the gap between bank loan demand and supply. Bank loans are the type of external funding referred to in this thesis since they are among the most significant SMEs source of external funding.

As previously stated, credit rationing can be defined from two perspectives: demand and supply. Data from bank loan applications should be examined in order to assess the demand side, explain the behavior of potential borrowers, and extract information on discouraged borrowers. Bank loan application outcomes must be studied in order to understand how banks, as the supply side, meet credit needs.

To achieve this goal, a database was required that contains required information. The SAFE survey was found to be the most relevant and comprehensive database. Therefore, contact was made with the ECB, and access to anonymous microdata from SAFE surveys conducted between 2009 and 2022 was obtained by filling out a confidentiality declaration form. Hence, all data used in this chapter, as well as all data to be used for performing regression model in Chapter 8, are derived from SAFE survey anonymous microdata.

This thesis considers three forms of credit rationing based on SAFE survey data in order to analyse credit rationing phenomenon. SAFE firm-level data provides detailed statistics on SMEs that refuse to apply for bank loans due to fear of rejection, as well as those who applied for bank loans but were rejected or only received a limited amount. As a result, three types of credit rationing are studied: self-rationing, complete credit rationing, and partial credit rationing.

In addition, important to consider that weighted variables are used for some questions in the SAFE surveys to ensure consistency across all survey rounds. In this study, the average of weighted variables is calculated and applied to data before creating graphs

for the required questions. The average weight is determined by averaging the weighting variables in the required category.

7.2 Information on SAFE Surveys

The Survey on the Access to Finance of Enterprises in the Euro area looks at what is the experience of businesses to manage their external funding requirements and how much external funding is available to them. In other words, it examines trends in the availability and need for external funding as well as recent changes to the financial status of businesses.

The SAFE data up to June 2022 consists of twenty-six waves of surveys conducted between June 2009 and April 2022. It is conducted twice a year, once by the European Central Bank covering countries in the euro area, and once in collaboration with the European Commission covering all EU countries as well as some neighboring countries. The SAFE survey takes into account all different categories of businesses in terms of their sizes- micro, small and medium-sized enterprises, as well as a small percentage of large firms.

7.1 SME Financial Sources in Euro Area

Figure 5 depicts a breakdown of SMEs' financing sources in the eurozone based on data from the SAFE survey conducted in 2021 and 2022. This graph shows that small and medium-sized businesses rely on internal and external finance sources, however, debt as external sources of finance is an important means of rising liquidity for SMEs.

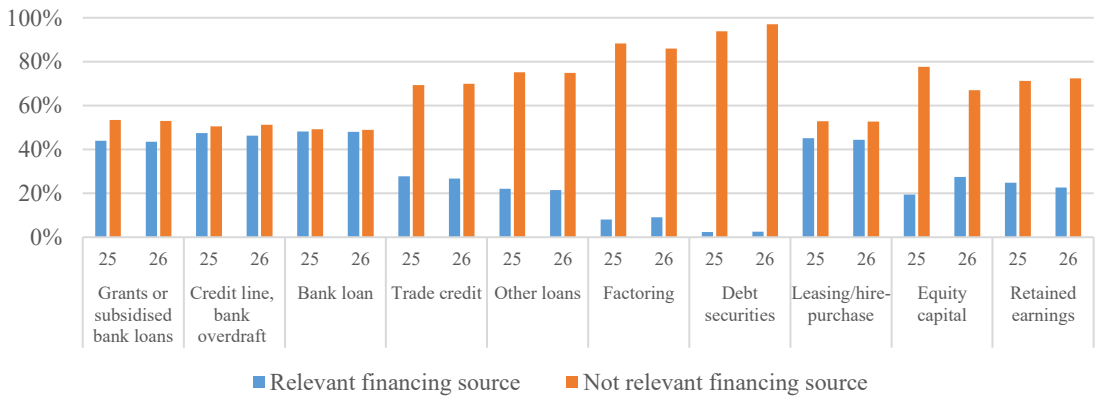

Figure 5- Financing Sources Relevant to SMEs in Euro Area
Source- SAFE Surveys Microdata related to wave 25 (2021H1) and wave 26 (2021H2). The data included in the chart refers to question 4 of the SAFE surveys

The most important sources of financing for SMEs were bank-related products and subsidized loans. According to data, SMEs reported bank loans as a relevant financing source to them with an average of 48%; and 28% among those 48% had used bank loans in the previous six months (Figure 6). Additionally, the relevance of grant or subsidized bank loans was comparable to bank loans, but still lower, at 44% on average. In 47% of cases, credit lines/bank overdrafts as short-term bank finance were relevant, leasing/hire purchase and trade credit were applicable to 44% and 27% of SMEs, respectively. The importance of other source of debts such as other loans, including loans from family, friends, or related companies, and factoring were relatively low at 13% and 9%, respectively.

In terms of equity, data demonstrate that equity capital and retained earnings played a less important role in financing than bank loans and subsidized bank loans. SMEs reported a 23% importance for equity capital and a 24% importance for retained earnings during the reference period.

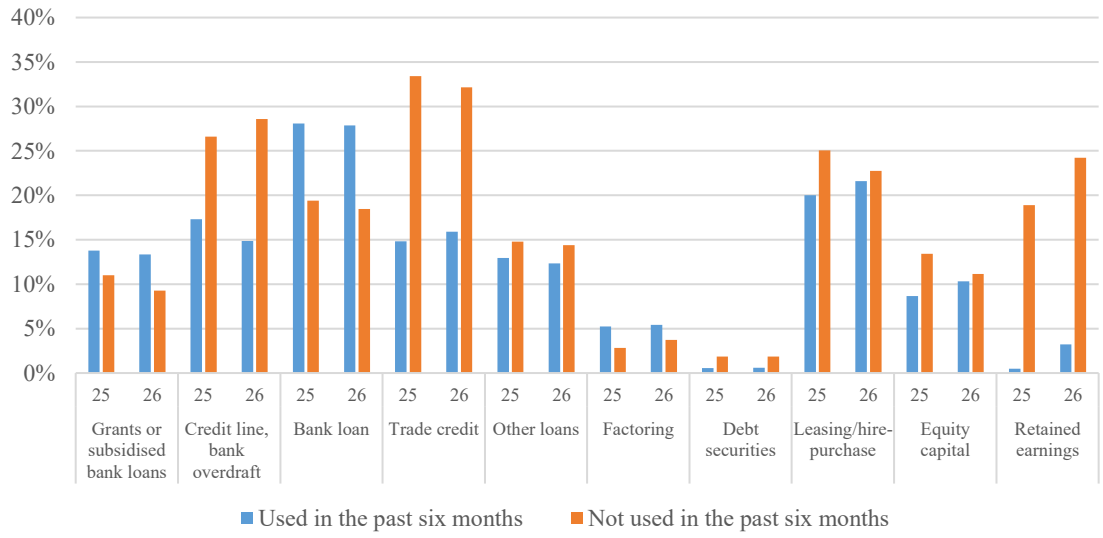

Figure 6- Usage of Financing Sources by SMEs in the Euro Area
Source- SAFE Surveys Microdata related to wave 25 (2021H1) and wave 26 (2021H2). The data included in the chart refers to question 4 of the SAFE surveys

The use of subsidized bank loans and bank loans increased as firm size increased (Figure 7). As a firm grows larger, the difference between using subsidized bank loans and bank loans rises. For micro-sized firms, subsidized bank loans (41%) were preferred over bank loans (42%), with a negligible difference between them. However, this gap increased to 9% for medium-sized firms and 19% for large firms.

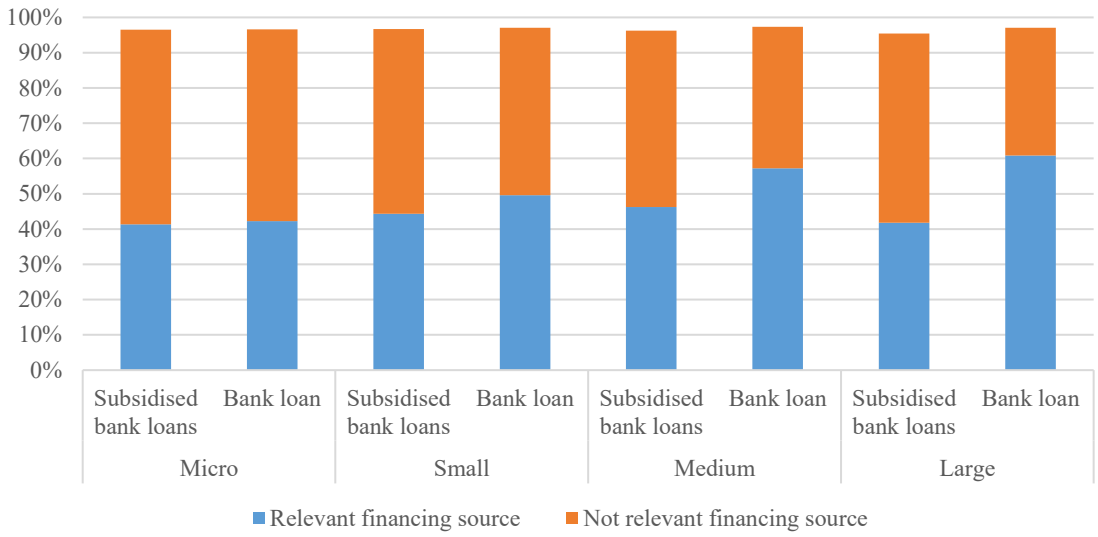

Figure 7- Use of Subsidised Bank Loans and Bank Loans by Enterprises in the Euro Area
Source- SAFE Surveys Microdata related to wave 25 (2021H1) and wave 26 (2021H2). The data included in the chart refers to question 4 of the SAFE surveys

7.2 Empirical Evidence of Credit Rationing in the Eurozone for SMEs

7.2.1 Bank Loan Applications

The tendency of SMEs to apply for bank loans is shown in Figure 8. In the most recent round of the survey, conducted in 2022, 24% of respondents stated that they requested bank loans, 46% did not apply because they had adequate internal funds, and 23% did not apply for other reasons. In fact, Eurozone SMEs reported slightly higher demand for bank financing in wave twenty-six. It is crucial to highlight that during the reference period businesses claimed that lack of skilled labour was their top concern and not lack of access to finance.

When looking at the overall trend between 2009 and 2022, it is clear that the percentage of SMEs that requested bank loans varied year to year, but not significantly. Nearly one-third of respondents (28% on average) applied for bank loans. A higher percentage of SMEs chose not to apply for bank loans due to having sufficient internal funds as well as other factors. It can be seen that there was a considerable difference between the percentage of SMEs that applied for bank loans and those that did not because of available sufficient internal funds over this period.

However, in wave twenty-three of the survey, which took place in September-October 2020, the gap between the percentage of SMEs that applied for bank loans and those that used internal funds was eliminated for the first time. In addition, the highest percentage of bank loan applications was observed in this wave.

This shift in trend was caused by the situation of SMEs during the COVID-19 pandemic, when bank loan demand increased more than usual. This increased demand could be traced back to the main stated concern of SMEs at the time, which was difficulty in finding customers, resulting in fewer sale and thus a revenue shortfall. As a result of an uncertain economic outlook, it was prudent for SMEs to build liquidity buffers through bank funding. This trend, as shown in Figure 9, did not last long, and again there was soon a considerable gap between the percentage of SMEs who applied for bank loans and those who did not because of having sufficient internal funds.

Besides, it is interesting to note that the average percentage of SMEs who avoid applying for bank loans due to their fear that they may be rejected (discouraged borrowers) was fluctuating around 6% from 2009 to 2022. In wave eleven, self-rationing among SMEs reached a peak of almost 9% and bottomed at 3.5% in wave twenty-three. There has not been a declining pattern over this time, though.

Respondents were also asked if there were any other reasons why they did not apply for bank loans. Figure 9 shows that the percentage of SMEs who did not apply for bank loans due to other factors fluctuated around 23%, which is considerably lower than the rate of SMEs who did not apply because of sufficient internal funds, however, it is identical to the percentage of SMEs who applied for bank loans.

Respondents were questioned regarding the causes of their refusal to apply for bank loans, and this subject is further discussed in detail.

