Direct public support, financial slack, and innovation in SMEs

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Abstract:

This article uses the Behavioral Theory of the Firm framework to analyze the innovation behavior of French SMEs benefiting from direct public financial support. We propose that the positive impact of public support is moderated by the initial level of financial slack. Furthermore, we argue that the extent to which this support is assimilated to debt influences its impact on the incremental or radical innovation type. We test our hypotheses using regressions on a large sample of 24,086 SMEs, of which 1,976 received support over the 2000–2014 period. The results are consistent with our expectations. They reveal an overall positive effect of direct public support on radical innovation. Incremental innovation is supported exclusively by forms of support that resemble debt, such as repayable advances and zero-interest loans. Additionally, the positive impact of support on innovation is negatively moderated by the initial level of financial slack, particularly for incremental innovation. This article highlights the importance of tailoring the types of support to innovation objectives and financial conditions of SMEs. It extends the theoretical application of financial slack and provides practical implications for evaluating public policies and their impact on SME innovation.

Keywords: *direct public support; financial slack; radical innovation; incremental innovation; SMEs.*

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1. Introduction

In France, public support for R&DI(Research and Development, Innovation) is substantial, amounting to nearly 10 billion euros when considering the total amount of both direct and indirect support provided (Rapport de la Cour des Comptes, 2021). Indirect support, particularly through the research tax credit, constitutes the majority (approximately 70%) and is captured by intermediate-size and large companies. However, direct support remains significant, amounting to 3.1 billion euros in 2017, and targets more specifically SMEs (Small and Medium Enterprises) and VSEs (Very Small Enterprises). Within this framework, Bpifrance plays a pivotal role in supporting innovative businesses, distributing the majority of direct support towards smaller companies (86% of the total amount and 95% of the supported businesses are SMEs and VSEs) (Hassine, Ciriez, and Mathieu, 2022). Moreover, Bpifrance's support is potentially accessible to all SMEs, regardless of their field or sector (Hassine, Marsant, and Mathieu, 2020). These direct forms of support, benefit approximately 6,000 SMEs and VSEs each year, thereby representing a significant contribution of financial resources and liquidity to these companies.

Targeting direct public support primarily towards SMEs and VSEs, addresses the challenges these businesses face in financing their innovation projects. Indeed, SMEs and VSEs often have more limited resources and are more likely to encounter financial constraints compared to larger firms (Allegret, 1995; Berger and Udell, 1998; Ben Ayed and Zouari, 2014; Adair and Adaskou, 2013; Chiappini, Montmartin, Pommet, and Demaria, 2022). Several authors highlight this scarcity of resources to explain why SMEs show greater interest in direct support rather than in indirect support (Radas, Anić, Tafro, and Wagner, 2015). Limited resources are typically associated with lower R&DI expenditures and investments, which in turn, reduces the relevance of indirect innovation support (e.g., because tax reductions become beneficial when the declared amounts are substantial, but SMEs, due to their size and resource constraints, can only

declare smaller amounts and thus incur limited expenses). This relative scarcity of resources also makes SMEs more vulnerable to the inherent risk of innovation. Consequently, studies have examined the effectiveness of direct support in overcoming these barriers. The relationship between public support and innovation in the context of SMEs is therefore not an uncharted research field (Radas *et al.*, 2015 ; Cecere, Corrocher et Mancusi, 2020 ; Chiappini *et al.* 2022 ; Wu et Hu, 2020).

Nevertheless, the literature highlights results that are often conflicted and contradictory (Rolfo and Novero, 2011). Additionally, prior studies tend to adopt either an overly broad or excessively narrow focus. Broad impact assessments and economics studies provide valuable insight into the effectiveness of specific support programs, as well as the complementarity or substitutability between different mechanisms (Hassine et al., 2022). However, these studies often address all types of firms, without specifically examining SMEs. When they do analyze this category of firms (Hassine and Mathieu, 2020), the focus is typically on assessing the specific impact of a single support program on their innovation, without offering a theoretical framework to further explain these results in terms of organizational behavior.

More targeted studies focusing on SMEs do exist; however, they often adopt a very narrow scope, focusing on a specific type of innovation and a particular type of support (Cecere et al., 2020; Wu and Hu, 2020), which limits the generalizability of their findings. Thus, even when the specific population of SMEs is considered (Radas et al., 2015), the emphasis tends to remain on assessing the effects of public support, without providing a theoretical framework to deepen our understanding of SMEs behave in response to the support provided.

For this reason, we consider it essential to deepen research regarding how direct public support, the most utilized type of support by SMEs, influences innovation within such firms. While the study of the relationship between public support and innovation strategy in SMEs is not an entirely unexplored field, we consider it necessary to propose a theoretical framework that enlightens and explains SMEs' behavior, adopting a sufficiently broad perspective on their innovation strategies in relation to public support.

In this regard, our study addresses a growing need to enhance the understanding of SMEs behavior by prioritizing the perspective of the recipient, rather than that of the provider, and by drawing on innovative theoretical frameworks that diverge from traditional approaches (Gandégnon, 2023). Consequently, we employ an integrative model based on the Behavioral Theory of the Firm (Cyert and March, 1963), which provides a perspective centered on the

support-receiving firm. This theoretical framework emphasizes the significance of financial slack in explaining organizational behaviors, particularly in the realm of innovation. It more particularly highlights the differentiated effects of slack on various types of innovation.

Within this framework, we argue that public support influences a firm's innovation strategy through two mechanisms. First, direct public support, as an injection of new funds, increases the firm's financial slack. This funding can initiate or accelerate innovation projects while simultaneously shaping the firm's research and innovation behavior ; the impact varying depending on the firm's initial level of slack.

Second, the nature and characteristics of public support must be taken into account. For instance, if public support resembles debt, entailing repayment obligations, SMEs managers may be inclined to adopt more cautious innovation strategies, favoring incremental innovation that presents lower risk.

In this study, we approach the topic by considering three interrelated dimensions: the type of innovation (radical or incremental), the type of direct public support for innovation (grants, repayable advances, or zero-interest loans), and the SME financial context, as assessed by initial slack. This multidimensional approach enables a deeper understanding of the varied behaviors of SMEs leveraging public support.

This multi-faceted approach leads us to propose several hypotheses regarding the effect of different types of direct public support on SMEs innovation. This effect is moderated by the firm's financial slack prior to receiving the support. We test these hypotheses on a sample of 24,086 French SMEs, of which, 1,976 firms received public support between 2000 and 2014. The dataset was constructed using answers to the Community Innovation Survey (CIS) - conducted every three years across various European countries – alongside accounting data from tax databases and records from the French public investment bank Bpifrance, which exhaustively tracks the support it distributed during the period. Our results reveal that, while public support appears, at an aggregate level, to be beneficial for both types of innovation, the relationship between direct public support and innovation is neither monotonic nor systematic. Specifically, we find that only some types of support foster incremental innovation. Moreover, we demonstrate that in certain slack contexts, no type of public support and innovation.

The proposed study and its findings are significant on multiple levels. From a theoretical perspective, this study demonstrates that the Behavioral Theory of the Firm (Cyert and March, 1963) provides a relevant framework for understanding and explaining how SMEs leverage public support to sustain their innovation projects. While the relationship between slack and innovation, as well as, that between public support and innovation, have been previously explored, to our knowledge, this study is the first to extend the concept of slack to public support mechanisms.

