The role of innovative entrepreneurship within Colombian business cycle scenarios: A system dynamics approach

Sebastian Aparicio
Universitat Autònoma de Barcelona, Department of Business, Edifici B, Campus UAB, 08913 Bellaterra (Barcelona), Spain; and Fundación ECSIM, Medellín-Colombia. sebastian.aparicio@e-campus.uab.cat

David Urbano (corresponding author)
Universitat Autònoma de Barcelona, Department of Business, Edifici B, Campus UAB, 08913 Bellaterra (Barcelona), Spain. david.urbano@uab.cat. Phone (+34) 935811209, Fax (+34) 935812555.

Diego Gómez
Fundación ECSIM
Cr. 43A # 6 sur – 26, Of. 423.
Medellín, Colombia
E-mail: direccion@ecsim.org, Phone: +057 (4) 311-8075.

Abstract: Since the advent of public and private initiatives in Colombia, there has been interest in exploring the possible future pathways of the Colombian business cycle. Based on a foresight analysis, it has been identified on the one hand that it is necessary to achieve greater productivity and competitiveness and on the other hand, collective intentionality toward progress must be encouraged. Using these analyses, new Colombian scenarios are discussed, taking into account intentionality towards entrepreneurship and innovation. Following the entrepreneurship research, it is suggested that innovative entrepreneurial activity is linked to long-term economic growth. Thus, the purpose of this paper is to identify the role of innovative entrepreneurship in Colombian business cycle scenarios using system dynamics (SD) modelling. Here, we approach futures studies, testing dynamic hypotheses concerning development based on societal and socioeconomic integration, in which innovative entrepreneurship is highly relevant. The model, supported by circular flow analysis and Schumpeterian theory, shows how this type of entrepreneurship contributes to sustainable economic growth during the simulation period (2003–2032). To achieve a 6.77% average growth rate (the higher scenario), policies regarding knowledge transfer from specialized foreign individuals, incumbent firms and universities, as well as incentives for entrepreneurial societies and collectivism, are discussed.

1. Introduction

Scholars in entrepreneurship research have been interested in the effects caused by entrepreneurial activity (Rocha, 2004; van Praag & Verslot, 2007; Wenneker & Thurik, 1999). It has been argued that entrepreneurship brings social benefits as the individual intentionality towards business creation generates new jobs (van Praag & Verslot, 2007; van Stel, Wennekers, & Scholman 2014), cluster formation (Lee, Lévesque, & Minniti, 2012; Li, de Zubielqui, & O'Connor, 2015; Rocha, 2004) and long-term

economic growth (Acs, Audretsch, Braunerhjelm, & Carlsson, 2012; Audretsch & Keilbach, 2008; Urbano & Aparicio, 2016). Beyond traditional entrepreneurial activity, an emphasis on innovative entrepreneurship is suggested as a driver of progress for society (Audretsch, 2013). For instance, Aparicio, Urbano, and Audretsch (2016) analysed long-term economic growth affected by opportunity entrepreneurship. In this case, controlling for time fixed effects, innovative entrepreneurial activity was found to be positively associated with countries' business cycles. These results open up new avenues not only to explore the recent past in terms of innovative entrepreneurship and economic development, but also to extend our comprehension of entrepreneurial activity and the development process through futures studies.

Ács, Autio, and Szerb (2014) suggested that equilibrium between entrepreneurial activity and the development path depends on public policies, such as the creation of a national system of entrepreneurship. Although Minniti and Lévesque (2010) found that innovative entrepreneurship and its effects on the business cycle have been examined for longer in developed economies than in developing ones, Ács et al. (2014), using the Global Entrepreneurship and Development Index (GEDI), highlighted the balance between entrepreneurship and development in emerging economies such as Puerto Rico and Colombia, among other developing countries. In relation to Puerto Rico, Padilla-Pérez and Gaudin (2014) underlined the recent effort made by Central American governments in terms of infrastructure, financing, and science, technology and innovation (STI) policies to encourage, inter alia, entrepreneurship behaviour.

Regarding the Colombian case, governmental support for entrepreneurship as a formal institution has only been provided since the mid-2000s (DNP, 2007; República de Colombia, 2006), despite the long history of entrepreneurial activity (Echavarría, 1999). Nevertheless, due to the lack of diversification caused by industrialization and import substitution (Hausmann, Hwang, & Rodrik, 2007), as well as the violence faced in the country (Hiatt & Sine, 2014), entrepreneurship and subsequently economic growth have declined. According to Gómez (2005a), to recover industrial expansion, competitiveness and long-term economic growth, greater emphasis on entrepreneurship and innovation incentives is required. However, few works exist that assess foresight scenarios regarding the importance of entrepreneurship (Alvarez & Urbano, 2011a) for socioeconomic dynamics in Colombia (Gómez, 2005b; Jaén & Dyner, 2014). According to Davis, Eisenhardt, and Bingham (2007) and Jaén and Dyner (2014), the simulation of scenarios requires modelling methods that take into account specific characteristics in order to provide new insights for theoretical discussion, as well as for policy analysis and design.

Therefore, the objective of this paper is to identify the role of innovative entrepreneurship in Colombian business cycle scenarios using system dynamics (SD) modelling. Work on foresight analysis regarding social development (Cowan, Eidinow, & Likely, 2000) was used to suggest new Colombian scenarios, which are assessed through SD. For this purpose, data for the year 2002 from the National Statistics Department (Departamento Administrativo Nacional de Estadística [DANE]) and for 2005 from the World Development Indicators (WDIs) were used as inputs in the SD

model. Through this methodology, it is possible to understand the complexity involved in socioeconomic processes and to analyse the possible behaviours in a defined system (Sterman, 2000); it is also useful for discussions concerning long-term policies. Our results suggest that the best scenario (high–high) for long-term Colombian economic growth (an average of 6.77% from 2003 to 2032) is obtained through an increasing number of innovative entrepreneurs (15% on average during the simulation period).

Following this brief introduction, section 2 provides a literature review of SD modelling in entrepreneurship and the business cycle; here, the concept of the circular flow model is the starting point. Section 3 defines the SD methodology and its importance in addressing our problem. Section 4 presents the scenarios and the model proposed. Section 5 assesses the validation of the model, while section 6 describes the results. Section 7 discusses the policy implications in terms of innovative entrepreneurship as a driver for achieving greater long-term economic growth. Finally, the conclusions are presented in section 8.

2. System dynamics modelling in entrepreneurship and the business cycle: a literature review

To understand the complexity involved in socioeconomic phenomena, it is useful to define the relationships between the elements interacting with each other (Cattaneo, D'Alisa, Kallis, & Zografos, 2012). By defining causal loops or circular flows, it is possible to understand the reinforced (or balanced) effect between the participating elements (Videira, Schneider, Sekulova, & Kallis, 2014).

Circular analysis is not new to economics. Indeed, Patinkin (1973a, 1973b) discussed the understanding of economies through circular flows of goods and money. According to Patinkin's works, the economy should be understood as a continuous flow of goods and services, in which the counter flows represent the payment for those goods and services, as well as the inputs required for production. Circular cumulative causality states that the processes in each economy depend on previous stages as well as the link between the variables (Berger, 2009). Veblen (1898) applied this rationality to explain the evolution of economies. Further developments, based on Veblen's analysis, allow an understanding of the circular dynamics of money. Based on this perspective, Myrdal (1931) created his monetary theory; later, Kaldor (1970) explained the export expansion process.

Even though this approach is not the dominant one in economics nowadays, the circular flow model is still used to understand the economy as a system. For instance, Mankiw (2012, p. 25) used the scheme to explain macroeconomic adjustment in a systemic way. The simple model contains two actors (households and firms) and two markets (factors of production and goods and services). Based on this representation, Hulten (2006) included other actors to obtain measures of national accounting in the US. In this case, the government and external sector (as other actors) and the financial system (as another market) were included in the circular flow model (see Figure 1). Hence, the

traditional macroeconomic identity on the demand side is embraced by circular flow analysis.

$$GDP = C + I + G + (X - M) \quad (1)$$

where:

GDP is the gross domestic product.
C is household consumption.
I is firm investment.
G is government consumption.
X is exports.
M is imports.

Insert Figure 1 about here

Drawing upon the circular flow analysis, SD models have provided representation of aggregated economic behaviour (Gallón, Gómez, & Barceló, 2011). Although most global models address population, environmental and developmental issues through SD, they also include an economic module to capture the linkage between socioeconomic fluctuations and sustainability (Boumans et al., 2002; Brecke, 1993; Bruckman, 2001; Cole, 1974). Despite efforts to understand the limits to growth around the world, projects such as World 2 and 3 (Meadows, Meadows, Randers, & Behrens III, 1972; Meadows, Meadows, & Randers, 1992; Meadows, Randers, & Meadows, 2004), GUMBO (Boumans et al., 2002) and Threshold 21 (T21) (Bassi & Pedercini, 2007; Millennium Institute, 2000) do not allow extension to comprehend embeddedness within particular countries or the analysis of relevant microeconomic behaviour which can explain the national output.