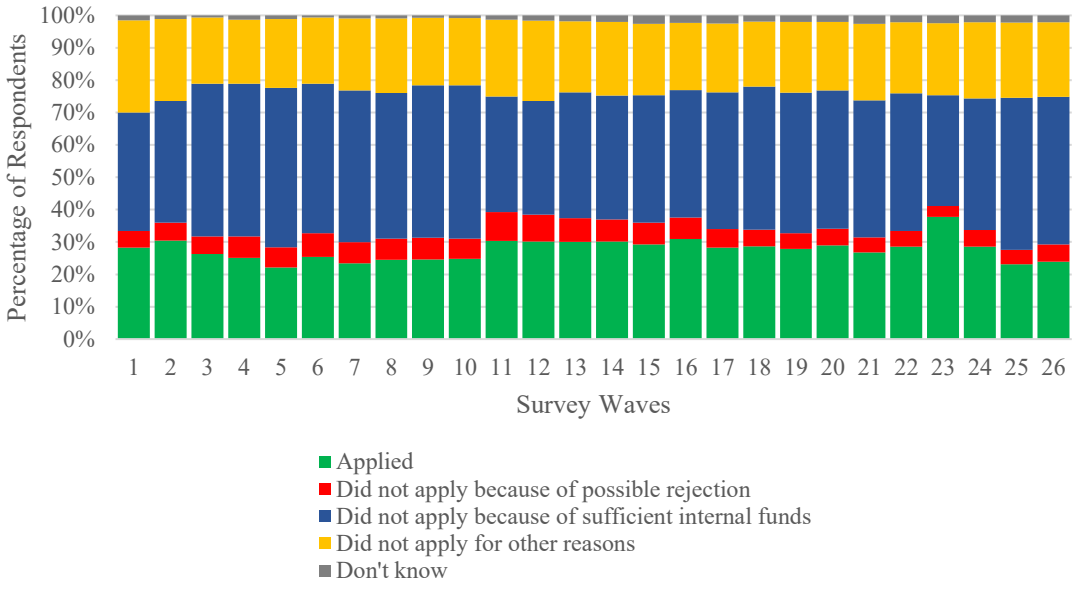

Figure 8- Applications for Bank Loan by SMEs in the Euro Area
Source- SAFE Surveys Microdata related to wave 1 (2009H1) to wave 26 (2021H2). The data included in the chart refers to question 7A-a of the SAFE surveys

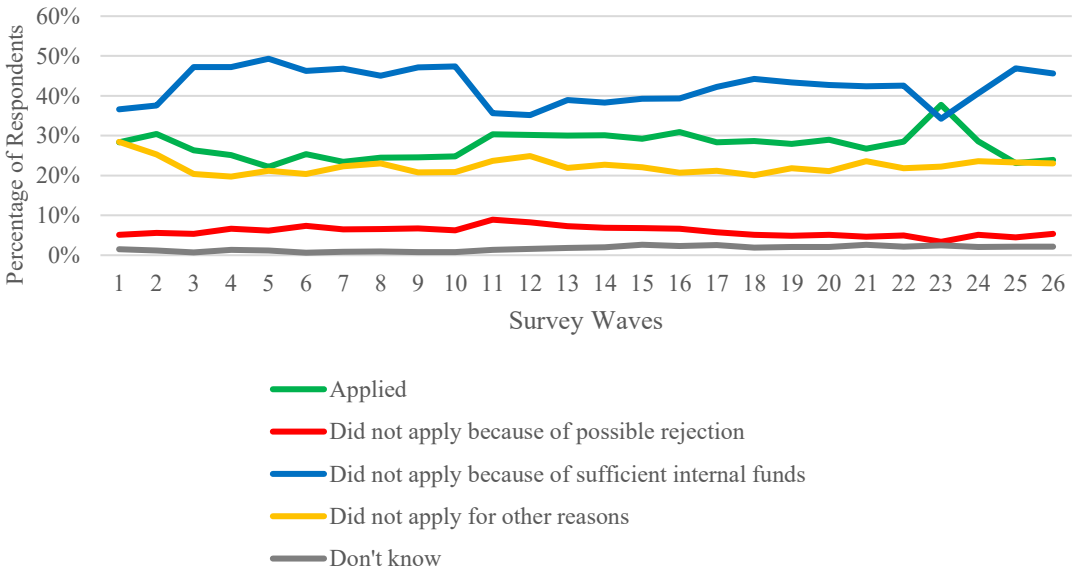

Figure 9- A line Chart of Applications for Bank Loan by SMEs in the Euro Area
Source- SAFE Surveys Microdata related to wave 1 (2009H1) to wave 26 (2021H2). The data included in the chart refers to question 7A-a of the SAFE surveys

Additionally, the rate of bank loan applications for SMEs is not the same in all euro countries, with some countries experiencing higher rates than others (Figure 10). According to data from 2019 to 2022, SMEs in Italy, France, and Belgium requested more bank financing. Although it is important to point out that in most euro countries the rate of bank loan application increased immediately at the beginning of the Covid-19 pandemic, with Greece, Portugal, and Italy having the greatest difference in bank loan demands in wave twenty-three, start of the pandemic than before the pandemic.

Bank loan applications rate in Greece increased by 96%, while applications in Portugal and Italy increased by 37% and 32%, respectively. This rate, however, fell again in the six months that followed.

In the last round of the survey, which was conducted in 2022, some countries experienced an increase in bank loan demands, while others did not. Germany, France, and Belgium all saw a comparable percentage of increase. Bank loan applications increased from around 19% to 22% in Germany, 30% to 33% in France, and 35% to 39% in Belgium. While there was a decrease in Austria, Spain, Greece, and Ireland. Furthermore, data from all SMEs showed a slight increase of 1% (Figure 8).

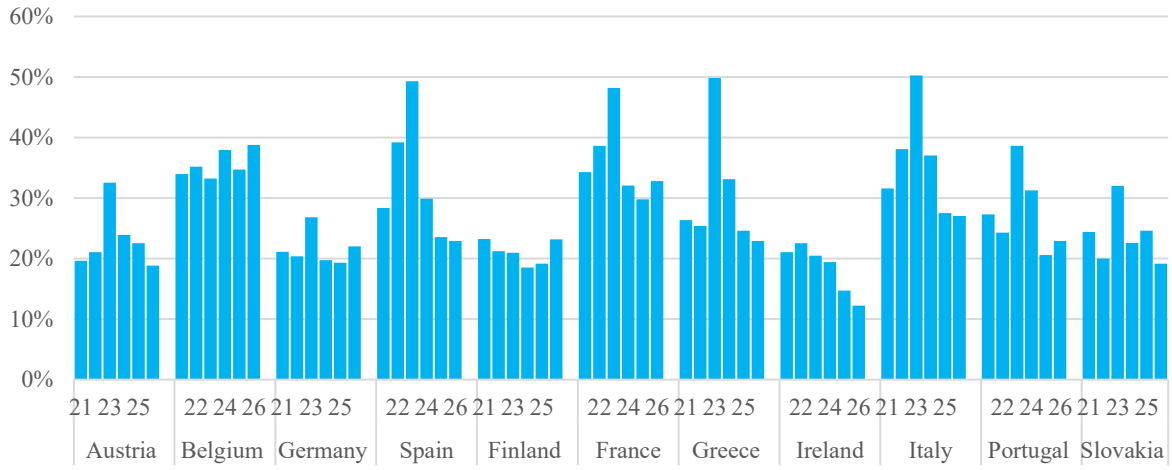

Figure 10- Filled Applications for Bank Loan by SMEs in the Euro Area per Country
Source- SAFE Surveys Microdata related to wave 21 (2019H1) to wave 26 (2021H2). The data included in the chart refers to question 7A-a of the SAFE surveys

Another significant point is the statistic of discouraged borrowers per country, as shown in Figure 11. Greece, in stark contrast to other countries, was at the top of the list of countries that had discouraged borrowers. From 2019 to 2021, the percentage of discouraged borrowers in Greece was greater than 10%, which is higher than the average rate in the eurozone (nearly 4.5%) over this period. Following 2019, the percentage of discouraged borrower that was greater than 15% decreased, but this rate increased again and increased slightly from 14% to 14.5% in the last round of the survey. Meanwhile, there was no clear trend in this rate in other countries. But, in the two last rounds of SAFE survey, Spain, France, Portugal and Slovakia had a higher rate of discouraged borrowers, with more than 4%.

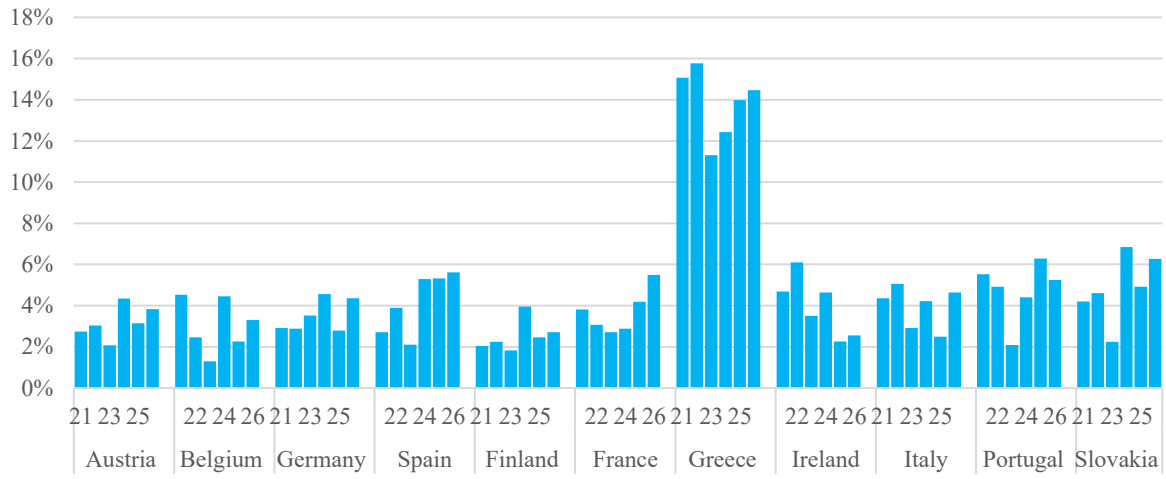

Figure 11- Discouraged borrowers for SMEs in the Euro Area per Country
Source- Surveys Microdata related to wave 21 (2019H1) to wave 26 (2021H2). The data included in the chart refers to question 7A-a of the SAFE surveys

7.2.2 Outcomes of Bank Loan Applications

Figure 12 depicts the outcome of bank loan applications, showing that the percentage of SMEs who applied for bank loans and received everything increased from 61.5% in 2009 to 77% in 2022. With 80%, wave eighteen had he highest percentage. However, when all firms, including SMEs and large firms, are considered, this increasing trend is seen at slightly higher rates; Figure 13 shows that the rate was 79% in 2022. Additionally, the percentage of those who received the majority of the requested loan (received 75% or more) was also not particularly low, averaging around 8%.

In Figure 14, data of bank loan applications from 2019 to 2022 is aggregated and it is shown that more than 76% of loan applicants received everything, nearly 7.5% received most of it, but 6% of SMEs received only a limited portion of the requested loan and more than 6% of applications were rejected. Nevertheless, data for large firms revealed that their loan requirements were fully satisfied 1.5 times more frequently than SMEs (85.2%) and, on the other hand, their loan applications were denied three times less frequently than those of SMEs. It indicated that SMEs are less likely than large firms to be able to obtain bank loans; instead, they should rely on internal funds to run their businesses.

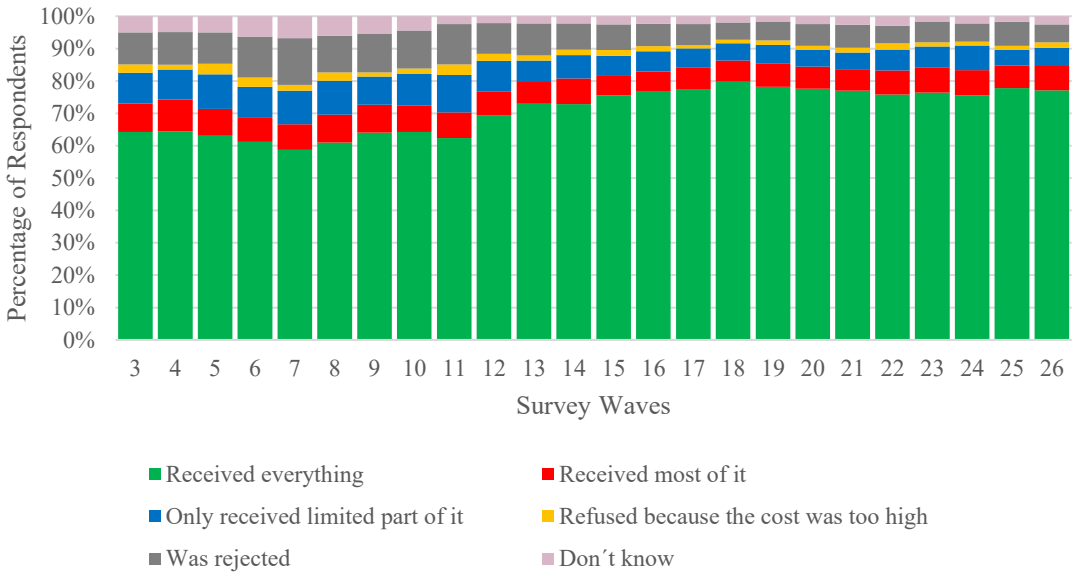

Figure 12- Outcome of Applications for Bank Loan by SMEs in the Euro Area
Source- SAFE Surveys Microdata related to wave 3 (2010H1) to wave 26 (2021H2). The data included in the chart refers to question 7B-a of the questionnaires. Respondents replying with "Application is still pending" are excluded to all rounds of the survey be consistent. As the item "Application is still pending" was added from wave 11 on (round 2014H1)