In doing so, this approach moves beyond the traditional analysis of the generally positive impact of public support on innovation – an effect consistently reported in most studies addressing public support and innovation (Huego and Moreno, 2017; Bpifrance, 2020; Cour des Comptes, 2021) – by examining the underlying behaviors and corroborating several fundamental postulates of the Behavioral Theory of the Firm. Regarding the slack innovation relationship.

Our study offers managerial contributions insights for evaluating direct public support policies for firms and provides valuable guidance for public policymakers. Specifically, the study explains and sheds light on the effect of different types of direct public support on innovation strategy, depending on SMEs financial situation. This approach is also of interest to SME decision-makers as a tool for evaluating the effectiveness of their resource allocation decisions.

The article is organized as follows: Section 2 presents the theoretical framework derived from the Behavioral Theory of the Firm and reviews the literature on the relationship between slack and innovation. Section 3 develops the research hypotheses based on this conceptual framework, distinguishing the specific characteristics of each type of public support. Section 4 describes the methodology, including data and variables. Section 5 presents the results of the statistical test, while Section 6 discusses these findings before concluding.

2. Slack and innovations

2.1. The slack innovations relationships: Theoretically non unequivocal relationships

The concept of slack, originating from the Behavioral Theory of the Firm (Cyert and March, 1963), refers to excess resources within an organization, beyond the minimum necessary to maintain a given level of production (Geiger and Cashen, 2002). Subsequent research has broken slack down into several components (Bourgeois, 1981; Bourgeois and Singh, 1983; Geiger and Cashen, 2002; Singh, 1986). Available slack or "unabsorbed slack" represents assets that can be immediately mobilized without restrictions, such as highly liquid assets. In contrast,

recoverable slack or "absorbed slack" refers to less accessible resources, already accounted for as costs in ongoing operations—such as surplus inventory or overstaffing—but that can be retrieved in times of difficulty (Bourgeois and Singh, 1983). Finally, potential slack pertains to a firm's ability to access new resources by engaging external stakeholders, such as its ease in securing financing through loans (Bourgeois, 1981). This article focuses on unabsorbed slack also known as available slack, consisting of perfectly liquid and readily available financial resources. Thus, in this study, the terms "slack" or "financial slack" will specifically refer to this type of slack.

According to the Behavioral Theory of the Firm (Cyert and March, 1963), slack promotes innovation by easing internal controls, reducing conflicts, and fostering a culture of experimentation (Bourgeois, 1981). Behavioral theorists argue that slack protects organizations from environmental uncertainty and provides surplus resources that stimulate scientific research and experimentation (Tan and Peng, 2003). In an environment where slack is abundant, managers are generally less concerned about the risk of failure, as surplus resources cushion potential losses. This enables firms to adopt more exploratory behavior, encouraging the development of new strategies and products (Bourgeois, 1963; Thompson, 2017). From this perspective, the benefits associated with slack are considered to outweigh its costs (Tan and Peng, 2003), and slack is seen as having a positive effect on innovation.

However, other authors argue that beyond a certain level, slack can also have negative effects. When an organization has excessive slack, controls over project selection and termination become less stringent, leading to reduced efficiency in innovation efforts (Jensen, 1993; Lebenstein, 1969). Managers, becoming less rigorous, may allocate resources to costly and poorly evaluated projects that would not have been selected in the absence of slack (Herold, Jayaraman, and Narayanaswamy, 2006). This relaxation in project selection results in dispersed investments, steering the firm away from the most effective innovations (Simon, 1957). This second perspective, which questions the benefits of slack within organizations, aligns with agency theory. According to this theory, managers, driven by their own interests, are prone to wasting the resources at their disposal (Jensen and Meckling, 1976). Excessive slack is thus perceived as a potential source of waste, potentially leading managers to pursue value-destroying projects—projects with negative net present value that serve their personal interests at the expense of shareholders. Within this theoretical framework, shareholders seek to restrict managerial discretion—defined as the range of choices available to a manager (Finkelstein and Boyd, 1998)—although they cannot entirely eliminate it, they may for example limit available

cash flows by requiring dividends or increasing debt. Considering the favorable and unfavorable effects of slack on innovation, Nohria and Gulati (1996) conclude that both a lack and an excess of slack may harm innovation. They describe the relationship between slack and innovation as curvilinear, taking the form of an inverted U.

2.2. Radical Innovation or Incremental Innovation? The Contrasting Effects of Slack on Different Types of Innovations

Although most studies take a monolithic approach to innovation, it is now well-established that financial slack has varying effects on innovation when distinguishing between innovations' different forms (available, recoverable, potential slack) (Greve, 2007; Tabesh, Vera, and Keller, 2019; Suzuki, 2018; Troilo, De Luca, and Atuahene-Gima, 2014). To understand the dynamic between financial slack and the various forms of innovation, it is essential to differentiate the impacts of slack on distinct innovative behaviors within organizations—exploration and exploitation (Greve, 2007; Suzuki, 2018)—and, consequently, on the two resulting types of innovation: incremental and radical innovations.

It is indeed possible to distinguish two types of search behaviors within organizations, each associated with a distinct type of innovation. Problemistic search is associated with exploitative innovation activities. Such a search typically addresses specific problems and aims to provide solutions (Cyert and March, 1963, p. 121). Problemistic search aims to address problems locally, focusing on immediate improvements to existing technology, increased efficiency, and discoveries in areas closely related to current activities (Levinthal and March, 1981, p. 309). This type of search behavior leads to the development of incremental innovations (Levinthal and March, 1981; Benner and Tushman, 2003).

Conversely, slack search refers to exploratory behavior. Slack search is characterized by open and distant inquiry aimed at venturing into uncharted areas (Tabesh et al., 2019). It involves moving away from the existing knowledge to address emerging customer needs (Benner and Tushman, 2002). In the context of innovation, exploration focuses on the creation of new knowledge. It does not address local or immediate problems but instead aims to uncover new development opportunities through a more indirect and exploratory approach (Troilo et al., 2014). This search leads to innovations that are radically new for the firm.

Literature shows that the impact of slack varies depending on the associated search behavior, influencing incremental and radical innovation differently. On the one hand, slack supports exploratory search behavior and radical innovation. Indeed, slack reduces a firm's sensitivity to

environmental fluctuations and competitive pressure, providing greater managerial flexibility to launch disruptive projects Slack facilitates investment in exploration, thereby enabling new projects that are distant from the firm's core activities (Troilo et al., 2014; Suzuki, 2018). With slack, firms are better equipped to tolerate higher levels of uncertainty and pursue radical innovation. Additionally, it enables firms to sustain and invest in multiple projects that might otherwise have been abandoned (Herold et al., 2006). Consequently, in the presence of slack, managerial decisions are more likely to promote radical innovation (Troilo et al., 2014; Voss, Sirdeshmukh, and Voss, 2008; Mishina, Pollock, and Porac, 2004; Tan and Peng, 2003).

