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ARTÍCULO

An Indicator to Measure the Regional Social Risk: The Case of the Cajamarca Department in Peru

Un indicador para medir el riesgo social regional: el caso del departamento de Cajamarca en Perú

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ABSTRACT

This research starts with a literature synthesis on risk and its measurement; then, as a second point, presents the methodological process for the construction of an index to measure social risk for Cajamarca's department in Peru, which has been based on the application of probability theory. The estimation methodology addresses two approaches: i) the probability of occurrence of an event that generates a total or partial paralysis of the private sector activity for a specific month, and ii) the probability of occurrence of at least one day of paralysis for a specific month. The data used has been recorded for the period between January 1992 and December 2022, based on journalistic information. The results are plotted in two-time series which show the evolution of the Cajamarca Social Risk Index in basis points for both methodological approaches. Additionally, I present a comparison of the annualized probability of occurrence of Cajamarca's private sector total or partial paralysis for five-year periods, regional governors, and political parties.

Keywords: Risk estimation, probability of occurrence, social risk index, risk measurement.
JEL Code: C13, G32, G41.

RESUMEN

En la investigación presento una síntesis de la literatura sobre el riesgo y su medición; luego, desarrollo el proceso metodológico para construir un índice para medir el riesgo social para el departamento de Cajamarca en Perú, basado en la aplicación de la teoría de la probabilidad. La metodología de estimación aborda dos enfoques: i) la probabilidad de ocurrencia de un evento que genere una paralización total o parcial de la actividad del sector privado para un mes específico, y ii) la probabilidad de ocurrencia de una parálisis de al menos un día para un mes especifico. Los datos utilizados han sido registrados para el período comprendido entre enero de 1992 y diciembre de 2022, en base a información periodística. Los resultados de la aplicación se grafican en dos series de tiempo que muestran la evolución del Índice de Riesgo Social de Cajamarca en puntos básicos para ambos enfoques metodológicos. Adicionalmente, se comparan la probabilidad anualizada de ocurrencia de parálisis total o parcial en el sector privado de Cajamarca por quinquenios, gobernadores regionales y partidos políticos. Finalmente, se discute la futura aplicación del indicador de riesgo social para futuros trabajos de investigación sobre economía regional.

Palabras clave: Estimación de riesgo, probabilidad de ocurrencia, índice de riesgo social, medición de riesgo.
Código JEL: C13, G32, G41

1. Introduction

One of the relevant aspects that influences the performance of the economic activity in Peru is its exposure to social risk, understood as those events that generate a stoppage of the productive activity of the private sector because of social protests. The most recent manifestation of this is the social conflict that affected the Las Bambas Mining Unit operations, of the Chinese company MMG in Cusco. However, the experiences of social risk in Peru are much earlier and are limited to the first foreign direct investment made in the country as part of its reincorporation into the international financial system. This occurred in the department of Cajamarca in the early 1990s with the first operation of Minera Yanacocha SRL. Therefore, this investigation used different journalistic sources to document the set of social protest events that affected the stoppage of private productive activity, from which a time series is estimated to measure the probability of stoppage.

The document, apart from the introduction, is divided into four sections: Section 2 summarizes the literature review on risk and its measurement; section 3 presents the methodology applied for estimating the Cajamarca social risk and the social risk index. In section 4 I present de estimations results. Section 5 concludes and remarks a discussion for further application of the Cajamarca social risk index.

2. Literature review on risk and its measurement

in traditional terms, the risk is viewed as a negative matter. For example, the Oxford Online Dictionary (2019) provides five definitions of risk: i) a situation that involves exposure to danger, ii) the possibility that something unpleasant or unwelcome will happen, iii) the possibility of harm or damage against which something is insured, iv) a person or thing regarded as likely to turn out well or badly in a particular context or respect; and v) the possibility of financial loss. In all cases, the definitions identify three components of risk: an unpleasant situation that would happen, the uncertainty or possibility of occurrence of that situation; and the magnitude of the amount of exposure to damage. In this section, I present a review of risk in a general context, risk in a financial context and the methodologies for measuring risk.