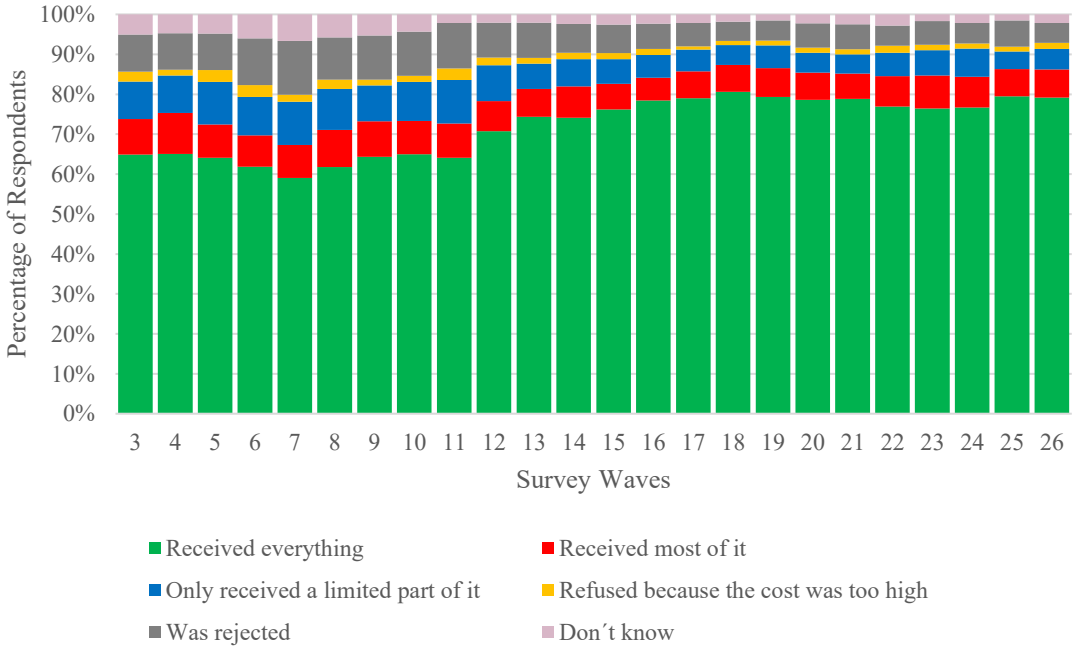

Figure 13- Outcome of Applications for Bank Loan by All Firms in the Euro area
Source- SAFE Surveys Microdata related to wave 3 (2010H1) to wave 26 (2021H2). The data included in the chart refers to question 7B-a of the questionnaires

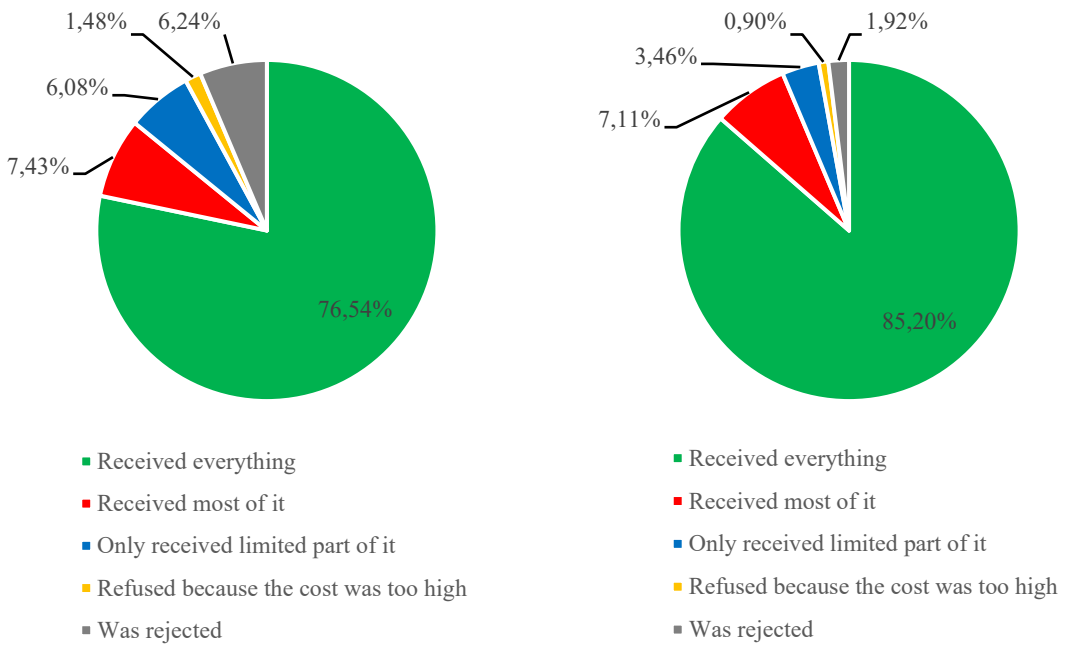

Figure 14- Aggregated Data of Loan Application Outcomes for SMEs (the right one) and large firms (the left one) over years 2019 to 2021
Source- SAFE Surveys Microdata related to wave 21 (2019H1) to wave 26 (2021H2). The data included in the chart refers to question 7B-a of the questionnaires

To be more precise, country-specific data from SMEs that applied for and successfully obtained bank loans is examined. Austria, Belgium, Germany, Finland, and France all had percentages of SMEs applying for and fully receiving bank loans higher than 70%, with France in most cases exceeding 80%, according to data from 2019 to 2021 (Figure 15). Since 2020, Italy and Portugal have had a high percentage of fully accepted bank loan applications, with around 70%.

Greece, on the other hand, had the lowest percentage of applications that were completely approved. This percentage was around 30% in some years. However, in the final round of the survey, it increased from 33% to 49%. Therefore, according to data thus far explained, Greece had the highest percentage of discouraged borrowers and the lowest percentage of fully accepted loan applications among eurozone countries. Figure 16 shows that Greece had also the highest percentage of rejected loan applications from 2019 to 2021.

On the other hand, Austria had a significantly low rejection rate of 3% in the latest round of the survey, France comes in second, and Italy and Germany can be considered third. In the reference round, nearly 5% of loan applications from Italy were denied, up

from 2.8% in wave twenty-five. However, the average rejection rate in Italy from 2019 to 2022 was less than 5%.

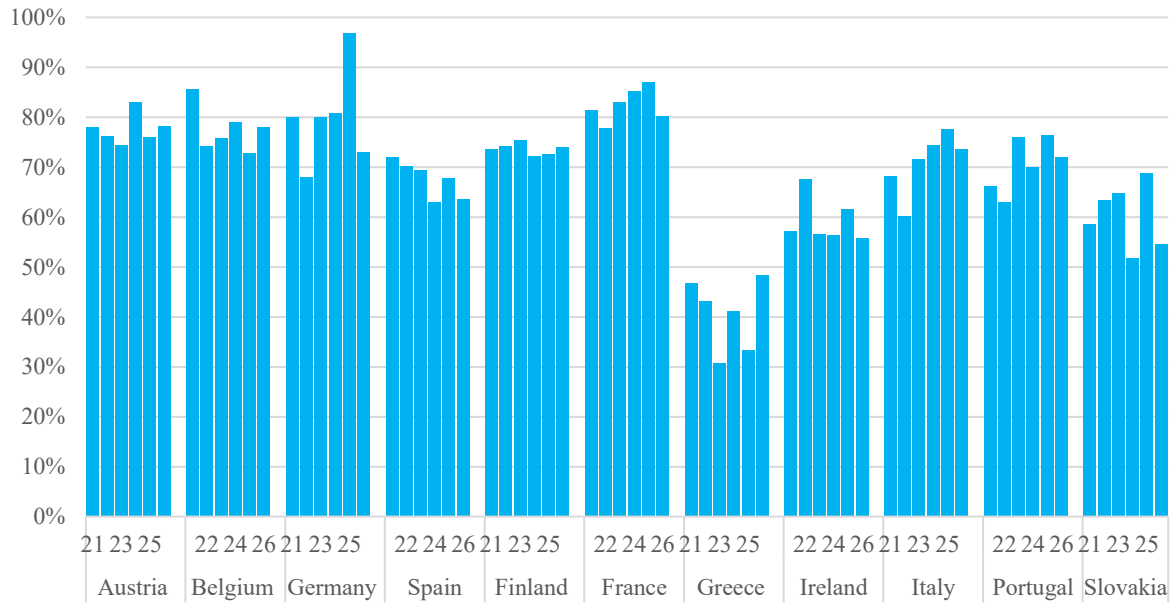

Figure 15- SMEs who applied for bank loans and received everything in the Euro Area per Country
Source- SAFE Surveys Microdata related to wave 21 (2019H1) to wave 26 (2021H2). The data included in the chart refers to question 7B-a of the questionnaires

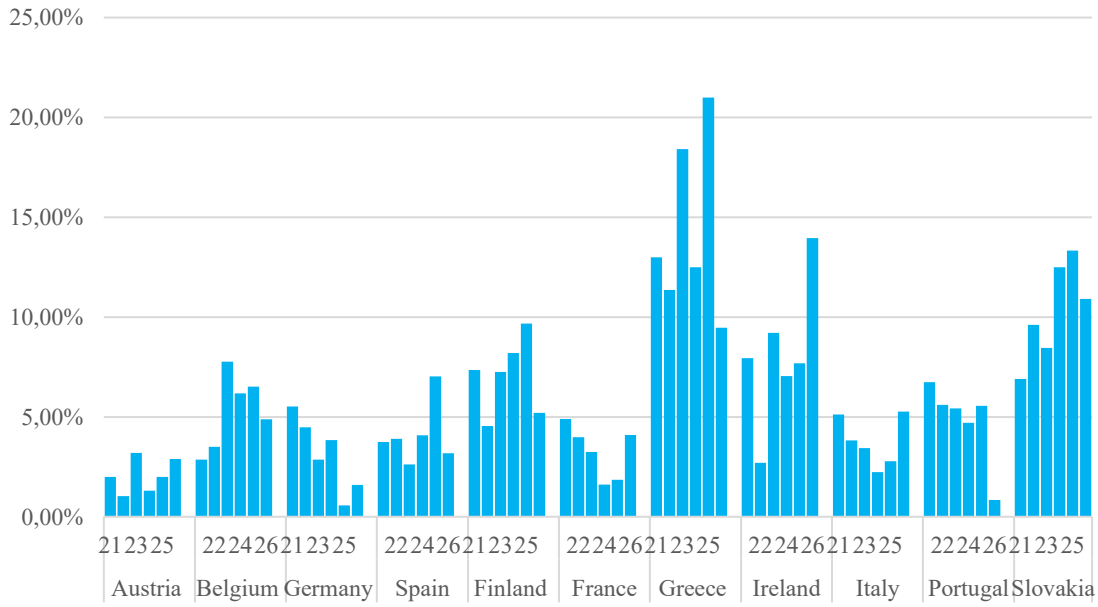

Figure 16- SMEs who applied for bank loans and was rejected in the Euro Area per Country
Source- SAFE Surveys Microdata related to wave 21 (2019H1) to wave 26 (2021H2). The data included in the chart refers to question 7B-a of the questionnaires

7.2.3 The Credit Rationing Rate Among SMEs

To summarize, the extent of credit rationing can be depicted in the following graphs (Figure 17, Figure 18), which include the percentage of firms that were completely credit rationed (their bank loan application was rejected), partially credit rationed (they only obtained a limited portion of the bank loan they requested), and self-rationed (they did not apply for bank loan because of possible rejection).

In general, credit rationing was more prevalent among SMEs than large firms. The results show that as firm size increases, the likelihood of being completely credit rationed decreases, as seen in Figure 18 and Figure 19. When comparing the rejection rates of SMEs and large firms, SMEs bank loan applications are more likely to be completely credit rationed than large firms.

From 2010 to 2022, SMEs and large firms reporting a declining rate of complete credit rationing, yet there was a considerable gap between them. Over this time, SMEs experienced complete credit rationing at a rate that was over three times higher than that of large firms, with average rates of 8.7% and 2.6%, respectively.

In the most recent round of the survey, however, the percentage of SMEs rejected was four times higher than large firms, at around 6% for SMEs and 1.5% for large firms. Furthermore, the difference between self-rationed SMEs and large firm is also significant; while the rate for SMEs was, on average, 6%, it was only 2.4% for large firms from 2010 to 2022 (2.5 times greater).

In addition, three different categories of SMEs all showed an inverse correlation between firm size and rejection rate. The highest rejection rate (complete credit rationing) was related to micro firms and small firms had the higher rejection rates in comparison to medium firms (Figure 19). However, rejection rates for all three types of SMEs decreased. In 2022, the percentage of complete credit rationing related to micro,

small, and medium firms was 9%, 5.5% and 3.5%, respectively. This means that the rejection rate for micro-sized firms was 2.5 times greater than for medium-sized firms.

Micro-sized firms also had the highest rate of self-rationing, followed by small and medium-sized firms. The proportion of self-rationed micro, small, and medium firms in the final round of the survey were 7.7 %, 4.5%, and 2.6%, respectively.