Symmetrically, slack is thought to have a negative effect on incremental innovation (Voss et al., 2008; Mishina et al., 2004; Tan and Peng, 2003). By reducing competitive pressure and decreasing sensitivity to the competitive environment, slack diminishes the firm's ability to identify potential problems, thereby hindering the development of more efficient solutions and slowing incremental innovation (Suzuki, 2018). Furthermore, excessive slack may lead managers to favor exploratory projects to answer simple problems, thus, diverting the firm from more direct and profitable solutions (Simon, 1957).

This concise review of the literature demonstrates that excess resources do not necessarily have a positive effect on all types of innovation. This review of the existing literature prompts a deeper analysis of the impact of different types of public support on various forms of innovation, while also accounting for the initial level of slack within the firms requesting such support.

3. Research Hypotheses

Direct public support, granted after the validation of the project's eligibility by the aid provider, supplies liquidity to the firm and can therefore be perceived as an extension of financial slack (with the support increasing the firm's initial slack level). This leads us to posit that public support, regardless of its form, contributes positively to innovation. However, according to the Behavioral Theory of the Firm (Cyert and March, 1963), a firm's initial slack level influences its behavior and decision-making regarding innovation strategy. Consequently, the firm's initial slack is likely to moderate the effect of direct public support on innovation. Furthermore, we propose that public support characteristics, by shaping decision-makers' degree of managerial discretion, may stir the firm towards one type of innovation over another. Specifically, support that more closely resembles debt imposes greater constraints on managerial discretion, steering the decision-maker choices toward incremental innovation. Below, we elaborate on our

arguments for each of these dimensions, which ensues in the formulation of an integrated research model.

3.1. Direct public support: An extension of slack promoting different forms of innovation

The various forms of support provided by Bpifrance are conditional upon the submission of a proposal by SMEs and are generally allocated to specific innovation projects. Nevertheless, companies benefit from non-intrusive, overarching, oversight from Bpifrance. Indeed, Bpifrance does not conduct a detailed review of every expense but instead performs a general follow-up *a posteriori*. Bpifrance disburses up to 70% of the support at the time of allocation, with the remainder released upon project completion. As such, the provision of support enhances the firm's financial slack without directly constraining the managerial discretion of its decision-maker. Furthermore, the funds received free up resources for other initiatives. Consequently, akin to an increase in slack, receiving direct support provides greater flexibility in terms of investment and innovation, which should enhance innovation activity.

In this vein, many studies show that public support impacts positively R&D expenditures (Huego and Moreno, 2017). Similarly, Bpifrance (2020) demonstrates that access to Bpifrance's support strengthens R&D spending within firms. A report by the Cour des Comptes (2021) confirms these findings. Finally, and most importantly, support is granted only if the company characterize its project as innovative. As a result, supported companies all have an innovation project and are more likely to innovate than non-supported firms. Based on this, we posit that the provision of support should result in a positive impact on innovation within the firm, regardless of the nature of the support. Consequently, we propose the following hypotheses:

Hypothesis H1: Direct public support has a positive effect on radical innovation.

Hypothesis H2: Direct public support has a positive effect on incremental innovation.

3.2. A positive effect of direct public support moderated by initial slack

It is essential to consider the context which can be more or less conducive to a specific type of innovation. Indeed, the effectiveness of government support is closely tied to the nature of the internal resources available within the firm (Zhang and Guan, 2018). The literature discussed in the previous section reveals that the level of slack affects radical and incremental innovation differently. Slack creates a more or less favorable context for a particular type of innovation. Hence, influencing the impact of public support on innovation. High slack promotes radical innovation while hindering incremental innovation, whereas low slack produces the opposite

effect. Indeed, a high initial slack level fosters a favorable context for radical innovation. Slack equips the firm with the resources necessary to partially or fully fund this radical innovation. However, the literature highlights a risk of weaker project selection and lower project completion rates when slack is abundant (Nohria and Gulati, 1996; Herold et al., 2006). Following a mechanism of diminishing returns, we posit that while the effect of public support on radical innovation remains positive, it should decrease as the initial slack level increases:

Hypothesis H1a: The effect of public support on radical innovation decreases as the level of initial slack increases.

This declining effect of public support as the firm's initial slack increases is expected to be even more pronounced for incremental innovation, as it is influenced by more than just a mechanism of diminishing returns. The literature review demonstrated that low initial slack favors incremental innovation by steering the firm toward cautious and less risky projects (Suzuki, 2018). In such a context, public support is more likely to be directed toward incremental innovation projects.

Conversely, high slack encourages exploratory innovation projects (Troilo et al., 2014), which are less focused on incremental innovation. As slack increases, not only does the mechanism of diminishing returns come into play, but the firm also finds itself in a context less conducive to incremental innovation, further reducing the effect of public support on this type of innovation. We therefore propose the following hypothesis:

Hypothesis H2a: The effect of public support on incremental innovation decreases as the level of initial slack increases.

3.3. A differentiated positive impact of the type of direct public support on radical and incremental innovation

The French public bank Bpifrance supports innovation in SMEs through various types of direct public support (Bpifrance, 2020), including grants, zero-interest loans, and repayable advances. A grant is a financial contribution with no repayment obligation, typically in smaller amounts than zero-interest loans or repayable advances. A zero-interest loan provides liquidity with a repayment obligation but without any interest charges. The amount of such loans is usually equal to or greater than that of grants but smaller than that of repayable advances. A repayable advance is similar to a zero-interest loan. It does, however, come with specific conditions,

including a reduced (or even zero) interest rate compared to a conventional bank loan, as well as deferred repayment. Repayment is often contingent on the project's success: up to 60% of the loan may be canceled in the event of an R&D project failure, subject to Bpifrance's approval. The amount of the repayable advance is generally higher than that of the zero-interest loan and the grant. Table 1 summarizes the characteristics of each type of support, as well as their relative amounts.

Support type	Characteristics	Relative Amount	
Grant	Provision of liquidity No repayment requirement	Amount less than or equal to the zero-interest loan Amount less than the repayable advance	
Repayable Advance	Provision of liquidity Interest rate below the standard banking market, potentially zero 100% repayment required if the project is successful 40% repayment required if the project fails Success or failure assessed by Bpifrance Repayment deferral possible, subject to Bpifrance's prior approval	Amount greater than both the grant and the zero-interest loan	
Zero-Interest Loan	Provision of liquidity Zero-interest rate Repayment requirement	Amount equal to or greater than the grant Amount less than to the repayable advance	

Table 1: Characteristics and relative amounts of direct public support

These characteristics show that the different types of support are more or less similar to debt. Building on the arguments and theory developed in Choi, Kumar, and Zambuto (2016) regarding the impact of debt on exploratory and exploitative innovation, we propose that certain types of support will be more conducive to radical innovation, while others will steer the firm more toward incremental innovation.

