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COVID 19… 84? The stringency of responses to COVID-19 across the world

MA thesis

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Abstract

In December 2019, the world heard about the COVID-19 virus for the first time. It has been almost two years since the date, yet political science and public policy disciplines cannot predict or explain the stringency level of introduced anti-coronavirus measurements. This MA thesis strives to fill in the lacuna from both theoretical and empirical viewpoints. For the former aspect, the paper deconstructs the process of COVID-19 policymaking on the basis of "policy diffusion" theory by Berry and Berry (2006) and other complementary theories (i.e., "external shock", "state capacity", "diffusion of innovations" theories). Such a complex framework allowed the paper to unpack every element of "policy diffusion" theory and, thus, produce a more detailed description of principles within the decision-making procedure. The theory computed thirteen hypotheses, extrapolated on 185 countries in the sample, which were tested in a large-N quantitative empirical analysis via the visualisations, correlations, the OLS regressions, and Bayesian Network methods. The analysis results are the following: the salience of the coronavirus crisis (number of cases/deaths; Cases Per Capita; Case Fatality Rate) is the primary explanatory variable for the high level of stringency embedded in the policy response. At the same time, as specified in the literature, the autocracies do apply more stringent policies; the malfunctioning accountability mechanism might explain this. What is more vital in terms of policy recommendations is that sufficient healthcare capacities (i.e., the number of hospital beds and healthcare expenditures) might mitigate the side-effects of the coronavirus, thus states introduce more lenient anti-COVID-19 policies. Additionally, the population density, institutional trust, and state's economic support have a positive association with the stringency. Apart from testing the connections between the variables, the paper has also left some clues for the following research, for instance, there is a regional pattern in terms of COVID-19 responses: some regional units might be more stringent than others.

Keywords: Coronavirus – COVID-19 Government Response Tracker – policy analysis

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Introduction

Academic relevancy. The end of 2019 was marked by the announcement of a relatively new disease appearing in Wuhan, the capital city of Hubei province — coronavirus (COVID-19 is an interchangeable term for it) (Tisdell, 2020, p. 20). The first three months of 2020 were a milestone for the whole world since it was a time to prepare the response to the impendent crisis, which evolved from international concern in January to the disease of pandemic scale in March (*Archived: WHO Timeline - COVID-19*, 2020).

Almost two years have passed, and retrospectively one can evaluate the 'preparedness' of the international community to the exogenous shock. The primary response was non-pharmaceutical interventions, NPIs: a general term for all government measures, which are aimed at reducing the interpersonal interactions, e.g., school closure, border closure, etc. (Cho, 2020). Some countries decided to repel the COVID-19 with more liberal non-pharmaceutical interventions without introductions of lockdowns and compulsory stay-at-home decrees (e.g., Belarus, Sweden at initial stages). At the same time, other states prioritised, or how they thought, the lives of the citizens by reaching the highest level of stringency in terms of implemented measures (e.g., Bolivia, Russia). This discrepancy provokes a consequent question: *what rationales are there for selecting 'liberal' or 'strict' policy response to the COVID-19 pandemic?*

The first sub-aspect of this topic's academic relevance stems from the fact that all the attention is focused on evaluating measures' effectiveness. In other words, my preliminary literature review included about 100 academic sources, and the vast majority was devoted to the effectiveness of the response in question (Dergiades et al., 2020; Mei, 2020; Mintrom & O'Connor, 2020; Pandey & Saxena, 2020). It seems counterintuitive because we are skipping the initial step of discovering the origins of these policy responses — why states in the first-place selected national lockdown instead of compulsory personal protective equipment use for the citizens. Moreover, once this question is answered, we could move to the effectiveness assessment analysis. Hence, within this paper, I offer not only a recap of related literature but also a full-scale cross-national analysis of the stringency response.