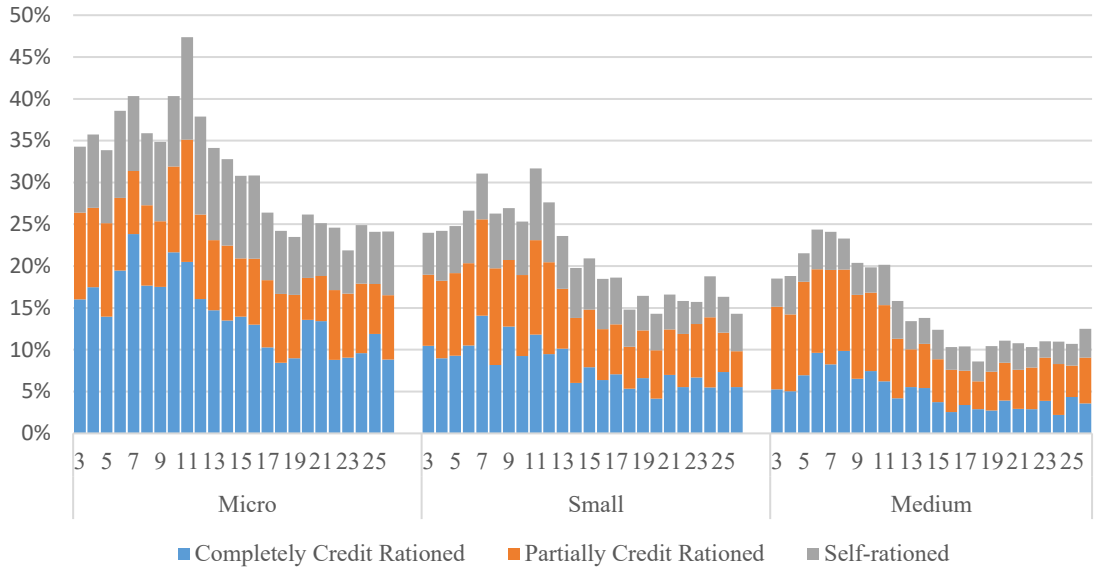

Figure 17- Credit Rationed SMEs in the Euro Area
Source- SAFE Surveys Microdata related to wave 3 to wave 26. The data included in the chart refers to questions 7A-a and 7B-a of the survey

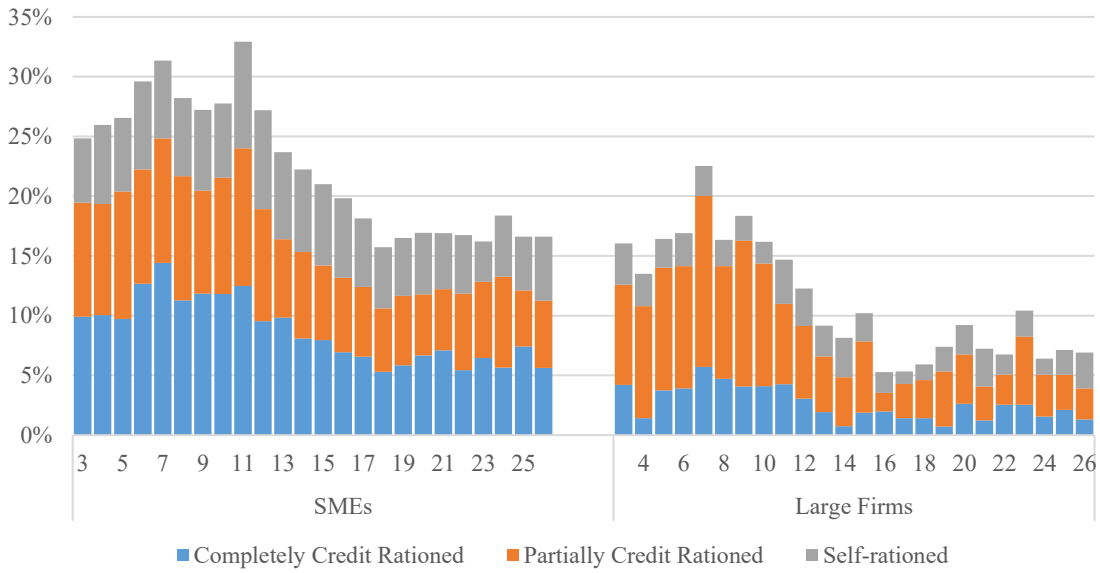

Figure 18- A Comparison of Credit Rationed SMEs with Large Firms in the Euro Area
Source- SAFE Surveys Microdata related to wave 3 to wave 26. The data included in the chart refers to questions 7A-a and 7B-a of the survey

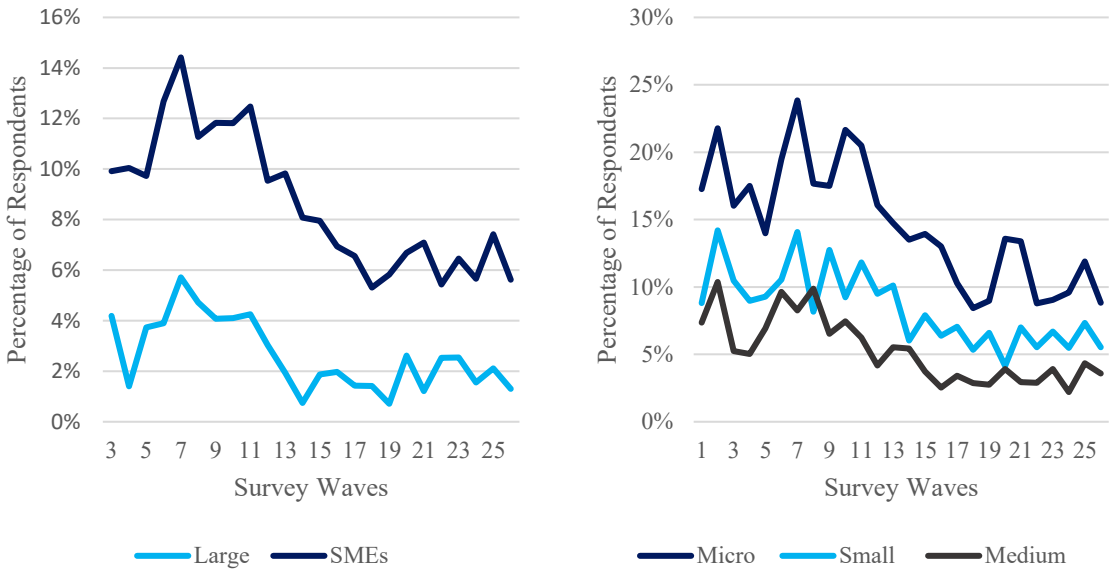

Figure 19- The Percentage of Rejected Loan Applications of SMEs and Large Firms
Source- SAFE Surveys Microdata related to wave 1 (2009H1) to wave 26 (2021H2). The data included in the chart refers to question 7B-a of the survey

7.3 Why do Firms not Consider Bank Loans to be Relevant to their Enterprises?

In response to the question of whether firms applied for bank loans in the previous six months, a significant proportion of respondents stated that they did not apply for bank loans for other reasons or refused a bank loan because the cost was too high, aside from fear of rejection or having available internal funds. In addition, the proportion of this group of respondents was comparable to the proportion of firms that applied for bank loans, indicating the importance of focusing on the reasons that led to the firm's decision.

One of these reasons can be insufficient collateral or guarantee particularly for smaller firms. As Figure 20 illustrates there is a significant difference between SMEs and large firms in terms of their inability to obtain loans due to a lack of collateral. Asymmetric information typically led SMEs to be viewed as a high-risk group by commercial banks. In addition, banks frequently demand some kind of collateral to alleviate the asymmetric information. Therefore, if a firm does not have enough of the right type of collateral a bank has less incentive to extend credit and may reject the requested loan application.

In 2022, wave twenty-six of the survey, 3.2% of SMEs stated insufficient collateral as one of the reasons they did not consider bank loans relevant to their businesses. However, this rate was only 0.85% for large firms, which was about four times lower than it was for SMEs.

As expected, this trend can be also seen among three different types of SMEs, as shown in Figure 21, where the role of collateral in not applying for a bank loan was less important in the case of medium-sized firms versus micro and small firms. The rate for micro-sized firms (3%) was three times higher than the rate for medium-sized firms (1%) in the most recent survey round, and it was more than three times higher (4%) for small firms compared to medium-sized firms. From 2019 to 2022, the reported rates of net change for micro and small businesses were comparable, with small businesses reporting slightly higher rates in some rounds.

A high loan interest rate stated even as more critical reason than a lack of collateral. It was earlier demonstrated in Figure 12 that the percentage of those SMEs who refused loans due to their high cost was not significant compared to other outcomes of bank loan applications. Due to the high lending costs, the average rate of loan refusal on the demand side from 2009 to 2021 was 2%. Additionally, it has been declining over this period, falling from 3.3% in 2009 to 1.7% in 2022. This data does not, however, contradict the view that a high interest rate or a high price is the most significant factor preventing SMEs from considering bank loans that are beneficial to their businesses. Micro-sized firms were the ones most affected by this problem. While all SMEs reported a rate under 8% from 2019 to 2022, the rate for micro-sized businesses fluctuated about 10%, peaking at 11% in round twenty-three as bank loan applications from all type of businesses rose dramatically as a result of the Covid-19 pandemic.

Another reason SMEs did not view bank loans as a useful way to increase liquidity was the need for excessive paperwork. Even though it might surprise us to learn this, it does occur. Firms frequently feel confused by the long list of necessary supporting documents and the challenging loan application process. From business plan, tax returns, bank statements to financial statements, legal documents and so on. Between

2019 and 2022, the related rate averaged around 3%. The final round of the survey saw a slight decrease from 3.2% to 2.9%.

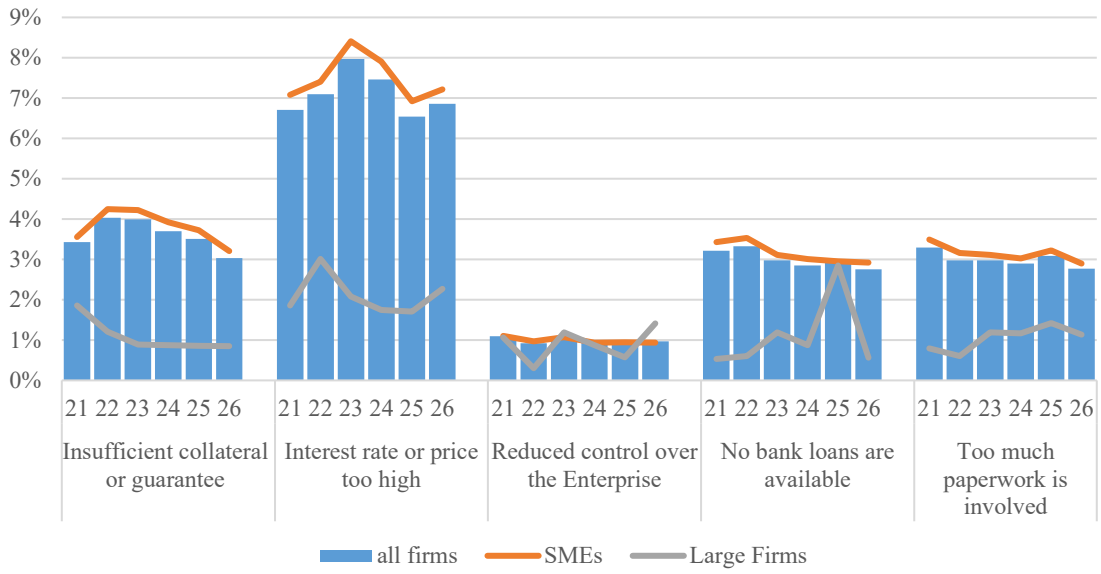

Figure 20- Reasons Why Firms did not consider Bank Loans relevant to their Enterprises among SMEs and Large Firms
Source- SAFE Surveys microdata related to wave 21 (2019H1) to wave 26 (2021H2). The data included in the chart refer to question 32 of the survey

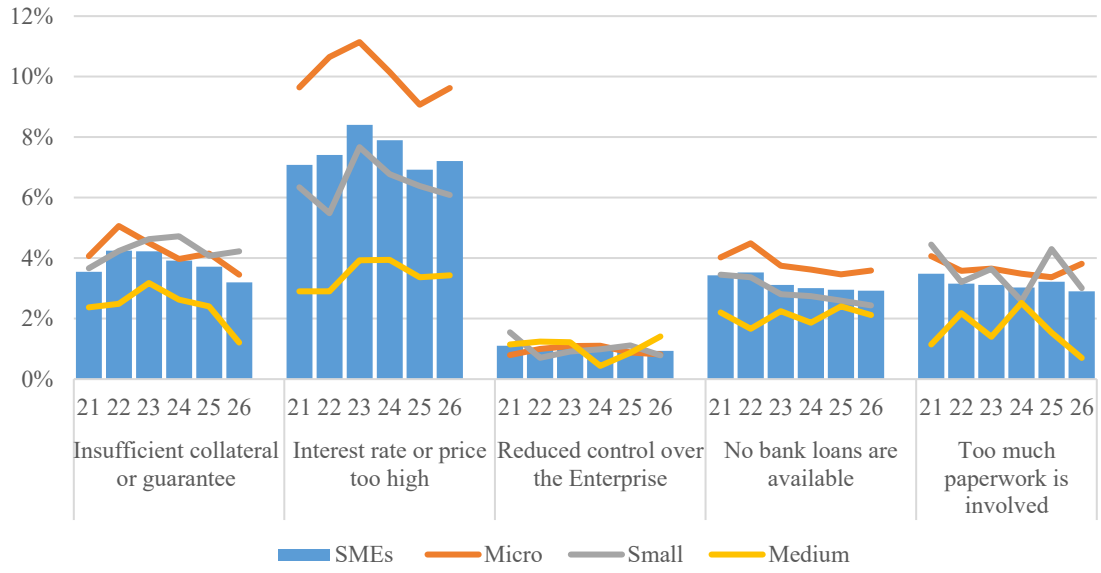

Figure 21- Reasons Why Firms did not consider Bank Loans relevant to their Enterprises among SMEs
Source- SAFE Surveys microdata related to wave 21 (2019H1) to wave 26 (2021H2). The data included in the chart refers to question 32 of the survey

Furthermore, it can provide a more comprehensive view by examining the net percentage changes in collateral requirements and interest rate levels. Figure 22 represents that banks demand more collateral from firms and this requirement was stricter among SMEs. While SMEs reported a 15% rise in wave twenty-six, large firms

observed a 9% increase. Their gap, though, is lower in case of changes in interest rate level. In this survey round, the net percentage of change increased significantly from 4% to 33% for SMEs and from 4% to 35% for large firms. This increase had not been seen in previous survey rounds, however, according to the ECB "the very high percentage is consistent with the recent net widening of margins applied to bank loans, also reported by banks in the April 2022".