The argument put forth by Choi et al. (2016) is based on the idea that debt financing steers the firm toward incremental innovation, which is grounded in the exploitation of existing knowledge. This effect is primarily linked to the repayment obligations associated with debt. The manager must ensure that the firm, and the innovation project itself, can generate enough cash flows to pay off the debt, placing the manager in a position focused on achieving financial performance. In this vein, the manager prioritizes incremental innovations, relies on the existing

knowledge stock, and adopts an exploitation approach. Choi et al. (2016, p. 1186) also observe that debt financing reinforces a manager's sensitivity to market forces (which, in the case of equity financing, would be less pronounced). Translating these arguments within the Behavioral Theory of the Firm (Cyert & March, 1963) framework, we argue that debt-like support will direct the firm toward incremental innovation for two complementary reasons. First, the manager is fully aware that the slack provided by the support in the form of a loan is temporary and hence must be repaid. The company certainly finds a way to implement its innovation projects, but the temporary slack provided in this case does not shield the firm from market forces. Furthermore, the repayment requirements associated with debt type support encourage the manager to opt for innovations that are likely to generate positive cash flows relatively quickly and with lower risk. These two factors are unfavorable to radical innovation and favorable to incremental innovation. Thus, the more public support resembles debt, the more it favors incremental innovation at the expense of radical innovation. Conversely, support that does not entail any repayment obligations will continuously increase the firm's available slack, thereby promoting radical innovation and discouraging incremental innovation.

We therefore argue that, all else being equal, forms of support that do not resemble debt will be more favorable to radical innovation than other types of direct public support, while support that resembles debt will be more favorable to incremental innovation than other forms of direct public support. The classification of different types of public support as debt is relatively straightforward: grants do not resemble debt in any way; interest-free loans are a form of debt (even though their cost is zero); between these two lies the repayable advance, which partially resembles debt, as partial repayment in case of failure is possible. This leads us to formulate the following hypotheses:

Hypothesis H1b: Grants have a more positive effect on radical innovation than interest-free loans and repayable advances.

Hypothesis H2b: Zero-interest loans and repayable advances have a more positive effect on incremental innovation than grants.

Figure 1 presents the general model of the research, incorporating all hypotheses. This diagram summarizes the expected relationships between the different forms of direct public support and the two types of innovation (H1 and H2), the moderating effect of initial slack on these relationships (H1a and H2a), and finally the differentiated effects of the two forms of public

support (based on their similarity to debt financing) on the two types of innovation (H1b and H2b). It thus provides a structured overview of the dynamics explored in this article.



Figure 1: General Research Model

The dashed arrows indicate less pronounced positive effects (in H1b, public support resembling debt has a less pronounced effect on radical innovation than grants; in H2b, grants have a less pronounced positive effect on incremental innovation than public support resembling debt).

*Refers to the two types of direct public support resembling debt.

4. Data and Methodology

4.1. Data

The dataset used in this research is constructed from several secondary databases: the CIS (Community Innovation Survey⁴) database, the Bpifrance (French Public Investment Bank⁵) database, as well as the FARE and FICUS accounting and financial databases from the DGFIP. The CIS questionnaires from the period 2002 to 2016 provided all the variables related to innovation in SMEs. These surveys inquire firms every 3 years about their innovation activities (context, efforts, barriers, outputs). We focus exclusively on SMEs (less than 250 employees or a turnover of less than 50 million euros). In France, the CIS surveys only systematically question companies with more than 250 full-time equivalent employees every 3 years; other companies are sampled. Therefore, SMEs observed, below this threshold, are typically

⁴ The Community Innovation Surveys (CIS) are a series of European innovation surveys carried out by national statistical agencies throughout the European Union, as well as in Norway and Iceland.

⁵ Public Finances General Dictetorate

surveyed only once or twice during the period. Our sample can thus be considered as a random sample within the population of French SMEs. This characteristic is advantageous, but it also makes it impossible to create a panel dataset of SMEs.

Using their SIREN number, the innovation data from the various CIS surveys were then matched with data from the Bpifrance database. These data are critical to our study as they record all firms that benefited from the supports and schemes provided by Bpifrance between 2000 and 2014. The data encompasses four main categories of interventions: innovation support, co-financing interventions, interventions with Bpifrance's guarantee, and operations related to the mobilization of receivables to finance the working capital cycle. In this study, we only consider Bpifrance's innovation-related aids that translate into financial support for the aided SME, namely direct individual supports (grants, zero-interest loans, repayable advances). For each intervention under one of these schemes, the data provide information on the year of the operation, the beneficiary, the nature of the financing, the amount, its purpose, and the project for which the operation is carried out. A single company may receive multiple Bpifrance fundings in the same year for either the same or different projects under the innovation aid scheme. We considered the total amount of support received in a given year - including all types of direct supports – as well as the specific amount for each type of support within that year. Note that, as the Bpifrance database is thorough, we can determine whether an SME received support each year between 2000 to 2014, even if the firm is only present in a single CIS questionnaire during that period.

We considered that Bpifrance's support could take several months to a few years to produce effects on the innovation of SMEs. Therefore, we incorporated a time lag between the year the Bpifrance support was obtained and the measurement of innovation in the CIS. Since each CIS survey covers a 3-year period, we adopted a 3-year time step for our study. We considered that the impact of Bpifrance's assistance on SMEs' innovation might not materialize for many months to a few years. Consequently, we included a delay between the measurement of innovation in the CIS and the year the Bpifrance support was obtained. We used a 3-year time step for our investigation because every CIS survey spans a 3-year period. Although it is not very common for the same SME to appear in multiple CIS surveys (especially consecutive ones), it is relatively frequent for a single SME to receive support from Bpifrance multiple times during the 2000-2014 period. In order to account for this, we included a variable that accounts for how many times a SME received support in the three years prior to the CIS survey.

Subsequently, we matched the Bpifrance and CIS data with accounting information from the FARE and FICUS databases regarding the liquidity of assets, size, and performance of the SMEs. These data are extracted for each SME two years before the start of the CIS observation period, that is, at the point when the SME may (or may not) receive Bpifrance's support.

Finally, we obtain data for seven successive CIS waves, amounting to approximately 135,000 observations (with SMEs being the majority in number, either observed once or multiple times). However, two CIS waves (CIS 2008, covering the 2006-2008 period, and CIS 2012, covering the 2010-2012 period) are excluded due to the lack of data on barriers to innovation. The numerous restrictions imposed by the availability of various variables result in a significant reduction of the sample. Additionally, we truncated extreme observations where the aid exceeded 100% of the firm's revenue. These extreme observations remain few, representing less than 1% of the sample observations. Ultimately, we have data for all variables for 24,086 observations, of which 1,976 received Bpifrance aid in the 3-year window preceding the CIS survey.

4.2. Variables

The dependent variables are measures of radical and incremental innovation. These variables are measured using the CIS questionnaires, surveying firms over a 3-year period. Radical innovation is measured by the proportion of turnover (from the last year of the considered CIS) generated by new (or significantly improved) products and services for the market, developed by the firm during the 3-year period covered by the CIS. Incremental innovation is measured in the same 3 year period by the proportion of turnover generated by products or services that are new only to the SME, but not to its market.

The central independent variables concern the measurement of slack, as well as the supports provided by Bpifrance. The initial slack level is measured for the fiscal year ending 2 years before the start of the CIS observation window, i.e., just before and up to 3 years before the potential allocation of Bpifrance support. It is measured by the total amount of liquid assets (cash and marketable securities) relative to net assets for the same year. This initial slack level is obtained using data from the FARE and FICUS databases. The amount of each type of public aid (grant, repayable advance, zero-interest innovation loan) received during the three years preceding the innovation observation period is related to turnover. For example, the amount of each type of support received in 2000, 2001, or 2002 is accumulated for this period and then compared to the innovation behavior of the company during the subsequent 3-year period based

on the CIS 2002-2004 survey. The "Bpifrance support" variable is thus a cumulative measure of all aid received during the pre-CIS period, regardless of its form. Given the 3-year interval imposed by the CIS questionnaires, the time gap between receiving aid and measuring innovation can range from 2 to 5 years. The temporal measurement framework of the different variables is illustrated in Figure 2.