While the majority of articles focus on effectiveness, there is a minority, which strives to explain the 'inside' of states' reaction. However, once we turn to the academic sources dedicated to the stringency of policy response aspect, we could observe different explanations; the most common one is: "*the need for non-pharmaceutical interventions aimed at curtailing the spread of infectious diseases [COVID-19] depends crucially on country-specific demographic and public health situations.*" (Sebhatu et al., 2020, p. 1). Authors narrow down the rationales to solely

demographic indicators and healthcare institutional capacity, thus leaving aside, for instance, regime variable and government-related indicators, which were not included in the analysis. Undoubtfully, these types of analyses are vital for academia since they do add up the whole COVID-19 puzzle, which consists of a plethora of variables. Despite the fact, this particular quotation from the V-Dem Institute working paper illustrates the status-quo of the state-of-the-art of the COVID-19 related research. Being published in August 2020, the WHO paper still shows the one-sidedness of the approach towards the stringency of COVID-19 policy responses: 'either…or' perspective is prevalent.

On the contrary to the one-sidedness of the analysis, there is a pattern, which I would title as 'unsystematic'. For example, Phadnis and Kudligi (2020) and Stojkoski et al. (2020), both papers speculate on the policy response issue. However, the former authors propose nine factors from the following categories: health, economy, population, culture, institutions, while the latter introduces 35 variables from six categories: "Healthcare Infrastructure, National health statistics, Economic performance, Societal characteristics, Demographic structure, Natural environment" (Stojkoski et al., 2020, p. 7). The issue with these technical-empirical works is their endeavour to be all-encompassing, which results in their lack of engagement with a theoretical basis. Again, I am not trying to boycott multi-variable designs; on the contrary, many-sided papers expose missing links in the existing explanations and revaluate the previous findings. I do realise that COVID-19 is a multifaceted exogenous shock without a singular cause and a specific localisation, yet it should not be studied in the same chaotic manner.

Summarising, the second aspect of relevancy is the absence of balance between the theoretical and empirical approach in the question of COVID-19 stringency analysis. Thus, this project will make an effort to fill in the lacuna in both theoretical and empirical knowledge since it will offer a synthesised lens, which can be used to analyse the policy responses to external crises from a perspective of policy research.

Finally, the last aspect of relevancy is the presence of geographical bias towards the Western and Eastern states. By Western states, I imply the US, states and counties (Moore et al., 2020; Painter & Qiu, 2020; Rocco et al., 2020); Europe, manifested in the OECD sample (Sebhatu et al., 2020); and the EU member-states (Bol et al., 2020; Lewandowski, 2020; Sabat et al., 2020). For Eastern states, I attribute mostly Asian countries: China (He et al., 2020; Hu & Sidel, 2020; Yan et al., 2020) (Yan et al. article perfectly illustrate the abovementioned bias, the sample consist of Sweden, China, France, and Japan); Hong Kong (Hartley & Jarvis, 2020), and the region in general (An & Tang, 2020). It seems that we lack information on the post-soviet region, for example. However, the bias is aggravated by the research designs of the papers in question; they

all apply small-N and few-N analyses, thus restricting the results solely to the particular geographical unit of analysis. While the usage of quantitative large-N designs would help from the deductive viewpoint, when the general patterns will be uncovered, academia could move the case studies and comparative research to find even more refined regularities.

As a result, this project on the stringency of COVID-19 policy response has three-fold academic relevancy: on the level of the research object, the thesis pull the attention and discussion to the source of COVID-19 responses — the stringency level, despite the effectiveness being a mainstream topic to study; on a theoretical level, it reemphasises the significance of the systematisation by implementing suitable public policy theory in the core; on the empirical level, the paper expands the case selection to 185 countries with a respective regional division by applying large-N statistical analysis, partly with a machine learning undertone.

This design aims to answer the following research question: *which factors have a higher explanatory potential in predicting the strictness level of non-pharmaceutical interventions across 185 countries?* The research timeline includes the beginning of the pandemic, 1st of January 2020, and, since the variables for the empirical analysis are updated daily, the cutting point is the 15th of February 2021.

