System Dynamics Review

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Dynamic Analysis of the Adoption and Diffusion of the Entrepreneur's Behavior: An Institutional Approach

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ABSTRACT

A high level of entrepreneurship is a positive indicator of a country's potential for economic growth. However, some countries are more entrepreneurial than others, and this trend is often difficult to change. This paper addresses why the entrepreneur-to-population ratio remains so consistent within a country over time. The analysis is based on the Spanish case, which is one of the countries with the lowest entrepreneurship rates worldwide, despite the regulative efforts of governments over the past 20 years. Drawing on Bass's adoption-diffusion theory of innovations, while also considering the regulative, normative, and cultural-cognitive institutional dimensions affecting the entrepreneurs' behavior, we have designed a model that reproduces the flow of entrepreneurs through an entrepreneurial process consisting of three stages: potential entrepreneurs, early-stage entrepreneurs, and established entrepreneurs. Our main findings suggest that the number of entrepreneurs goes after a dynamic of growth and stagnation throughout the process. The Adoption and Diffusion of Entrepreneurs' Behavior (ADEB) model proposed herein explains both the time-limited effect of regulative incentives on the diffusion of entrepreneurs through the entrepreneurial process, as well as the long-term effect of normative and cultural-cognitive institutional dimensions. The theoretical discussion derived from this dynamic analysis provides relevant implications for academics, policy makers, and entrepreneurs.

1 | Introduction

Potential entrepreneurs are individuals with valuable capacities to encourage a region's economic growth, a signal of the entrepreneurial level of a society (Audretsch 2009). Entrepreneurship, as setting up new organizations, is multidimensional (Gartner 1988) as it is a context-dependent, social, and economic process (Low and Abrahamson 1997; Reynolds 1992). Entrepreneurship is a social and local phenomenon that depends not only on the institutional context (Thornton 1999) but also on individuals' decisions on financing, hiring, and other actions that often involve changing the founder's life.

Bird et al. (2012, 890) define entrepreneurs' behavior as the concrete enactment by individuals (or teams) of tasks or activities such as those named by Carter et al. (1996) (e.g., prepare a business plan, look for facilities, organize a team, hire employees, form a legal entity, and enter a market), which are somehow required to start and grow most new organizations. As we will argue later, behaviors are best understood as discrete units of goal-oriented actions that could be observed by third parties while being considered meaningful by both actors and an audience. These authors also highlight the relevance of knowing entrepreneurs' behavior to shape other entrepreneurs' behavior and to lead stakeholders' contributions like investors, local

governments, or educators. Following this approach, and after having analyzed the different entrepreneur-to-population ratios in Europe, Audretsch and Belitski (2017, 1045) defined an efficient entrepreneurial ecosystem as "a complex system of interactions between agents within various socioeconomic, institutional and informational contexts which generate more new businesses and growth."

According to Reynolds and White (1997), 1 out of 25 (4%) individuals are available to start a new firm at any time, which forms the baseline of entrepreneurship in any place. On the other hand and on the same basis, the Global Entrepreneurship Monitor (GEM) reflects a significant cross-country variability among national entrepreneur-to-population ratio (entrepreneurs' rates) in contrast with a lack of in-country variability over time (Hill et al. 2025). Previous research has explained, through institutional lenses, why this percentage is higher in some countries than in others (Urbano et al. 2019). Nevertheless, there is still a research gap that explains why these entrepreneurs' rates remain stable within those countries or regions over time, despite the change of governments, the evolution of socioeconomic conditions, and even different population distribution. This research gap addresses the concerns of academics and policymakers in countries with low entrepreneurship levels, who question why these rates have not increased over time despite significant investments aimed at fostering entrepreneurship. This stagnation persists even though such countries maintain similar regulations to those of nations with higher entrepreneurship rates. This research seeks to explore the dynamics of entrepreneurs' behavior, specifically their progression from being a potential entrepreneur (an individual who intends to start a new venture) to an early-stage entrepreneur (someone leading a new venture that is less than three and a half years old) and finally to an established entrepreneur (someone managing a venture that has existed for more than three and a half years).

Given the complexity of studying entrepreneurship as a socioeconomic phenomenon during the past two decades, researchers have mainly analyzed entrepreneurs' behavior from two points of view: institutional and individual. The institutional perspective, which uses social and cultural approaches at the macro level, delves into the analysis of the impact of formal institutions (regulations, agreements, and rules) and informal institutions (cultural values, value systems, and social networks) on entrepreneurs' behavior (Aldrich and Zimmer 1986; Cooper et al. 1994; Salvato et al. 2020; Shapero and Sokol 1982; Stephen et al. 2009; Stephen et al. 2005). On the other hand, the individual perspective uses micro-level economic and psychological approaches, focusing on explaining why some people engage in entrepreneurial behavior and others do not (Anwar et al. 2022; Braun and Sieger 2021; McClelland 1961; Sarasvathy 2001; Shane and Venkataraman 2000; Wennekers et al. 2005) under similar circumstances. Most researchers have worked from these two perspectives independently, and while they have found evidence on how changes influence both formal and informal entrepreneurship-related institutions in recent years, it is still underexplored how entrepreneurs' behavior is maintained, increased, or reduced along the entrepreneurial process. For example, Autio and Rannikko (2016) and Jourdan and Kivleniece (2016) analyzed the impact of institutional policies on entrepreneurial activity at a specific time. However, little is understood on entrepreneur evolution drivers over time and the effect of institutional policies on such behavior.

Until now, researchers have omitted the study of variable biases, causality issues, and the potential heterogeneity of answers to institutional policies (Bjørnskov and Foss 2016). Moreover, most previous studies are based on quantitative and qualitative analyses of a static nature, which prevents us from being able to project institutional change effects on entrepreneurs' flow over time or the inverse and/or combined effect of both formal and informal institutional policies. In this sense, Davidsson and Honig (2003) studied the factors involved in the nascent entrepreneurs' status and concluded that entrepreneurs' human and social capital was relevant to explain their behavior, using GEM data. In the same line, while using the Panel Study of Entrepreneurial Dynamics (PSED), Reynolds et al. (2004) showed the prevalence of the individuals' demographic characteristics to explain nascent entrepreneurs' rates in the United States. Involving institutional factors, Audretsch and Belitski (2017) analyzed entrepreneurs' rate variations in a cross-section panel of 70 European cities and developed the Regional Entrepreneurship and Development Index (REDI), including six domains of the entrepreneurial ecosystem (culture, formal institutions, infrastructure and amenities, information technologies, melting pot, and demand). However, some researchers have criticized the tautological nature of entrepreneurial ecosystems in the last decade, while demanding new explanations about the cause-effect factors, individual factors, and institutional impacts from a dynamic perspective (Alvedalen and Boschma 2017; Stam 2015).

The institutional approach (North 1990; North 2005; Scott 2001) applied to entrepreneurship is aimed at understanding the "rules of the game" of entrepreneurial behavior (Berger 1991; Shapero and Sokol 1982) as a result of different institutional configurations. On the one hand, following North (1990, 2005), some authors have distinguished between the formal (procedures to set up a business, entrepreneurship support entities, etc.) and the informal factors (favorable attitudes and cultural values toward entrepreneurship, entrepreneurial spirit, etc.) that condition entrepreneurial activity (Urbano et al. 2019; Welter 2011, among others). On the other hand, based on Scott (2001), some scholars have pointed out that entrepreneurship is influenced by the constraints, incentives, and resources established by institutions, which are classified into three dimensions: regulative, normative, and cultural-cognitive (Alvarez et al. 2025; Bağış et al. 2024; Urbano and Alvarez 2014). The regulative dimension refers to policies implemented to foster entrepreneurial activity. The normative dimension encompasses entrepreneurship societal perceptions and the legitimacy attributed to this profession. Lastly, the cultural-cognitive dimension examines individual traits that support entrepreneurial endeavors, such as the knowledge and skills required to start a business or the fear of failure that limits this behavior. From this perspective, previous research has provided evidence of these dimensions' effect on entrepreneurs' rates across different countries. However, there are not yet models ready to explain the stability of the entrepreneurs' rates within a country over time, because there is a lack of research that looks into the endogenous drivers of entrepreneurs' behavior through the entrepreneurial process (potential-nascent-established stages).