Recent advances have been focused on understanding specifically a country or group of countries, in which some intrinsic dynamics could explain what occurs in terms of productive decisions. For instance, Gallón et al. (2011) analysed how innovation and productivity could address problems of poverty and enhance sustainability in South American countries. Similarly, Gallón (2009) created the KITWe model to explain the importance of knowledge and technology transfer in the health sector and Rodríguez, Navarro–Chávez, Gómez, and Mier (2015) explored science, technology and innovation policies in Mexico in the agricultural biotechnology sector. Gómez and Dyner (2009) employed SD to explore in depth the effect of innovation on social transformation. According to these authors, what could explain the development path is the number of projects on entrepreneurship and innovation.

Since Schumpeter (1911, 1939) and Kirzner (1973, 1979), it has been argued that innovative entrepreneurs and entrepreneurial activity characterized by the discovery, evaluation and exploitation of new opportunities, as another innovation process, affect

fluctuations in national income. Based on these ideas, several authors have shown interest in the relationship between entrepreneurial activity and the business cycle, although most of their conclusions are derived from econometric analysis. For instance, Faria (2015) and Beneito, Rochina-Barrachina, and Sanchis-Llopis (2015) attribute business cycle behaviour to technological innovation and the pass from unemployment to self-employment. Other authors have analysed at the individual level how the registration of new firms and own-account workers create and destroy employment depending on the stage of the business cycle (Klapper, Love, & Randall, 2015; Millán, Millán, Román, & van Stel, 2015). In general, Sanchis Llopis et al. (2015) have suggested that further studies dealing with entrepreneurship and business cycle are needed. Here, examining long-term economic growth fluctuations through entrepreneurship would need non-linear approaches.

Literature on entrepreneurship has shown the importance of the SD approach to explain entrepreneurial dynamics (Yearworth & White, 2013). For instance, Bloodgood, Hornsby, Burkemper, and Sarooghi (2015) developed an SD model to understand the evolution of corporate entrepreneurship. Similar literature suggests that the continuous evolution of technology generates risk-based decision making in entrepreneurial teams within the firms (Wu, Kefan, Hua, Shi, & Olson, 2010). Analysing the institutional environment and entrepreneurship, van Burg and van Oorschot (2013) found that fairness perceptions change over time, generating different cooperative ties. Likewise, using an SD model, von Heland, Clifton, and Olsson (2014) found that entrepreneurs and their networks evolve constantly. Alvarez and Urbano (2011a) have suggested that institutions and entrepreneurship are dynamically related and hence further analysis is needed to understand these dynamics in developed and developing countries.

In particular, some authors have analysed the determinants and consequences of entrepreneurial activity in Latin American countries, including Colombia (Ács et al., 2014; Alvarez & Urbano, 2011b; Aparicio, Ramírez Hassan, & Gómez Sánchez, 2013; Aparicio et al., 2016; Urbano & Aparicio, 2016). One common conclusion is that although Colombia has higher levels of unofficial economy, entrepreneurial activity is necessary to achieve a longer development path. So far, the business cycle literature on the Colombian case has studied the financial system (Arias Rodríguez, Gaitán Maldonado, & López Velandia, 2014; Hamann, Hernández, Silva, & Tenjo, 2014), international trade (Sánchez, 2010), interest rate and technology shocks (Fernández, 2010) and fiscal policy analysis (Lozano & Toro, 2007), among other aspects. Although there is no empirical evidence on entrepreneurial activity affecting economic dynamics, Gómez (2005b) has proposed possible scenarios for Colombian economic growth considering the importance of knowledge, innovation and entrepreneurship.

Previous exercises involving Colombian scenarios were developed due to the debilitated production sector. Initially, economic openness policies (López Pineda, 2010) and the high level of violence (Ibáñez & Vélez, 2008) affecting society were some of the motivations that encouraged a group of 43 individuals from different sectors to rethink the Colombian future (Cowan et al., 2000). The analysis, called Destino

Colombia Scenarios, was carried out for possible pathways, taking into account not only production factors, but also social embeddedness; it was a common-sense construction and a consensus exercise (Cowan et al., 2000). The main focus of this project was to identify possible trends in the political, military, industrial and societal classes, which were totally disconnected at the time (Cowan et al., 2000).

The four scenarios identified were: (i) "when the sun rises we will see", which defines people surrendering to resignation; (ii) "a bird in the hand is worth two in the bush", proposing agreement and dialogue between state and armed groups; (iii) "forward march!", denoting the instance in which society elects a government that proves strong enough to impose order and put an end to institutional chaos; (iv) "in unity lies strength", in which all the actors (government, firms and civil society) undergo a transformation in the individual and collective mentality towards unity. According to Gómez (2005b), the latest scenario could be achieved if that mentality is transformed into actions through entrepreneurship and innovative initiatives. Thus, higher GDP per capita and a lower level of inequality could be attained. In spite of this theoretical exercise, further development and assessment of Colombian scenarios using methodologies involving complexity are needed to discuss long-term growth policies (Gómez, 2005a, 2005b).

3. Methodology

As mentioned above, using SD modelling, this paper explores the role of innovative entrepreneurship in Colombian business cycle scenarios. Hence, we analyse the feasibility of some possible future development paths. The systemic understanding of society and the economy opens up new avenues for socioeconomic foresight and forecasting (Videira, Schneider, Sekulova, & Kallis, 2014). To perceive society and economy together as a set of continuous flow processes, interrelated with each other and constantly imbalanced, requires a technique to determine the complexity involved (Soydan & Oner, 2012). Hence, Sterman (2000) suggested an SD approach to facilitate the simulation of long-term socioeconomic processes.

Using causal diagrams, it is possible to understand the functioning of the system, which is sketched by establishing cause–effect behaviour between the relevant variables. This structure determines the future behaviour of the system, which could be influenced by some public policies allowing better performance (Randers, 1980). The inclusion of certain policies within the system could result in a reinforced (R) or balanced (B) loop. According to Soydan and Oner (2012), if two elements in the system are positively or negatively affected by each other simultaneously, the loop is reinforced; if one element affects another element positively and the latter generates a negative impact on the previous one, the loop is balanced. The identification of these forces facilitates the control and analysis of any intervention within the model; hence, policies and strategies could be identified to modify current performance (Sterman, 2000).

Given the advantages of SD, future scenarios could be analysed by taking into account the possible fluctuations of the system, caused essentially by a specific policy. In particular, for the Colombian case, Crespi, Fernández-Arias, and Stein's (2014) work suggested that to obtain greater and inclusive economic growth in the next 20 years, it is necessary to rethink industrial strategy based on innovative entrepreneurship initiatives. Gómez (2005a, 2005b) agreed with this idea several years ago. Nonetheless, the problem to be faced here is the construction of an SD model capable of quantifying the response of the Colombian business cycle to a public policy intervention. In particular, the SD model that we propose in the following section takes into account different numbers of innovative entrepreneurs, in some cases achieving export success. In this regard, the model is useful for exploring long-term scenarios (from 2003 to 2032) of Colombian economic growth.

It is worth highlighting both that is difficult to measure scenarios that involve a large amount of complexity quantitatively (Karaca & Öner, 2015; Turner, 2008) and relative lack of works in the literature dealing with future scenarios concerning the Colombian case affected by entrepreneurship (Alvarez & Urbano, 2011a; Feola, Gallati, & Binder, 2012). By applying SD analysis to the Colombian economy, it is possible to gain an understanding of a continuous flow system in permanent unbalance (Feola et al., 2012). Therefore, our proposed model aims to extend the current debate on the determinants of the Colombian business cycle and provide other insights regarding the complex relationship between entrepreneurial activity and economic growth.

4. Proposed model

Based on the Destino Colombia Scenarios and the Economic Prospect (SD) model (Gómez, 2000), five new scenarios were developed. In relation to this, two dynamic hypotheses describe the central processes that would have to be carried out to generate social transformation in the near future. These two hypotheses consider inclusion in the external markets with the highest value and the transformation towards collective compromise. Moreover, we establish in the hypotheses those dynamics generated by increasing the number of firms with export success and the number of entrepreneurs capable of creating social and economic value.

Regarding the external markets, Hausmann and Rodrik (2003), Lall (2013) and Low and Isserman (2015), among others, suggest that socioeconomic integration deals with the innovative capacity of entrepreneurs, changes in patterns of specialization and the ability to adapt to global production capacity. Moreover, as Hausmann (2013), Klimek, Hausmann, and Thurner (2012), Ocampo and Vallejo (2012) and Rodrik (2014) suggested, the development of knowledge and insertion into the global economy require that the challenges of inequality, poverty and labour market exclusion be overcome. Indeed, some factual evidence suggests that those countries undergoing a learning process related to new and high added-value goods and services trigger socioeconomic transformation dynamics, with higher economic growth levels, exports, employment generation and social inclusion. In addition, by acquiring experience from

abroad, it is easier to transfer knowledge to the country from which to learn than any amount of goods and services (Hausmann, 2013).

Taking into account the above discussion, the first dynamic hypothesis posits that long-term economic development depends on knowledge, innovative entrepreneurial activity and insertion into the global economy. Higher exports increase a firm's total production, which implies more technical and skilled workers. This greater human capital makes it possible to attain higher income levels, which are also part of the taxation system, redistributed to society. In this case, higher added value is achieved by linking the expansion of the local markets to economic globalization. Here, the dynamics are generated by the firms and entrepreneurs and transferred to the rest of the economy. This hypothesis is located on the horizontal axis.