We also include control variables. These concerns, first, the existence of Bpifrance support provided during a period prior to the 2-year observation window before the CIS start. Therefore, we tallied the years that the SME was supported in the time frame leading up to the two years prior to the CIS. The control variables relate to barriers to innovation. Each CIS questionnaire asks firms about their barriers to innovation. Measured by items divided into barriers relating to costs (3 items), knowledge (4 items), and markets (2 items), these barriers are assessed on a scale from 0 (not relevant) to 3 (very substantial constraint). We considered that a firm experienced a barrier in each of these 3 categories if any item from that category was reported as exerting a very significant constraint on innovation. These variables allow us to account for financial constraints, as well as knowledge and market-related constraints that may impact innovation. We then included the intensity of innovation effort, measured by the number of R&D activities carried out by the SME during the CIS period in which innovation is measured. The CIS database includes up to seven types of innovation activities (internal R&D, external R&D, design, acquisition of machines, etc.). Finally, we include the SME's size, measured by the logarithm of turnover (log turnover) at the end of the CIS period, and the industry sector, measured using 10 dichotomous sector variables.

Table 2 presents each variable, its definition, and its measurement period, where the fiscal year "t" refers to the year in which the dependent variable is measured. All other variables are from prior periods and are ordered in a way that aligns with causal logic: the control and initial slack measurement variables are the most temporally distant, followed by the aid measurement variables.

Variable	Definition et Measurement	Measurement period
Radical Innovation (as % of Turnover)	Proportion of turnover generated by products or services new to the market. These innovations must have been developed over the last 3 years.	End of year t
Incremental Innovation (as % of Turnover)	Proportion of turnover generated by products or services new to the company, but not to the market. These innovations must have been developed over the last 3 years.	End of year t
Grant (as % of Turnover)	Total amount of support received in the form of a grant for the fiscal years t-4, t-3, t-2. This amount is related to the turnover of fiscal year t-2.	End of t-4 to end of t-2
Repayable Advance (as % of Turnover) Total amount of support received in the form of a repayable advance for the fiscal years t-4, t-3, t-2. This amount is related to the turnover of fiscal year t-2.		End of t-4 to end of t-2
Zero-interest Loan (as % of Turnover)Total amount of support received in the form of an zero-interest loan for the fiscal years t-4, t-3, t-2. This amount is related to the turnover of fiscal year t-2.		End of t-4 to end of t-2
Bpifrance Support (as % of Turnover)	Bpifrance Support (as % of Turnover)Cumulative total amount of all supports (regardless of form) received for the fiscal years t-4, t-3, t-2. This amount is related to the turnover of fiscal year t-2.	
Slack (as % of Net Assets)	Ratio [(total cash + marketable securities) / total net assets], measured at the end of fiscal year t-5.	End of t-5
Knowledge Barrier	Constructed from the ratings [on a scale from 0 (not concerned) to 3 (very significant constraint)] of the 4 CIS items related to knowledge barriers.	End of t-3 to end of t
Cost BarrierConstructed from the ratings [on a scale from 0 (not concerned) to 3 (very significant constraint)] of the 3 CIS items related to cost barriers.		End of t-3 to end of t
Market Barrier	Market BarrierConstructed from the ratings [on a scale from 0 (not concerned) to 3 (very significant constraint)] of the 2 CIS items related to market barriers.	
Innovation Effort	The number of R&D activities undertaken by the SME during the CIS period.	End of t-3 to end of t
Prior Supports	Number of years the company received Bpifrance support before t-5.	De fin 2000 à fin t-5

Table 2 : Variables presentation

Log(Turnover)	Logarithm of the firm's turnover.	End of t
Industrial Sector	Set of 10 dichotomous variables constructed from the first digit of the APE code (main business activity).	All years (since the main firm activity of the company does not change)

4.3. Descriptive statistics

The descriptive statistics are detailed in Table 3, and the correlation matrix is provided in Appendix 1. The variance inflation factors (VIF) are all below 5, indicating no risk of multicollinearity. Radical innovation and incremental innovation each represent, on average, just over 5% of the turnover for the companies in the sample. This average is significantly higher for firms that received Bpifrance support in the two years preceding the start of the CIS period, particularly for radical innovation, which accounts for more than 17% of turnover for these firms. For SMEs receiving Bpifrance support, the aid represents more than 6% of their turnover at the time the support is received. When provided, the zero-interest loan represents, on average, nearly 0.9% of turnover, the grant represents 2.4%, and the repayable advance represents 3.1%. The initial slack, which refers to liquid assets measured before the potential receipt of Bpifrance support and before the measurement of innovation, represents, on average, 15% of the total net assets. This amount is slightly higher for firms that received Bpifrance support, but the difference is only statistically significant at the 10% level.

	Global Sample (24,086 obs.) Average	(1) Subsample without Bpi support (22,110 obs.) Average	(2) Subsample with Bpi support (1,976 obs.) Average	(3) =(1)-(2) Difference in Mean	t associated with the difference
Radical Inno.	5.410	4.356	17.203	-12.846***	-34.64
Incremental Inno.	5.151	4.752	9.617	-4.865***	-14.08
Bpi Support	0.652	0	6.317		
Grant	0.193	0	2.361		
Repayable Advance	0.252	0	3.081		
Zero-Interest Loan	0.071	0	0.874		

Table 3: Descriptive Statistics

Initial slack	0.153	0.153	0.160	-0.007^{\dagger}	-1.88
Knowledge Barrier	0.174	0.171	0.214	-0.043***	-4.86
Cost Barrier	0.269	0.261	0.360	-0.099***	-9.49
Market Barrier	0.182	0.180	0.206	-0.026**	-2.92
Innovation Effort	1.792	1.637	3.531	-1.894***	-43.66
Previous Supports	0.104	0.008	1.177	-1.169***	-100
Turnover (End of CIS)	8795.029	8772.617	9045.801	-272.814	-1.17

Significant at the level of: † 10%, * 5%, ** 1%, *** 0.1%

About 20% of forms report experiencing barriers to innovation in terms of knowledge, cost, or market (17.4%, 26.9%, and 18.2% for knowledge, cost, and market barriers, respectively). Regardless of the type of barriers, this proportion is significantly higher for firms that received Bpifrance support. Firms that wish to innovate experience these barriers more acutely, as shown by D'Este, Iammarino, Savona, and Von Tunzelmann (2012). These companies also engage in a higher level of innovation activities. They are, on average, involved in 3.5 innovation activities, compared to the 1.64 activities for unsupported SMEs.

It is also notable that firms that did not receive support in the two years before the start of the CIS survey may have benefited from support in a prior period. On average, they received 0.1 support during the period preceding the two years before the CIS survey. On the other hand, Bpifrance support appears to be more recurrent for firms that have already benefited from it. On average, such firms received 1.17 supports during the period prior to the observation window. However, our data (not reported here) show that very few companies received support for more than three years during the designated period.