Among the largest eurozone countries, SMEs in Finland, Belgium, France, and Italy reported higher growth rates in collateral requirements, with Finland displaying the highest rate at 28%, Italy having the lowest at 14%, and Belgium and France experiencing 23% and 19%, respectively. In addition, SMEs in Italy and Portugal reported the lowest rate of increase over this period among countries depicted in Figure 23.

Besides, these countries experienced a high percentage of rise in interest rate levels as previously observed in case of SMEs statistics as a whole in 2022. But, in Figure 24, the attention should be paid to Greece as having negative percentage of net interest rate change from 2019 to 2022, with the exception of wave 26. However, its collateral requirement was always increasing. The terms of bank loans made available to Greek SMEs can be critical as earlier it was noted that Greece experienced a higher percentage of credit rationing than other countries studied.

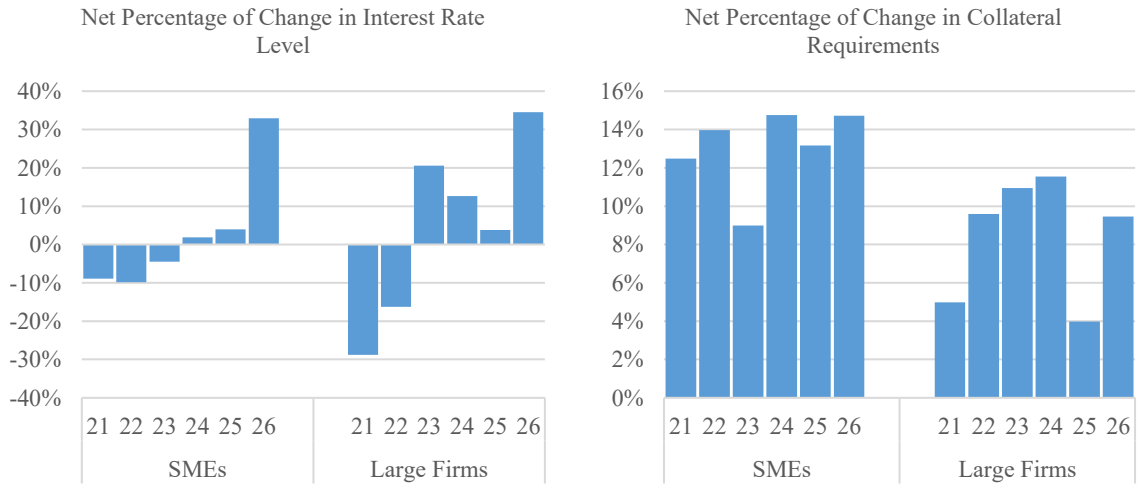

Figure 22- Net Percentage of Changes in the terms and conditions of Bank Financing for Euro Area Enterprises
Source- SAFE Surveys microdata related to wave 21 (2019H1) to wave 26 (2021H2). The data included in the chart refers to question 10 of the survey

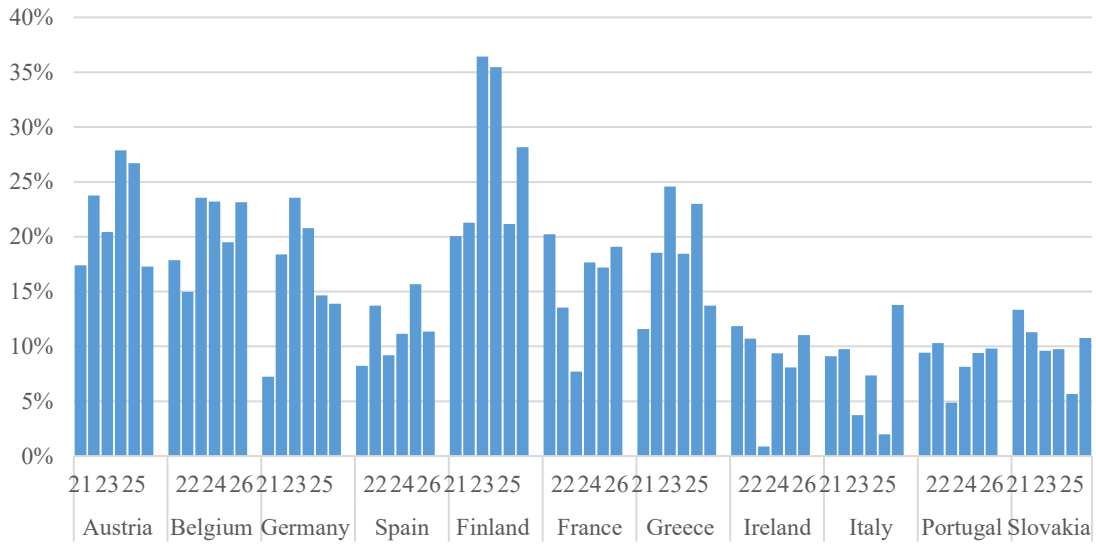

Figure 23- Net Percentage of Changes in collateral requirements of Bank Financing among SMEs per Country
Source- SAFE Surveys microdata related to wave 21 (2019H1) to wave 26 (2021H2). The data included in the chart refers to question 10 of the survey

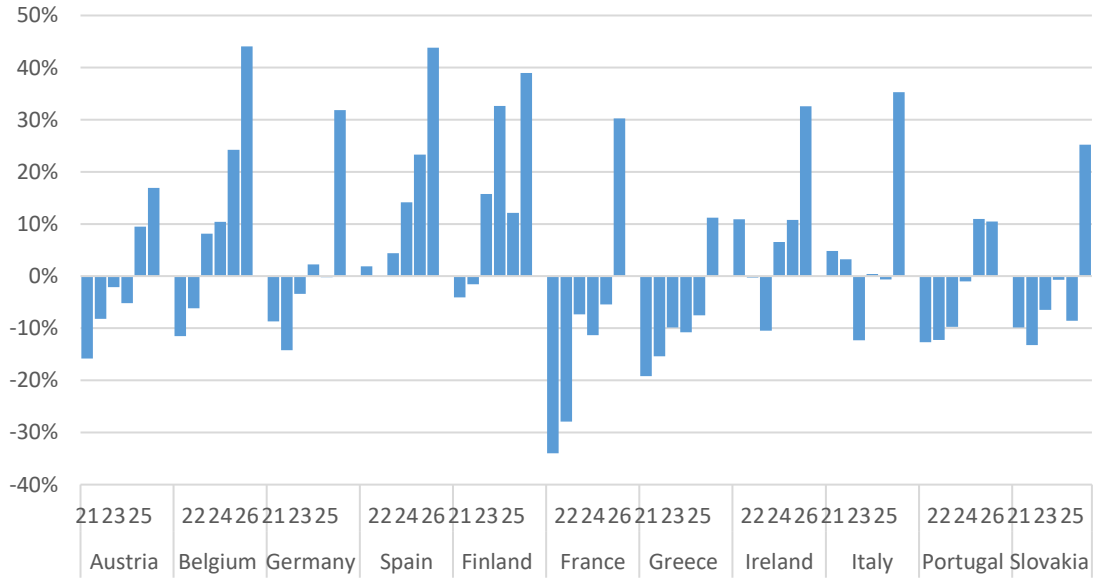

Figure 24- Net Percentage of Changes in interest rate of Bank Financing among SMEs per Country
Source- SAFE Surveys microdata related to wave 21 (2019H1) to wave 26 (2021H2). The data included in the chart refers to question 10 of the survey

7.4 Summary of Descriptive Analysis

Small and medium-sized firms (SMEs) make up more than 99% of all businesses in the EU, contribute to half of the GDP, and account for two-thirds of all jobs. This highlights how important it is to consider their financial accessibility in order to ensure that they can develop and thrive.

Bank loans are cited as one of the primary sources of external funding for SMEs. They, however, have more difficulty accessing bank finance than larger firms due to their size and its consequences. Smaller businesses, in general, face greater information asymmetry with banks, and in order to narrow this information gap, they are unable to provide the required collateral or cannot afford to pay the interest rate. Even though, eurozone policies aim to make it easier for SMEs to obtain bank loans.

According to analysis, access to finance for eurozone SMEs has improved from 2010 to 2022, particularly since 2014, as a result of looser monetary policy and more supportive bank capital regulations. Statistics indicate that a significant number of SMEs that asked for bank loans either got everything they asked for or got more than 75%. According to survey results from 2022, 83% of SMEs received all or most of the loans they requested. However, there is still potential for improvement as still many SMEs experience credit rationing and face bank denials. It can also be seen that self-rationing is not negligible, and, more importantly, the percentage of SMEs who did not apply for bank loans due to possible rejection has not decreased over the reference period.

Credit rationing may occur at varying rates among countries. According to analysis, either in the form of self-rationing or complete CR, Greece experienced higher levels. However, its number of filled bank loan applications was not significantly lower than in other countries, and Greece was among countries that had a strong increase in bank loan demand during the start of the Covid-19 pandemic. This condition may be caused by a variety of circumstances, but the economic strength of countries may have a significant role. For instance, Greece's GDP is lower than average (Statista, 2021).

8 Determinants of Credit Rationing Based on Empirical Data

8.1 Introduction

The last chapter examined empirical data on credit rationing among SMEs in the Eurozone using SAFE surveys. In fact, it was determined how the extent of credit rationing differs between different types of firms and countries, as well as how the difference is. However, it is still unclear which factors play a significant role in determining different credit rationing forms. It is also necessary to determine whether there are any credit rationing determinants (identified in the empirical model of this study) which do not have a significant relationship with credit rationing and can therefore be excluded.

To begin, it should be noted that this thesis considers three forms of credit rationing based on SAFE survey data in order to analyze the credit rationing phenomenon. Complete credit rationing, partial credit rationing and self-ratioing are the three types of credit rationing studied. Their definition are as follows, Table 3.

Table 3- Definitions of Three Forms of Credit Rationing Investigated in this Thesis

Credit Rationing form	Definition
Complete credit ratioing	It occurs when firms applied for bank loans but were completely rejected
Partial credit ratioing	It occurs when firms applied for bank loans but only received a limited amount (75% or less of the amount asked)
Self-ratioing	It occurs when firms refused to apply for bank loans for fear of being rejected

This section addresses the stated issues by running a regression model on micro-level data from the SAFE survey to identify determinants of credit rationing for Euro area SMEs. In accordance with the type of dependent variable in this study, which has three categories, multinomial logistic regression model should be employed. Before going through the regression analysis and explaining data selection considerations in the following section, a brief explanation of the selected regression model will be provided.

8.2 An Overview on Multinomial Logistic Regression Model

Multinomial logistic regression (often just called multinomial regression) is a classification method in statistics that extends logistic regression to problems with more than two discrete outcomes. In other words, it is a model used to predict the probabilities of various outcomes of a categorically distributed dependent variable, nominal variable, given a set of independent variables (which may be nominal, ordinal and/or continuous independent variables). It is a particular solution to classification problem that estimates the probability of each particular value of the dependent variable using a linear combination of the observed features and some problem-specific parameters.

The multinomial logistic model assumes case-specific data, which means that each independent variable has a single value for each case. It also assumes that in any given case, the dependent variable cannot be perfectly predicted from the independent variables. There is no requirement that the independent variables be statistically independent of one another; however, collinearity is assumed to be low. When independent variables are highly correlated, the regression model is unable to accurately associate which independent variable contributes to the explanation of the dependent variable, resulting in confused results and incorrect inferences. There are two ways to check for multicollinearity: correlation coefficients and variance inflation factor (VIF) values.