Concerning the transformation towards collective compromise, North (2005) defined intentionality as the motivation on the part of individuals to undertake innovative projects, high productive capacity on the part of firms and efficient performance on the part of the government. All these actors, interacting with each other with the same purposes, generate development in and for society (North, 2005). According to Inglehart and Baker (2000), in societies with longer state dependency, lower autonomy levels, appropriation, empowerment and necessity entrepreneurship, there are lower levels of development and therefore a higher propensity towards messianic states. These differences are related to the perspectives of political, social and religious norms and beliefs across rich and low-income societies.

From the previous analysis, two dimensions emerge, reflecting cross-national polarization between traditional and secular–rational orientations towards authority and survival versus self-expression values (Inglehart & Baker, 2000). Societies with a predominance of secular–rational values are more accepting of issues such as abortion, divorce and euthanasia, among others. The survival vs. self-expression dimension is related to trust, tolerance, subjective wellbeing, political activism and self-expression, which emerge in post-industrial societies with high levels of security. Acemoglu and Robinson (2012) showed that those countries with colonization styles promoting autonomy and centred on creating their own capacities have undertaken development processes and nowadays are predominantly advanced societies. These authors also discussed the fact that those extractive colonies with a lack of institutional arrangements have encountered problems in constructing their own development dynamics.

Therefore, the second dynamic hypothesis deals with individual intentionality towards progress and development. Here, the conception of development arises from the capacity to convert ideas into opportunities for society (Acs et al., 2012; Aparicio et al., 2016; Audretsch & Keilbach, 2008). The institutional environment encourages individuals (households) to face risk-based decision making, expanding the total offer in the economy and generating inclusive dynamics. New entrepreneurs create new jobs and new markets, providing opportunities for the entire economy. Overall, innovation

and entrepreneurship allow the expansion of economic growth. This hypothesis is located on the vertical axis.

From the above discussion, it is possible to develop five scenarios to understand the possible trends in Colombian development. These scenarios are characterized and labelled according to the parameters chosen to define the future pathways. In this regard, the first scenario (the high scenario) is that Colombia attains an agreement to implement key social and economic reforms that facilitate the creation of new firms, for which a favourable context for international trade is also needed. As discussed previously in the first dynamic hypothesis, this could transpire from growth in productivity and the level of internal demand greater than 2% and 3%, respectively (Eslava, Haltiwanger, Kugler, & Kugler, 2004). According to Hausmann and Klinger (2008), trade reforms that allow slight product differentiation with respect to the current export basket could imply an expansion in external sales, at least more than was the case until 2004. Nonetheless, these authors highlight that this reform is still parsimonious as households' and firms' expectations are prudent due to institutional distrust and coordination problems. In terms of this, as we proposed in the second dynamic hypothesis, individuals seek social mobility by entering into innovative processes and entrepreneurial activities. This implies that the entrepreneurship rate should grow faster to generate not only product expansion and productivity, but also wellbeing throughout society (Mejía & Meléndez, 2014).

In the second scenario (the high–high scenario), Colombia attains consensus on the development of intentionality from the collective. Innovative entrepreneurship and learning are on the government's central and permanent agenda. Here, social values lead to the transformation of the specialization pattern. Entry barriers to new foreign markets are overcome by implementing new products derived from innovative entrepreneurs and firms, as well as increasing the quality of the existing export basket (Hausmann & Klinger, 2008). Evidence from Spain suggests that new firms with a large proportion of external sales are positively associated with economic growth and productivity (González-Pernía & Peña-Legazkue, 2015), as we posited in the first dynamic hypothesis. However, the innovation process and opportunity recognition are strongly required to boost entrepreneurial activity (Audretsch & Keilbach, 2008). Effectively, as Urbano and Aparicio (2016) found, entrepreneurs driven by opportunity allow a higher economic outcome in Colombia, among other countries. In particular, Colombia exhibited an opportunity entrepreneurship rate of about 11.5% in 2006, although in 2013 this declined to 7.4% (Varela, Moreno, & Bedoya, 2015). Comparing this evidence with Colombian GDP growth, it is possible to note that greater innovative entrepreneurship is positively correlated with higher economic growth (6.70% in 2006 and 4.94% in 2013). As we mentioned in the second dynamic hypothesis, societal development implies a large number of active individuals innovating and creating new firms. We suggest a rate above 11% (as seen in 2006) to generate economic dynamics such as greater employment and higher productivity, which could result in higher demand and thus in growing expectations among economic agents. According to these dynamics, the high–high scenario is the most optimistic one in terms of achieving the optimal development path.

In the third scenario (the base scenario), Colombia develops an obsession with peace, regardless of other social and economic objectives (e.g. education, research, innovation, entrepreneurial activity, etc.). Evidence concerning opportunity entrepreneurship suggests a downturn in this sort of activity, which stood at 7.4% in 2013 (Valera et al., 2015). The lower trend in GDP growth after 2008 discourages household and firm expectations. This presumably increases the idle capacity, leading to stagnation in productivity levels. As Eslava et al. (2004) found, without structural reforms, capital and labour productivity could remain below 2% in Colombia. However, according to Tafur Saiden (2009), Colombia is being driven by credit consumption, which has increased again since 2003. This allows firms to sustain employment generation to a moderate extent, implying a partial regeneration in terms of social wellbeing. Nevertheless, with a parsimonious industrial and trade policy, internal consumption and external sales would not be able to surpass the thresholds of 3% and 5% average growth respectively (Eslava et al., 2004; Hausmann & Klinger, 2008).

With respect to the fourth scenario (the low scenario), Colombia opts for protectionist policies, supported in part by incumbent firms with low expectations. As we proposed in the first hypothesis, a lack of economic integration and export diversification leads to a reduced market and constrains demand (Haumann & Klinger, 2008). Eslava et al. (2004) suggest that entry firms could shortly become exit firms as there are no policies encouraging innovative activity or adaptive processes in new and incumbent firms. In addition, a level of productivity lower than 1% does not foster an entrepreneurial context that would motivate sufficient individuals to become entrepreneurs. Following the second hypothesis, we assume lower levels of entrepreneurship rates compared to those observed in Valera et al. (2015), which implies that fewer individuals are incorporated in the wellbeing generation and therefore there is lower consumption (lower than 2.5%).

In the worst scenario, the economy, democracy and the institutional environment are weakened by corruption and confrontations between political leaders guided by their own interests. As we argued in the second hypothesis, if society is not motivated to make changes by itself, it is hardly likely that a government with corruption issues would generate the necessary effort to increase the development level. In this respect, Aparicio et al. (2016) found that control of corruption is a significant institutional variable encouraging opportunity entrepreneurship, which in turn is positively associated with the economic growth of Colombia. The other side of this evidence suggests a lower level of entrepreneurial activity driven by opportunity and therefore less growth. These ideas, together with the first hypothesis discussed, constrain the economy even to the extent of generating negative results. According to Hausmann and Klinger (2008), a lack of specialization strategies and of innovation in products and services generate a significant reduction in the production capacity and therefore in the expansion of demand. Following Eslava et al. (2004) and Hausmann and Klinger (2008), we assume marginal internal and external consumption (1–2% and 2–3% respectively), depending on the income obtained mostly from the public sector. Figure

2 illustrates the emergence of the Colombian business cycle scenarios and Table 1 their configuration.

Insert Figure 2 about here

Insert Table 1 about here

To assess the scenarios previously described, we develop a SD model based on the structure proposed by Gómez (2000). In essence, the model is drawn based upon the circular flow scheme defined in previous sections (Hulten, 2006). Hence, two main agents are supported by the dynamic hypotheses mentioned above. Households and firms interact with each other, generating economic expansion and inclusive dynamics. In addition, both of them are linked to the government, which participates in consuming, investing and creating employment. Annex A shows a simplified stock and flow diagram, in which firms and households represent a set of stocks and the flows and some auxiliary variables are their interactions. Annex B provides the equations and Annex C the input functions.

To specify the particular dynamics behind the stock and flow diagram (Annex A), a set of causal diagrams explains the behaviour of each agent. In particular, households participate in the economy by consuming and providing a labour force and the other inputs necessary for production. Salaries and rents depend directly on the production level (private firms) and public salaries (the government). In addition, if expenses are higher than income, households require loans from the bank system (see loop B2) (Fuller, 2015). Higher interest rates, albeit increasing the cost of debt (B1), encourage savings (R1) but reduce demand capacity (Mason & Jayadev, 2015). In the case of higher savings, there is the possibility of investing in the private sector (B3) and thus obtaining new income from it. In terms of expenses, it is expected that the income received would be used for tax payments (to the government), debt and interest rate payments (to banks) and consumption (to firms, both internal and external). The exchange rate plays an important role in defining the amount of external purchases (see Figure 3).

Insert Figure 3 about here

In terms of the government, following Mankiw's (2012) assumption, households' tax payments alone represent the main source of income (Hulten, 2006). Similar to households, the government has to service debt with internal and external banks, which reduces the budget available for social investment (B4) (Égert, 2015; Greiner, 2015; Panizza & Presbitero, 2014). Conversely, savings could contribute to the government's social investment (R4). However, the income received through internal and external

debt could also be used for public investment, which could generate new income and therefore cover the debt (B6). However, if there is demand in excess of the loans, the interest rate tends to rise and therefore public investment is discouraged, generating a reduction in government income (B5) as well as the saving capacity (B7). In terms of public expenses, apart from debt payments, there are also salaries for public employees, subsidies and government consumption (see Figure 4).