This study seeks to research the mechanisms that condition entrepreneurs' evolution along the entrepreneurial process from a dynamic perspective for the purposes of filling this research gap, thus responding to the initial research question: Why do entrepreneurs' ratios not increase over time, despite all the money invested in encouraging more entrepreneurs among a country's population, when maintaining regulations similar to those of countries with higher entrepreneurs' ratios? This research question frames the two main objectives of this analysis:

1. To explain why entrepreneurs progress through the stages of the entrepreneurial process (potential, early-stage, and established).
2. To understand the role that institutional dimensions play in this flow.

We have designed an entrepreneurial process model, following a system dynamics approach (Forrester 1961), have analyzed entrepreneurs' flow behavior along two stages of the entrepreneurial process (early-stage and established-stage), and have contrasted the model to the real data gathered from the Global Entrepreneurship Model (GEM Spain) from 2002 to 2022. The GEM is an international project dedicated to analyzing the entrepreneurial phenomenon in different contexts, encompassing all stages of the entrepreneurial process (potential entrepreneurs, TEA, and owners or managers of established businesses) (Hill et al. 2025). This research project represents the most prestigious and extensive study on entrepreneurship worldwide, with more than 50 associated countries. The Adoption and Diffusion of Entrepreneurs' Behavior (ADEB) that we propose allows us to understand the endogenous structure of entrepreneurs' behavior in a laissez-faire mode and also to include the effect of policies in the process of adoption and diffusion of entrepreneurs' behavior in the future.

After this introduction, the paper is structured as follows. First, we analyze entrepreneurs' behavior from institutional and individual perspectives and present a theoretical approach supported by the similarities between entrepreneurial diffusion and innovation diffusion. Then, we explain the utility of the system dynamics method for modeling entrepreneurs' flow along the entrepreneurial process, identifying the causal logic of this behavior. We also evaluate main model variable sensibility to different institutional parameters. Finally, we discuss the theoretical contributions and some implications for academics and policymakers and identify the study limitations and suggestions for future research.

2 | Conceptual Framework

Entrepreneurship is a complex and multidimensional phenomenon (Gartner 1985) that results from the interaction between individuals, markets, and policymakers. Baumol (1996) argues that the level of entrepreneurial activity remains relatively constant across countries. However, other researchers have found that changes in economic conditions influence entrepreneurial motivation and drive the movement of individuals between entrepreneurship and salaried employment. This highlights the dynamic nature of the entrepreneurial ecosystems and helps to frame the interconnections and transitions between entrepreneurs and intrapreneurs (Cantner et al. 2021). Additionally, entrepreneurship is also a multilevel issue, as the movement of individuals along the entrepreneurial process can affect the varying contributions of entrepreneurs to economic growth and prosperity (Bowen and De Clercq 2008; Koster and Rai 2008; Murphy et al. 1991).

The "entrepreneurial process" encompasses several stages, from the initial exploration of a potential entrepreneurial initiative to the eventual establishment of a venture (Reynolds and White 1997). The GEM, the most comprehensive international source of information on the entrepreneurial process over the last decade, states that policymakers in some countries perform better than others in facilitating the creation of successful businesses. Meanwhile, entrepreneurs justify their role as economic actors by identifying market opportunities (Hill et al. 2023). This highlights that institutions shape entrepreneurial activity, while individuals react not only to this institutional framework but also to other factors intrinsically connected to their economic behavior, such as the market structure and their professional and personal attitudes (Ranaei Kordshouli and Maleki 2023). According to these authors, entrepreneurs with opportunity-based motivations are political innovators who play a relevant role in institutional changes.

The relationship between institutions and entrepreneurs' behavior is intricate. Entrepreneurs need social structures and networks to know how to take advantage of the business opportunities of a specific context, primarily in uncertain times (Davidsson 1995, 2005; Davidsson et al. 2017). According to Acs et al. (2017), an ecosystem (ecological system) is characterized by the interrelation among participants (living and nonliving agents) because each one of these interrelations adds value to the entire system. The transition of individuals from potential to early-stage entrepreneurs reflects labor mobility within a regional ecosystem driven by innovation (Fabel 2004). While established entrepreneurs can gain competitive advantages by exploiting current innovations, early-stage entrepreneurs can seize market opportunities through the exploration of innovations (Lehmann and Schwerdtfeger 2016). The existence of entrepreneurs depends on the availability of business opportunities. However, certain factors, such as the individual's fear of failure, often limit the creation of firms (Ahmadi and Soga 2022; Fabel 2004), within the dynamic relationship between individuals and the institutional environment.

From an individual perspective, potential entrepreneurs are key drivers of a region's entrepreneurial activity, as they signal the ceiling of the entrepreneurs' rate. A potential entrepreneur is a decision maker who is active in the labor market and who assesses the possibility of starting a business, facing two main alternatives: either effectively starting a business or being employed by others (private or public employers). This decision, following a rational judgment, will depend on the socioeconomic cost–benefit analysis of both alternatives. Regarding this specific issue, two main factors are involved: the socioeconomic costs of starting a business and the perception of the socioeconomic opportunities of starting a new venture. Both factors are influenced not only by the institutional environment but also by the individual characteristics of entrepreneurs (Eckhardt and

Shane 2003; Hayek 1996; Kirzner 1997; McMullen et al. 2007). The relationship between the institutional and individual levels of analysis is reflected by the institutional dimensions (Scott 2001). This approach expands the traditional study of regulation effects (regulative dimension—formal institutions) and firm creation legitimacy (normative dimension—informal institutions) by incorporating individual competencies within a specific institutional context (cultural-cognitive dimension) to better understand entrepreneurs' behavior.

Institutional incentives can be effective or ineffective in encouraging entrepreneurship. Effective entrepreneurship policies favor the market dynamics that ensure old and new firms have opportunities to be competitive (Baumol 1996; McMullen et al. 2008). However, ineffective entrepreneurship policies can also interfere with the intention and adoption of entrepreneurial behaviors (Chowdhury et al. 2019; Guerrero et al. 2021; Shane and Venkataraman 2003), as they may not be well adapted to the individual profiles of entrepreneurs at a given time. Moving into the institutional dimensions (Scott 2001), previous literature has identified how individuals react to specific institutional interventions along the entrepreneurial process (Alvarez et al. 2025; Bağış et al. 2024; Bjørnskov and Foss 2016; Guerrero et al. 2021). In this sense, reducing legal barriers and simplifying the procedures to start new ventures (regulative dimension), encouraging entrepreneurial attitudes (normative dimension), and addressing cultural and cognitive issues such as improving entrepreneurial skills, reducing fear of business failure, and improving the understanding of entrepreneurship (cultural-cognitive dimension) will increase the likelihood of individuals becoming entrepreneurs (Alvarez et al. 2025; Urbano and Alvarez 2014). The legal framework that supports new businesses traditionally includes direct and indirect measures which evolve over time. Direct measures often imply tax rate reductions for start-ups or the reduction of new employee hiring costs by decreasing the firm's contribution to the public health system for these employees. Indirect measures are mainly the protection of property rights, shareholders, and creditors, and educational investments. Policymakers design institutional incentives through laws and expect these measures to reduce the entry costs when starting a business while increasing the entrepreneurial adoption of that group of individuals previously selected as the objective group for such support. This means that laws provide selection criteria and a system of institutional incentives aimed at achieving the explicit planned objectives, that is, an increase in entrepreneurial survival or the growth rate of new firms.

However, policymakers often overlook the combined influence of the regulative, normative, and cultural-cognitive dimensions on entrepreneurial behavior. As a result, even when incentives are designed within the regulative dimension, potential and current entrepreneurs act differently from policymakers' expectations. This discrepancy highlights a lack of understanding of the endogenous mechanisms driving entrepreneurs' behavior, which are also shaped by normative and cultural-cognitive dimensions (Bjørnskov and Foss 2016). This effect is commonly observed in epidemiologic models and has been studied in the field of innovation by Rogers (1962), but it is still unexplored in the entrepreneurial field. According to Rogers' theory (Rogers 1962), which was complemented by the application of the Bass model (Bass 1969), innovation adoption and diffusion rate can be predicted by those innovations' perceived attributes, the type of decision involved, communication channels, the nature of the social system involved, and the promotion efforts of change agents. Extensive literature has used this approach to demonstrate innovation diffusion, although there are still research gaps regarding the adoption and diffusion of innovations embedded in different institutional contexts (Marikyan et al. 2023).