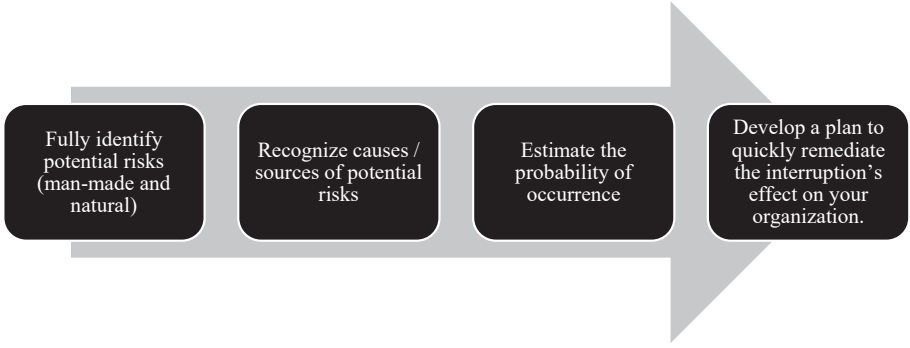
2.1. Risk in a general context

Renn *et al* (1992) provide a technical definition of risk as the product of the probability of events and the magnitude of consequences; he considers the social perception of risk in terms of what human beings perceive as threats to their well-being, and how they evaluate probabilities and magnitudes of unwanted consequences. The focus of this theory is on two cultural people prototypes: the entrepreneurs who tend to regard risks as opportunities for development and the egalitarians who tend to perceive risks as threats to their lifestyle and values. Following this point of view, Damodaran (2015) reconciles the concept of risk as a mix of danger and opportunity, where someone cannot have one, without the other. In contrast, de Villiers Getz (2017) states that the risk appetite is the upper bound on risk when a firm is willing to take in pursuit of its purpose and strategy. Risk appetites are typically articulated as high, medium, or low, which can be defined as:

- High – the firm deliberately accepts the risk to deliver its strategic goals.
- Medium – the firm accepts the risk as necessary, but it is supported with the appropriate controls.
- Low – the firm actively seeks to avoid risk, other than as is incurred through the normal course of business. Controls are adopted to minimise any risk accepted.

Clark & Short (1993) provide a different point of view, they consider that it is not probabilities and risks that make people concerned about exposure to danger, but fairness, competence, and responsibility. They affirm that most people do not worry about slight differences in probabilities when faced with risk management decisions. Rather than technical issues, people worry about how risky decisions are made. Following this line of thought, Eleftheriadis & Vyttas (2017) present risk administration as a central core of each organization's strategic management to achieve sustainable benefits. So too, Boyd (2010) proposes the following steps for preventing or lessening an interruption's effect on any organisation and its customers:

Figure 1
Steps for Managing Risk in an Organisation

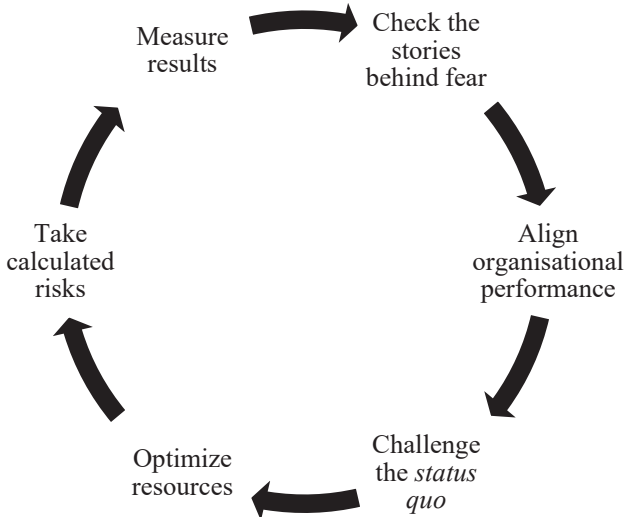


Notes: Four steps process to manage risk: 1) Identification of the full kind of risk an organisation faces, 2) recognition of the diverse kinds of risk's sources, 3) estimation of probabilities of occurrence for each risk, and 4) development of contingency plans according to probability evaluation.
Source: Boyd (2010).
Elaboration: Own.

Taking on account Guttman's (2012) statement, powerful leadership is the best antidote to organizational fears. During times of turmoil, high-performance leaders are "no-fear" models; they used to think of themselves as warriors who challenge themselves and those around them. On the other hand, Atkins (2011) considers that many economists have traditionally relied on statistical principles to understand movements in important variables such as employment, gross domestic product and soon. At the same time, these statements are based on historical movements, where high or minimal risk is determined by the number of standard deviations from the mean such a variable has. At the same time, Shermer (2004), based on the Law of Large Numbers, and Barrowman (2014) coincide that probability theory is a good base for measuring risk. They explain that causation is rarely as simple as we tend to assume due to its complexities; consequently, misunderstanding causal links can result in ineffective actions being chosen to mitigate risk, harmful practices perpetuated, and beneficial alternatives overlooked. Following this line of thought, Osterloh & Jenisch (2016) consider that rare events are understood to be events occurring occasionally but with dramatic consequences. Their occurrence cannot be predicted precisely, only a probability might be estimated, for example from past experiences. These authors, with Atkins (2011), consider that alternative

distributions to normal distribution characterise the intervals at which a certain event may occur.