Multinomial regression is to build a linear predictor function that generates a score by linearly combining a set of weights with the explanatory variables of a given observation using a dot product:

$$\text{Score}(X_i, k) = ß_k \cdot X_i, \qquad (7.1)$$

where X_i is the vector of explanatory variables describing observation i, $ß_k$ is a vector of weights (or regression coefficients) corresponding to outcome k, and score (X_i, k) is the score associated with assigning observation i to category k. The highest score shows the predicted outcome.

The procedure for determining the optimal weights/coefficients and the way the score is interpreted are what distinguishes the multinomial logit model from numerous other

methods, models and algorithms with the same basic setup (the perceptron algorithm, support vector machines, linear discriminant analysis, and so on). In particular, in the multinomial logit model, the score can be directly converted to a probability value, indicating the likelihood of observation i selecting outcome k given the observed characteristics.

In the multinomial logit model, one outcome group is used as the "reference group" (also known as a base category), and the coefficients for all other outcome groups describe how the independent variables are related to the probability of being in that outcome group compared the reference group. In other words, regression models are run for each outcome level and compared it to the reference category (El-Habil, 2012).

8.3 Empirical Model

The CR determinants discovered through the literature review are tailored to the available data from the SAFE survey in this section. Figure 25 depicts the final determinants under consideration in this thesis.

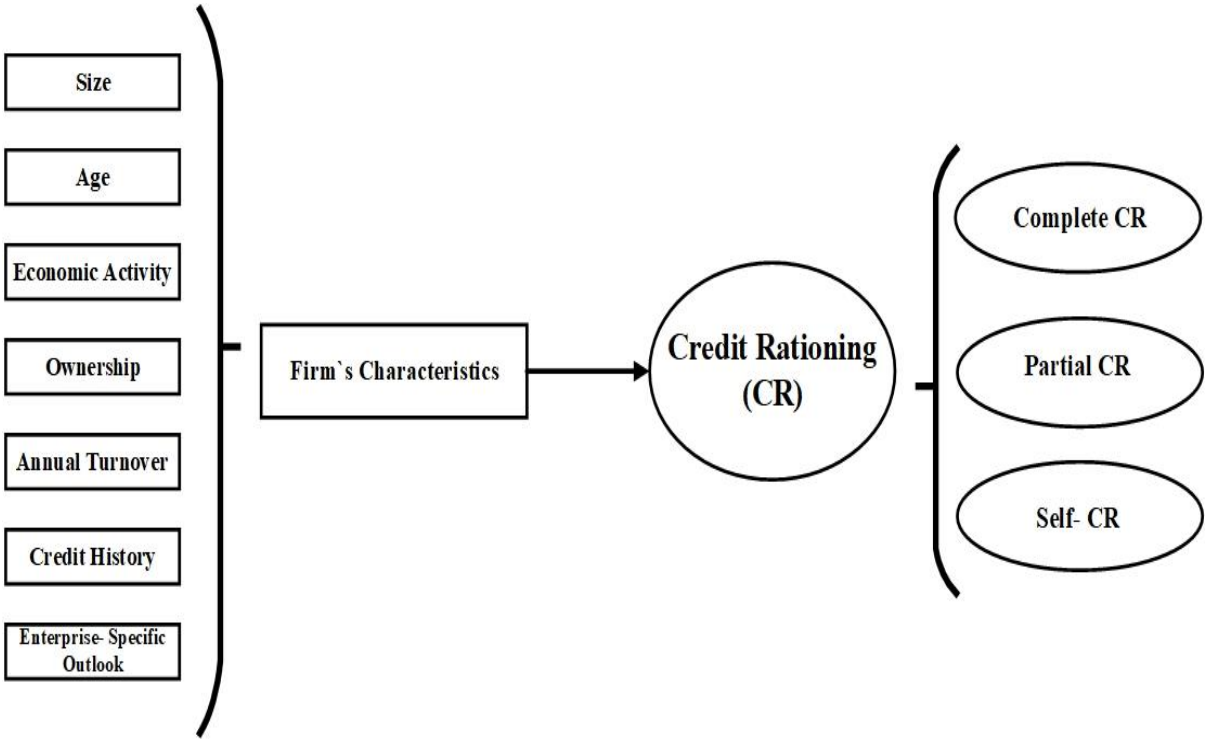

Figure 25- Research Framework based on SAFE Survey Data

Earlier, in the theoretical section, effective factors on credit rationing were extracted from the literature and classified into two groups: firm characteristics and manager characteristics; however, they must be revised since all of those factors were not specifically asked in the SAFE survey.

There were survey questions that corresponded to the firm's characteristics category, but about factors other than age and size needed to be clarified in this context.

It is necessary to explain the question that is being considered in order to analyze the impact of the firm's business plan. According to the SAFE survey, the most appropriate factor for the “business plan” was the question regarding "enterprise-specific outlook." Firms were asked whether their enterprise-specific outlook (including sales/profitability or business plan) had improved, remained unchanged, or deteriorated in the previous six months in the questionnaire. Even though sales and profitability can also affect credit rationing. This type of question is also asked about a company´s “credit history.”

Finally, "ownership." The type of ownership is determined by whether the company belongs to the group of public shareholders, family or entrepreneurs, venture capital enterprises, one owner only, or other enterprises/business associates.

According to available data, two new factors are being investigated under the category of firm´s characteristics as well: to begin, annual turnover of a firm. Looking at what is annual turnover, it appears to be a potential factor that may play a role in bank loan application decisions by banks. Turnover can be defined as the rate at which a company's inventory is sold or the rate at which a company collects payments in comparison to sales over a specific time period. In general, turnover refers to the speed and efficiency with which a company's operations run. Fundamental analysts and investors, in fact, use this indicator to determine whether a company is a good investment (Investopedia, 2022). As a result, this factor has been included in the research model to investigate if it affects credit rationing.

There is also another variable that could be related to credit rationing. The SAFE survey asked about the sectors in which firms are active under the variable name "economic activity." Economic activity, in particular, encompasses a wide range of sectors and

may provide a comprehensive set of data for analyzing this relationship. It includes industry (including manufacturing, mining, electricity, gas, and water supply), as well as construction, trade, and other services (for example, hotels and restaurants, IT services).

Gender, race, and education were three elements in the area of manager's characteristics that were taken from the literature but were not asked about in the survey. Therefore, the firm's characteristics are the only category examined in this thesis as a determinant of credit ratioing.

Descriptions of CR determinants are presented in Appendix 1 (section 13).

8.4 Methodology

As previously discussed, non-price credit rationing can be observed in equilibrium as a result of informational asymmetries between lenders and borrowers. This thesis employs the broadest definition of credit rationing (full credit rationed firms whose loan applications were rejected by banks, and partial credit rationed firms whose bank loan applications received only a portion of the requested loan), as well as discouraged borrowers (firms that did not apply for credit because of fear of rejection, even though they needed it).

When performing the multinomial regression, the group of respondents who applied and got everything is used as the reference category, with three categories of rationing compared to applied and got everything. Regression analysis is carried by using SPSS Statistics version 26.

The necessary data on the extent of credit rationing was extracted from the SAFE questionnaire using questions Q7A.a (asked about bank loan applications) and Q7B.a (asked about bank loan application outcomes).

The analysis takes into account data from wave 3 (2010H1) to wave 26 (2021H2). The options for question 7B were slightly different in wave 1 and wave 2 compared to the others, hence the first two rounds of the survey were not taken into account. The regression analysis aggregates the data from all waves from 3 to 26. It is important to

note that data is country-based filtered; only SMEs in the euro area are taken into account. The list of euro area countries may have varied in different rounds of the survey that was done over time, and this was also taken into consideration.

Respondents, in SAFE surveys, were also asked if companies had declined bank loan offers because interest rates were perceived to be too high. This thesis does not consider this type of response as a form of credit rationing in the regression analysis. Furthermore, firms with sufficient internal funds that did not apply for bank loans cannot be classified as rationed since they did not require external financing, therefore, such businesses are also excluded from the regression analysis in this thesis.

However, statistics from both of these groups of respondents were presented in the previous part, section 7. The aim was to explain why SMEs did not consider bank loans to be a relevant source of financing for their businesses, as well as to provide a more detailed explanation of the eurozone's financial environment.

Firms could choose "do not know" in response to selected questions, Q7A.a, and Q7B.a, in the questionnaire. Those who responded "do not know" to the questions were excluded as missing data. Therefore, 3765 out of 44343 responses were eliminated, which was a negligible fraction. Given these criteria for selection, the actual sample consists of 40578, of which 14195 were rationed

In the following, the data will be checked for multicollinearity as an assumption for multinomial regression, then the analysis results will be presented and interpreted.

8.5 Multicollinearity Test

The Variance Inflation Factor (VIF)[3] method is used to check for multicollinearity. In this test VIF for each independent variable is calculated. The greater the value of VIF, the stronger the correlation between a variable and the others. In general, a VIF greater than 4 or tolerance less than 0.25 indicates the possibility of multicollinearity and necessitates further investigation. When VIF exceeds 10 or tolerance falls below 0.1, there is significant multicollinearity that must be corrected (corporate finance institute website, 2022).

As it can be seen in Table 4, the VIF values for each independent variable are between 1 and 2, and no tolerance value is less than 0.4. This indicates that the results are satisfactory and that the required assumption for performing multinomial logit regression is met.

Table 4- The result of Multi-collinearity Test

		Collinearity Statistics	
Model		Tolerance	VIF
1	Firm Size	.468	2.135
	Firm Age	.963	1.038
	Economic Activity	.922	1.084
	Ownership	.956	1.046
	Annual Turnover	.469	2.132
	Credit History	.902	1.108
	Enterprise Specific Outlook	.901	1.110

a. Dependent Variable: CR category

[3] A variance inflation factor (VIF) provides a measure of multicollinearity among the independent variables in a multiple regression model. "Detecting multicollinearity is important because while multicollinearity does not reduce the explanatory power of the model, it does reduce the statistical significance of the independent variables."
Mathematically, the VIF for a regression model variable is equal to "the ratio of the overall model variance to the variance of a model that includes only that single independent variable."
Source: Investopedia Website

8.6 Regression Analysis

8.6.1 Descriptive Data

Table 5 provide descriptive data for the variables considered in this thesis. For each variable, which are all categorical, the proportion of respondents is presented.

Table 5- Summary Statistics of Main Variables

		N	Marginal Percentage	
CR category	Applied and got everything	26383	65.0%	
	Did not apply because of possible rejection	8210	20.2%	
	Applied but was rejected	3111	7.7%	
	Applied and received a limited part of it	2874	7.1%	
Firm Size	from 1 employee to 9 employees	13236	32.6%	
	from 10 employees to 49 employees	14231	35.1%	
	from 50 employees to 249 employees	13111	32.3%	
Firm Age	10 years or more	34412	84.8%	
	5 years or more, but less than 10 years	4168	10.3%	
	2 years or more, but less than 5 years	1625	4.0%	
	less than 2 years	373	0.9%	
Economic Activity	Industry	11840	29.2%	
	construction	4640	11.4%	
	Trade	10643	26.2%	
	Services	13455	33.2%	
Ownership	public shareholders,	677	1.7%	
	family or entrepreneurs	22019	54.3%	
	other enterprises	4528	11.2%	
	venture capital enterprises	379	0.9%	
	one owner only	12975	32.0%	
Annual Turnover	Up to €2mln	19139	47.2%	
	more than €2 million and up to €10 million	11806	29.1%	
	more than €10 million and up to €50 million	8122	20.0%	
	more than €50 million	1511	3.7%	
Credit History	Improved	10918	26.9%	
	Deteriorate/Unchanged	29660	73.1%	
Enterprise Specific	Improved	12163	30.0%	
Outlook	Deteriorate/Unchanged	28415	70.0%	
Valid		40578		100.0%
Missing		0		
Total		40578		
Subpopulation		1562[a]		

a. The dependent variable has only one value observed in 636 (40,7%) subpopulations.

8.6.2 Model Fitting Information

Model fitting information results are provided in Table 6. This is a likelihood ratio test which make a comparison between the final model and one with zero parameter coefficients (Null). The difference between the -2 log-likelihoods of the Null and Final models is the chi-square statistic. The "Sig."[4] column, (significance level), shows that p is less than 0.05, it can be infered that the final model outperforms the null. Thus, the full model statistically significantly predicts the dependent variable better than the intercept-only model.

Table 6- Model Fitting Information

	Model Fitting Criteria	Likelihood Ratio Tests		
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	13928.123			
Final	9261.600	4666.523	51	.000

8.6.3 Likelihood Ratio Test

The likelihood ratio test, whose results are shown in Table 7, examines the contribution of each independent variable to the model, determining whether the contributions are statistically significant. According to the Sig. column, all independent variables in this study have a significant effect on the model as having P-values of zero, indicating the right model is constructed and best predictors are included in the model.