Insert Figure 4 about here

Incumbent organizations and new entrepreneurs constitute the entire set of producers in the economy, enhancing the markets in which they are involved (R6) (Lee et al., 2012; Li et al., 2015; Rocha, 2004). Their income flows are generated by sales within internal and external markets (Corrado, Hulten, & Sichel, 2009; Hulten, 2006; Mankiw, 2012), household investments (Corrado et al., 2009) and private debt from the internal bank system (Mankiw, 2012). Access to the latest income flow is of considerable importance for innovative entrepreneurship (Aparicio et al., 2016; Giordani, 2015; Song, Ai, & Li, 2015, among others). When entrepreneurs finally gain access to financing, the fixed costs immediately increase (B8) (Alvarez & Urbano, 2011b), affecting the production capacity (B9). Although some reinvestments could be achieved, liquidity at that moment is reduced, affecting output in the short term (B10). Finally, salaries, rents and dividends (to households), consumption (to other firms) and debt (to the bank system) represent the firms' expenses (Figure 5).

Insert Figure 5 about here

Figure 6 shows all the agents interacting together. Loop (R7) is explained by the fact that public firms also exist and therefore represent a source of income for the government. If the constraints on the public budget increase, this creates greater government consumption, which represents higher firm income. Regarding loop (R2), there is an exchange of salaries in the labour force, dividends from household investment and goods and services for money. With regard to this, if households receive higher income, they could increase their consumption level, thereby enhancing production capacity due to the higher income of firms. Here, it is important to highlight that the consumption of those households, the government and even firms, minus external production (represented by imports), constitute the aggregate demand in the economy (see Eq. 1). Hence, it is possible to compute the national GDP and simulate the Colombian business cycle taking into account an increasing number of entrepreneurs.

Insert Figure 6 about here

According to the previous structure, two external inputs were introduced to analyse the Colombian scenarios: the total number of new firms (current and expected) and export expectations up to 2032. The data used in this model correspond to national aggregates (GDP, gross capital formation, exports and imports and government consumption; all this information is at 2005 constant prices in Colombian pesos [COP]) and come from the institutional accounts to measure the income and expenses of the household production sector. The information was taken from the National Statistics Department (Departamento Administrativo Nacional de Estadística [DANE]) for the year 2002. The information concerning new business creation came from the World Development Indicators (WDIs) for the year 2005. In general, the aggregated information corresponds to the period 2003–2013, which is that used to validate the model's goodness of fit.

5. Testing and validation

The model was simulated over the period 2003–2032, with a set of parameter values giving the closest possible overall fit to the historical indicator data. The baseline simulation was validated according to tests suggested by Barlas (1989) and Forrester and Senge (1980), which consist of emulating the actual values (2003–2013). As Table 2 shows, the simulation of Colombian scenarios oscillates around the real value of GDP. On average, there is a difference of 7.64% between the simulations and the reality observed. It is worth highlighting that the base scenario obtains the best adjustment. Therefore, the model fits the data relatively well.

Insert Table 2 about here

In addition to the simulation results, we also validated our model following Sterman's (2000) process. First, the model-testing process starts when the initial set of equations is written as from that time the model and the modules developed are constantly checked. This implies that not only does the model emulate real data from the very beginning, but also that the causal relationships between variables maintain the same direction as defined theoretically. Second, we validated the model by applying extreme conditions within the initial parameters, which constitute unreal scenarios. Thus, we employed two sets of variables to validate the model's consistency. As we show in Annex A, the two groups of stocks and flows are highly integrated. Investment is required to define the production capacity of firms. Here, we first set the initial investment equal to zero. Second, after applying this extreme value, we also modified our initial variable of interest (GDP growth), as well as the households' participation in the production function (employment). Thus, we set initial GDP and employment equal to zero. As a result of this validation process, the model provided different results compared to the five scenarios assessed, although the trends were relatively stable over time, implying that the model preserved the reinforced and balanced loops, avoiding extreme results in terms of GDP.

Although differences in the simulations contain different interventions (mainly the number of entrepreneurs and external sales expectations), some delays were also introduced depending on the scenario. Here, a sensitivity test was conducted. We assessed the market absorption of the entry of new entrepreneurs and the firms' capacity to respond to higher external demand. We found the model to be capable of increasing production capacity through endogenous investment; however, the natural delays (given by the stocks) do not allow instantaneous capacity expansion. Here, the reinforced and balanced dynamics also span relatively different dimensions across scenarios.

Finally, apart from the validation process, we also performed various forecast error measurements to compare the real data to the simulation results across the five scenarios (see Table 3). Although scenario 2 (high–high) has longer dispersion measures, it is still robust to explaining the possible pathways of the Colombian business cycle (Barlas, 1989). Table 3 shows that the goodness of fit of this scenario is high and close to the others. Hence, for the foresight analysis, the proposed structure of the system shows in particular how innovative entrepreneurship increases productive capacity, boosting GDP over time. Our analysis suggests that the model captures the main structure of the economy. Thus, the model is accurate in terms of simulating alternative scenarios in which our dynamic hypotheses can be tested with greater care (see Figure 7).

Insert Table 3 about here

Insert Figure 7 about here
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6. Discussion of simulations and behaviour

Figure 7 shows the five scenarios simulated in their corresponding order. As mentioned previously, the period covered (2003–2013) provides understanding of each pathway found in the simulations. According to the scenarios defined previously, the Colombian business cycle could range from 2.39% to 6.77% average growth, in which the baseline scenario has a mean value of 3.08%. Here, it is worth mentioning that we changed the number of entrepreneurs following the trends observed in the period 2005–2012 and the definition of the parameters discussed in the previous sections. According to the WDI dataset, the new business creation rate has grown 11.76% on average, similar to the opportunity entrepreneurship rate found in Varela et al.'s (2015) work.

In terms of each scenario, the first (high) presents an increase in innovative entrepreneurs (11% during the simulation period). The average of the economic growth rate over 2003–2032 is 4.81%, in which the best year is 2022. However, the last decade simulated shows lower performance (4.42%) than the previous one, which has

a 5.68% growth rate on average. Furthermore, the economic growth from 2022 to 2032 is even lower than the average rate of the entire period. Following Hausmann's (2013) ideas, greater new business formation and export basket diversification should be achieved. Hence, the parameters established for this scenario are not sufficiently strong to increase long-term economic growth.

In the scenario high–high, longer productive capacity is attained mainly as a result of society deciding to participate on its own initiative. Here, the rate of innovative entrepreneurs grows at 15%. In addition, taking into account the achievement of innovativeness, export expectations are increased (17.38% on average). These two elements imply that the creation of new business plus the incumbent firms are capable of incentivizing the internal and the external market. In this scenario, the long-term economic growth rate is 6.77% on average and the next two decades remain similar in their mean values (7.82% from 2012 to 2021 and 7.76% from 2022 to 2032). Here, as Aparicio et al. (2016) and González-Pernía and Peña-Legazkue (2015) suggest, higher innovative entrepreneurship focused not only on internal markets but also on external ones increases regional and national output, generating employment and inclusive dynamics.

The third scenario (base), in which Colombia seems to be located, presents moderate long-term economic growth (an average of 3.08% over the total period and 3.75% and 1.60% in the second and third periods respectively). The current strategy of the national government lies somewhere between two Destino Colombia Scenarios ("a bird in the hand is worth two in the bush" and "when the sun rises we will see") as there is the intention on the part of the central government to agree peace with armed groups. However, there has been a violent reaction to which, causing society to distrust the government (González Muñoz, 2015). However, it is worth mentioning that in this scenario there is an intention to progress through improving the educational and science and technology systems, which is in accordance with current public policies. Fergusson et al. (2014) suggested that this contradiction could be due to the economic and political incentives generated by the armed conflict. In this scenario, the rate of innovative entrepreneurs increases by 9%.

The low scenario increases the rate of innovative entrepreneurs by 4%. In making this change, we observe economic growth of 2.43% on average, which offers a modest development pathway by generating incentives for progress in society. As defined in the section on scenarios, in this case, there is an increase in protectionism and pressure on the production sector. Here, the low level of entrepreneurial activity achieved can be perceived in the economic performance over the next two decades. From 2012 to 2021, the average growth rate is equal to 3.19%, while from 2022 to 2032, it is 0.30%. According to Pombo (2001), although some entrepreneurial activity is encouraged, innovation and insertion into foreign markets are crucial for industrial development. Otherwise, Colombia could fall into a deindustrialization process, deterring productive capacity and obtaining null social benefits from the moderate entrepreneurial incentives.

The last scenario, the worst, comprises a combination of protectionism strategies and a totally dependent society. Here, the number of innovative entrepreneurs grows at 0.5%. As Oppenheim, Steele, Vargas, and Weintraub (2015) suggested, low levels of autonomy within society plus distrust in the central government trigger social, economic and political chaos. Similar to the Venezuelan case, such problems, temporarily solved through the use of natural resources, not only hold back the internal economy, but also some external relationships, which could generate long-term punishments (Fields, Duval-Hernández, Freije, & Puerta, 2015). This scenario shows that growth rate of the Colombian business cycle is on average 2.39%. The second decade shows survival through commodity prices (the economy growing at 3.18%), but the final decade is depressed in economic terms (0.19%).