The Kirznerian perspective on entrepreneurship emphasizes that a company's success is influenced by its capacity to seize opportunities in an unsettled market (Kirzner 1978). In contrast, the Schumpeterian perspective highlights a firm's ability to disrupt the existing equilibrium and gain advantages through innovation in various forms, such as new products, processes, organizational, or commercial advances (Schumpeter 1934). Joining both perspectives, Kirznerian and Schumpeterian, entrepreneurship can be considered as the act of introducing innovation (product, process, organizational, or commercial), taking advantage of an unsettled market gap, and its spread in a local context can be viewed as a social construction process (Rogers 1962). More recently, Cantner et al. (2021) modeled the transition of individuals from the entrepreneurial condition toward the intrapreneurial condition (working for others), and vice versa, thus reflecting the dynamic and interconnected nature of entrepreneurial ecosystems. According to these authors, all ecosystem components and properties are endogenous in the long term, although only some of them can be shaped by short-term actions and decisions. In their study of the entrepreneurial ecosystem's lifecycle, these researchers state that the emergence of these ecosystems is based on those individuals that make the decision of becoming entrepreneurs. In this line, Buratti et al. (2023) demonstrated empirically that the transfer between the entrepreneurial and intrapreneurial status of individuals through the different phases of an ecosystem's lifecycle was balanced; that is, the increase in the entrepreneurial status would compensate for the decrease in the intrapreneurial one and vice versa, reinforcing the idea of a balancing loop of entrepreneurs.

Additionally, Samadi (2019), supported by GEM data, showed a bidirectional causality between institutions and entrepreneurial activity in the long run in innovation-driven countries; that is, within this context, institutions condition the entrepreneurs' behavior, but also entrepreneurs can change institutions in the long term. Using the same approach, Ranaei Kordshouli and Maleki (2023) proposed a system dynamics model that related entrepreneurs' motivation and institutional factors in Iran and showed long-term bidirectional causal relationships between opportunity-based entrepreneurs and institutional factors like financial market efficiency, government effectiveness, and entrepreneurial-supportive laws. In line with Samadi (2018, 2019), these researchers state that entrepreneurs' motivation depends on the internal dynamics of the entrepreneurial process subsystem and the institutional subsystem, and also on their mutual interaction. Finally, using the job demands-resources theory (Demerouti et al. 2001), Dimov and Pistrui (2024) studied entrepreneurs' well-being through the entrepreneurial process and concluded that it is necessary to consider the interplay between entrepreneurs' characteristics (ambition, skill, and self-regulation) and the dynamism of the environment in which they operate in order to explain properly the entrepreneurs' behavior.

Building on this previous evidence-based studies, we have considered the need for new evidence on entrepreneurship from a systemic perspective (Alvarez and Urbano 2011), evidence that accounts for the interaction between context and entrepreneurs (Audretsch et al. 2022; Autio et al. 2014). Thus, we offer the view of entrepreneurs as innovation adopters or imitators. To complete this analysis, we have also deemed it necessary to understand how entrepreneurs behave throughout the entrepreneurial process, particularly in relation to the normative and cultural-cognitive dimensions.

Informal institutions, such as the social norms that shape the entrepreneurial culture of a region, play a key role in strengthening entrepreneurship, reinforcing the new venture expansion and density through imitation (Audretsch 2009; Lehmann and Seitz 2017). According to literature focused on the cultural-cognitive dimension of entrepreneurship at individual level, higher knowledge, skills, and better access to entrepreneurs increase the perception of business opportunities among potential entrepreneurs, even in uncertain situations (Korber and McNaughton 2017; Simón-Moya et al. 2016). In this sense, the contagious effect based on the imitation of other entrepreneurs has a lower cost and more returns for entrepreneurial activity, forming a kind of inertia (normative dimension) in the flow of individuals along the entrepreneurial process. Previous literature based on the normative dimension of entrepreneurship also showed that the knowledge and access to other entrepreneurs also increase the learning economy of starting a business by simply imitating the business model of their predecessors (van Stel et al. 2005), so the higher the number of entrepreneurs, more individuals will see entrepreneurship as a good alternative. From an institutional approach, this is a signaling effect of "entrepreneur's role models" in the encouragement of entrepreneurs (Stephen et al. 2005). However, despite existing evidence, the endogenous mechanism of contagion between current entrepreneurs and potential entrepreneurs remains unexplored. Therefore, we propose that the evolution of both early-stage (TEA) and established entrepreneurs could be conditioned by the imitation rate of other entrepreneurs.

Based on these premises, as previously mentioned, we address the dynamic, multilevel, and interconnected problem of studying the stagnation in the entrepreneurs' rate over time in Spain. We use Rogers' innovation diffusion theory (1962) and the Bass diffusion model (1969) to model the evolution of entrepreneurs along the entrepreneurial process, as framed by the GEM project, which considers the transition of individuals from potential entrepreneurs to early-stage (TEA) entrepreneurs and, ultimately, to established entrepreneurs. We aim to explain the endogenous mechanism behind the diffusion of entrepreneurs' behavior, considering entrepreneurship as the act of introducing innovation.

3 | Method

We developed a model to simulate individuals' flow through the entrepreneurial process, as defined in the GEM project (Reynolds et al. 2005; Reynolds et al. 2002). We applied the system dynamics method (Forrester 1961) using Ventana Systems S.L. (VENSIM) software and based our approach on Bass' (1969) innovation diffusion model. System dynamics has been previously applied to the talent management field (Calvo 2011; Calvo Babío and García Rodríguez 2010; Warren 2005) and also to the entrepreneurship field at the firm-level (Ranaei Kordshouli and Maleki 2023), but its potential to study the dynamics of the entrepreneurial process remains unexplored (Bianchi 2002; Zali et al. 2014).

According to Bass, product diffusion in the market follows the theoretical foundation of the logistic growth model, specifically the logistic equation. In line with this, we have used the system dynamics approach (Forrester 1961, 1968; Sterman 2000) to replicate the entrepreneurs' behavior as a process of adoption and imitation of other entrepreneurs. This method helps identify the internal structure of a system and highlights the feedback loops that shape key variable behavior, which can evolve according to different growth patterns over time.

We represent the model as a stock and flow diagram, following the theoretical framework of the GEM Project (Reynolds et al. 2005; Reynolds et al. 2002) and the specifications gathered from meetings with experts. This framework allows us to differentiate between three types of entrepreneurs: *potential entrepreneurs* (individuals intending to start a business within the next 3 years), early-stage entrepreneurs (*TEA entrepreneurs*) (those with entrepreneurial initiatives less than three and a half years old), and *established entrepreneurs* (those with entrepreneurial initiatives older than three and a half years).

Individuals' flow through these stages depends on various factors that influence their decisions to become entrepreneurs (transitioning from *potential* to *TEA entrepreneurs*), establish their entrepreneurial initiative (moving from *TEA* to *established entrepreneurs*), or give up their initiatives at different phases (resulting in dropout or lost entrepreneurs).

We have started with an entrepreneurs' behavior diffusion model used in the GEM project (potential entrepreneurs, early-stage entrepreneurs, and established entrepreneurs), which is capable of generating growth dynamics and stagnation in entrepreneurs' life cycle along the process.

We have also conducted several meetings with academic and professional experts to validate the cause–effect relationships among the variables included in the model. Specifically, we conducted the following meetings:

- March 27, 2025. Panel of 15 academic experts in entrepreneurship (research group of Institutions and Entrepreneurship) at University Federico II in Napoli.
- May 28, 2024. Meeting with four policymakers who are experts in legal programs of entrepreneurial support (Spanish national government) and five entrepreneur participants in some of these programs (national innovation grants to entrepreneurs) at Mapfre Foundation, in the presentation of the GEM national report in Madrid.
- November 19, 2023. Interview with an expert in entrepreneurs' behavior at Gdansk University of Technology during the XXXVII RENT Conference.