In order to answer the question following **research objectives** should be achieved:

1. The general object-related literature review should be provided so that the reader would have an understanding of the concept of 'policy stringency'; additionally, the overview of 'stringency' in the context of COVID-19 is another compulsory component for the cohesive research;
2. Since I would like to establish the framework on more than one theory, the entire section should be dedicated to the explanation of the benefits, which are produced by the complex theoretical framework, consisting of four theories;
3. The next step is to study the issue of responses to the coronavirus via the lens of a theoretical framework to conceptualise core notions of the paper;
4. After theoretical contemplation, the research design, which would transfer the narration from a theoretical level to an empirical, will be explained, as well as methods of the analysis;
5. Once the design is described, the following operationalisation of the concepts is beyond question: their sources, how they are measured, their codification, if necessary;

6. After all the preparations are done, the final step is to test the stringency-related hypotheses by conducting an empirical analysis with the help of visualisation, correlations, OLS regressions, and Bayesian networks;
7. Concluding remarks will summarise the accomplished work, list the factors affecting the level of stringency, and pinpoint limitations and prospects for further research.

A couple of words should be said about the **theoretical part** of the paper. The thesis relies on the complex theoretical framework, consisting of 4 sub-theories. This decision allows me to alleviate the drawbacks of theories, and moreover, these theories move the narrative. The core theory is the "policy diffusion" by Berry and Berry (2006), which is used for the initial categorisation of factors influencing the process of policymaking. The theory will be described in more details in a separate section, but it can be easily summarised in one equation:

$ADOPT_{i,t} = f(MOTIVATION_{i,t}, RESOURCES/OBSTACLES_{i,t}, OTHERPOLICIES_{i,t}, EXTERNAL_{i,t})$ (Berry & Berry, 2006, p. 237)

The equation illustrates the process of new policy adoption, which involves government *motivation*, available *resources*, *obstacles* faced by the decision-makers, *complementary policies* related to the central policy, and *external factors* that impact the process from outside the political system.

Additional theories of "external shock" (Birkland, 1998, 2004; Dekalchuk, 2014; Kingdon, 2014), "state capacity" (Andersen, Møller, Rørbæk, et al., 2014; Evans et al., 1985), and "diffusion of innovations" (Rogers, 1983; Rogers et al., 2019) will be applied to each of the categories from this adoption equation. This decision was primarily made due to the fact that the "diffusion of innovations" theory does not carry a decent explanatory mechanism for the causal relations. It is used for the systematisation of data, while other theories will explain the causality between the stringency level and determinants.

Apart from theory, this paper offers a new angle on the **empirical analysis** of COVID-19 measures' stringency. As it was stated, this paper strives to mitigate the geographical bias by including all states for which data is available, with the regional subdivision in the analysis. To be more precise, there will be two types of regional division; one is by Teorell and Hadenius[1] (2007),

[1] It consists of 10 regional units: Eastern Europe and post-Soviet Union, Latin America, North Africa & the Middle East, Sub-Saharan Africa, Western Europe and North America, East Asia, South-East Asia, South Asia, The Pacific, The Caribbean.

another is taken from the United Nations methodology[2] (*UNSD — Methodology*, n.d.). This feature will produce generalised, extrapolatable results and shed light on the regional state of things in terms of stringency of response. In general, the stringency patterns among the states will be analysed by essential tools of visual statistics, correlations, regressions, as well as a more complicated test of Bayesian Networks. The latter tool is another 'innovation' of the paper since neither political science nor public policy papers use this technique on a regular basis; however, it is straightforward in terms of interpretation. This method, which belongs to Machine Learning and Probability Graphical Modelling families, combines mechanisms from binomial logistic regression analysis (the odds ratio parameter) and Qualitative Comparative Analysis (the combination of factors and binarity of codification) (Chai et al., 2020).

Regarding the data sources, this paper uses the most common datasets. The Stringency index is used for the dependent variable, but with some transformations (*Coronavirus Government Response Tracker | Blavatnik School of Government*, n.d.-a). In contrast, for independent variables (i.e., socio-economic, political-institutional, and demographic indicators), I refer to the V-dem (ver. 10) dataset (Data Version 10 | V-Dem, n.d.), World Bank Indicators (*World Bank Group - International Development, Poverty, & Sustainability*, n.d.), and Worldwide Governance Indicators (*WGI 2020 Interactive > Home*, n.d.). These are the primary sources of aggregated data, which will be used in the analysis. A more detailed description of operationalisation is provided in the self-titled section.

