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# EXCERPT

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## Pandemic risk: operational aspects

**Camilla Bello, Stefano Desando, Veruska Orio, Paolo Giudici, Barbara Tarantino**

# Pandemic risk: operational aspects

**Bello Camilla, Desando Stefano and Orio Veruska (Intesa Sanpaolo); Giudici Paolo and Tarantino Barbara (University of Pavia).**

## Abstract

At the beginning of the COVID-19 pandemic, Intesa Sanpaolo has developed a contagion model aimed at calibrating the measures to be taken to safeguard its employees and the provision of banking services, according to the risk deriving from the external environment.
The model is based on both external and internal views: the combination of such elements provides a holistic picture of the overall contagion risk level, enabling the opportunity to take informed decisions for each geographical area.
One of the most useful external indicators to feed the model is the reproduction index (Rt) provided by the University of Pavia which is calculated using the Poisson autoregressive (PAR) model.
Though more research and development are needed, the proposed model represents a useful tool for supporting the Top Managers in the decision process to continue business as usual safely.

## Introduction

Since the end of February 2020, Intesa Sanpaolo (hereinafter also "ISP") has activated its Emergency Unit to define guidelines aimed at facing the evolution of the COVID-19 pandemic and simultaneously adapting to the requirements of the Prime Minister's Decree of 23rd February 2020.
Jointly with the Cybersecurity and Business Continuity Management and within the Emergency Unit, the Chief Risk Officer provides support to the Top Managers there convened for understanding the phenomenon and its evolution and to foster the assumption of informed decisions (e.g., organizational choices, closure or limitations of branch operations, upgrading of IT systems for smart working and addressing of the related security issues). Indeed, the new way of working exposes to potentially increased risks (i.e., data breaches, internal and external frauds due to remote operating processes and controls, contingency plans of key suppliers and resilience of the supply chain) that must be identified and addressed; above all, it remains essential to continue business as usual safely and to anticipate measures to be taken locally, according to the evolution of the infection, balancing the needs of doing business with security and respect of the Government's measures.
Therefore, Intesa Sanpaolo decided to develop a contagion model aimed at calibrating the measures to be taken to safeguard its employees and the provision of banking services, according to the risk deriving from the external environment.
Based on such experience and on the research by the University of Pavia, we propose a contagion model, described hereinafter.
However, the statements in this article are to be intended as exclusive opinions of the authors and do not represent those of Intesa Sanpaolo Group.

## Proposed contagion model

According to our experience, the contagion risk of a Bank depends on the environment (where the Bank is based, where people work, how concentrated are the employees in a certain location, etc., as this affects Bank's employees and Bank's opportunity to carry out business as usual).
Consequently, a contagion model should be developed considering both external and internal perspective and pursuing the following key objectives:

- understand the epidemic dynamic of the COVID-19 virus (so-called external view);
- identify geographical areas where the contagion trend could get out of control and have a significant impact for a Bank (so-called internal view);
- suggest a set of countermeasures to be analyzed to reduce the risk exposure and to protect employees and assets/services provided (e.g., close one or more branches, reduce opening hours).

Such model should envisage several steps (see *Figure 1*), from the collection of relevant data for populating the risk indicators to the provision of feedbacks useful to support the Top Management in the decision-making process.

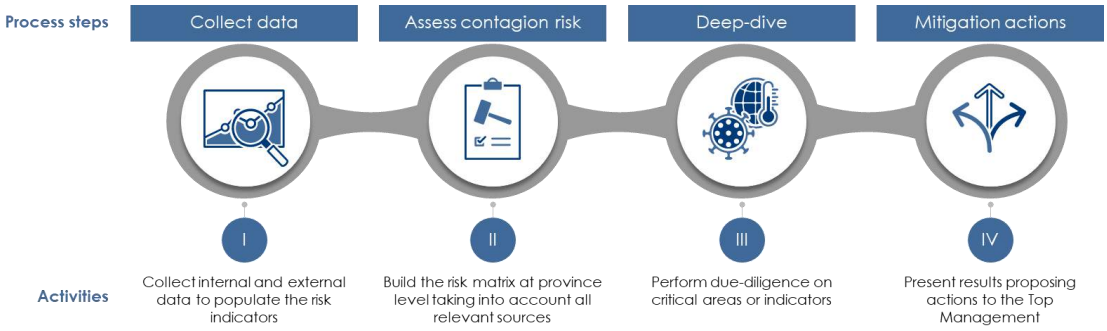


**Figure 1: Steps of the contagion model**

Based on our experience, the combination of a limited number of internal and external indicators (see *Table 1*) can define the risk level of a certain geographical area (Italian region or province).