We have explored data on potential, early-stage, and established entrepreneurs provided by the GEM project for Spain over the past 21 years. The reason is that Spain has the most extensive sample

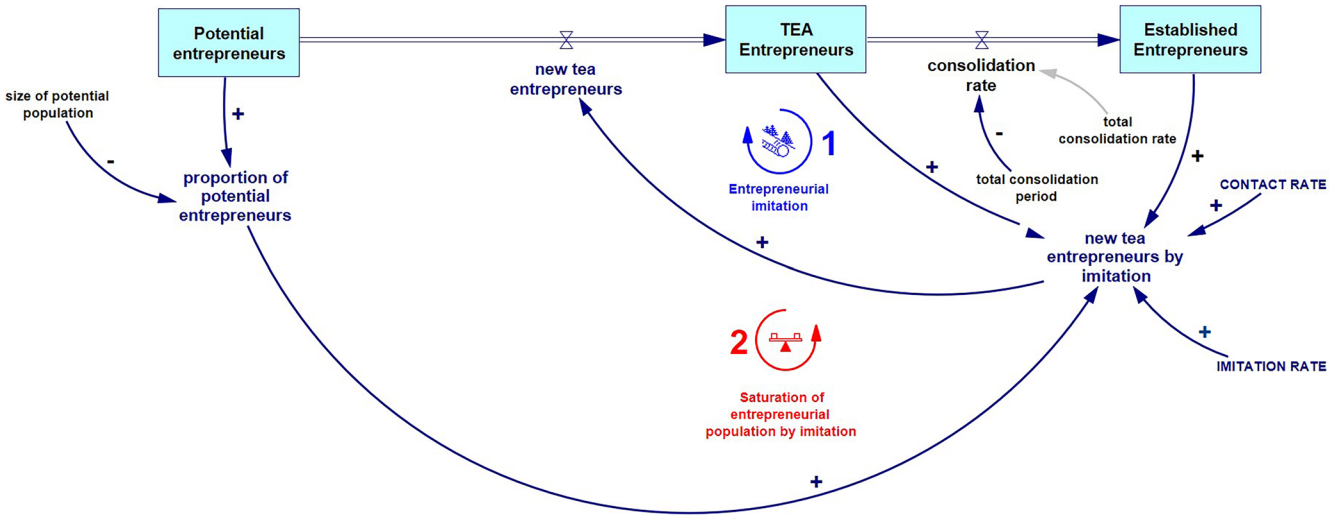

FIGURE 1 | Stock and flow model. Phase 1.

of entrepreneurs in this international database, with more than 30,000 people surveyed each year since 2002, and it is one of the countries with the lowest entrepreneurs' rates in the world. We have analyzed the adoption-diffusion pattern of entrepreneurs' behavior in this country to identify the endogenous mechanisms driving it. This analysis integrates both institutional and individual perspectives by considering the three dimensions of entrepreneurship: regulative, normative, and cultural-cognitive.

Potential entrepreneurs' rate refers to the percentage of adults (individuals aged 18–64) who have answered affirmatively the question: "Do you expect to start a new business, including any type of self-employment, either alone or with others, within the next three years?" Early-stage entrepreneurs' rate (TEA entrepreneurs) refers to the percentage of adults who responded affirmatively to the questions: "Are you, either alone or with others, currently trying to start a new business, including any type of self-employment, or selling any goods or services to others?" and "Have you, either alone or with others, been the owner of a business within the past three and a half years?" Finally, established entrepreneurs' rate refers to the percentage of adults who responded affirmatively to the previous questions for a period longer than three and a half years.

Figure 1 shows the diffusion of entrepreneurial behavior among potential and recent entrepreneurs (new TEA entrepreneurs) caused by the imitation effect. This effect, according to experts consulted, will depend on potential and recent entrepreneurs' contact rate. The saturation effect over time is produced by the limitation of the number of potential entrepreneurs.

Figure 2 shows the adoption of entrepreneurial behavior among potential entrepreneurs caused by the formal entrepreneurial support of the government. The saturation effect over time of this case–effect relationship will be conditioned, as in the previous case, by the number of potential entrepreneurs.

Figure 3 shows the complete stock and flow model, which represents the entrepreneurs' evolution through the stages identified by the GEM project, including the key variables considered by academic experts, policymakers, and entrepreneurs. The adoption and diffusion effects of the entrepreneurs' behavior are complemented by the dropout effect of entrepreneurs in each one of the stages. Following the GEM framework (Hill et al. 2025), we have distinguished between lost entrepreneurs, who abandoned the entrepreneurial process, and those who dropped the entrepreneurial initiative at early or established stages to reengage again in the entrepreneurial process as potential entrepreneurs.

4 | Results: Modeling and Sensitivity Analysis

After building the basic structure of the stock and flow model, we analyzed the evolution of data provided by the GEM-Spain project from 2002 to 2022 with the evolution simulated by the flow diagram, using the endogenous mechanism of adoption-imitation supported by Rogers' theory (1962). Simulated data were compared against historic GEM data for potential entrepreneurs, TEA, and established entrepreneurs from 2002 to 2022. Several metrics were used to assess model validation (Hamilton 1994; Lewis 1982): mean absolute error (MAE), root mean square error (RMSE), and mean absolute percentage error (MAPE). For

$$\text{Potential Entrepreneurs} = \text{INTEG (replacement of entrepreneurial projects} - \text{new TEA entrepreneurs, initial potential entrepreneurs)}$$

$$\text{TEA Entrepreneurs} = \text{INTEG (new TEA entrepreneurs} - \text{TEA dropouts} - \text{Establishment Rate, INITIAL VALUE OF NEW TEA ENTREPRENEURS)}$$

$$\text{Established Entrepreneurs} = \text{INTEG (Establishment Rate} - \text{exit of entrepreneurial projects, INITIAL ESTABLISHED ENTREPRENEURS} \times 1000)$$

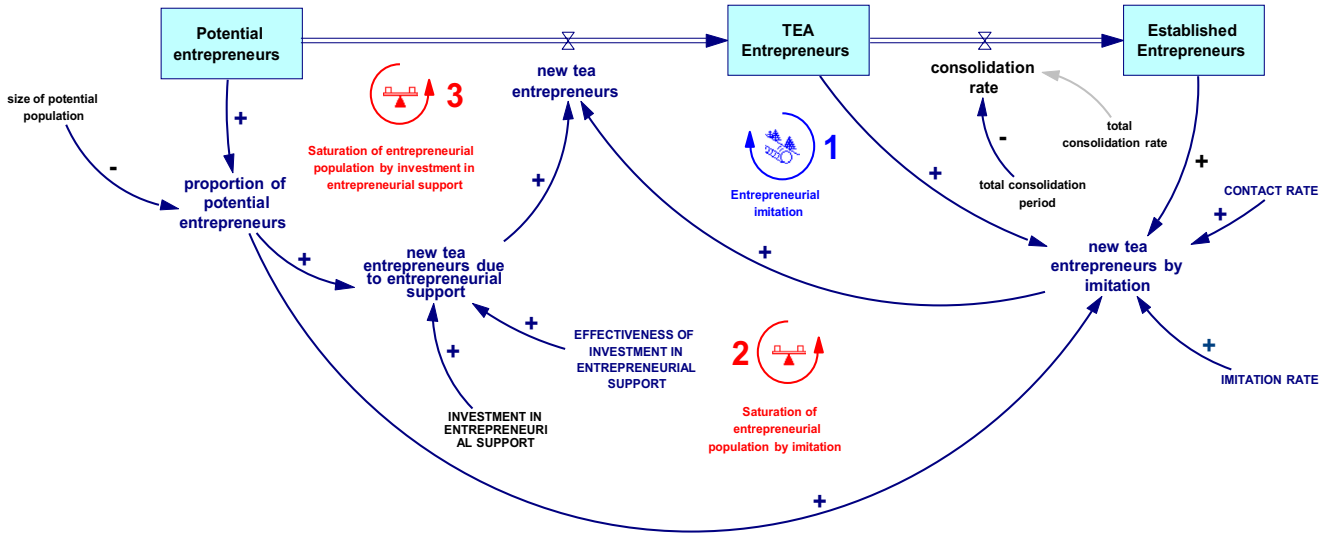

FIGURE 2 | Stock and flow model. Phase 2.