Since I was not entirely confident in the plausibility of such an analysis, I have conducted a pre-research: similar theoretical-empirical design and research question were used in the pioneer paper, which scrutinised stringency amidst the post-soviet states. The paper's results were presented at the international IDC-2020 conference in November, with substantial and valuable feedback from the commission. The results, applicable only to the 14 post-soviet states[3], showed that *democracies enforce stringent policy response* to the COVID-19. Secondly, since the COVID-19 pandemic creates an additional burden on the healthcare systems, *states with sufficient healthcare capacities (number of hospital beds and healthcare expenditures) tend to produce less stringent policies*, because the state has resources to manage the consequences of the coronavirus. The third conclusion is that *wealthy states will have a higher degree of stringency because strict*

[2] Second version has 17 categories: Northern Africa; Northern America; Eastern Asia; Southern Asia; South-eastern Asia; Southern Europe; Australia and New Zealand; Melanesia; Micronesia; Polynesia; Central Asia; Western Asia; Eastern Europe; Northern Europe; Western Europe; Sub-Saharan Africa; Latin America and the Caribbean.

[3] These 14 countries are (regional division in parenthesis): Estonia, Latvia, Lithuania (Baltic states); Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan (Central Asia); Belarus, Moldova, Ukraine (Eastern Europe); Azerbaijan, Georgia (Transcaucasia); and Russia (Eurasia). Armenia was excluded since the Coronavirus Government Response Tracker lacks data on this case.

response does not jeopardise the economy. Another conclusion, which finds support in the literature, since high-income states are affected the most by the COVID-19, it would make sense for them to implement all possible mechanisms to ensure social distancing and hence 'flatten the curve' (Teixeira da Silva & Tsigaris, 2020). Finally, *countries with high trade and financial globalisation rates might have less stringent responses as a tool to maintain economic networks and well-being.* The same pattern is present in the tourism branch if the state is highly integrated into the international activity, it cannot abruptly cut its channels of interaction, otherwise, an even more severe crisis could be provoked (Farzanegan et al., 2020; C.-C. Lee & Chen, 2020).

Overall, the thesis project offers a reader a policy research paper on the topic of COVID-19 response's stringency, which considers the crucial caveats in the theoretical (lack of structured and cohesive theoretical frameworks) and empirical (limited number of units of analysis) fields. The paper's outcome is a list of variables, which explains the dynamic in the level of stringency to the COVID-19 pandemic on the global scale.

Regarding the **structure**, the thesis mostly follows the order of research objectives. The first section will provide an overview of the literature connected to the policy stringency, COVID-19 pandemic, and responses to it. The second part will be devoted to the unpacking of the theoretical framework, which is placed in the core of the paper, how a theory of "policy diffusion" is fused with "external shock", "state capacity", and "diffusion of innovations" theories. The third chapter is dedicated to the methodological aspect of the analysis, provides an overview of the research design and operationalisation for dependent and independent variables. The fourth substantial section consists of results for the empirical tests (i.e., visual statistics, correlations, regressions, Bayesian networks) and provides results' interpretation. The concluding part will recap all findings, present the project's limitation, and pinpoint the prospects for further research.

Before I commence with the overview of the literature, I would like to express my genuine gratitude to the supervisors of the paper, Mihkel Solvak and Yuri Kabanov, for the help with the design, technical aspects, and the literary inspiration. Additional appreciation is addressed to Irina Busigina, who read the pioneer version of the paper and shared their opinion on it and Denis Stremoukhov, who helped with the recodification of variables. Appreciation goes to Michael Dorsch, who assisted me with regional division and where to find it. The final portion of gratitude goes to Gadir Mamedov, who supported me while writing the thesis; I am sure that he has an outstanding project.

Chapter 1. 'Stringency' literature review

The core purpose of this section is to provide an understanding to the reader about the 'policy stringency' concept in general and in relation to the COVID-19 pandemic. This should be done since the stringency has various ways of conceptualisation and operationalisation in different works, and here I would like to put a reader on the same page with the narration, mostly because this is the dependent variable of the paper. Hence, the subject-related literature review will be structured around the deductive approach: in the first part, I will present branches of academia, which interfere with the concept of 'stringency'; and in the following section, I will provide an overview of papers studying the stringency level in the context of coronavirus outbreak. Within both sections, I will mention the most common ways of stringency operationalisation.