Overall, the innovation profiles of SMEs are quite distinct, depending on whether or not the firm has received support. This is not the case for financial variables preceding the support, such as initial slack. In the next section of the article, we present the results of the regressions performed using Stata (version 17).

5. Regression results

We first test the hypotheses concerning the relationship between total Bpifrance support and innovation (5.1), without decomposing the different forms of support. Then, we test the

hypotheses linking the various forms of support (grants, zero-interest loans, and repayable advances) to innovation (5.2).

5.1. Regression Models Considering Total Bpifrance Support

Table 4 presents the results of the regressions testing hypotheses H1, H2, H1a, and H2a, which focus on the total amount of support received by firms. Regression 1 shows that Bpifrance support is positively associated with the level of radical innovation. The effect is both statistically and economically significant. Thus, hypothesis H1 is corroborated: financial support from Bpifrance is positively associated with radical innovation. Regression 2 reveals a non-significant effect of Bpifrance support on incremental innovation. Therefore, hypothesis H2 is not corroborated: financial support from Bpifrance is positively associated with radical innovation.

Regressions 3 and 4 incorporate interactions between Bpifrance support and the initial slack level, allowing us to test hypotheses H1a and H2a. The statistically significant negative coefficient for the interaction term between Bpifrance aid and initial slack supports these hypotheses: as the level of slack increases, the positive effect of public support diminishes, both for radical and incremental innovation. This negative moderation effect is particularly pronounced for incremental innovation. The estimated coefficient for the "Bpifrance support" variable in regression 4 shows that public support has a significant positive effect on incremental innovation when the initial slack level is low (more specifically, zero). As slack increases, this effect weakens. This significant moderation effect explains the statistical insignificance of public support in the absence of interaction terms in regression 2. In contrast, the results from regressions 1 and 3 show that the effect of public support on radical innovation, although negatively moderated by the initial slack level, remains positive and significant on average when the slack level is held constant.

Table 4:	Regression	Model	Considering	Total Bpifr	ance Support
				1	11

	Regressions without interactions		Regressions with interactions	
	(1)	(2)	(3)	(4)
	Radical	Incremental	Radical	Incremental
	Innovation	Innovation	Innovation	Innovation
Bpi Support	0.434***	0.066	0.489***	0.139***
	(0.024)	(0.023)	(0.036)	(0.034)

Initial Slack	2.265***	0.178	2.434***	0.047
	(0.575)	(0.546)	(0.580)	(0.552)
Bpi Support X Initial Slack	-	-	-0.188* (0.091)	-0.252*** (0.086)
Knowledge Barrier	-0.351	0.293	-0.354	-0.299
	(0.278)	(0.264)	(0.278)	(0.264)
Cost Barrier	0.614 [*]	-0.449	0.626 [*]	-0.434 [†]
	(0.240)	(0.228)	(0.240)	(0.228)
Market Barrier	-1.357***	0.186	-1.356***	0.187
	(0.272)	(0.258)	(0.271)	(0.258)
Innovation Effort	2.437***	2.088 ^{***}	2.437***	2.089***
	(0.053)	(0.051)	(0.531)	(0.050)
Previous Supports	3.316***	0.663***	3.286***	0.622***
	(0.179)	(0.170)	(0.180)	(0.171)
Log Turnover	-0.473***	-0.401***	-0.468 ^{**} *	-0.393***
	(0.088)	(0.083)	(0.088)	(0.083)
Industrial Sector	Included	Included	Included	Included
Constant	-1.121	2.724	-1.209	2.608
	(2.792)	(2.652)	(2.792)	(2.652)
Number of Observations	24,086	24,086	24,086	24,086
Chi-square	4282.46***	2122.53***	4287.52***	2131.80***
R ²	0.1510	0.0810	0.1511	0.0813

Significant at the level of: † 10%, * 5%, ** 1%, *** 0.1%

*: The R² corresponds to the percentage of variance explained by the predictors; it is provided for descriptive purposes, but it is a poorly defined concept when generalized least squares estimation is used.

Captions: Regressions on radical and incremental innovation for the various variables listed in Table 2. The sample consists of 24,086 observations, of which 1,976 received aid during the period 2000-2014.

To explore and better explain the effect of public support on both radical and incremental innovation, we examine in Table 5 the marginal effect of total Bpifrance support on each type of innovation, depending on different initial slack levels. These slack levels are defined based on percentiles determined from the observed statistical distribution of the overall sample (24,086 firms). The categories for initial slack—low, median, and high—are respectively based on the 5th, 50th, and 90th percentiles. Thus, a low initial slack represents 0.02%, a median initial slack represents 10.35%, and a high initial slack represents 42.39% of the firm's net assets. The results confirm that Bpifrance support has a significant positive effect on incremental innovation for low to median slack levels. However, when slack is high, the effect of the support on incremental innovation becomes statistically insignificant. Regarding radical

innovation, Bpifrance support has a significant positive effect at all levels of slack. However, this effect decreases as initial slack increases.

		Low Initial Slack	Median Initial Slack	High Initial Slack	
Bpi Support	Radical Inno.	0.489**	0.469***	0.409***	
	Incremental Inno.	0.139***	0.113***	0.032	

Table 5: Estimation of the Marginal Effects of Total Bpifrance Support on Innovations by Different Initial Slack Levels

5.2. Regression Models Considering Decomposed Bpifrance Aid

Regressions 5 and 6 presented in Table 6, along with the coefficient difference tests in Table 7, allow us to test hypotheses H1b and H2b; Hypotheses which suggest a differentiated effect of the various public supports on the two types of innovation. Regarding radical innovation (regression 5), the results show that all kinds of support are positively associated with radical innovation. The estimated coefficient for the grant (0.661) is higher than those for the zero-interest loan (0.407) and the repayable advance (0.278). The results of the coefficient difference tests, shown in the first column of Table 7, confirm that the marginal effect of one euro of grant on radical innovation is statistically significantly greater than that of one euro of repayable advance or interest-free loan. Therefore, hypothesis H1b is confirmed: non-debt-based supports are more favorable to radical innovation than debt-like supports.

	Regression without interaction		Regression with interactions	
	(5)	(6)	(7)	(8)
	Radical	Incremental	Radical	Incremental
	Innovation	Innovation	Innovation	Innovation
Grant	0.661 ^{***}	0.010	0.783^{***}	0.051
	(0.041)	(0.039)	(0.065)	(0.061)
Repayable Advance	0.278 ^{***}	0.091 ^{**}	0.312 ^{***}	0.179 ^{***}
	(0.0349)	(0.033)	(0.050)	(0.048)