Figure 2
Leadership Postures for High Performance During Turmoil Times



Notes: Leadership postures to promote high performance in turmoil times: 1) checking stories behind fear to risk, 2) developing goals to align the organisational performance, 3) challenging the organisational *status quo*, 4) resources optimisation, 5) taking calculated risks to move forward, and 6) results from measurement in comparison with plans.
Source: Guttman (2012, pág. 9).
Elaboration: Own.

Barrowman (2014) explains that causation is rarely as simple as we tend to assume due to its complexities; as a consequence, misunderstanding causal links can result in ineffective actions being chosen to mitigate risk, harmful practices perpetuated, and beneficial alternatives overlooked.

2.2. Risk in the financial context

When analysing the consequences of the 2007-2008 financial crisis, Dragan, Bătrâncea, & Bechis (2013) and Svensson (2012) consider the intensification of the interlinkages between banks and firms to expand the scope for financial shocks to spread and become a systemic risk. Systemic risk can be defined as an event which influences the entire banking, financial and economic system, rather than just one or a few institutions

(Bartholomew & Whalen, 1995). Kaufman (as cited in Guttman, 2012, p. 178), believes that systemic risk is the risk of chain reactions that cause a collapse of interconnected institutions.

Guttman (2012) identifies five models of systemic risk assessment: 1) aggregate indicators of imbalances, 2) indicators of financial markets considering risk appetite and liquidity conditions, 3) indicators of risk concentration in the financial system, 4) macroeconomic stress tests; and 5) integrated monitoring systems. When applying the risk assessment model, five causes of systemic risk are identified: 1) mismanagement of credit risk, 2) strong macroeconomic shocks, 3) currency crisis, 4) oligopolistic banking system; and 5) counterparty risk in derivative transactions. At the same time, it is possible to classify the adverse effects of systemic risk as follows: 1) banking disintermediation, 3) inefficient allocation of resources, 3) increasing interest rates, 4) fiscal and monetary distortions; and 5) ineffective macroeconomic policies. In this context, Dragan, Bătrâncea, & Bechis (2013) consider that financial information taken from the financial statements, forecasts, investment programs and international news will be the basis of determining the assessed rating after selection and adjustment.

From another point of view, Damodaran (2015b) considers that people care about risk because 1) when diversifying their portfolio, investors who have chosen to stay invested in domestic companies have been exposed to emerging market risk indirectly because of investments made by these companies; 2) the need to understand, analyse and incorporate country risk has also become a priority at most large corporations, as they have globalized and become more dependent upon growth in foreign markets for their success; 3) governments are not bystanders in this process, since their actions often have a direct effect on country risk, with increased country risk often translating into less foreign investment in the country, leading to lower economic growth and potentially political turmoil, which feeds back into more country risk. Additionally, this author identifies eight sources of country risk: 1) when a country is in the economic growth life cycle is more exposed to risk than mature companies; 2) risk exposure can be affected by the political system in place in a country, with some systems augmenting risk far more than others; 3) corruption and side cost; 4) continuous versus discontinuous risk (stability of the political system); 5) physical violence;

6) nationalisation/expropriation risk; 7) legal risk; 8) economic structure/ highly dependence of commodities.

Văcărel *et al* (2004), Moșteanu, Vuță, Câmpeanu, Gyorgy, & Cataramă (2008); and Damodaran (2015b) explain the public debt includes all amounts borrowed by the government, the administrative units and other public entities, individuals, or legal entities from domestic and abroad and of outstanding at a time. Consequently, risk premiums are a principal component of every risk and return model in finance. Moreover, risk assessment is an essential activity for management. It is directly determining the success or failure of a project; and it is often based on vague, inconsistent, partially subjective data or knowledge items of interdisciplinary nature (Doskočil, 2015).