1.1. Policy stringency

I was surprised when I started analysing the origins of the 'stringency' concept and the most common contexts within which it was used. Once I gathered literature via SAGE, JSTOR, SSRN and other electronic sources provided by the UT library, I found out that most search outputs are connected with tobacco control policy and environmental topics.

When I was working on my 3rd-year term paper, I have faced the absence of a unified parameter for the tobacco policy stringency, thus I had to calculate one for myself as a number of restrictions and prohibitions implemented by the member states of the Framework Convention on Tobacco Control (FCTC) (WHO, 2005). However, authors do assess perceived stringency via expert surveys in different locations (Glasgow et al., 1993, 1996), yet tobacco policy is not the most common branch of policy studies, which appeal to the concept of stringency.

The notion of stringency is more frequently[4] applied to the measures against climate change, which are invoked by the international treaties and agreements: for instance, Renewable Portfolio Standards in the US (Anguelov & Dooley, 2019) and the European Union Emission Trading System (Bel & Joseph, 2018; Kettner et al., 2008). Both policies tend to alleviate the environmentally-hazard aftermaths of economic activity ("pollution of water sources, smoke, powder" (Ding et al., 2016, p. 638)) by introducing restrictions on the production process — these restrictions are the 'environmental/regulatory stringency'. This stringency not only regulates firms and corporations' activity but also is perceived as a tool for innovation since the introduction of a new 'playfield' with limited possibilities and cancellation of previous standard practices forces actors to develop new approaches toward the ecologically friendly production. This hypothesis is

[4] The conclusion is made on the sample of 32 papers, downloaded via the UT library sources.

regularly studied in the environmental works on different samples, and the outcome is almost always the same: “Depending on the stringency of [environmental] regulation, the change in opportunity costs of pollution then translates into increased cost of some factors of production, and thus incentives to innovate in a manner which saves on the use of these factors” (Johnstone et al., 2012, p. 2158). This logic of stringency affecting the degree of innovation was tested with different operationalisations of the stringency. For one it is de facto *ex-post* evaluation of units of pollution (Cao et al., 2020); for others, it is *ex-ante* taxes and technological standards (Herman & Xiang, 2019; Hille & Shahbaz, 2019). Moreover, all these discrepancies in measurements provoke how authors measure environmental policy stringency, especially since the primary rationale behind indicator selection is the data availability rather than the theoretical justification (Sauter, 2014).

1.2. COVID-19 policy stringency

Fortunately for me, the COVID-19 context does not face such an issue, despite the fact that there are some new, improved indices and measurements of stringency (Gros et al., 2021). As I stated in the introduction, responses’ stringency topic is undervalued, and nevertheless, the authors who use it either as a dependent or independent variable apply the same discourse to describe it. The notion of stringency originated right after the state’s government faced the COVID-19 with the help of various reactive non-pharmaceutical interventions: a set of policies, for instance, “closing schools, restricting domestic travel, and public information campaign policies” (Feng et al., 2021, p. 707), which are aimed at the reduction of pressure on the healthcare facilities, resulting in reduced contagion rate and consequently lowered number of deaths, since there are sufficient capacities to take care about patients (Cho, 2020). Thus, in this regard, stringency is the degree to which policies restrict the person-to-person interaction; for the sake of comparison, the liberal approach would imply the use of personal protective equipment, while the state with the highest stringency would introduce compulsory lockdown and shutdown of non-essential businesses (Hale et al., 2020). In other words, COVID-19 stringency is the set of “interventions [aimed] to create social distancing, to augment public health provision and fiscal and monetary policies… (Barberia et al., 2020, pp. 1–2).

By the common academic consent, the most reliable and valid indicator to measure the stringency is the index by Thomas Hale and his colleagues (2020), which converts the news, announcements and other sources of information into interval values from 0 to 100. I would say that this is a descriptive indicator depicting the guidelines for the citizens, some could be voluntary, while others are more compulsory (Cao et al., 2020). It cannot be taken for granted as a manifestation of effectiveness since there are various intervening variables (Lurie et al., 2020).