Zero-Interest Loan	0.407 ^{***}	0.131*	0.574 ^{***}	0.198 ^{**}
	(0.067)	(0.634)	(0.105)	(0.099)
Initial Slack	2.244***	0.169	2.481 ^{***}	0.449 [†]
	(0.575)	(0.546)	(0.580)	(0.552)
Grant X Initial Slack	-	-	-0.362** (0.147)	-0.123 (0.140)
Repayable Advance X Initial Slack	-	-	-0.127 (0.137)	-0.331 (0.130)
Zero-Interest Loan X Initial Slack	-	-	-0.654** (0.322)	-0.256 (0.403)
Knowledge Barrier	0.357	-0.294	-0.353	-0.303
	(0.278)	(0.264)	(0.278)	(0.264)
Cost Barrier	0.620†	-0.447	0.631**	-0.430
	(0.240)	(0.228)	(0.240)	(0.228)
Market Barrier	1.348***	0.186	-1.347***	0.187
	(0.271)	(0.258)	(0.271)	(0.258)
Innovation Effort	2.440***	2.089***	2.440***	2.090***
	(0.053)	(0.050)	(0.053)	(0.050)
Previous Supports	3.244***	0.667***	3.177 ^{***}	0.638***
	(0.180)	(0.170)	(0.180)	(0.172)
Log Turnover	0.459***	0.404***	0.449***	-0.397***
	(0.088)	(0.084)	(0.088)	(0.084)
Industrial Sector	Included	Included	Included	Included
Constant	-1.257	2.747	1.404	2.635
	(2.789)	(2.652)	(2.789)	(2.652)
Number of Observations	24,086	24,086	24,086	24,086
Chi-square	4339.27***	2126.52***	4352.80***	2135.69***
R ² *	0.1527	0.0811	0.1531	0.0814
Residuals correlation	0.0231		0.0228	
Breusch-Pagan Independence Test (chi2(1))	12.829***		12.522***	

Regarding incremental innovation (regression 6), the results indicate a differentiated effect of each type of support on incremental innovation. The marginal effect of the grant is not statistically significant: an additional euro of grant is not associated with a higher level of incremental innovation. In contrast, both interest-free loans and repayable advances are positively and significantly associated with incremental innovation. Despite these differentiated effects of the different types of support, the coefficient difference tests shown in Table 7 reveal no statistically significant differences at the generally accepted significance threshold. Only the coefficient for grants is significantly lower than that for interest-free loans, and this difference is significant at a 10% level, which is rarely used in academic studies. Therefore, hypothesis H2b is only partially corroborated.

Radical Innovation	Incremental Innovation			
Chi-square	Chi-square			
2.98***	2.76^{\dagger}			
47.90***	2.37			
10.96*	0.33			
	Radical InnovationChi-square2.98***47.90***10.96*			

Significant at the level of: † 10%, * 5%, ** 1%, *** 0.1%

Regressions 7 and 8 in Table 6 are not intended to test a particular hypothesis in our study, but they complement the regressions with interactions shown in Table 4. These regressions reveal that the negative interaction between initial slack and public support is statistically significant for two of the three types of public support regarding radical innovation. These interaction effects are not significant for each type of support regarding incremental innovation, although the interaction effect is significant when considering all public support globally (see regression 4 in Table 4).

To explore and better explain these results, we present in Table 8 the marginal effects of each type of support on each type of innovation for different slack levels. These results are informative. They confirm that, for radical innovation, the effect of each type of support remains positive and significant but decreases as the slack level increases. Regarding incremental innovation, two main results emerge. First, grants are never positively associated with incremental innovation, even when initial slack is low. Second, other types of support with a

debt-like nature (repayable advance and zero-interest loan) are positively associated with incremental innovation, but only when slack is low or moderate. When slack is high, these supports no longer have a statistically significant effect on incremental innovation. The idea that a high slack level is detrimental to incremental innovation is supported by this result, which supports hypotheses H1a and H2a. In this setting, no support—even if theoretically favorable— is linked to incremental innovation.

Radical Innovation	Low Initial Slack	Median Initial Slack	High Initial Slack
Grant	0.783**	0.746***	0.630***
Repayable Advance	0.312***	0.298***	0.257***
Zero-interest loan	0.574***	0.507***	0.297***

 Table 8: Estimated marginal effects of public aid on innovation for different levels of slack

Significant at the level of: † 10%, * 5%, ** 1%, *** 0.1%

Incremental Innovation	Low Initial Slack	Median Initial Slack	High Initial Slack		
Grant	0.050	0.038	0.001		
Repayable Advance	0.178***	0.144***	0.038		
Zero-interest loan	0.198**	0.172**	0.090		

Significant at the level of: † 10%, * 5%, ** 1%, *** 0.1%

6. Discussion and Conclusion

6.1. Discussion of Results

Our findings highlight the relevance of direct public support mechanisms for fostering innovation within SMEs, as they help reduce the financial constraints that innovative SMEs face while also taking on some of the risk (Chiappini, Christophe, Demaria, Dortet-Bernadet, Montmartin, and Pommet, 2023). The theoretical perspective adopted in this study, along with the results obtained, provide a new insight into the effect of public support on innovation within SMEs. They allow us to go beyond simply confirming previous findings, which establish that direct public support is positively associated with innovation in SMEs, by qualitatively deepening the study of the relationship between different types of public support and various types of innovation.

At an aggregated level, that is, across all forms of support, we confirm a statistically and economically significant relationship between the amount of public support and radical innovation. However, the relationship appears less clear when it comes to incremental innovation. Our theoretical framework, by mobilizing the initial level of slack as a negative moderator of the relationship between public support and innovation, explains this result ; particularly for incremental innovation. Indeed, in a situation of abundant cash flow, beyond the diminishing returns of the additional funds provided by public support and the reduced selectivity of innovation projects, the context is fundamentally unfavorable to incremental innovation. According to the Behavioral Theory of the Firm (Cyert and March, 1963), an abundance of slack isolates, or protects, the firm from market pressures (Tan and Peng, 2003). It pushes the firm toward more exploratory than exploitative search behaviors because the potential problems that the firm may face does not appear as acute (Troilo et al., 2014). The significant negative moderation of the initial slack level on the relationship between public support and innovation is therefore substantial in the case of incremental innovation. Subsequently, in the context of incremental innovation, the relationship holds only in contexts of low to moderate slack. In situations of high initial slack, it is difficult to expect public support to foster incremental innovation.

At a more detailed level, by breaking down public support into three distinct categories, we show that each type of support has a different capacity to foster the two forms of innovation. Supports that resemble debt, because they entail a repayment obligation, are likely to encourage search behavior oriented toward exploitation and subsequently incremental innovation, rather than radical innovation. Subsidies, which are less constraining for the future of the firm, should foster more radical, riskier innovation. Our results are broadly consistent with these predictions. Thus, we observe that zero-interest loans and repayable advances are positively and significantly associated with incremental innovation, while grants, compared to other forms of support, have a significantly stronger effect on radical innovation.

The results of this empirical study offer several contributions for both public authorities and the firms themselves. First, they legitimize the importance of direct public support mechanisms to foster innovation within SMEs. These results provide a favorable response to the often-raised concerns regarding the effectiveness of public support distributed to firms. The overall picture that emerges from our analyses is one of a strong relationship between public support and radical innovation. Furthermore, grants prove to be the most effective form of support for fostering radical innovation. However, other types of support are also positively associated with

this type of innovation. Therefore, even though grants more strongly favor radical innovation than the other two types of support, we show that any form of direct support promotes radical innovation. However, the level of initial slack negatively moderates this relationship. The effectiveness of support decreases as initial slack increases, but the association remains positive and significant in the context of radical innovation. In contrast, the relationship between public support and incremental innovation is more fragile. There is no significant effect between receiving a grant and incremental innovation. Other types of support do foster this type of innovation, but only when initial slack is not too high, that is, when the firm's available resources are relatively low. One must therefore be aware that in certain contexts, particularly when financial pressures are less strong, public support may not be favorable to incremental innovation. Moreover, only public support akin to debt—which maintains the decision-maker's vigilance regarding the various effectiveness or performance issues their firm may face—is favorable to incremental innovation. This study thus highlights the importance of tailoring support types according to innovation goals and the financial conditions of SMEs.