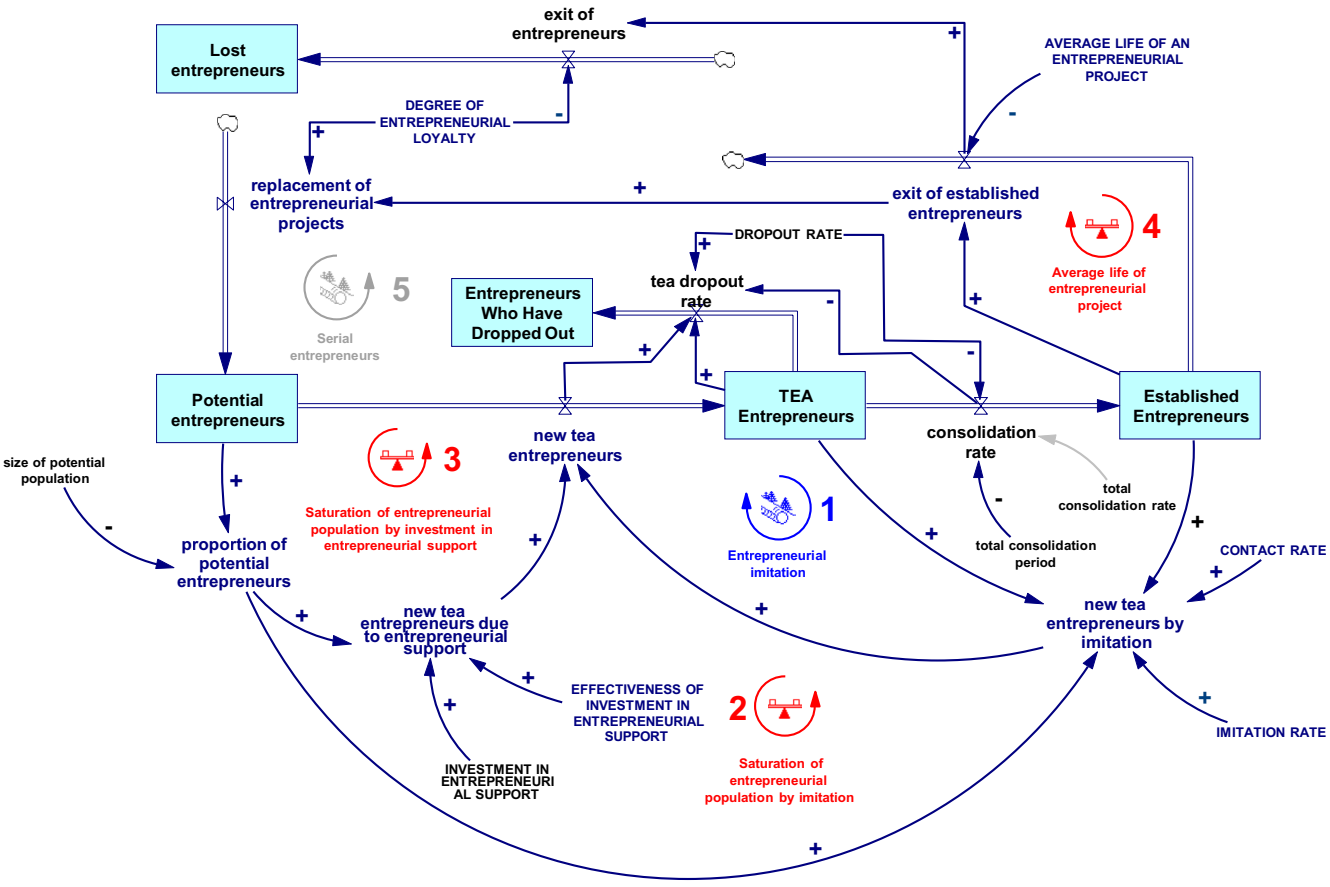

FIGURE 3 | Complete stock and flow model.

potential entrepreneurs, MAE = 499,901, RMSE = 569,084, and MAPE = 24.26%. For TEA, MAE = 641,634, RMSE = 687,992, and MAPE = 40.01%. For established entrepreneurs, MAE = 311,082, RMSE = 384,738, and MAPE = 16.27%. Values between 10% and 20% are considered good (Lewis 1982), and values between 20% and 50% reasonable.

The proposed model shows a good fit to historical data, as shown by all MAPE values below 40. This finding indicates that the model's endogenous structure replicates the dynamic behavior of the entrepreneurs in Spain. MAE and RMSE low absolute values related to GEM's historic data confirm the lack of variability of TEA rates and established entrepreneurs over time. The model's good fit supports Roger's theory, thus providing foundations for the practical implications described in the following section.

Figures 4 and 5 show the historical data plotted against the simulated data. It can be observed that the model slightly overestimates

and underestimates the number of TEA and established entrepreneurs in some years, although the deviation is reasonable.

We also conducted a sensitivity analysis on the previously identified variables, focusing on key parameters such as entrepreneurs' contact rate and investment in entrepreneurship support to test the hypotheses.

We have planned two scenarios following Kunc (2024) requirements: (1) a scenario of entrepreneurial support by formal institutions, and (2) a scenario of the evolution of *early-stage (TEA)* and *established entrepreneurs* conditioned by informal institutions.

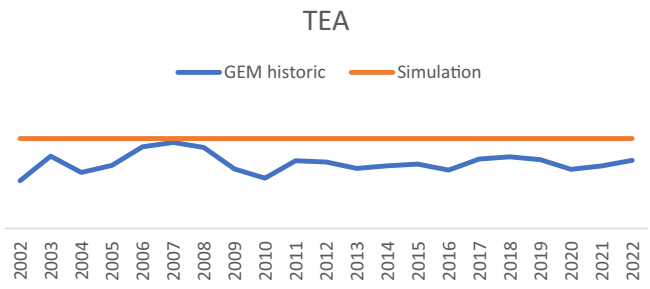

FIGURE 4 | Data adjustment of TEA entrepreneurs.

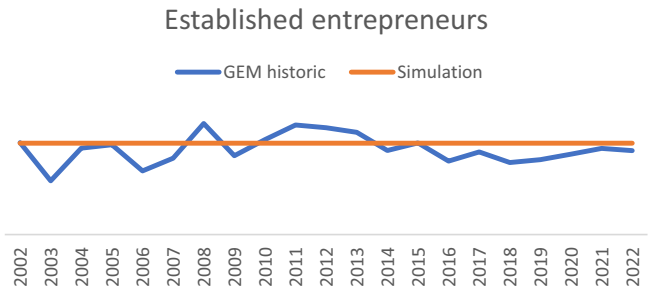

FIGURE 5 | Data adjustment of established entrepreneurs.

Following the information gathered in the meeting with experts, the first scenario stated that government incentives have increased *the initial adoption rate among new entrepreneurs*. Therefore, we analyzed the model's sensitivity to the parameter of *investment in entrepreneurship support* while keeping all other parameters constant. Figure 6 shows a short-term increase in entrepreneurial adoption (*TEA entrepreneurs*), followed by saturation in the long term, as *TEA entrepreneurs* transition into *established entrepreneurs* after three and a half years. This result aligns with the findings of Chowdhury et al. (2019), Jensen et al. (2014), and Shane and Venkataraman (2003). This scenario shows the regulatory dimension of formal institutions (government) through the public investments in entrepreneurship support.

Following again the information gathered by academic experts, policymakers, and entrepreneurs, the second scenario assumed that *the evolution of early-stage (TEA) and established entrepreneurs was conditioned by the imitation rate of other entrepreneurs*, so we conducted a sensitivity analysis on the *contact rate* parameter (ranging from 10 to 30 individuals) while keeping the rest invariant. The results indicate a more sustained effect on *TEA entrepreneurs* over time, reinforcing the key role of the contagion effect among entrepreneurs in explaining the flow of individuals through the entrepreneurial process and their long-term stability (Figure 7). This finding aligns with the research of Bosma et al. (2012), Sørensen and Sorenson (2003), Thornton et al. (2011), and Williamson (2013), and it adds new evidence on how this stability is maintained. This scenario shows the normative and cultural-cognitive dimensions of informal institutions (social capital and common system of values) as key drivers of the entrepreneurial diffusion.