Regarding the research connected with the level of COVID-19 responses' stringency, there are several specific findings. First of all, higher stringency is associated with a lower spread rate of the coronavirus, and in general, the "daily confirmed COVID-19 cases are assumed to be the main variable considered by the policy-makers when deciding on mobility restrictions" (Frey et al., 2020, p. 1). This is another example of a one-sided approach toward stringency since I hope that policy-makers are not so myopic and are not guided solely by the COVID-19 indicators without considering other resources and variables. However, this might be the case why almost all states skyrocketed their level of stringency once the COVID-19 was announced to be a pandemic threat, since retrospectively we know that states that acted proactively showed lower infectious rate, in comparison to those who decided to postpone the response implementation (Gibson, 2020b; Migone, 2020). The second causal mechanism can explain the pattern in early responses: higher stringency leads to higher compliance with social distancing regulations, and this is expected because if the government decided to close all public spaces (i.e., parks, malls, airports), citizens have to reduce their recreational mobility, especially, since some citizens have lost their jobs. Additional, speaking of household income, higher stringency leads to higher unemployment and, hence, reduced economic well-being; this patter is more common for developing countries, where the population was hit severely by the economic crisis, primarily due to the meagre savings and absence of networks, which would ensure the maintenance of living standards (Caselli et al., 2021; Feng et al., 2021). Finally, another general finding of stringency is the association between higher stringency and authoritarian regime (Frey et al., 2020).

To summarise, even though the topic of COVID-19 stringency is overlooked, some findings explain the results of increased stringency and what factors could affect it. However, all these notions should be placed into one narrative rather than in several separated ones — this is the main agenda of this paper, which is why the following chapter will introduce the core theoretical framework that revolves around the concept of stringency and factors which impact it. Hence, the second chapter will also incorporate some aspects of the literature review, which will be closely connected to the concept in question.

Chapter 2. Fusion of theoretical framework

One cannot speak about public policy without mentioning the governance aspect. That kind of discourse is crucial for this theoretical framework since it consists of only state-centric theories, which do not consider psychological factors attributed to the decision-makers or the entourage. On the contrary, the framework involves institutional theories, which operate with the results of previous decision making and institutional arrangements, with the actions taken by the elites but without the role of the elites in details, or, in other words, with the status-quo within the state. Moreover, the framework does not delineate 'government' from 'society'; the latter is another significant institution shaping the policymaking process.

For the role of psychological factors in the context of the COVID-19 responses, I can recommend the article by Maor and Howlett (2020), who included 'elite panic', 'limited attention span', and accompanying variables in the theoretical explanatory models. My theoretical framework is based on the macro-level assets of a country but without apparatus/government personnel psychological determinants. The primary justification for such a narrow approach for the depth of analysis is the large-N empirical design, which would require qualitative data gathering via the content and document analysis to measure psychological indicators. That is why the theoretical framework revolves around state-centric, macro-social and demographic parameters.

However, in order to mitigate subsequent drawbacks related to the state-centric focus, the analytical part of the thesis is based on the premise of theoretical synthesis. This is the combination of several theories, which are located on the same level of Sartori's (1970) ladder of abstraction and which operates with the *high-level categories*. "Cross-area comparisons among heterogeneous context" (Sartori, 1970, p. 1044) — this is the primary goal of the synthesis since I am interested in the stringency of the responses among different states all over the world in different regions.

Regarding the theory itself, the 'backbone' for the theoretical framework is the "policy diffusion" by Berry and Berry (2006), which proved to be a reliable theory for the systematisation of factors during the pre-research on the post-soviet sample. However, at the same time, the authors did not provide an elaborated mechanism for the explanation of adoption under the impact of the factors (i.e., *motivation*, *resources/obstacles*, *other policies*, *external*). What readers receive is a vague multi-level theory, which sketches the process of policy diffusion. Thus, proceeding from the basic assumptions by Berry and Berry, I will add new theories on each of the categories from the equation of adoption to prove a sophisticated explanatory mechanism for different levels of stringency of responses to the COVID-19, Figure 1.