7. Policy discussion

Given the above results, which highlight the high-high scenario as the best development path for Colombia (with the rate of innovative entrepreneurs growing at 15%), this section discusses some implications that might help the accomplishment of this trajectory. Taking into account that the high-high scenario provides sustainable economic growth over time, a set of institutional, political, economic and societal strategies should be employed to increase individual opportunities for innovation-based entrepreneurial activity focused on external markets. In a general sense, it is important to obtain agreement to implement key reforms in terms of the labour market, taxation, regulatory frameworks and fiscal structure, facilitating the creation of new firms. Innovation, entrepreneurship and the learning process should be on the government's central agenda; no matter what the changes of a mandatory nature, the strategies and policies in this regard should be continuous over time.

From the theoretical point of view, the importance of innovative entrepreneurs for the business cycle has been recognized (Kirzner, 1973, 1979; Schumpeter, 1911, 1939). Further developments of this theory have suggested technological change as an important tool for the success of innovative entrepreneurial activity (Nelson & Winter, 1982). However, this could be achieved by acquiring learning (specialized skills) from foreign individuals, who transfer knowledge from advanced markets (Hausmann, 2013). Here, higher incentives in the science and technology sector should be aimed at reaching agreements with foreign research centres and universities.

As Urbano and Guerrero (2013) suggested, knowledge and technology transfer could enhance the development of new start-ups and encourage innovativeness among individuals, especially university students. According to Acs and Amorós (2008), entrepreneurial activity surrounded by the knowledge environment creates opportunities for the development of new products. This dynamic would be especially helpful for Colombian competitiveness, in which innovation should be strongly encouraged to obtain diversification and thereby conquer new markets (Hausmann & Rodrik, 2003).

Regarding institutional strategies, when North (2005) suggested that economic development depends on individual intentionality (shaped by formal and informal institutions), key directions were indicated to propose innovative entrepreneurship as a mechanism of growth (Aparicio et al., 2016). In this respect, the Colombian government should design long-term policies oriented towards the creation of an entrepreneurial society. According to Thurik, Stam, and Audretsch (2013), universities and their research environments play a key role not only in the formation of professionals, but also in the formation of entrepreneurs, who create social value. Audretsch and Keilbach (2008) stated that a greater innovative entrepreneurial density is positively related to economic growth. Thus, entrepreneurial societies indeed comprise the entrepreneurship capital required for regional and national production.

To achieve entrepreneurial economies and societies, it is important to generate incentives for cooperation between the agents involved within the economic dynamic. Here, large incumbent firms should allow knowledge transfer by including potential entrepreneurs in their organizational structure. Learning from this experience, future entrepreneurs might be able to face risk aversion with greater ease. In addition, to coordinate all agents, a national system of entrepreneurship is needed alongside the national system of innovation (Ács et al., 2014). Here, it is worth recognizing the joint contribution of the government (providing infrastructure and adequate regulations), incumbent firms (facilitating the connection between new and SME firms) and civil society (contributing trust and progress intentionality). Therefore, as Solow (2007) suggested, long-term economic growth relies, inter alia, on innovative entrepreneurship, which directly links collective society with socioeconomic development.

There is no doubt that increasing the rate of innovative entrepreneurship to obtain the high-high scenario is a major challenge, especially as it has been recognized that innovation in SMEs and entrepreneurs is around 2% or less in some economies (OECD, 2009; Öner & Kunday, 2016; Veugelers, 2015). However, opportunities to exploit new products, services, markets and so on are constantly being generated (Hausmann & Klinger, 2008). According to De Smedt, Borch, and Fuller (2013), possible solutions to encourage opportunity recognition in relation to innovativeness lie in addressing innovation systems in the appropriate manner, which implies connecting the actors playing a role on both sides, supply and demand. These authors proposed the analysis of future scenarios as a mechanism to generate accurate inputs for planning and decision-making. Similar to this line of thought, Hausmann and Klinger (2008) discussed a set of scenarios to increase innovative entrepreneurial activity, at the same time achieving external sales. Among these, "let it be" is the optimal structural transformation path that Colombia could take as it suggests not only an increase in the supply level by encouraging entrepreneurs to produce products that already exist in Colombian market, but also takes full advantage of producing non-existing products in Colombia, which could be derived from existing ones. To exploit these opportunities and boost the learning process, the institutional context for entrepreneurs must be in place to allow interaction between the public and private sectors; in addition, the learning process should incorporate what new activities are being considered and what

public policies are required for entrepreneurs to emerge successfully. As Varela et al. (2015) showed, Colombia could return to and even improve on the 11.5% rate of entrepreneurs exploiting new opportunities seen in 2006. Modelling futures thinking might prove to be a relevant method for analysing such strategies in order to discuss the best development path for Colombia.

8. Conclusions

This paper has examined the role of innovative entrepreneurship in Colombian business cycle scenarios using system dynamics modelling. Five scenarios have been assessed, supported by the Destino Colombia Scenarios (Cowan et al., 2000). Using system dynamics, it has been possible to embrace some of the complexity involved in the economic process. Data from DANE and the WDI databases were used to define the initial condition of the model. All the scenarios were simulated from 2003 to 2032.

The main findings suggest that an innovative entrepreneurship rate growing at 15% allows higher economic growth, in which export expectations also play an important role. According to Hausmann and Rodrik (2003), if new innovative firms are created, it is possible to improve the export basket through differentiation. In this regard, the scenario with higher levels of innovative entrepreneurship creates a long-term economic growth rate of 6.77% on average. Furthermore, the high scenario, despite having a lower entrepreneurship rate (11%), but more than the remaining scenarios, creates economic growth of 4.81% on average. The base scenario, which is likely to be representative of Colombia's situation (Fergusson et al., 2014), shows an economic growth rate of 3.08%, while the low scenario is 2.43% and the worst scenario is 2.39%. The analysis by decades suggests that the high–high scenario provides a sustainable growth rate over time. Based on tests and validations, the structure defined in the system dynamics model is accurate in explaining the complexity and non-linearity of the Colombian business cycle.

In terms of limitations, this paper is no exception. One of the possible problems presented by system dynamics models is the omission of some variables or possible relationships between the existing variables. Moreover, although innovative entrepreneurship and export expectations were defined as intervention variables within the model, new research lines could be focused on understanding the determinants and the intrinsic dynamics of these two elements. As Alvarez and Urbano (2011a) suggest, entrepreneurial activity could be endogenized in system dynamics models by taking into account the institutional settings (e.g. procedures, regulations, networks, social values, role models, etc.), which also change over time. Here, greater complexity could be introduced and therefore particular strategies to encourage innovative entrepreneurship could further be discussed.

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Insert Annex A about here

Insert Annex B about here

Insert Annex C about here

Tables, Figures and Annex

Table 1. Colombian scenarios configuration

Scenario	1	2	3	4	5
Key dynamics	**High scenario**	**High-high scenario**	**Base scenario**	**Low scenario**	**Worst scenario**
Expectations and decision-making process	Highly prudent	Highly optimistic	Low growing	Low growing	Invariantly prudent
Households	Prudent	Growing	Prudent	Prudent	Low
Entrepreneurs and firms	Prudent	Growing	Low	Low	Low
Government	Growing	Prudent	Prudent	Prudent	Imprudent
Household consumption	Middle–high growing	High growing	Middle growing	Low growing	Low
Individual wellbeing generation	Transformation	High transformation	Partial transformation	No transformation	No transformation
Productivity change	4–6% annual	6–10% annual	2% annual	≦ 1% annual	≦ 1% annual
Entrepreneur and incumbent firm wellbeing generation	Transformation	High transformation	Partial transformation	Low transformation	No transformation
Innovative entrepreneur growth rate	9–11% annual	> 11% annual	5 - 9% annual	1–4% annual	< 1% annual
Demand expansion					
Internal	Middle–high	High	Middle	Middle	Low
	5% annual	> 7% annual	3% annual	2.5% annual	1–2% annual
External	Middle–high	High	Middle	Middle	Low
	9% annual	> 10% annual	5% annual	3% annual	2–3% annual

Table 2. Real vs. simulated Colombian GDP (2003-2013)

Scenario		1	2	3	4	5
Year	Real value[a]	High scenario	High-high scenario	Base scenario	Low scenario	Worst scenario
2003	3.92	2.43	2.44	2.44	2.44	2.44
2004	5.33	4.12	4.12	4.12	4.12	4.12
2005	4.71	4.50	4.50	4.52	4.52	4.52
2006	6.70	6.66	6.66	6.62	6.62	6.62
2007	6.90	7.55	7.55	7.56	7.56	7.56
2008	3.55	2.46	2.46	2.47	2.47	2.47
2009	1.65	1.48	1.48	1.48	1.48	1.48
2010	3.97	2.83	2.85	2.44	2.44	2.44
2011	6.59	6.83	7.30	5.78	6.11	6.11
2012	4.04	6.66	7.94	5.55	6.66	6.58
2013	4.94	6.04	8.08	5.06	4.75	3.36