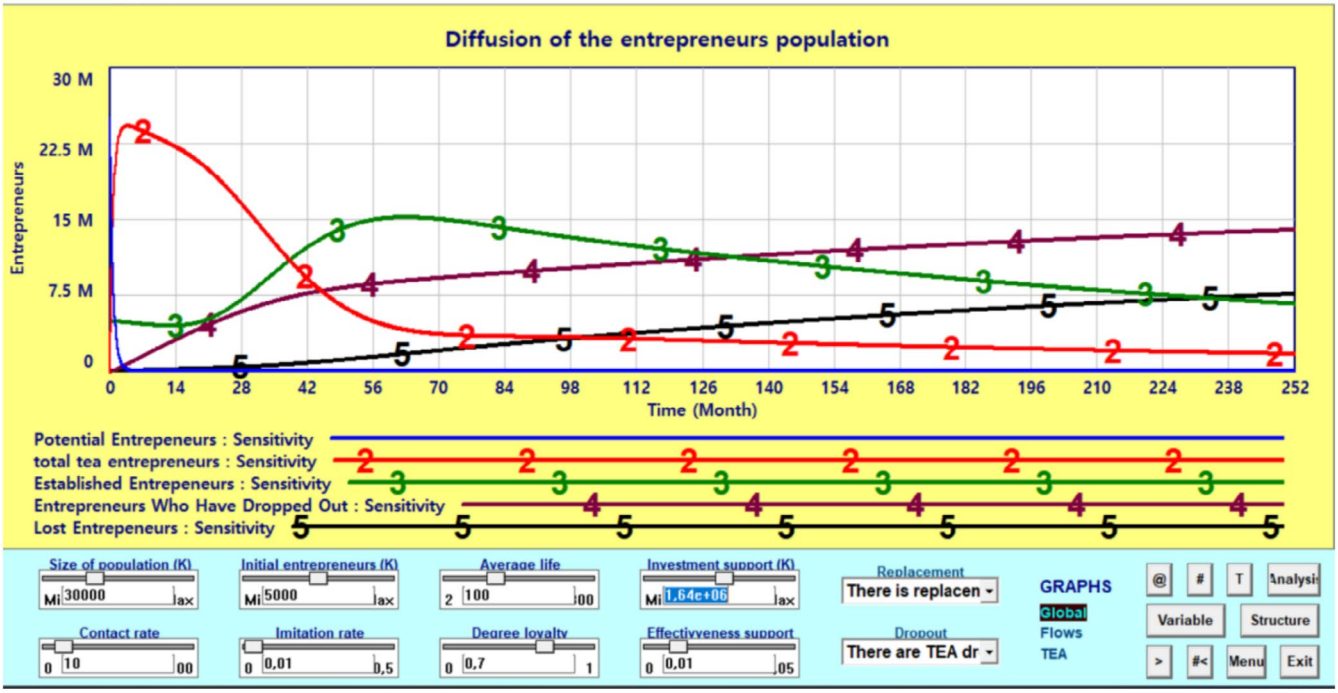

FIGURE 6 | Sensitivity to the parameter *investment in entrepreneurship support*.

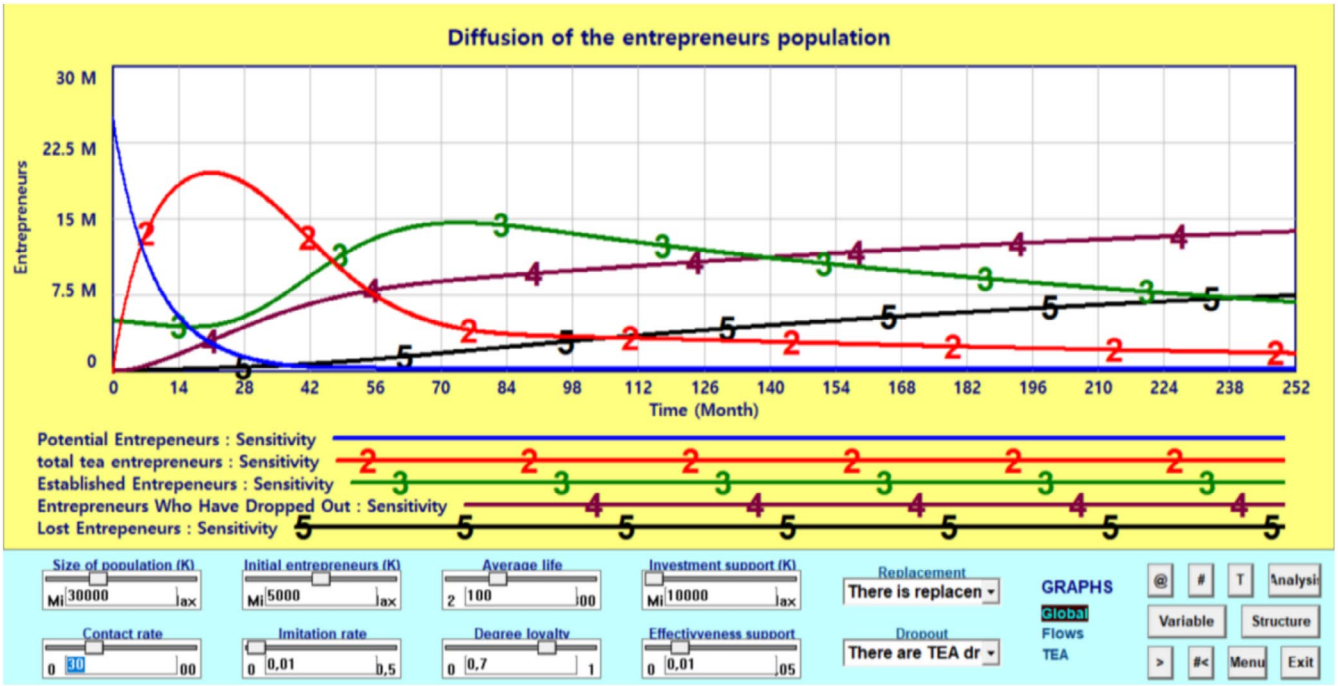

FIGURE 7 | Sensitivity to the parameter *contact rate*.

5 | Discussion and Conclusions

National entrepreneurs' rates have remained relatively stable for years despite variations across countries, even when governments implemented institutional incentives from the regulative dimension of entrepreneurship. Researchers have traditionally studied entrepreneurship by isolating key factors from either an institutional or individual perspective. However, a more integrated and dynamic approach is necessary to better understand the endogenous mechanisms that guide individuals through the entrepreneurial process over time and to clarify how institutional dimensions (regulative, normative, and cultural-cognitive) influence this flow.

This analysis aims to explain why entrepreneurs progress through the entrepreneurial process as well as to understand the role of institutional dimensions in this flow, which are issues demanded by previous literature (Cantner et al. 2021). From a dynamic perspective, the theoretical contribution of this study lies in the proposal of the ADEB model, designed to explain entrepreneurs' behavior by drawing on epidemiologic structures previously applied by Rogers (1962) and Bass (1969) in their studies on innovation adoption and diffusion. Additionally, it incorporates the systems dynamics methodological approach to examine the endogenous effects of institutional dimensions on the flow of entrepreneurs over time.

The next figures present the causal diagrams that reflect the entrepreneurs' behavior in five loops, according to Roger's theory (1962).