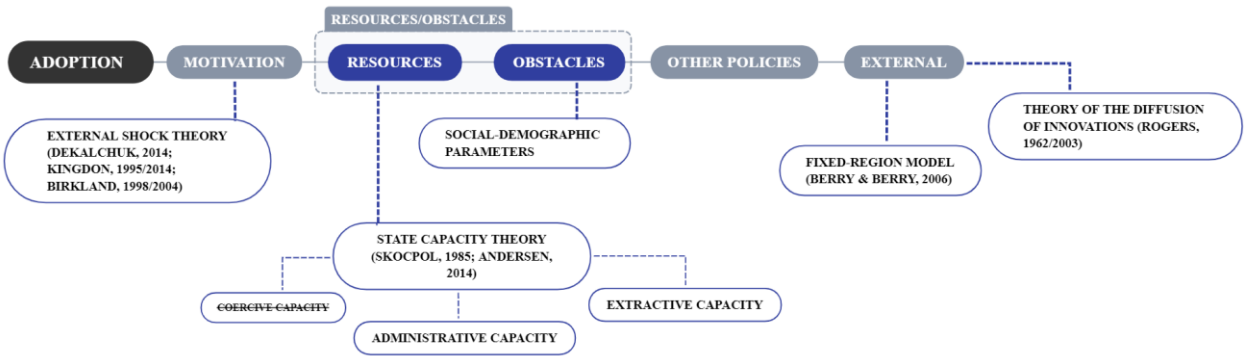


Figure 1. Complex theoretical framework, based on the "policy diffusion" theory (Berry & Berry, 2006), which explains the level of stringency (*ADOPTION*) of the policy response to the COVID-19

First, the main research object of the thesis is an *adoption* segment of the equation since it encapsulates the level of stringency, which is incorporated in the non-pharmaceutical interventions provoked by the coronavirus. The *adoption* does not require additional explanation since I take this concept for granted as a separate dependent variable. As it can be seen from Figure 1, *motivation* to adopt a policy response with a certain level of stringency will be coupled with the "external shock theory" (Birkland, 1998; Dekalchuk, 2014; Kingdon, 2014), which will provide insights into the additional incentives for the officials to contain the shock as soon as possible with minimal aftermaths. In the original version of "policy diffusion" theory, Berry and Berry do not explicitly separate resources and obstacles (2006, pp. 235–236). However, in this paper, I will divide the category into two to achieve an even more meticulous level of analysis: *resources* obtained "state capacity" theory (Andersen, Møller, Rørbæk, et al., 2014; Evans et al., 1985), which will split resources into different sub-categories, administrative and extractive. *Obstacles* will consist of social and demographic parameters, which officials should consider during the policy formulation. *Other policies* group will not have an additional theoretical layer because the four-level distinction embedded into the "policy diffusion" theory is sufficient for the conceptualisation and operationalisation of variables. The final section of *external* experienced the most drastic changes in comparison with the pioneer paper: initially, it was merely economic and trade globalisation indices (*KOF Globalisation Index – KOF Swiss Economic Institute | ETH Zurich*, n.d.), yet now this category involves spatial ("fixed-region model" (Berry & Berry, 2006), based on the regional division of countries) and time-related ("diffusion of innovations" theory by Rogers (1983), who pays attention to the time variable) aspects of potential policy diffusion, which include the procedure of policymaking in the context of high uncertainty. Overall, this framework will contribute structure and theory-related answers in the research of stringency of COVID-19

policy responses on the global scale. More detailed explanation of theories will follow in the next sections.