2.3. Methodologies for estimating risks

Since financial resources are finite, there is a hurdle that projects must cross before being deemed acceptable: This hurdle will be higher for riskier projects than for safer projects and a simple representation of the hurdle rate which is equal to a riskless rate plus a risk premium. Therefore, the two basic questions every risk and return model in finance tries to answer are: 1) how do you measure risk? 2) how do you translate this risk measure into a risk premium? (Damodaran, 2015b). Atkins (2011), proposes a simple methodology for measuring risk by identifying any movement in a variable that is more than a couple of standard deviations from the mean has a low probability of occurrence. However, just because an event has a low probability of occurrence does not mean that it will not occur; it is just unexpected. Renn *et al* (1992) consider behavioural patterns generate secondary social or economic consequences that extend far beyond direct harm to humans or the environment, including significant indirect impacts such as liability, insurance costs, loss of trust in institutions, or alienation from community affairs. For this reason, they propose to use the magnitude of risk (weighted by the probability of occurrence) as a yardstick for risk assessment.

Clarke & Short (1993) consider that probability theory counsels concern about what is most probable (and thereby stakes a claim for what is important to worry about); benefit/cost logic reasoning adequately regis-

ters obvious damages. Nevertheless, these propose the following questions: 1) Are decisions taken fairly? 2) Whose interest's decision-makers are serving? 3) Are costs and benefits equally distributed? 4) Why this decision and not another? 5) Who has assumed authority in that situation?

When analysing the cause-effect of events in everyday life, Barrowman (2014) considers that people routinely make causal claims that would require a counterfactual analysis to confirm. At the same time, the author states that counterfactuals are the heart of what makes causation so perplexing; for that reason, an evaluation of a causal effect is not possible without making assumptions or incorporating information external to the connection in question.

When analysing determinants and measurement methodologies for country risk, Damodaran (2015) identifies the following ways to measure risk: 1) Risk services that attempt to measure country risk, though not always from the same perspective or for the same audience. 2) Sovereign default risk is the most direct measure of country risk when lending to the government of a specific country.3) Sovereign ratings. Since few people have the resources or the time to dedicate to understanding small and unfamiliar countries, third parties have stepped into the breach, with their assessments of sovereign default risk. The assessment uses a scale where an AAA-rated country is viewed as close to riskless whereas a C-rated country is very risky. 4) Market interest rates. As every day more countries have shifted from bank loans to bonds, the market prices commanded by these bonds have yielded an alternate measure of sovereign default risk. 5) Credit default swaps (CDS). The new millennium has seen the evolution of the CDS market, where investors try to put a price on the default risk in an entity and trade at that price.

Bătrâncea *et al* (2016) consider the most common way of measuring financial performance and quality of bank management is the calculation of financial ratios and their comparison with benchmarks. At the same time, these authors explain that different statistical methods that include regression form or production function form are often used for this purpose, as well as the non-parametric operational research method, named Data Envelopment Analysis (DEA). On the other hand, Lacko (2004) and Doskočil (2015) explain the risk analysis process by RIPRAN method,

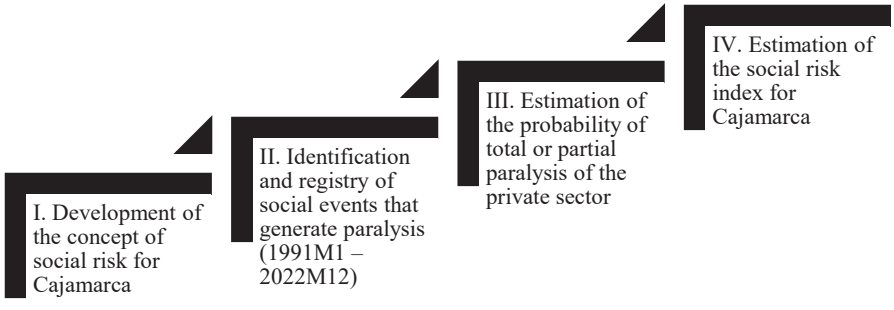
which comprises the following phases: 1) Risk preparing – agreement on the process, identification of materials, team building, identification of relationships. 2) Risk identification – identification of threats and scenarios. 3) Risk quantification – identification of probabilities of threats and impact of scenarios. 4) Risk response – identification of steps to reduce the risk. 5) Risk assessment – total project risk evaluation based on the number of sub-risks and the total value of sub-risks.

Finally, when analysing rare events, Osterloh & Jaenisch (2016) identify three alternatives of probability distributions to the Gaussian bell shape: 1) the Gumbel distribution, which has been used for rating the occurrence of extreme values, such as the maximum water levels in rivers, for example, in certain time intervals; 2) the Fréchet distribution which is commonly used to determine risks in financial statistics; 3) the Weibull distribution is frequently applied for estimating the lifetime of products.