Figure 8 shows the contagious effect between entrepreneurs and potential entrepreneurs, which means the imitation effect on entrepreneurs through two loops: the *entrepreneurs' imitation* loop and the *saturation by imitation* loop. The *entrepreneurs' imitation* loop reflects entrepreneurs' behavior diffusion among potential and early-stage (TEA) entrepreneurs, with innovation levels and contact rate serving as key drivers of the contagion effect (imitation rate). The second loop, namely the *saturation by imitation* loop, illustrates the gradual slowdown in the emergence of TEA entrepreneurs over time as the potential entrepreneur pool susceptible to the entrepreneurial spirit declines. These loops align with previous literature on the effect of normative and cultural-cognitive dimensions. For instance, Davidsson and Honig (2003) demonstrated that social capital is a strong predictor of entrepreneurial adoption, while emphasizing the importance of institutional factors, such as embeddedness, relational networks (i.e., social factors), and culture on entrepreneurial activity. Sorenson (2017) analyzed the differences between the entrepreneurial systems of various societies and concluded that the knowledge gained by staying in a region where there are already entrepreneurs encourages people to become entrepreneurs. It seems that the presence of entrepreneurial role models in a society can increase the desirability of being an entrepreneur due to the social legitimation of this profession (normative dimension). This also involves the cultural-cognitive dimension, as imitation raises entrepreneurs' expectations about market opportunities and boosts their confidence in successfully running businesses within a given local context (Bosma et al. 2012; Sørensen and Sorenson 2003). In this sense, the existence of previous entrepreneurs in a region can be perceived as a proxy for the existence of business opportunities, increasing the social desire to be an entrepreneur (Williamson 2013).

Figure 9 shows the entrepreneurial support investment effect of a regulative institutional dimension proxy (policies involving tax incentives for entrepreneurs and investors and other forms of support) on the increase of entrepreneurs' adoption, which is also supported by Roger's theory (1962). According to this

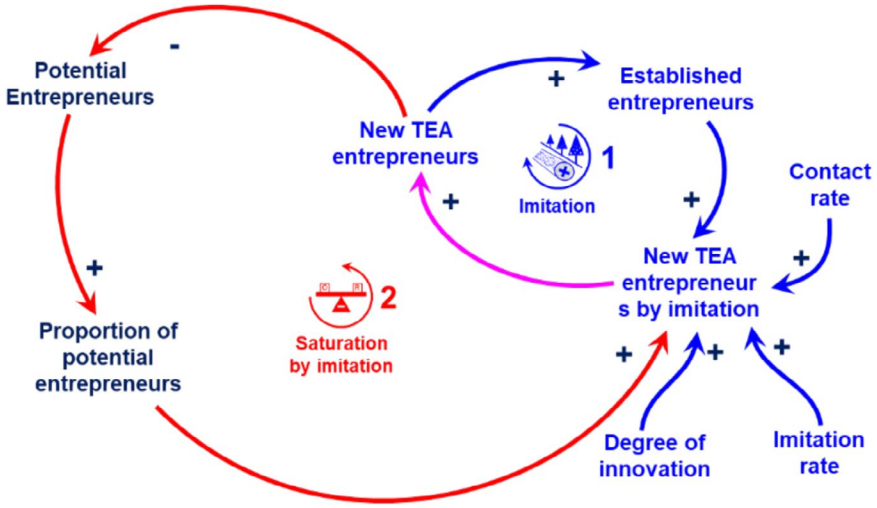

FIGURE 8 | Loops of entrepreneurs' imitation and saturation by imitation.

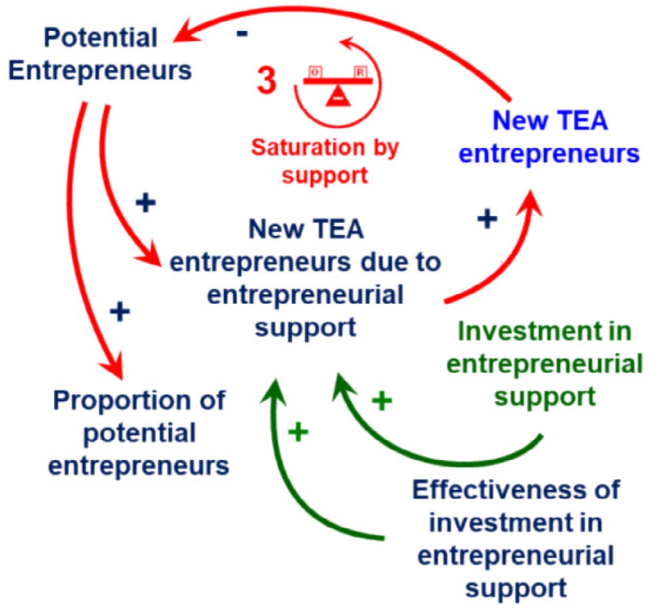

FIGURE 9 | Loop of entrepreneurs' adoption and saturation by support.

approach, the effectiveness of the investment in regulative institutional incentives, which are planned to increase entrepreneurs' adoptions, has a limited effect over time due to the gradual reduction of the number of potential entrepreneurs ready to adopt the innovation of setting up a new business. This effect is also evidenced in previous studies. According to institutional literature focused on entrepreneurship, there is evidence that investments that supporting entrepreneurial activity through laws and norms can increase the entrepreneurial rate in the short term if effective (Urbano et al. 2019). Previous studies have bolstered these effects with empirical evidence, enabling us to identify institutional patterns of reference in different contexts (e.g., institutions, society, economic situation) and also select the main variables involved in the relationship between these patterns and the entrepreneurial process (Caiazza et al. 2020; Chowdhury et al. 2019; Welter 2011; Welter et al. 2019). However, other researchers also highlighted the ineffectiveness of some institutional incentives. Jensen et al. (2014) traced the effects of a change in the law of mortgages on workers in Denmark to make their new businesses financing easier against their home equity. These researchers showed that the increased liquidity did not change the individual's inclination to start a new business. Even those who began new ventures had higher failure rates than those who did not benefit from the law change, demonstrating a counterintuitive effect of some regulative incentives.

Focusing on innovative entrepreneurship, policymakers have traditionally designed laws and norms that address incentives, expecting to reduce barriers to the creation of new ventures in high-tech industries by interfering in the autonomous dynamic of the market structure. Direct incentives include tax reductions for entrepreneurs and cost reductions from using business incubators or technology agreements (Amezcua et al. 2013; Bradley et al. 2021; Kolympiris and Klein 2017). Moreover, indirect measures such as tax incentives for informal investors or venture capital firms are also frequent and vary among regions (Colombo et al. 2016; Munari and Toschi 2015). However, factors like strong employment legislation (Román et al. 2011) or limited labor market dynamics (Failla et al. 2017) could promote entrepreneurship while creating entry barriers for hiring employees in new firms. Countries with strong employment legislation produce greater friction in the labor market, lowering the probability of employers developing practices to attract employees and increasing the likelihood of contracting self-employed labor (Liebregts and Stam 2019). Strong employment protection legislation may also affect the allocation of talent. Employment-protective legislation causes firms to contract out more work, relying less on intrapreneurship (Román et al. 2011). Alternatively, this legislation also increases the opportunity cost of leaving employment for current employees who opt for self-employment (Liebregts and Stam 2019). Thus, there is evidence of the bias of the individual perspective of policymakers when designing laws and the joint effect of different laws affecting entrepreneurs, who suffer the collateral effects of the lack of coherence of the legal framework and, consequently, develop behaviors counterintuitive to those expected (Bradley et al. 2021).

Therefore, we have considered the balancing effect of the regulative institutional dimension on entrepreneurs in Figure 10,

including both the entrepreneurial support investment effect on entrepreneurial dynamics and the level of effectiveness of this investment.

Finally, to complete the causal explanation of the problem addressed, Figure 10 shows the entrepreneurial process leaks through two loops: the *average life* loop reflects the average time of an entrepreneurial initiative, and the *serial entrepreneurs'* loop describes the flow of entrepreneurs' leaks that exit their current initiatives to propose new ones, reengaging themselves again in the entrepreneurial flow as potential entrepreneurs.

Figure 11 shows the whole diagram of the causal relationships involved in the previous loops, which sets up the ADEB.