[a] http://www.dane.gov.co

Table 3. Measures of goodness of fit

Scenario	1	2	3	4	5
Year	Actual value vs High scenario	Actual value vs High-high scenario	Actual value vs Base scenario	Actual value vs Low scenario	Actual value vs Worst scenario
Coeffecient of determination, R^2	0.95	0.91	0.96	0.95	0.94
Median absolute deviation (MAD)	4.24	4.21	3.05	3.20	3.33
Mean absolute percentage error (MAPE)	21.41	28.63	18.77	20.93	23.31
Mean absolute percentage deviation	0.91	1.25	0.80	0.88	1.00
Mean square error (MSE)	1.34	2.92	0.96	1.34	1.53
Theil index	0.10	0.12	0.09	0.10	0.11

Figure 1. Circular flow model

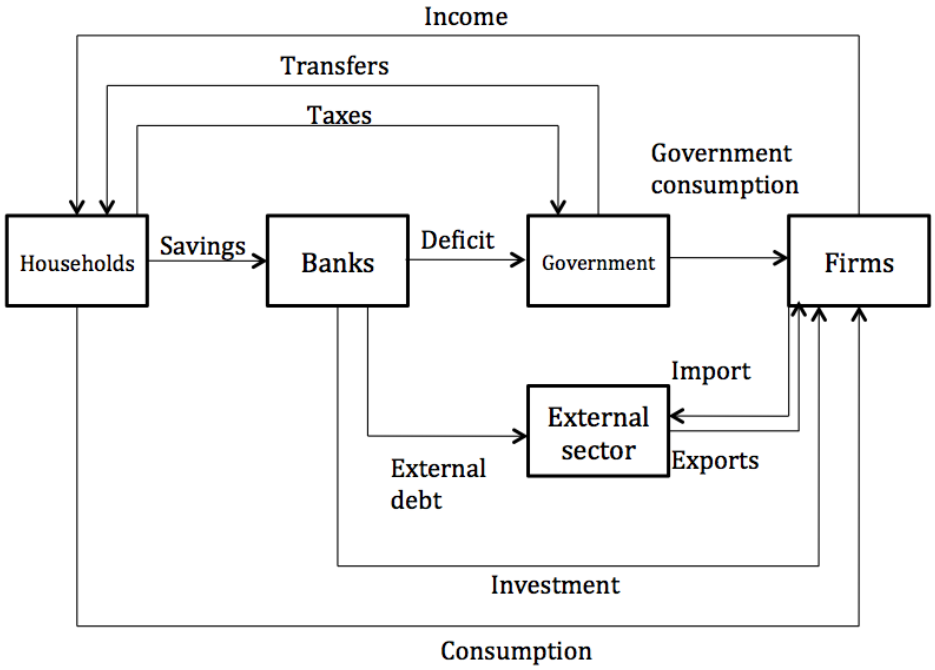


Figure 2. Colombian scenarios

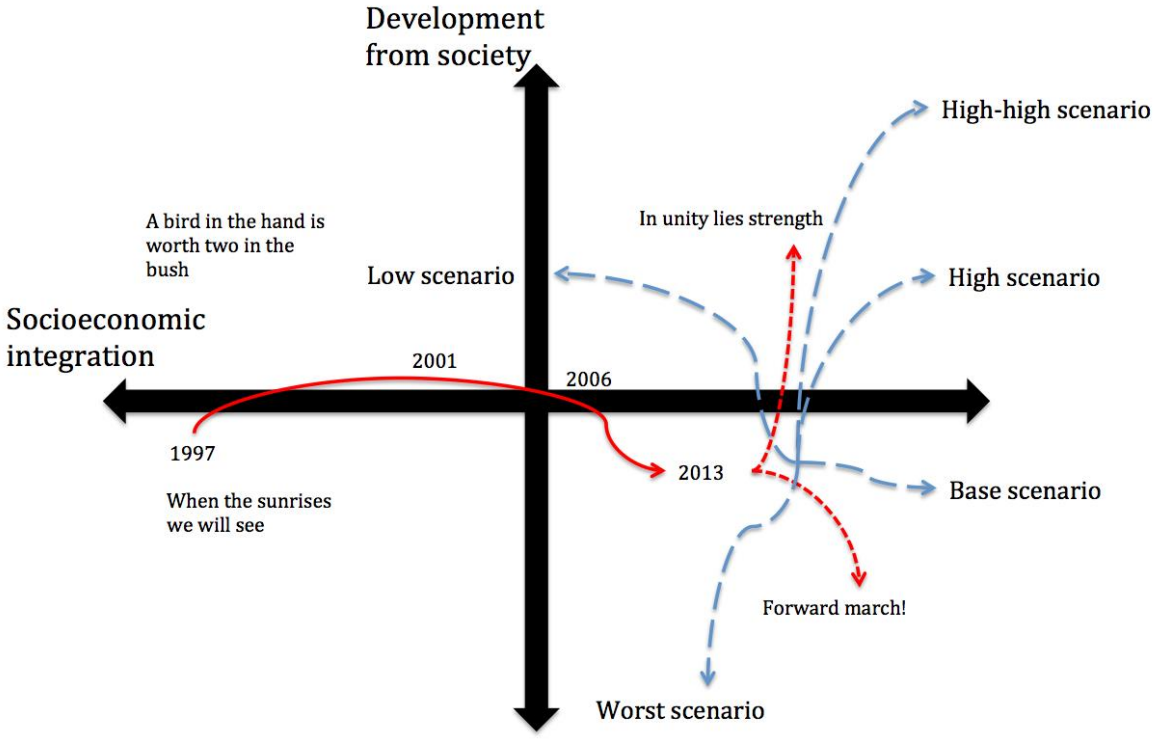
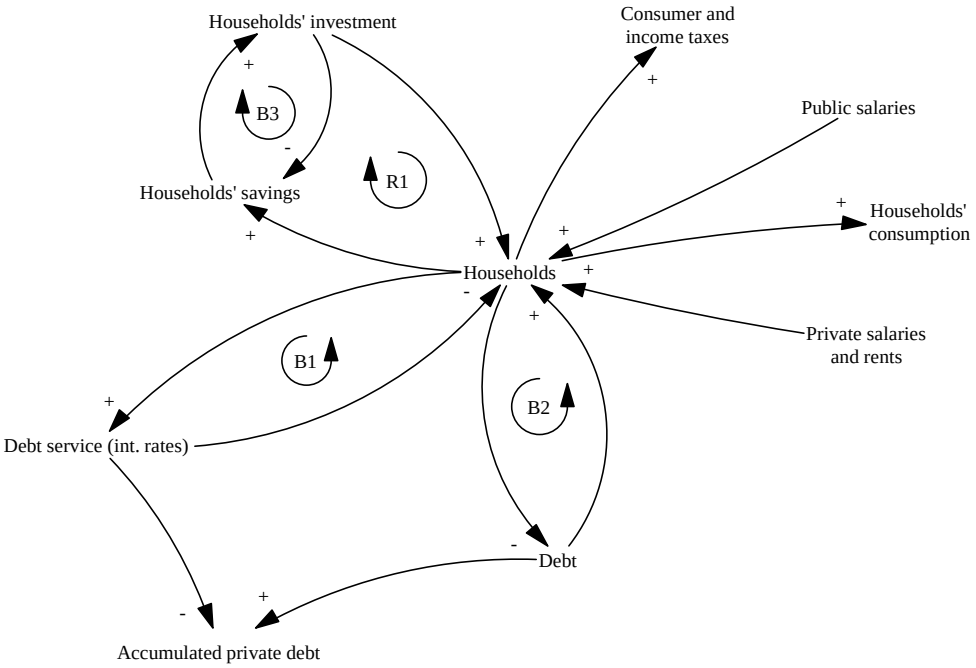


Figure 3. Households' dynamics



Abbreviations: int. rates, interest rates.