3. Methodology for estimating Cajamarca Social risk index

Figure 3 presents the four stages I used for estimating the Cajamarca Social Risk Index: 1) The development of the concept for social risk in Cajamarca, 2) Identification and registry of social events that generate paralysis in private productive activity for the period January 1991 to December 2022, 3) the estimation of partial and total probabilities of private sector activity paralysis, and 4) the estimation of Cajamarca social risk index.

Figure 3
Methodological procedure for estimating an index for social risk in Cajamarca



Elaboration: Own.

3.1. The development of the concept of social risk in the Cajamarca department

I will stand in the probability theory to develop a concept of social risk for the Cajamarca as many authors consider it the most reliable methodology for measuring risk (Renn *et al*, 1992; Clarke & Short, 1993; Shermer, 2004; Borge, 2008; Boyd, 2010; Damodaran, 2015b; Bătrâncea, Găban, & Bechiş, 2016; Osterloh & Jaenisch, 2016; Eleftheriadis & Vyttas, 2017). I take two approaches to conceptualisation:

- The first approach defines the social risk for Cajamarca as the annualised probability of occurrence that a specific social event would generate partial or total paralysis in the private sector activity in a specific month.
- The second approach defines the social risk for Cajamarca as the annualized probability of occurrence that a social event would generate at least one day of partial or total paralysis of the private sector activity during a specific month.

3.2. Identification and registry of social events which generate private sector paralysis from January 1991 to July 2022

I register a list of events which generate paralysis in the private sector activity from journalistic reports from January 1991 to December 2022 and organised them in a database which records the description of those events, the source information which accounted for it, the number of events by period and the duration of the event in days. I present this information in an electronical annexe. For the first approach, a list of 68 events had been recorded for 372 months. For the second approach, the record accounts for 345 days of paralysation in the private sector activity generated by a social event, from a total of 11 325 days in the study period. Those events include a wide range of typologies: from simple requests for the reduction of the dust in the mine's highways to the cancellation or devolution of a project.

3.3. Estimation of probability of occurrence of partial and total paralysis in the private sector activity

As had been presented above, there are two approaches for estimating the probability of occurrence of total or partial paralysis in the private sector activity. In all cases, I consider events in the previous five years (60 months) to the evaluation period. For the first definition and approach, the probability of occurrence of a social event causing private sector partial or total paralysis, $POPSP_{1.t}$, is estimated as follows:

$$(1) \quad POPSP_{1,t} = \frac{\sum Events\ which\ generates\ private\ sector\ paralysis\ during\ last\ 60\ months}{60\ months}$$

For the second definition and approach, the probability of occurrence of a social event causing private sector partial or total paralysis, $POPSP_{2.t}$, is computed as follows:

$$(2) \quad POPSP_{2,t} = \frac{\sum Days\ of\ paralysis\ in\ the\ private\ sector\ during\ last\ 60\ months}{\sum Calendar\ days\ in\ the\ last\ 60\ months}$$

3.4. Estimation of Cajamarca social risk index

To estimate the social risk for Cajamarca, I compute a monthly index, with the purpose to make its following during different periods. For both approaches, the time series for the indexes has 312 observations: From January 1997, which value is estimated on the records available from January 1992 to December 1996; to December 2022, which estimation is based on the records from January 2018 – December 2022. The indexes are expressed in basis points, for the first definition in equation (3) and the second definition in equation (4):

$$(3) \quad CAJSR_{1,t} = \left[\left\{\left(1 + POPSP_{1,t}\right)^{\frac{1}{5}}\right\} - 1\right] * 10{,}000$$

$$(4) \quad CAJSR_{2,t} = \left[\left\{\left(1 + POPSP_{2,t}\right)^{\frac{1}{5}}\right\} - 1\right] * 10{,}000$$

Where t represents the period evaluated and $POPSP_{i.t}\ \forall\ i = \{1,2\}$ represents the probability of occurrence of a social event which causes partial or total paralysis in private sector activity according to each approach.

4. Results for the measurement of Cajamarca Social risk

4.1. Probability of occurrence of an event which generates total or partial paralysis in the private sector activity in a specific month

Table 1 shows the probability of occurrence of an event that generates total or partial paralysis in the private sector in a specific month, as stated in our first definition for risk, which is as high as 18,3 % of chances. To compare this probability in annual, quinquennial, and decadal terms it reaches 0,54 %, 2,74 % and 5,56 % respectively. As it is shown in Figure 4, the probability changes over time, based on the concept of social amplification of risk that can heighten or attenuate individual and social perceptions of risk and shape risk behaviour (Renn *et al*, 1992).