The main findings of this study reveal the long-term stability of entrepreneurial rates (including potential, TEA, and established entrepreneurs) attributable to a saturation effect among potential entrepreneurs. This pattern is explained through an adoption-diffusion process of entrepreneurs' behavior. The sensitivity analysis provides new insights into the limited impact of institutional policies based solely on regulative incentives on promoting entrepreneurship. Instead, the results highlight the critical role of diffusion mechanisms embedded in the normative and cultural-cognitive dimensions, particularly through entrepreneurial role models and the cognitive effect of imitation, which foster entrepreneurs' behavior. Future studies could expand on this analysis by incorporating socioeconomic scenarios that reflect geopolitical instability in order to examine how "game rule" changes might affect the relevance of institutional dimensions in shaping entrepreneurial behavior. Previous literature has examined the effect of formal and informal institutional configurations on individuals and societies so far. However, capturing the dynamics of disruptive geopolitical changes within traditionally formal institutional configurations remains a clear research gap when studying individual behavior.

The ADEB model serves as an analytical tool, leveraging the system dynamics method to examine both the influence of regulative policies on the entrepreneurial process and the impact

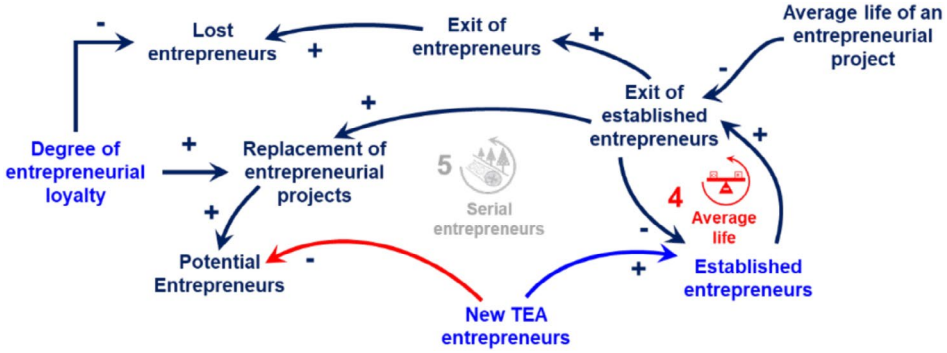

FIGURE 10 | Loops of average life and serial entrepreneurs.

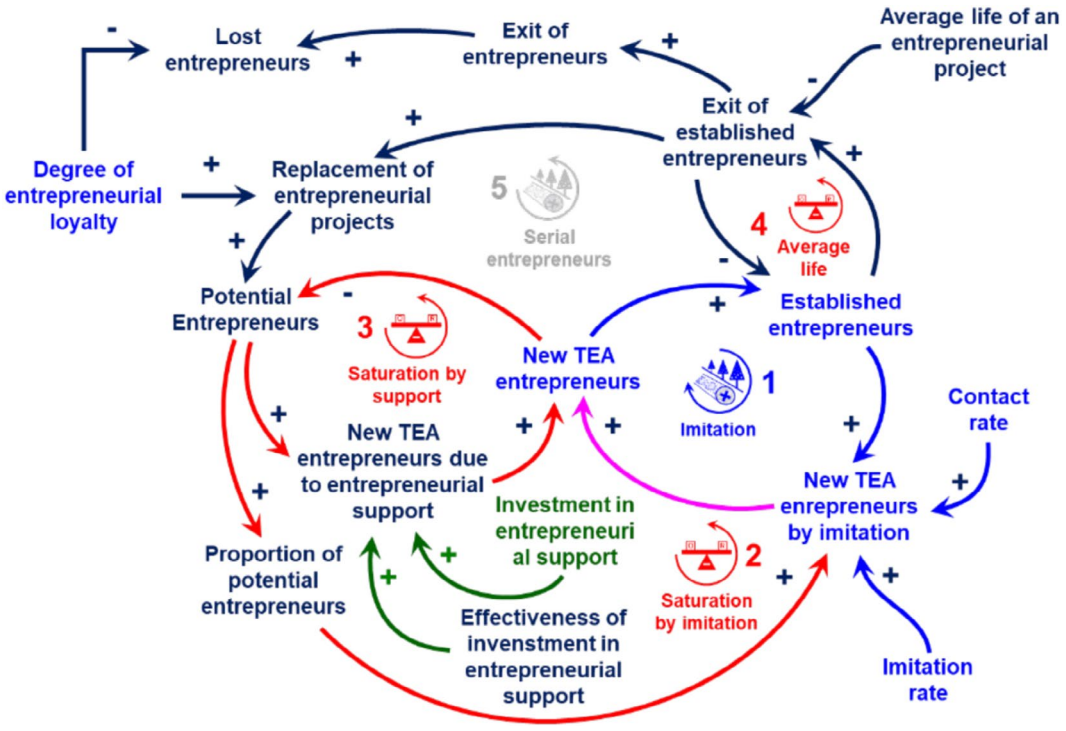

FIGURE 11 | Causal diagram of the ADEB.

of normative and cultural-cognitive dimensions on entrepreneurs' behavior. By applying this approach, we aim to identify the endogenous dynamics of entrepreneurship, recognizing the limited effect of regulative institutional incentives on entrepreneurial adoption, while emphasizing the diffusion effects of the normative and cultural-cognitive dimensions, particularly through entrepreneurial imitation (infection effect).

While the regulative institutional dimension may help generate an environment where firms operate efficiently and invest with greater confidence (Baumol 1996), this does not imply that governments should regulate economic activity, condition commercial transactions, or manipulate market rules through incentives in favor of some firms and against others. Recent studies indicate that lower levels of bureaucracy to start a business and laws and policies to support entrepreneurship favor the entrepreneurial capacity of a society (Audretsch et al. 2024; Bağış et al. 2024). However, the normative and cultural-cognitive dimensions that shape entrepreneurs' beliefs about their own skills are even more significant, as well as the presence of a supportive community (culture and social norms), and the reinforcement of individual characteristics and entrepreneurs' social capital (Williamson 2013). Entrepreneurship is inherently a social and local phenomenon from an institutional standpoint. Meeting and interacting with other entrepreneurs is widely regarded as an important support in entrepreneurial dynamics because it provides firsthand experiences that help entrepreneurs anticipate challenges and reduce fear of failure (Hill et al. 2022).

Regarding practical implications, the ADEB model contributes to the institutional approach by offering a dynamic analysis of the effects of institutional dimensions. It highlights the short-term impact of regulations on entrepreneurial adoption and the long-term influence of normative and cultural-cognitive dimensions through the diffusion of entrepreneurial role models on potential entrepreneurs. This model complements the previous approaches of Cantner et al. (2021), Dimov and Pistrui (2024), Ranaei Kordshouli and Maleki (2023), and Samadi (2019), by providing new evidence of the dynamic nature of entrepreneurship and the interplay between entrepreneurs and institutions.

The ADEB model also offers policymakers a valuable tool to evaluate the potential impact of regulatory changes aimed at supporting entrepreneurship. It also enables an analysis of possible adverse effects, including conflicting policy effects (eroding goals) on the efficiency level resulting from interactions between different policies. Moreover, researchers could use the model to evaluate the effects of various policies on the entrepreneurial process in different institutional contexts. Finally, entrepreneurs, as main actors to this model, could benefit from this analysis by gaining a better understanding of the factors that influence entrepreneurial behavior, as well as the long-term role of community support in the diffusion of this behavior. This model offers a clear perspective of the limited effect of regulations on stimulating entrepreneurship, as compared with the social embeddedness that truly supports entrepreneurial behavior diffusion.

This research has several limitations that should be considered. First, it analyzes only the specific case of Spain, so the results can only be extrapolated to national contexts with similar entrepreneurial behavior patterns. Future research could further validate this model using data collected from other international regions. Furthermore, the simulation does not consider the segmentation of entrepreneurs by demographic criteria or incorporate cultural modeling, which limits its ability to capture significant differences between different entrepreneur profiles. Consequently, future research could broaden the scope by including these variables to obtain a more complete and comparative view of the entrepreneurial phenomenon. Second, the ADEB model focuses on designing the endogenous mechanism of entrepreneurial adoption and diffusion through imitation, treating institutional effects as fixed parameters. Future studies should extend policy design, integrate policy interventions into the model, and validate it using not only GEM data but also other institutional data regarding new scenarios that consider contextual uncertainty factors such as corruption or country risk and also different policies affecting entrepreneurs. In addition, future research could explore factors explaining the volume of potential entrepreneurs, the inertia of the flow of entrepreneurs along the entrepreneurial process, and the leaks of individuals out of the entrepreneurial process.

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Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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