Consequently, the data collected in the first step should include indicators possibly referred to the specific region or province under assessment:

- the most useful external indicators are the reproduction index (Rt) and those issued by the Italian Ministry of Health, that provide information concerning probability of transmission and severity of the disease;
- the internal indicators should focus on the features of the Banks (e.g., concentration in specific areas or buildings) and the spread of the disease within Bank's employees and premises.

| Indicators (at region or province level) | External | | Internal |
|---|---|---|---|
| | *Provides input on* Probability of transmission | *Provides input on* Severity of the disease | |
| Government measures applied (e.g. lockdown) | ✓ | | |
| Hospital occupancy ratio | | ✓ | |
| Reproduction rate (Rt) | ✓ | | |
| Percentage of infected employees | | | ✓ |
| Percentage of closed branches due to COVID infection | | | ✓ |

**Table 1: Example of indicators used as input to the contagion risk model**

Based on external data, the risk level of a certain region can be obtained by combining the probability of transmission and the severity of the disease, through a risk map (see *Figure 2*); all regions could be clustered within such risk map.

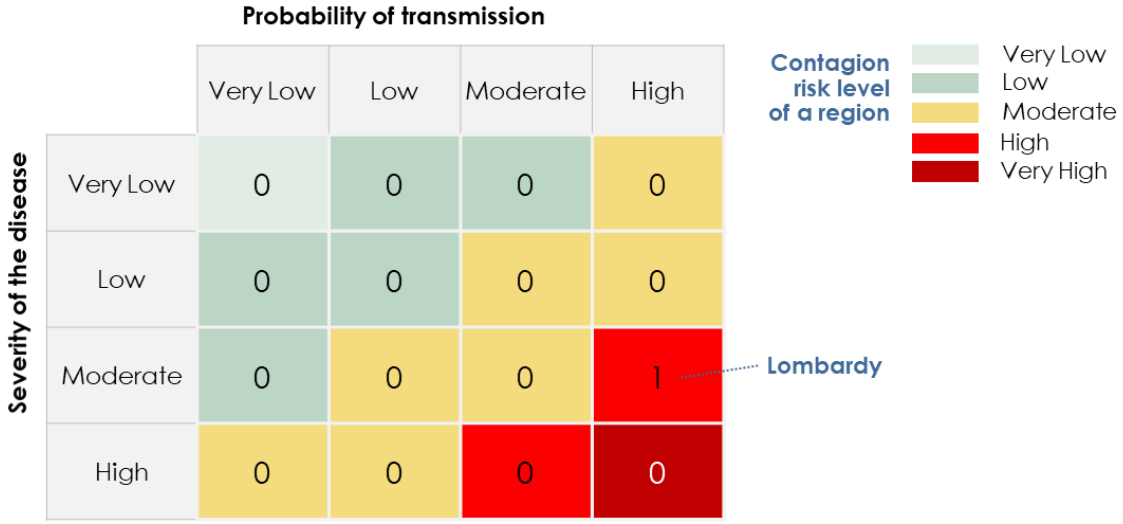


**Figure 2: External view: contagion risk level of a region (e.g., Lombardy)**

The contagion risk level of the environment affects the Bank's contagion risk level (e.g., employees living or working in a region with high contagion risk could likely contract the virus): therefore, the external view is one dimension of the Bank's risk matrix represented in *Figure 4*.
The internal view (the other dimension of the Bank's risk matrix in *Figure 4*) should focus on the assessment of % and trend of sick employees or of closed branches (i.e., due to COVID infection in a certain area). A useful tool to assess the internal contagion risk level of the Bank in a certain area (region or province) is a decision tree (see *Figure 3*).