Table 1

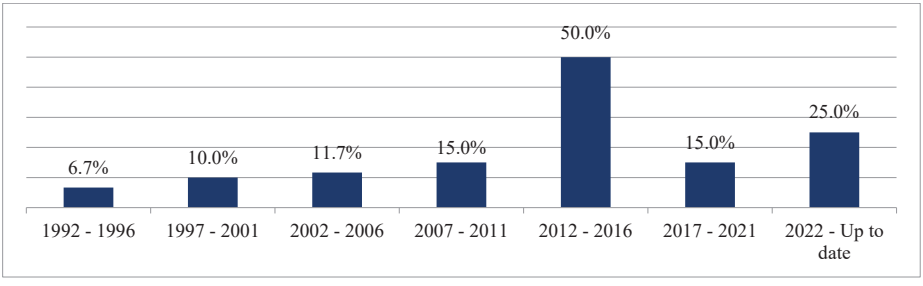
Summary of the probability of occurrence of an event that generates total or partial paralysis in the private sector in a specific month

Variables	Data
Number of months	372
Number of events	68
Probability of occurrence	18,3%
Annualised probability of occurrence	0,54%
Quinquennial probability of occurrence	2,74%
Probability of occurrence by decade	5,56%

Elaboration: Own.

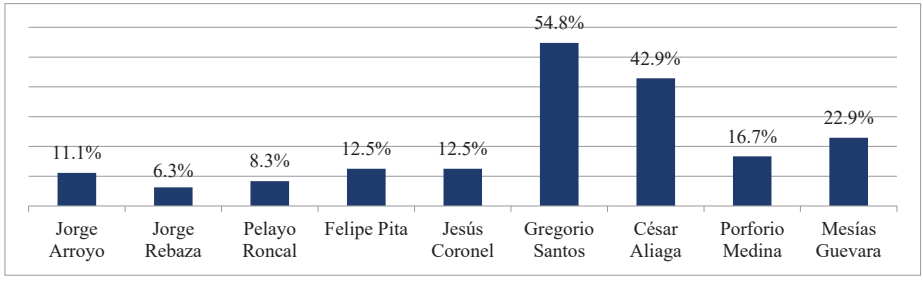
Figure 4

Probability of occurrence of an event that generates total or partial paralysis in the private sector by quinquennials



Elaboration: Own.

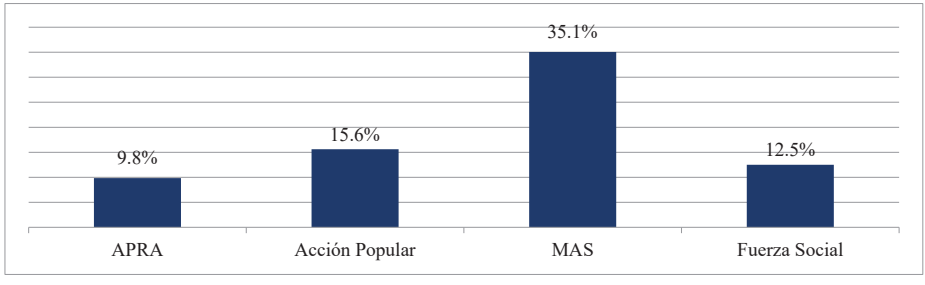
Figure 5
Probability of occurrence of an event that generates total or partial paralysis in the private sector by the regional governor



Elaboration: Own.

Taking on account that two of the country risk sources explained by Damodaran (2015a) are risk exposure which can be affected by the political system in place in a specific country, and the continuous versus discontinuous risk regarded to the stability of the political system; figures 5 and 6 present the probability of occurrence of an event that generates total or partial paralysis in the private sector in a specific month for a specific regional governor and political party.

Figure 6
Probability of occurrence of an event that generates total or partial paralysis in the private sector by political party



Elaboration: Own.