Beyond practical implications, the study contributes to theoretical advancements. It first demonstrates that the Behavioral Theory of the Firm (Cyert and March, 1963) framework is useful for understanding and explaining SMEs' reactions to public support for innovation. Although this theoretical framework has led to numerous studies on the link between slack and innovation, to our knowledge, it is the first time it has been applied specifically to public support. It emphasizes the differentiated effect of slack on different research behaviors: "loose" or exploratory behaviors leading to radical innovation, and behaviors focused on problem-solving and exploitation leading to incremental innovation. Our results confirm the importance of this distinction on two levels. At a general level, they highlight a differentiated effect of support and slack on each type of innovation. At a more specific level, they show that the "debt" nature of support - because it is only a temporary added slack and places the decision—maker in a favorable position for exploitation-oriented research—can foster incremental innovation.

The concurrent examination of two forms of innovation in our study is also pertinent to a topic raised in the literature since the late 2000s: does slack foster innovation, or does resource constraint spur innovation? Some studies try to re-examine this subject by focusing on an entrepreneurial approach (Keupp and Gassmann, 2013) or on the dual character (both enabling and limiting) of any innovation constraint (Gibbert, Hoegl, and Valikangas, 2014). Though reflection does not end here, the Behavioral Theory of the Firm (Cyert and March, 1963) has long provided a straightforward answer (Troilo et al., 2014; Suzuki, 2018) that appears to be

accepted: it depends (on the sort of innovation and the type of slack). This response is supported by our findings. They show the contingent and potentially complex nature of the relationship between slack and innovation while emphasizing the strong flexibility and explanatory power of this theoretical framework.

6.2. Conclusion

The literature on direct public support and innovation often adopts a broad perspective, encompassing various types of firms and support mechanisms. These studies often develop an approach to evaluating public policies at the expense of a more positive and behavioral approach. Other studies, by focusing on a specific type of firm and a particular support mechanism, can address these gaps, but their very narrow focus limits their explanatory power beyond their specific field of study. Therefore, it seemed relevant to us to propose a model that studies the impact of public support on the innovations of a broad group of firms-SMEswith a behavioral approach that helps explain the observed results. The choice of SMEs is particularly relevant because, beyond the large number of firms represented, SMEs face resource constraints to innovate and are the primary beneficiaries of such direct public support. The proposed model is based on the Behavioral Theory of the Firm (Cyert and March, 1963) developed in the mid-20th century, which explores the relationship between slack and innovation. This model allows and even encourages, the adoption of a broad view of innovation, distinguishing radical innovation, which is more exploratory in nature, from incremental innovation, which is related to an exploitative behavior. It enables us to develop hypotheses regarding the effect of public support on these types of innovation, depending on their initial slack condition. These hypotheses are tested on a large sample of 24,086 French SMEs among which 1,976 received direct support between 2000 and 2014. The results largely corroborate the hypotheses. They show that public support is generally positively associated with subsequent innovations, whether radical or incremental. This relationship is negatively moderated by the firm's initial slack level. Regarding radical innovation, this negative moderating effect significantly reduces the relationship but does not eliminate it. The relationship between public support and incremental innovation, on the other hand, is economically weaker and statistically fragile. It diminishes and becomes statistically insignificant when the slack level is high. In the context of our model, the explanation for this phenomenon is twofold. First, from a behavioral perspective, supports that do not carry the characteristics of debt (grants) are less favorable, or even detrimental, to incremental innovation, whereas other forms of support (zero-interest loans, repayable advances) may foster it. Our results clearly show that only those forms of support with the characteristics of debt are associated with subsequent incremental innovation. Second, incremental innovation is favored by a context of limited slack, conducive to a problem-solving approach to innovation. As the slack level increases, the context becomes unfavorable to incremental innovation and instead favors more exploratory research leading to radical innovation. Consequently, the relationship between public support and innovation is hindered, more so for incremental innovation than for radical innovation, by a high level of slack.

These results are easily translatable into managerial recommendations. They highlight the consistently positive impact of public support on radical innovation, although it decreases as the firm initially has a high level of slack. They also point to greater difficulty in promoting incremental innovation through public support. Only certain types of support (repayable advances and zero-interest loans) can lead to incremental innovation, and only under certain conditions, namely when cash flow is not overly abundant. The theoretical interest of the study particularly lies in the application of the Behavioral Theory of the Firm and the concept of slack to a new subject of study: direct public support. The analysis and results obtained demonstrate the great flexibility and explanatory power of this framework, which is now widely used in management research. Through its capacity to embrace a broad view of innovations and to rely on various underlying organizational processes and behaviors, this framework invites a departure from one-dimensional predictions in the study of innovation strategies.

Appendix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14	(15)	(16)
(1) Bpi Support	1.0000															
(2)Grant	0.3211	1.0000														
(3)Zero-Interest Loan	0.1975	0.0036	1.0000													
(4)Repayable Advance	0.3630	0.1087	0.0101	1.0000												
(5)Initial Slack	0.0219	0.0513	0 .0147	0.0418	1.0000											
(6)Radical Inno.	0.2369	0.1697	0.0772	0.1218	0.0495	1.0000										
(7)Incremental Inno.	0.0958	0.0379	0.0337	0.0536	0.0102	0.1187	1.0000									
(8) Knowledge Barrier	0.0285	0.0019	-0.0078	0.0046	-0.0045	0.0007	0.0049	1.0000								
(9) Cost Barrier	0.0608	0.0224	-0.0066	0.0346	-0.0870	0.0231	0.0024	0.3401	1.0000							
(10)Market Barrier	0.0161	-0.0015	-0.0123	0.0080	-0.0211	-0.0312	0.0021	0.3233	0.3179	1.0000						
(11)Inno. Effort	0.2743	0.0918	0.0515	0.1071	0.0115	0.3225	0.2771	0.0530	0.0508	-0.0013	1.0000					
(12) Previous Support	0.5730	0.2563	0.1793	0.2086	0.0307	0.2198	0.0857	-0.0189	0.0004	-0.0106	0.1957	1.0000				
(13) Turnover	-0.0120	-0.0490	-0.0218	-0.0448	-0.1560	-0.0168	-0.0014	-0.0461	-0.0741	-0.0283	0.1181	0.0017	1.0000			
(14) Group	-0.0219	-0.0325	-0.0052	-0.0288	-0.1892	0.0110	-0.0246	-0.0517	-0.0514	-0.0096	0.0905	-0.0141	0.3384	1.0000		
(15)Log Turnover	-0.0264	-0.1230	-0.0309	-0.0860	-0.1812	-0.0470	-0.0104	-0.0425	-0.0709	-0.0075	0.1002	-0.0153	0.7698	0.3626	1.0000	
(16)Total charges	-0.0028	-0.0012	-0.0009	-0.0011	-0.0105	-0.0022	-0.0013	-0.0063	-0.0050	-0.0032	0.0007	-0.008	0.0128	0.0177	0.0081	1.0000

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