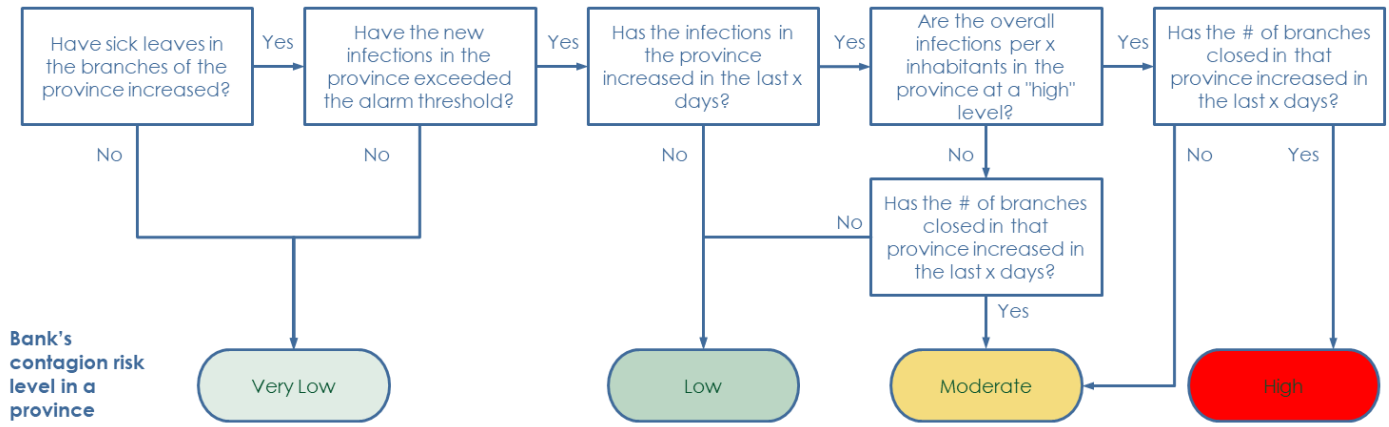


**Figure 3: Internal view: decision tree to estimate the internal contagion risk level in a province**

The combination of internal and external views in each region/province provides a holistic picture of the overall contagion risk level, enabling the opportunity to classify each province in a specific cluster.
In our example, Lombardy has a High contagion risk level; assuming that, from an internal perspective, Bergamo province has a Low contagion risk level, the overall risk level of that province is Moderate.