Table 7- Likelihood Ratio Tests

	Model Fitting Criteria			Likelihood Ratio Tests		
Effect	AIC of Reduced Model	BIC of Reduced Model	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	9369.600	9834.593	9261.600[a]	.000	0	.
Firm Size	9592.818	10006.145	9496.818	235.218	6	.000
Firm Age	9470.888	9858.382	9380.888	119.288	9	.000
Economic Activity	9419.291	9806.785	9329.291	67.691	9	.000
Ownership	9465.901	9827.562	9381.901	120.301	12	.000
Annual Turnover	10240.671	10628.165	10150.671	889.071	9	.000
Credit History	9775.753	10214.913	9673.753	412.153	3	.000
Enterprise Specific Outlook	9385.401	9824.561	9283.401	21.801	3	.000

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.
a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

[4] In the SPSS output, the p-value is represented with the term "Sig." To determine whether to reject the null hypothesis, P-values are utilized in hypothesis testing. If the test result is statistically significant (P <=0.05), the null hypothesis is unreliable or needs to be rejected. If the P-value is higher than 0.05, no effect was seen.

8.6.4 Parameter Estimates

This step in the regression analysis is particularly important as helping to more deeply understand the effect of each independent variable on the dependent variable. The model coefficients are determined here, as shown in Table 8, Table 9, and Table 10.

An important feature of the multinomial logit model is that it estimates k-1 models, where k is the number of levels of the outcome variable. As previously stated, three forms of credit rationing are considered in this thesis; however, there is an ideal outcome in the case of a potential borrower (a firm) not self-rationing itself, applying for a bank loan, and then receiving everything. This ideal outcome is also taken into account to clarify the risk of occurrence of each form of credit rationing, and thus the reference group in this thesis is "applied and got everything."

In this instance, SPSS estimates three models; a model for “did not apply because of possible rejection” relative to “applied and got everything,” a model for “applied but was rejected” relative to “applied and got everything” and a model for “applied and received a limited part of it” relative to “applied and got everything.”

Furthermore, statistics are provided for each sub-category of one single independent variable rather than for each independent variable as a whole. This is due to the fact that all of the independent variables in this study are categorical. As a result, when calculating coefficients in SPSS, one sub-category of the independent variable is used as the reference group, and the others are compared to it.

SPSS by default uses the last category as the reference. For example, in the firm size category, the last sub-category, which is the group of medium-sized firms (size 3), is the reference group, and thus the amount of Sig. is not calculated, and the coefficient is also set to zero.

Subcategories of independent variables are coded in SPSS as shown in tables 8, 9, and 10. Thus, Appendix 1 describes subcategories.

Before proceeding with the analysis of results, the items in the tables of estimated coefficients are explained as follows (Source: UCLA-Statistical Consulting Group).

- Intercept: It is the multinomial logit estimate for an outcome category relative to the reference category when the independent variables (predictor variables) in the model are evaluated at zero (It should be noted that since no firms in this thesis have characteristics including age or size equal to zero, the intercept has only geometric and not economic interpretation).
- "B" or log-odds: It is the estimated coefficient, with standard error, "S.E."

  "Since the parameter estimates are relative to the reference group, the standard interpretation of the multinomial logit is that for a unit change in the predictor variable, the logit of outcome m relative to the reference group is expected to change by its respective parameter estimate (which is in log-odds units) given the variables in the model are held constant."

- "Wald" and "Sig": The ratio of "B" to "S.E.", squared, equals the Wald statistic. The Wald test is used to determine statistical significance for each independent variable. The "Sig." column shows the statistical significance of the test. "Sig." shows p-value used in assessing the null hypothesis that the coefficient (parameter) is zero.

  In the case of performing a 2-tailed test, each p-value compares to preselected value of alpha which is 0.05. Coefficients having p-values less than 0.05 are statistically significant. It means the null hypothesis can be rejected and say that the coefficient is significantly different from zero.

- "Exp(B) or the odds ratio: "The odds ratio of a coefficient indicates how the risk of the outcome falling in the comparison group compared to the risk of the outcome falling in the reference group changes with the variable in question." The "exp" refers to the exponential value of "B".

  To put it in another way (Source: Scale Statistics Website):
  "If the p-value is LESS THAN .05 and the adjusted odds ratio with its 95% confidence interval (CI) is above 1.0, the risk of the outcome occurring increases that many more times versus the reference category outcome."

"If the p-value is LESS THAN .05 and the adjusted odds ratio with its 95% CI is below 1.0, then the risk of the outcome occurring decreases that many times versus the reference category outcome."

"If the p-value is MORE THAN .05, then the 95% CI for the adjusted odds ratio crosses over 1.0 and the association is non-significant."

8.6.4.1 Did not Apply Because of Possible Rejection (Self-ratioing) Relative to Applied and Got Everything

Variable- Firm Size:

In the case of micro-sized firms (firm size=1), the estimated coefficient (B) is equal to 0.554, indicating that the multinomial logit for micro-sized firms relative to medium-sized firms (firm size=3) is 0.554 units higher for self-rationing relative to "applied and got everything" when all other predictor variables in the model are held constant.

In fact, for every unit increase in the level of micro-sized firm subcategory, the logit of outcome self-rationing relative to the reference group is expected to increase by 0.554 units. Furthermore, the amount of "Sig." is equal to zero, implying that the null hypothesis can be rejected and that the regression coefficient for micro-sized firms has been found to be statistically different from zero in this CR category, given that all other variables are held constant.

In the case of small businesses, the coefficient (B) is 0.055. As a result, given that all other predictors in the model are constant, the multinomial logit for them in the case of self-ratioing is 0.055 units higher than for "applied and got everything."

However, its associated P-value (Sig.) is 0.232 which means the null hypothesis cannot be rejected and indicate that the regression coefficient for small firms has not been found to be statistically different from zero, given that all other variables are considered in the model. In this case, we cannot conclude that the explanatory variable affects the outcome.

In addition, for micro-sized firms, the amount of Exp(B) equals to 1.741. This is the relative risk ratio comparing micro-sized firms to medium-sized for self-ratioing relative to "applied and got everything" given that the other variables in the model are

held constant. For micro-sized firms relative to medium-sized, the relative risk for occurring self-ratioing relative to “applied and got everything” would be expected to increase by a factor of 1.741 given the other variables in the model are held constant. In other words, micro-sized firms are more likely than medium-sized firms to rationed themselves over applied for bank loans and got everything.

Variable- Firm Age

Firms who are aged 10 years or more (firm age= 1) shows a P-value greater than 0,05. Therefore, changes in this predictor are not associated with the change in outcome. However, the other two sub-categories “5 years or more” and “2 years or more” are meaningful to the outcome, self-ratioing related to “applied and got everything.”

In the case of firms which are “5 years or more, but less than 10 years”, the estimated coefficient (B) is equal to 0.465 and Exp(B) is larger than 1 (1.592). The results indicate that the multinomial logit for firms with the age of “5 years or more” relative to firm age “less than 2 years” is 0.465 units higher for self-rationing relative to “applied and got everything” when all other predictors in the model are held constant. In addition, according to the amount of Exp(B), the relative risk for occurring self-ratioing relative to “applied and got everything” is expected to increase by a factor of 1.592 given the other variables in the model are held constant.

For firms with age of "2 years or more, but less than 5 years," B and Exp(B) are 0.586 and 1.798, respectively, and the same interpretation can be applied.

Variable- Economic activity

In this group, firms which are active in “services” are considered as the reference category. The three other sub-categories all have p-values equal to or less than 0.05. As a result, "industry," "construction," and "trade" are all statistically significant.

“Construction” has the highest estimated coefficient (0.234), followed by trade (0.198), and industry (0.093), indicating that an increase in "construction" changes the outcome more strongly than others.

Furthermore, since the amount of Exp(B) for all of them is greater than 1.0, risk of self-rationing increases rather than “applying for and receiving everything.”

Variable- Ownership

The p-values for the cases "one owner only," "family or entrepreneurs," and "other enterprises" all equal zero, which means that the null hypothesis can be rejected in these scenarios. The association between "venture capital enterprises" and outcome, however, is not statistically significant, as indicated by p-values greater than 0.05 (0.785).

On the contrary, when "B" and "Exp(B)" are considered, surprising results reveal that the likelihood of self-rationing occurrence decreases that many times versus "applied and got everything." For example, for "one owner only," the estimated coefficient (B) is -0.641 and the exp(B) is 0.527.

Variable- Annual Turnover

The reference group in this category is an annual turnover of “more than €50 million” (annual turnover= 4). Additionally, all other subcategories are significant, with p-values equal to zero.

The estimated coefficient, B, is 1.857 for "annual turnover up to €2 mln," 1.132 for "annual turnover between €2- €5 mln," and 0.436 for "annual turnover between €10-€50 mln." As a result, given that the variables in the model are held constant, the logit of outcome "self-ratioing" relative to the reference group, "applied and got everything," is expected to change more by the sub-category of "annual turnover up to €2 mln."

Furthermore, all of them have Exp(B) greater than 1. For instance, Exp(B) for "annual turnover up to €2 mln" is 1.098, indicating that the relative risk ratio comparing firms with annual turnover up to €2 mln to more than €50 mln for self-rationing relative to applied and got everything would be expected to increase by a factor of 1.098 if all other variables in the model were held constant.

Variable- Credit History

In this group, there are only two situations; if credit history has improved over the past six months, or it has deteriorated/ remained unchanged. In case of having an improved credit history, self-ratioing will be decreased by 0.596 (the amount of B).

Moreover, the fact that Exp(B) is less than one (0.551) indicates that the relative risk of self-rationing to apply and get everything is expected to decrease by a factor of 0.551 if the other variables in the model were held constant. In other words, firms with improved credit history are less likely to not apply because of possible rejection than those with a deteriorated or unchanged credit history.

Variable- Enterprise Specific Outlook

Enterprise-specific outlook is similar to the previous category. Firms with improved enterprise-specific outlooks are less likely to be self-rationing than those with a deteriorated or unchanged enterprise-specific outlook. The amount of estimated coefficient is equal to -0.134 and odd ratio is 0.874.

Finally, by putting the number aside we can conclude that:

The effect of micro-sized firms on self-rationing is significant in this CR category, and micro-sized firms are more likely to increase the likelihood of self-rationing occurrence as preliminary analysis has already confirmed. When looking at the firm age group, SMEs aged 2 to 5 years have the highest impact on self-rationing in the age category.

As a result, a younger firm is more likely to abandon the idea of obtaining a bank loan as an external funding source due to possible rejection. However, it is worth noting that the subcategory "Age=1," defined as 10 years or older, has no significant impact on self-rationing. In the ownership category, all sub-categories have significant relationship with self-rationing except “ownership=4” which links to venture capital enterprises. However, they have negative relationships with the outcome.

Despite the fact that SMEs in "industry" sub-categories such as manufacturing appears to be slightly less likely to be self-rationed than others, all economic activity subcategories show a significant relationship with self-rationing. That makes sense

given that SMEs in each of these industry sectors may struggle to obtain bank financing. There may be more effective factors than the category of economic activity to make firms reliable to banks, such as firm size, years of activity, financial background.

For instance, different amount of annual turnover reveals a significant difference between firms in terms of being self-rationed. SMEs with less than 2 million euros in annual turnover (Turnover=1) have a much higher coefficient than other sub-categories.

In the case of a turnover of 10 to 50 million euro, the variable has much less impact on self-rationing. Alternatively, by increasing sales and improving the business plan and credit history, SMEs are less likely to be discouraged from applying for bank credit out of fear of rejection.

It is interesting to note that improved credit history and enterprise-specific outlook both have a negative coefficient, implying that as firms improve in these areas, self-rationing will decrease.

Table 8- Parameter Estimates for CR Category- Did not apply because of possible rejection

CR category		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B) Lower Bound	95% Confidence Interval for Exp(B) Upper Bound
Did not apply because of possible rejection	Intercept	-3.017	.181	277.651	1	.000			
	[Firm Size=1]	.554	.053	110.899	1	.000	1.741	1.570	1.930
	[Firm Size=2]	.055	.046	1.428	1	.232	1.056	.966	1.155
	[Firm Size=3]	0[b]	.	.	0	.	.	.	.
	[Firm Age=1]	.209	.135	2.379	1	.123	1.232	.945	1.606
	[Firm Age=2]	.465	.139	11.125	1	.001	1.592	1.211	2.093
	[Firm Age=3]	.586	.147	15.979	1	.000	1.798	1.348	2.396
	[Firm Age=4]	0[b]	.	.	0	.	.	.	.
	[Economic Activity=1]	.093	.036	6.595	1	.010	1.098	1.022	1.179
	[Economic Activity=2]	.234	.044	28.298	1	.000	1.264	1.160	1.378
	[Economic Activity=3]	.198	.035	32.907	1	.000	1.219	1.139	1.304
	[Economic Activity=4]	0[b]	.	.	0	.	.	.	.
	[Ownership=5]	-.641	.107	35.872	1	.000	.527	.427	.650
	[Ownership=2]	-.595	.106	31.688	1	.000	.552	.448	.678
	[Ownership=3]	-.631	.113	31.273	1	.000	.532	.427	.664
	[Ownership=4]	.047	.173	.074	1	.785	1.048	.747	1.470
	[Ownership=1]	0[b]	.	.	0	.	.	.	.
	[Annual Turnover=1]	1.857	.124	222.773	1	.000	6.406	5.020	8.176
	[Annual Turnover=2]	1.132	.121	87.286	1	.000	3.101	2.446	3.932
	[Annual Turnover=3]	.436	.123	12.635	1	.000	1.546	1.216	1.967
	[Annual Turnover=4]	0[b]	.	.	0	.	.	.	.
	[Credit History=1]	-.596	.034	301.985	1	.000	.551	.515	.589
	[Credit History=3]	0[b]	.	.	0	.	.	.	.
	[Enterprise Specific Outlook=1]	-.134	.032	17.960	1	.000	.874	.822	.930
	[Enterprise Specific Outlook=3]	0[b]	.	.	0	.	.	.	.

a. The reference category is: Applied and got everything.
b. This parameter is set to zero because it is redundant.