4.2. Probability of occurrence of a day stoppage in the private sector activity for a specific month

Table 2 shows the probability of occurrence of a day stoppage in the private sector activity for a specific month, as stated in our second definition

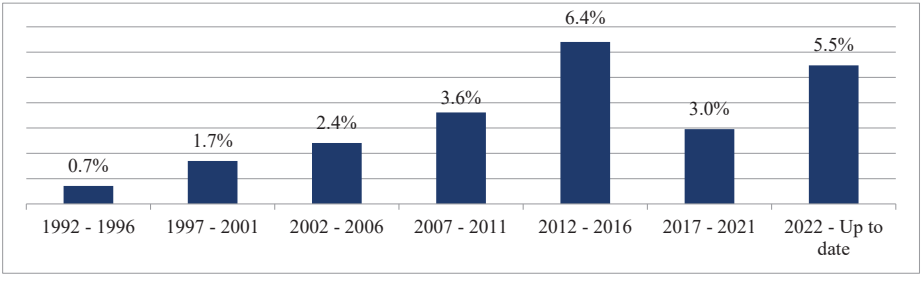
for risk, which is as high as 3,0 % of chances. To compare this probability in annual, quinquennial, and decadal terms it reaches 0,003 %, 0,016 % and 0,032 % respectively. Figure 7 shows the behavioural patterns of risk for different quinquennials.

Table 2
Summary of the probability of occurrence of a paralysis-day in the private sector activity for a specific month

Variables	Data
Number of days	11,325
Number of days of paralysation	345
Probability of occurrence	3,0%
Annualised probability of occurrence	0,003%
Quinquennial probability of occurrence	0,016%
Probability of occurrence by decade	0,032%

Elaboration: Own.

Figure 7
Probability of occurrence of a paralysis-day in the private sector activity by quinquennials

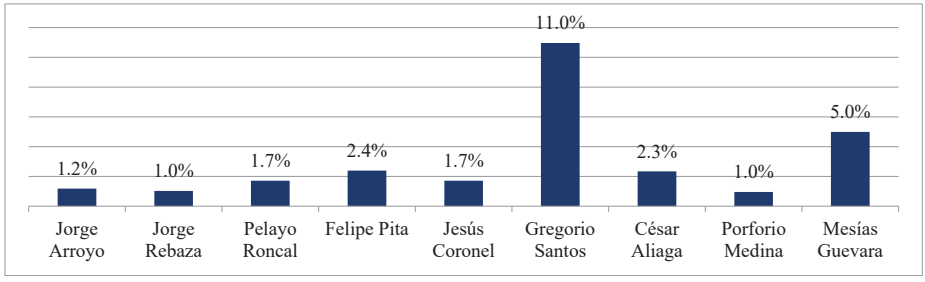


Elaboration: Own.

Figures 8 and 9 present the probability of the occurrence of a day stoppage in the private sector activity in a specific month for a specific regional governor and a specific political party.

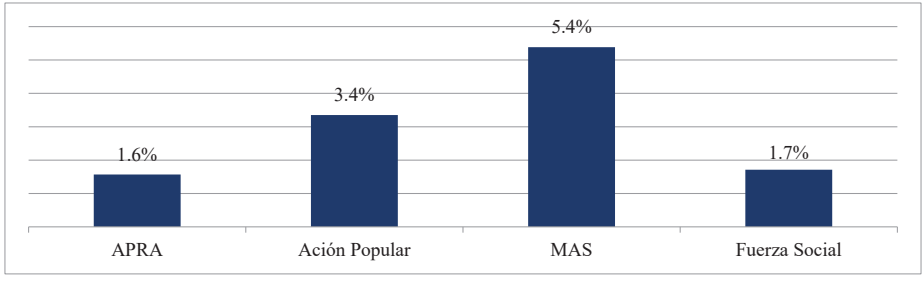
As the reader can observe in this section, our second definition of risk generates the computation of extremely low probabilities in comparison with the first one. Moreover, provides useful information in terms of the duration of private sector paralysis.

Figure 8
Probability of occurrence of a day stoppage in the private sector activity in a specific month by the regional governor



Elaboration: Own.

Figure 9
Probability of occurrence of a day stoppage in the private sector activity in a specific month by political party



Elaboration: Own.

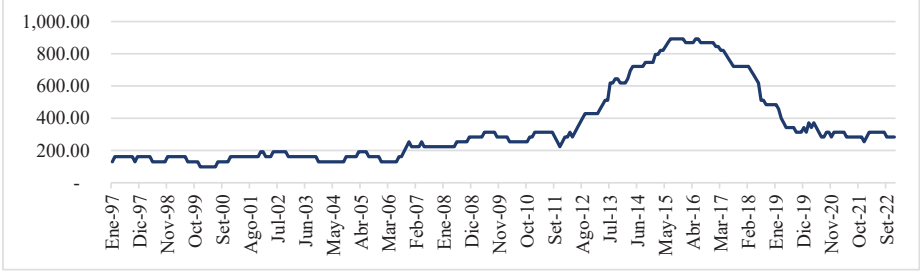
4.3. Cajamarca Social Risk Index

Figure 10 plots the evolution of the Cajamarca social risk index for our first definition with formula (3), in terms of the annualised probability of occurrence of an event that generates total or partial paralysis in the private sector activity measured. On the other hand, figure 11 plots the evolution of the Cajamarca social risk index for the second definition with formula (4), in terms of the annualised probability of occurrence of a day stoppage in the private sector activity in a specific month. For both cases, the indexes are plotted in basis points. When comparing both figures, both indexes show the same behaviour over time, with the difference that the second one measures risk with the lowest values.