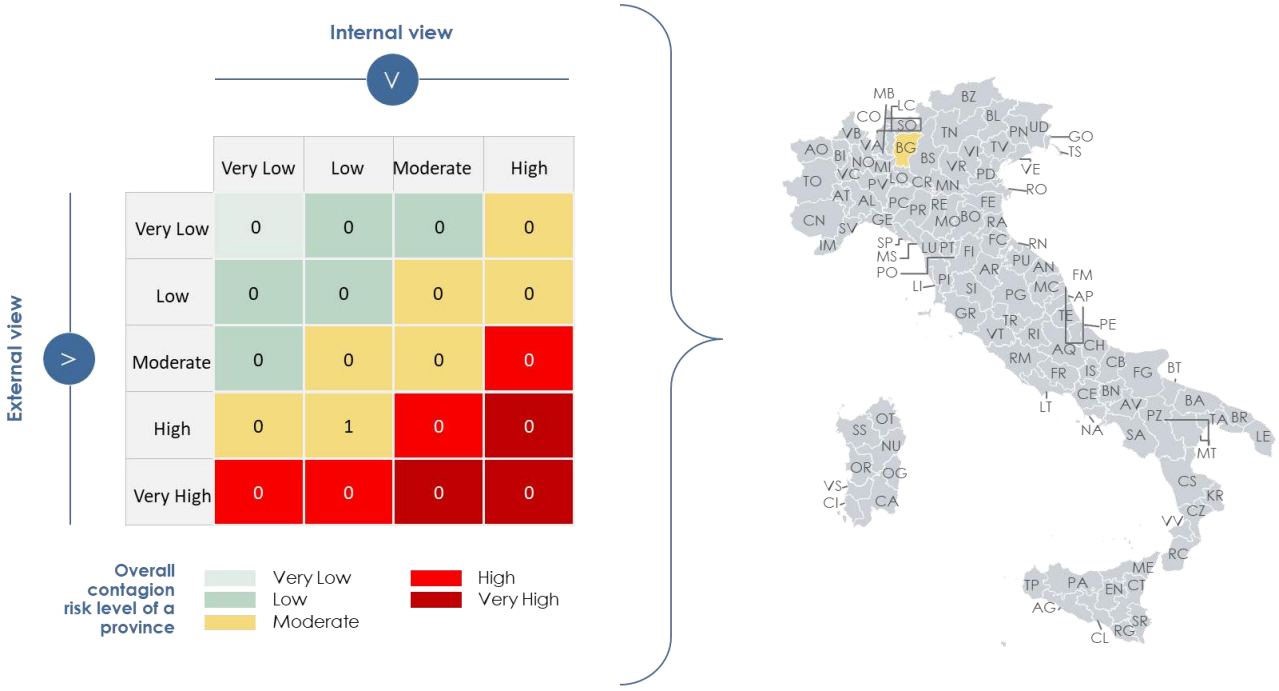


**Figure 4: Overall contagion risk level of one province (e.g., Bergamo)**

The set of possible mitigation actions to be considered by the Top Management could be associated with the overall contagion risk level of a certain province (see *Figure 5* for an example).

## Estimation of the reproduction rate Rt

The reproduction rate of a region could be calculated using the Poisson autoregressive (PAR) model, introduced by Agosto and Giudici (2020), to which we refer for further details.
The PAR model is an extension of the classical Susceptible-Infected-Recovered (SIR) model, in which the logarithm of the daily positives is not assumed to follow a simple one-size-fit-all linear trend but, instead, is assumed to depend on past observed values, thereby allowing to incorporate the effects of contagion shocks into the model.
The PAR model can be easily implemented at the national, regional and/or provincial level. It just requires a time series of daily counts and a software code written in the open source R language, downloadable at the website indicated in the bibliography.

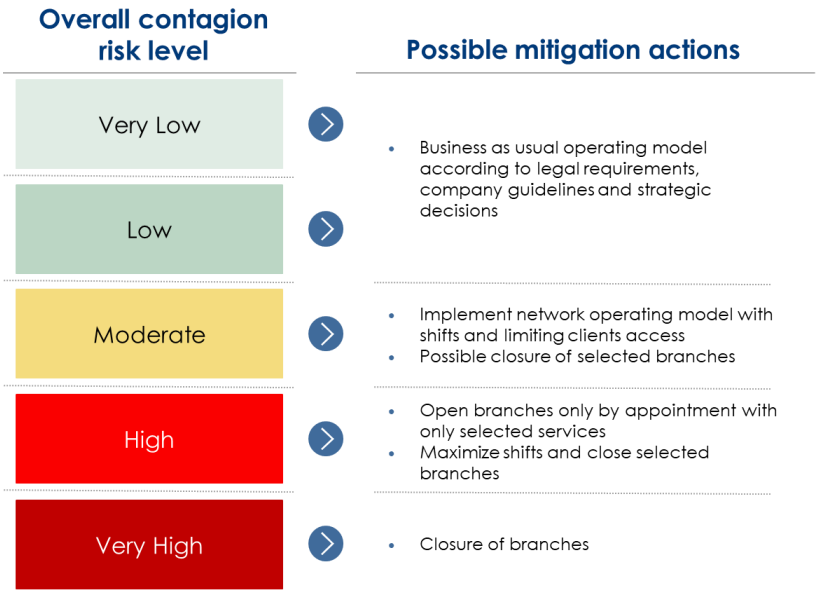


**Figure 5: Set of possible mitigation actions according to the risk level**

## Conclusions

We believe that a contagion model could represent an effective tool to assess the potential impacts of pandemic risks on Bank's operations and business processes.
Our proposal can be considered as a reliable option where the available data are significant (e.g., larger banks with several branches or several employees in one province).
More research and development are needed, both in the application of the contagion model to financial institutions, and in the improvement of the statistical model, particularly taking into account the effect of decisions such as lockdowns, testing and schools' closures, which should be embedded into explanatory variables.
Indeed, the COVID-19 pandemic has strong implications on risk management; while here we have focused on operational risks, other risks are also heavily affected. For example, Agosto and Giudici (2020b) shows the impact on market risks.

## Acknowledgments

We would like to thank the colleagues of the Cybersecurity and Business Continuity Management who have contributed to the development of the ISP contagion model.
We would also like to extend our appreciation to Boston Consulting Group, involved in the activities underlying the creation and the implementation of ISP's model.

Bello Camilla, Desando Stefano, Orio Veruska, Giudici Paolo and Tarantino Barbara

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