The following sections highlight the differences between the next two CR categories and the previous one.

8.6.4.2 Applied but Was Rejected Relative to Applied and Got Everything

In the category of firm size, the result related to micro-sized firms with a p-value of 0.002 shows that the regression coefficient for micro-sized firms is statistically different from zero. It has an estimated coefficient (B) of 0.228 and an Exp(B) greater than one (1.256).

The amount of Exp(B) suggests that the relative risk for “applied but was rejected” relative to “applied and got everything” is expected to increase by a factor of 1.256 given the other variables in the model are held constant. In other words, micro-sized firms are more likely than medium-sized firms to be completely credit rationed.

The results of the previous CR category revealed that SMEs aged "5 to 10 years" are significantly related to self-rationing; however, the result in the category of SMEs who "applied for bank loans but were rejected" relative to "applied and got everything" is now different. As the “sig.” value is 0.151, it demonstrates that firms in this age group do not have a meaningful statistical relationship with fully credit rationing, and thus the null hypothesis cannot be rejected.

In fact, only firms with “2 years or more, but less than 5 years” has a significant overall effect on the outcome with “sig.” equals to 0.048.

Among different sub-categories of economic activity, “economic activity=1” which stands for “industry” does not affect credit rationing (sig. is equal to 0.259). In addition, it has previously shown the least effect on self-rationing when compared to other sectors.

Table 9- Parameter Estimates for CR Category- Applied but was rejected

CR category		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B) Lower Bound	Upper Bound
Applied but was rejected	Intercept	-3.315	.248	179.125	1	.000			
	[Firm Size=1]	.228	.074	9.373	1	.002	1.256	1.085	1.453
	[Firm Size=2]	-.051	.063	.645	1	.422	.950	.840	1.076
	[Firm Size=3]	0[b]	.	.	0	.	.	.	.
	[Firm Age=1]	-.116	.181	.410	1	.522	.890	.624	1.270
	[Firm Age=2]	.268	.187	2.059	1	.151	1.308	.906	1.887
	[Firm Age=3]	.389	.197	3.896	1	.048	1.476	1.003	2.172
	[Firm Age=4]	0[b]	.	.	0	.	.	.	.
	[Economic Activity=1]	.059	.053	1.271	1	.259	1.061	.957	1.177
	[Economic Activity=2]	.290	.062	21.567	1	.000	1.336	1.182	1.510
	[Economic Activity=3]	.172	.051	11.558	1	.001	1.187	1.075	1.311
	[Economic Activity=4]	0[b]	.	.	0	.	.	.	.
	[Ownership=5]	-.508	.150	11.483	1	.001	.602	.449	.807
	[Ownership=2]	-.541	.148	13.373	1	.000	.582	.435	.778
	[Ownership=3]	-.599	.159	14.282	1	.000	.549	.403	.749
	[Ownership=4]	.097	.237	.168	1	.682	1.102	.692	1.755
	[Ownership=1]	0[b]	.	.	0	.	.	.	.
	[Annual Turnover=1]	1.653	.175	89.654	1	.000	5.220	3.708	7.349
	[Annual Turnover=2]	1.120	.169	43.801	1	.000	3.066	2.200	4.272
	[Annual Turnover=3]	.479	.171	7.850	1	.005	1.615	1.155	2.258
	[Annual Turnover=4]	0[b]	.	.	0	.	.	.	.
	[Credit History=1]	-.554	.050	122.775	1	.000	.574	.521	.634
	[Credit History=3]	0[b]	.	.	0	.	.	.	.
	[Enterprise Specific Outlook=1]	-.108	.046	5.552	1	.018	.898	.821	.982
	[Enterprise Specific Outlook=3]	0[b]	.	.	0	.	.	.	.

a. The reference category is: Applied and got everything.
b. This parameter is set to zero because it is redundant.

8.6.4.3 Applied and Received a Limited Part of it Relative to Applied and Got Everything

The effect of the age variable changes as the extent of credit rationing varies. In this CR category, it can be seen that none of the age variable sub-categories have a significant relationship with “applied and received a limited part of it” relative to “applied and got everything” (“Sig.” greater than 0.05).

Furthermore, variable firm size has no significant relationship with the outcome in the case of both micro and small firms. This suggests that for CR categories include “self-ratioing” and “applied but was rejected” relative to “applied and got everything,” size does matter more.

The result for annual turnover has also changed. There is no overall association with SMEs with annual turnovers greater than "10 million euro but less than 50 million euro" and "applied and received only a portion of it" versus "applied and received everything" (Sig. equals to 0.2).

In contrast, SMEs in this sub-category have demonstrated a significant relationship with outcomes in the previous two CR categories. However, based on the previous estimated coefficients and odds ratios, every unit increase in this predictor results in a much lower logit of outcome, and this sub-category of SMEs is much less likely to be credit rationed.

Up to this point, a negative relationship has been observed between “enterprise-specific outlook” and being self-rationed and completely credit rationed. However, the findings show that there is no statistically significant relationship between improved enterprise-specific outlook and partial credit rationing, according to the amount of p-value (0.07).

Table 10- Parameter Estimates for CR Category- Applied and received a limited part of it

CR category		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B) Lower Bound	Upper Bound
Applied and received a limited part of it	Intercept	-2.729	.237	133.011	1	.000			
	[Firm Size=1]	.111	.075	2.167	1	.141	1.117	.964	1.295
	[Firm Size=2]	.003	.059	.002	1	.965	1.003	.894	1.124
	[Firm Size=3]	0[b]	.	.	0	.	.	.	.
	[Firm Age=1]	-.114	.203	.316	1	.574	.892	.599	1.328
	[Firm Age=2]	.107	.210	.260	1	.610	1.113	.737	1.680
	[Firm Age=3]	.189	.223	.718	1	.397	1.208	.780	1.870
	[Firm Age=4]	0[b]	.	.	0	.	.	.	.
	[Economic Activity=1]	.140	.052	7.142	1	.008	1.150	1.038	1.275
	[Economic Activity=2]	.191	.068	7.850	1	.005	1.210	1.059	1.383
	[Economic Activity=3]	.183	.054	11.716	1	.001	1.201	1.082	1.334
	[Economic Activity=4]	0[b]	.	.	0	.	.	.	.
	[Ownership=5]	-.687	.139	24.434	1	.000	.503	.383	.661
	[Ownership=2]	-.455	.136	11.293	1	.001	.634	.486	.827
	[Ownership=3]	-.785	.147	28.369	1	.000	.456	.341	.609
	[Ownership=4]	.045	.220	.042	1	.837	1.046	.679	1.612
	[Ownership=1]	0[b]	.	.	0	.	.	.	.
	[Annual Turnover=1]	.575	.128	20.094	1	.000	1.777	1.382	2.284
	[Annual Turnover=2]	.475	.119	15.831	1	.000	1.609	1.273	2.033
	[Annual Turnover=3]	.152	.118	1.646	1	.200	1.164	.923	1.467
	[Annual Turnover=4]	0[b]	.	.	0	.	.	.	.
	[Credit History=1]	-.365	.049	56.478	1	.000	.694	.631	.763
	[Credit History=3]	0[b]	.	.	0	.	.	.	.
	[Enterprise Specific Outlook=1]	-.083	.046	3.287	1	.070	.920	.841	1.007
	[Enterprise Specific Outlook=3]	0[b]	.	.	0	.	.	.	.

a. The reference category is: Applied and got everything. b. This parameter is set to zero because it is redundant.

9 Conclusion

This thesis investigated the impact of firm characteristics on credit rationing in SMEs. Moreover, its findings help to understand which firm characteristics can forecast the likelihood of credit rationing more accurately.

Credit rationing was studied from both the demand and supply sides to examine its different degrees, including self-rationing as well as complete and partial CR. The analysis was obtained by running multinomial logistic regression on a large and representative sample of eurozone businesses (the SAFE survey conducted by the European Central Bank). The sample included responses from 40578 businesses.

To gain a more comprehensive picture of the situation of eurozone SMEs in terms of credit rationing, a descriptive analysis of SAFE microdata was first conducted; the trend of credit rationing over time was then discovered.

The findings of this thesis show that not all eurozone SMEs apply for bank loans; in fact, only about one-third of SMEs do apply. Banks, on the other hand, are reluctant to entirely fulfill loan demands. However, loan granting has improved, and the rate of both complete and partial credit rationed SMEs has decreased from 2010 to the present. It should be kept in mind that impacts of the 2008 financial crisis may be blamed for the higher rates of credit rationing at the beginning of the reference period, as most countries implemented regulatory restrictions on banking and lending.

A different pattern is discovered in case of discouraged borrowers. Although the average percentage of self rationing was comparable to the complete and partial rationing; but the number of self-rationed borrowers has neither increased nor decreased since 2010, almost maintaining a steady trend.

However, the results demonstrate how potential borrowers' behavior may shift during a crisis when the future of their sales and, in a broader sense, the future of the economy, is uncertain. The trend of loan demand was different when the COVID-19 pandemic started. There was a high demand for bank loans during the first year of the pandemic, and for the first time during the reference period, firms requested bank loans rather than

relying on internal funds. Furthermore, the lowest rate of self-rationing occurred during that time.

Furthermore, regression analysis gives insight into more specific aspects of credit rationing. The findings suggest factors which can reduce information asymmetry between banks and potential borrowers result in lower credit ratioing; complete credit rationing is less likely to occur among older firms with higher sales and liquidity, as well as larger employment sizes. While when a company has only one owner, complete rationing is more likely.

Additionally, it appears that the access to bank loans is more difficult for construction companies than it is for businesses engaged in industries like manufacturing.

When comparing the findings between CR categories, regression analysis also reveals some differences between them. The size of a company influences both self-ratioing and complete rationing. However, there is no statistically significant relationship between size and partial credit rationing. The same could be said for the firm age.

Finally, the results suggest that some of the CR determinants assessed in this thesis may be more informative and useful than others in distinguishing between credit-constrained and unconstrained firms. Notably, “economic activity” and “enterprise-specific outlook” do not appear to be accurate predictors of credit rationing. Significant differences between the impact of sub-categories of “economic activities” and “enterprise-specific outlook” on CR were not discovered. On the contrary, firm`s size, age, ownership, and annual turnover have stronger links with credit rationing as a result of having significantly larger coefficients and showing meaningful differences in results across CR categories.

10 List of Abbreviation

CR	Credit Ratioing
ECB	European Central Bank
EU27	European Union
MRL	Multinomial Logistic Regression
SAFE	Survey on the Access to Finance of Enterprises
SMEs	Small and Medium-sized Enterprises

11 List of Figures

12 List of Tables

13 Appendix 1- Independent Variables Descriptions

Variables	Description	Sub-categories Code (in regression analysis)	Sub-categories Name
Firm Size	Total number of employees employed by an organization across all of its locations, either full-time or part-time	[Firm Size=1]	from 1 employee to 9 employees
		[Firm Size=2]	from 10 employees to 49 employees
		[Firm Size=3]	from 50 employees to 249 employees
Firm Age	Number of years that an organization has been officially registered	[Firm Age=1]	10 years or more
		[Firm Age=2]	5 years or more, but less than 10 years
		[Firm Age=3]	2 years or more, but less than 5 years
		[Firm Age=4]	less than 2 years
Economic Activity	A process that results in the production of a good or the provision of a service based on employed inputs	[Economic Activity=1]	Industry
		[Economic Activity=2]	construction
		[Economic Activity=3]	Trade
		[Economic Activity=4]	Services
Ownership	Those who own the largest stake in an enterprise	[Ownership=1]	Public shareholders
		[Ownership=2]	family or entrepreneurs
		[Ownership=3]	other enterprises
		[Ownership=4]	venture capital enterprises
		[Ownership=5]	one owner only
Annual Turnover	The annual turnover of an enterprise over the last year	[Annual Turnover=1]	Up to €2mln
		[Annual Turnover=2]	€2-€10 mln
		[Annual Turnover=3]	€10- €50 mln
		[Annual Turnover=4]	more than €50 mln
Credit History	A record of an organization's responsible repayment of debts over the past six months	[Credit History=1]	Improved
		[Credit History=3]	Deteriorate/Unchanged
Enterprise Specific Outlook	The sales and profitability status of an organization or its business plan over the past six months	[Enterprise Specific Outlook=1]	Improved
		[Enterprise Specific Outlook=3]	Deteriorate/Unchanged

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