The evolution shows an increasing tendency from January 2007 until September 2011, after that, there is a breakpoint and increment in the ascending tendency, which lasted until January 2016. Then the tendency changes to decrease until December 2021. The second index evolution shows an increasing tendency from December 2004, which lasted until September 2009, after that, there is a brief period of stability until October 2010, when a breakpoint occurs and generates a larger increment in the ascending tendency, which lasted until November 2015. From this point, the tendency is to decrease until November 2019. From this point, there is a stage of increasing risk.

Figure 10

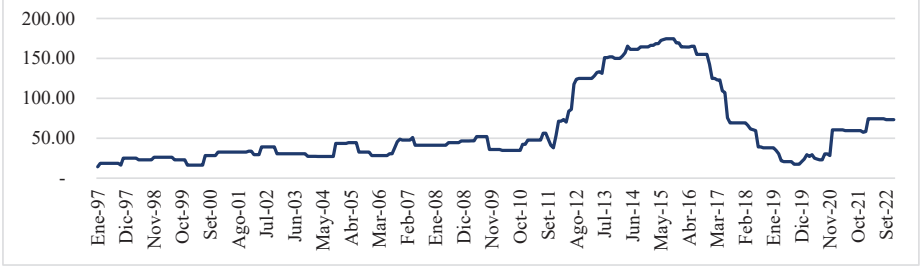
Cajamarca Social Risk Index based on the probability of occurrence of an event that generates total or partial paralysis in the private sector in a specific month



Elaboration: Own.

Figure 11

Cajamarca Social Risk Index based on the probability of occurrence of a paralysis-day in the private sector activity in a specific month



Elaboration: Own.

5. Conclusion

When speaking about risk, it is important to consider the following criteria for a model of risk assessment in the case of social risk in Cajamarca (Damodaran, 2015b):

- The indexes I developed are measures of risk that apply to all assets and not be asset-specific, in our case the private sector activity of Cajamarca, but the methodology can be extended for other regions or countries and the public sector.
- The indexes I developed should delineate what types of risk are rewarded and what are not, and provide a rationale for the delineation, which is the case of events that generates paralysis in the private sector activity.
- The indexes produce standardized risk measures, which are basis points: An investor presented with a risk measure for social events can interpret that the higher the index goes, the higher social risk is, and vice versa.
- The indexes I developed, as measured in basis points, can be translated into a rate of return that the investor should demand as compensation for bearing that kind of risk.
- The indexes, as presented as time series, should work well not only at explaining past returns but also in predicting future expected returns.

Considering the valuation of risk, Damodaran (2015b) suggest that it is important to consider the maximum impact. In the Cajamarca case, it is more convenient to consider the index generated by the first approach of social risk, in terms of the probability of occurrence of an event that generates total or partial paralysis in the private sector activity in a specific month. At the same time, I identify the following aspects for further research:

The application of Box & Jenkins methodology for time series identification of both Cajamarca social risk indexes to assess whether the second index is a leading indicator of the first one (Box, Jenkins, & Reinsel, 2013)

Assess if the Cajamarca Social Risk Index have an impact on the Peruvian country risk indicator, or whether it is a leading indicator for other departments' social risk. This application implies a correlation analysis with EMBIG Peru, and the extension of the methodology to elaborate the social risk index at the departmental level in Peru.

Assess the incidence of the Cajamarca Social Risk Index in the flows of departmental aggregate demand: Private investment and consumption, public investment and expenditure, and exports, considering the growth at risk methodology as presented by Gondo (2019).

In terms of social risk vulnerability, the following questions required answers: 1) Does the Cajamarca Social Risk Index affect labour productivity in the department? 2) Does the Cajamarca Social Risk Index affect tax collection in the department? 3) Does the Cajamarca Social Risk Index affect agricultural productivity? For all the previous cases, it is important to identify the transmission mechanisms of such incidence or affectation to be modelled.

When considering the Cajamarca Social Risk Index as a spread which can be included in the discount rate for future investment projects, there is a need to estimate hurdles rates for several sectors of economic activity.

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