Figure 4. Government's dynamics

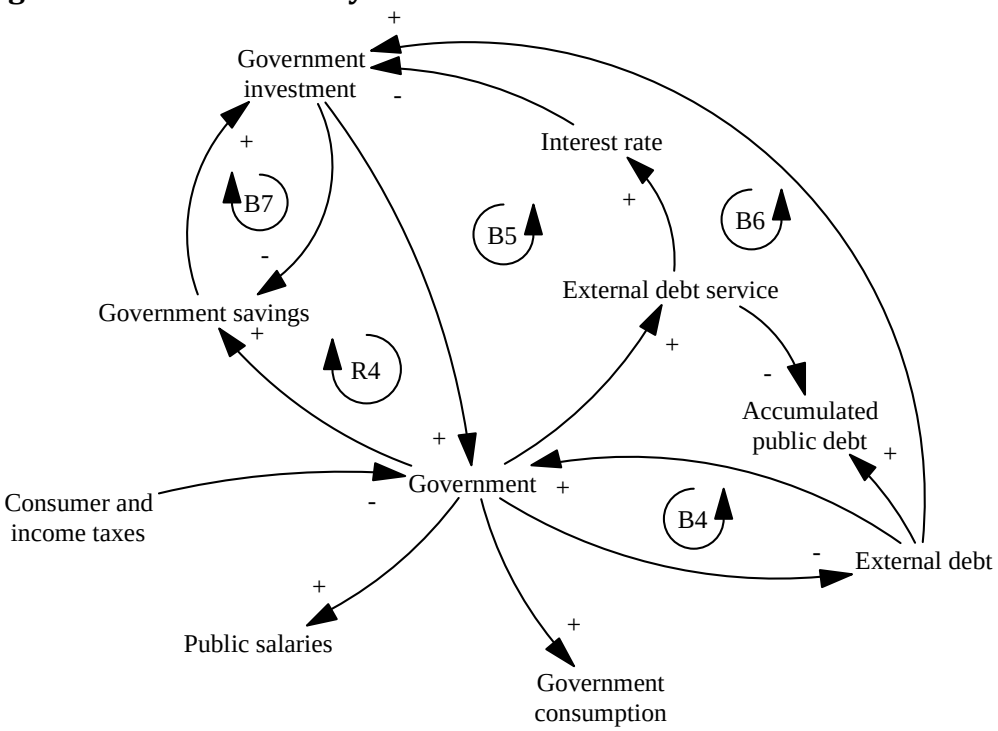


Figure 5. Firms' dynamics

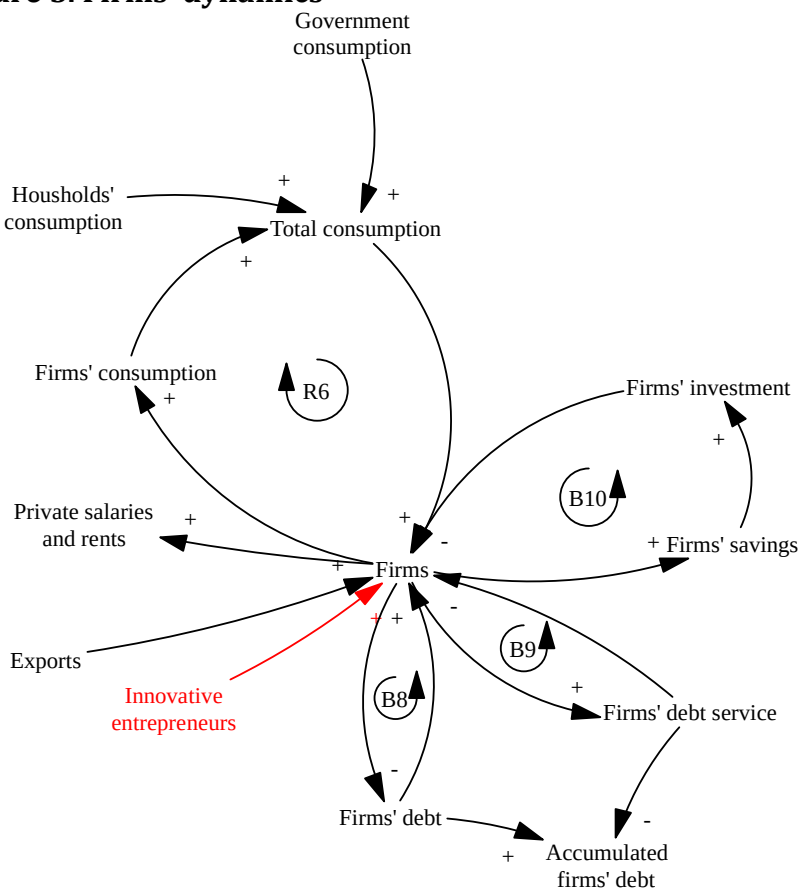
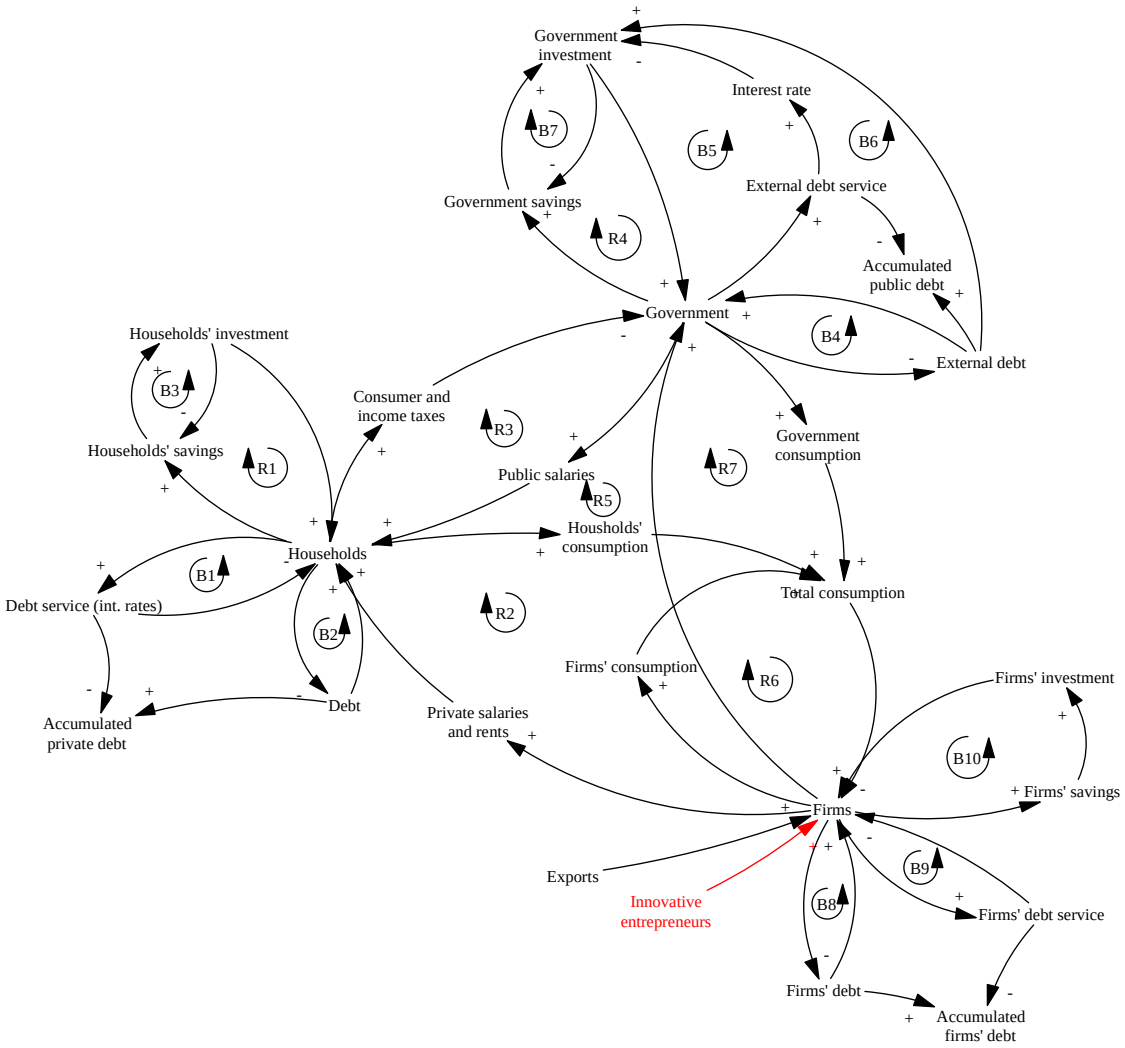
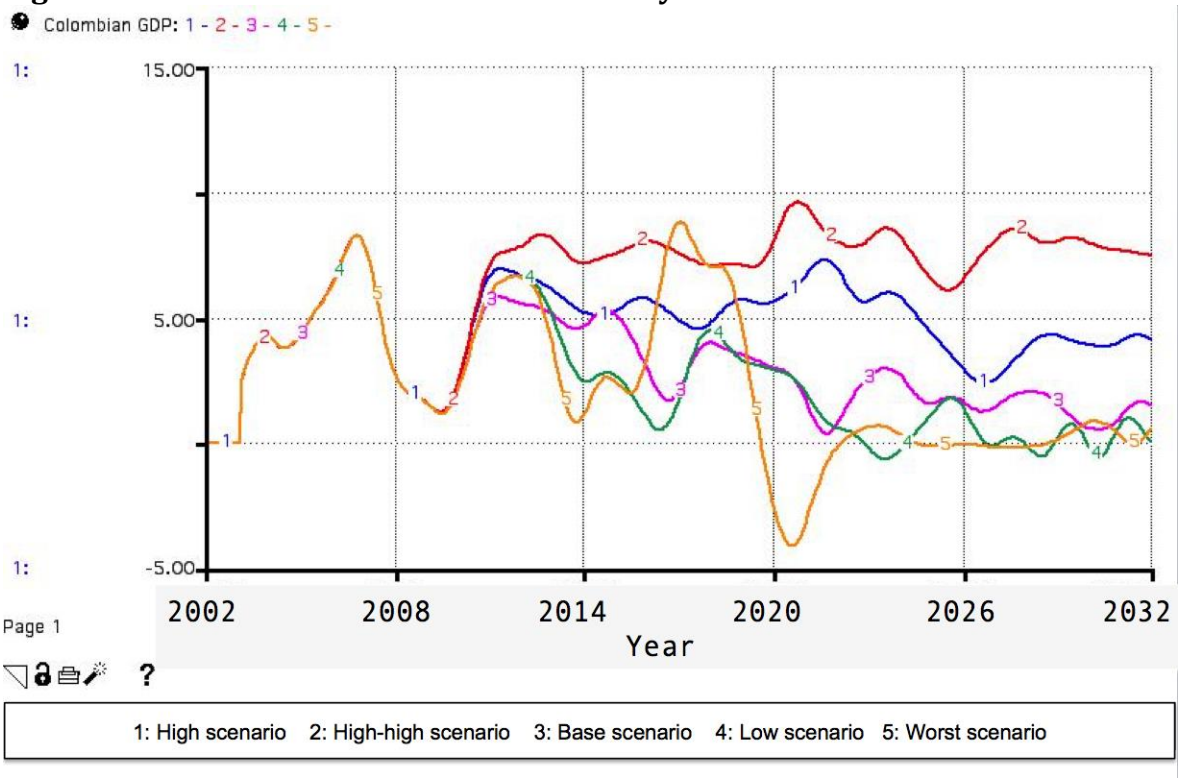


Figure 6. Economic dynamics



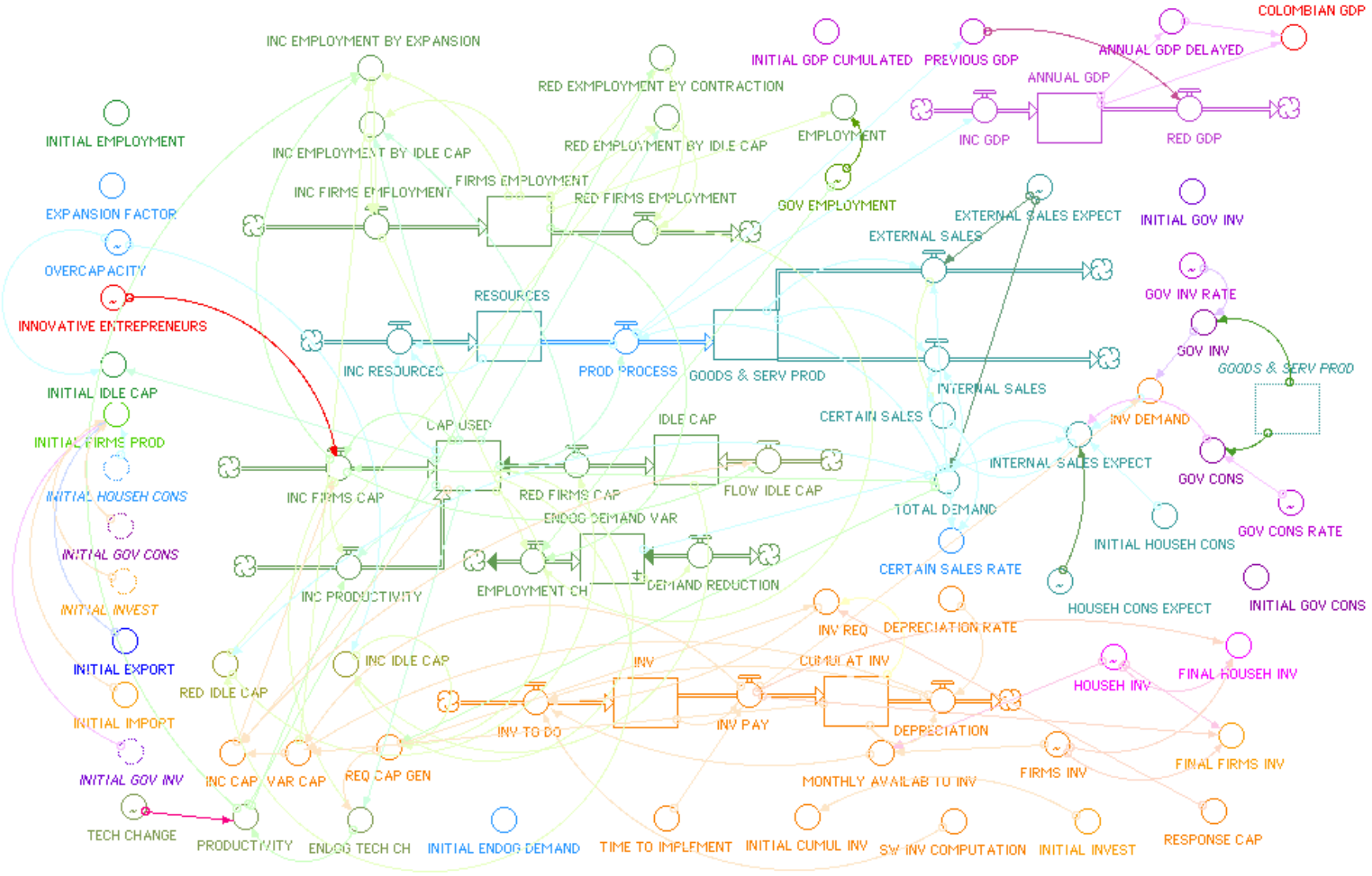
Abbreviations: int. rates, interest rates.

Figure 7. Simulation of Colombian business cycle scenarios



Note: The simulations were obtained throughout the software iThink ® 10.0.4.

Annex A. Stock-and-flow diagram



Annex B. Stocks and flows equations

Agent/Structures	Stock and flows	Equations		
		Stock	Inflows	Outflows
Firms	Productive capacity	Cap Used = Initial Firms Prod*Expansion Factor	Inc Firms Cap = If((Total Demand-Cap Used)>0)Then(If((Total Demand-Cap Used)>Inc Cap)Then(Inc Cap+Innovative Entrepreneurs/1000)Else(Total Demand-Cap Used))Else(0);	Red Firms Cap = Red Idle Cap
		Idle Cap = Initial Idle Cap	Inc Productivity = If(Inc Firms Cap>0)Then(Cap Used*(Productivity))Else(0) Flow Idle Cap = If(Inc Cap-Inc Firms Cap>0)Then(Inc Cap-Inc Firms Cap)Else(0)	Red Firms Cap = Red Idle Cap
	Resources and production	Resources = Cap Used	Inc Resources = If(Resources>(Cap Used+Prod Process))Then(Prod Process)Else(Cap Used)	Prod Process = If(Total Demand>Cap Used)Then(Cap Used)Else(Total Demand) Internal Sales = If(Goods & Serv Prod<Total Demand)Then(Internal Sales Expect*(Goods & Serv Prod/Total Demand))Else(Internal Sales Expect);
		Goods & Serv Prod = Initial Firms Prod	Prod Process = If(Total Demand>Cap Used)Then(Cap Used)Else(Total Demand)	External Sales = If(Goods & Serv Prod<Total Demand)Then(External Sales Expect*(Goods & Serv Prod/Total Demand))Else(External Sales Expect)

Agent/Structures	Stock and flows	Equations		
		Stock	Inflows	Outflows
Households	Investment	Inv = Initial Invest*Time To Implement	Inv To Do = If(Sw Inv Computation=0)Then(Monthly Availab To Inv)Else(Inv Req+Depreciation)	Inv Pay = Inv/Time To Implement
		Cumulat Inv = Initial Cumul Inv	Inv Pay = Inv/Time To Implement	Depreciation = Cumulat Inv*Depreciation Rate
	Demand	Endog Demand Var = Initial Endog Demand	Employment Ch = (Inc Firms Employment-Red Firms Employment)/Firms Employment+(Gov Employment-Delay(Gov Employment,1))/Gob Employment	Demand Reduction = If(Endog Demand Var>0)Then(Endog Demand Var)Else(Endog Demand Var)
	Employment	Firms Employment = Initial Employment	Inc Firms Employment = Inc Employment By Idle Cap+Inc Employment By Expansion	Red Firms Employment = Red Exmployment By Contraction+Red Employment By Idle Cap
Colombian economic growth	GDP computation	Annual Gdp = Initial Gdp Accumulated	Inc GDP = Prod Process	Red GDP = Previous Gdp

Abbreviations: Availab, Availability; Cap, Capacity; Ch, Change; Cumulat, Cumulative; Endog, Endogenous; Expect, Expectations; Gov, Government; Inc, Increasing; Inv, Investment; Pay, Payment; Prod, Production; Red, Reduction; Req, Requirement; Sw, Switch.

Annex C. Main input variables used in the system dynamics model

Input	Data	Source[a]
Depreciation rate	0.003	DANE
Expansion factor	0.950	DANE
External sales expectations	15,000	DANE
Firms' investment	1,604	DANE
Government employment	1,050,000	DANE
Government consumption rate	0.196	DANE
Government investment rate	0.042	DANE
Hourseholds' investment	273.368	DANE
Initial employment	16,015,487	DANE
Initial exports	11.980	DANE
Initial GDP Accumulated	203,000	DANE
Initial Government consumption	3,321	DANE
Initial Government investment	710.450	DANE
Initial households consumption	11,273	DANE
Initial imports	3,509	DANE
Initial investment	1,878	DANE
Initial entrepreneurs	29,343	WDI
Overcapacity	0.200	DANE
Technical change	0.100	DANE
Time to implement	12.000	DANE

[a] DANE: Departamento Administrativo Nacional de Estadística, http://www.dane.gov.co; WDI: World Development Indicators, http://databank.worldbank.org/data/

Note: All these inputs correspond to the year 2002, except Initial entrepreneurs, which is for 2005.