2.1. Policy diffusion exposition

The core theory of the construct is the "policy diffusion" theory by Berry and Berry (2006), which takes into account both internal and external factors influencing the adoption process. I refer to this theory since the policy response to the COVID-19 is an 'innovation' at least to some extent. Conceptually, it is a set of policies, which were established and implemented in chain order by the majority of countries, but were not borrowed by the 'laggards' in terms of adoption pace. In other words, China is a pioneer state, which was the first to establish a response to the COVID-19 on 22-23 of January because it was the first to meet the danger "at the door". However, for the sake of comparison, Ukraine took some measures only during the period of 4-11 of March, at the exact moment when WHO proclaimed COVID-19 to be a pandemic danger. In order to implement adequate policy response, Ukraine from the example and other states had to refer to the experience of their neighbours, of the ones who encountered the virus earlier, and those who had experienced some backfire or benefits from too strict or too liberal policymaking. Moreover, national resources should be considered; one cannot commence strict anti-COVID-19 programmes if the healthcare (personal protective equipment, number of hospital beds, etc.) and institutional capacities are insufficient. So, until the state did not formulate and implement the set of policies, which aimed to mitigate COVID-19, the response is still an 'innovation'.

This general scenario is perfectly delineated in the "policy diffusion" theory, which is a final result of works devoted to diffusion models and internal determinants, which impact the adoption of the innovative policy. Diffusion models are the most straightforward notion of policymaking since the states are not isolated from each other, not physically, not in terms of international processes: globalisation, international trade, and other forms of interactions. At the dawn of the development of this branch of policy analysis, the field of diffusion models was teemed with various works, studying cross-states, cross-counties adoption process (J. L. Walker, 1969; R. M. Walker et al., 2011). As a result, there were three mechanisms of diffusion pinpointed: firstly, states rely on the diffusion as on the educational technique, sort of lesson-drawing, borrowing of the most optimal practices, which would benefit the borrowing state; secondly, as in Hobbesian heritage, states do compete with each other for the power, which could be measured either as the number of weapons or as the economic parameters — the diffusion is a tool to achieve better position; finally, states might decline the idea to emulate one's policy, but the pressure from

the international society or other 'hegemon' might be a solid argument to adopt the policy (Berry & Berry, 2006, pp. 225–228).

Obviously, whenever we speak about new pandemic-scale danger, the first scenario of learning seems to be the most plausible because not all countries had the notorious background of SARS and MERS, and they want to ensure the survival of their population. That is why, in the first place, I will test this 'learning' diffusion mechanism within this paper. Berry and Berry mentioned several of the most common models, like "Leader-Laggard Models", "Isomorphism Models", etc., but I am interested mainly in the "Regional Diffusion" model since it will add up to the few-N discussion in a result. The model is called *the fixed-region model*; it moves from national to the regional (terms 'regional' and 'sub-regional' are interchangeable in this paper, both reflects the more detailed classification of territorial units than continents) level in order to trace the interaction between quasi-homogeneous units within the same region[5]. The idea behind this is that the states should have a similar innovation adoption process because of belonging to the same region (Berry & Berry, 2006, p. 229). This is only the *external* part of the theoretical framework, which will be explained in this paper, diffusion patterns among countries in sub-regions and how they set the stringency level of their responses to COVID-19.

Regarding the internal determinants, these are "the factors leading a jurisdiction to innovate, such as political, economic, or social characteristics internal to the state." (Berry & Berry, 2006, p. 224). Authors attribute *motivation to innovate* and *obstacles/resources* to the internal category, moreover, to the former group of variables they ascribe "problem severity", which is not explicitly explained neither in terms of economic income nor in death tolls; and "electoral cycles", to which decision-makers appeal, whenever they introduce a new policy, because flawed designs may result in the discontent from the electorate (Berry & Berry, 2006, p. 235). The latter set consists of "financial resources" and "citizens' education", where economic well-being give a higher hand to the wealthy states since their economy constitutes safeguards, which would allow the state to backup in the case of unsuccessful policy adoption (Berry & Berry, 2006, pp. 236–237). In my opinion, these two groups are not exhaustively deconstructed; there could be dozens of other factors prescribed to the *motivation* and *resources/obstacles* — this is one of the tasks of the paper, to enable a theoretical framework with not only sorting mechanisms but also with explanatory potential.

[5] The regional division is based on the abovementioned categorisation by Teorell and Hadenius (2007), and by the United Nations geoscheme (*UNSD — Methodology*, n.d.). The more detailed information is presented in *external* section and in operationalisation of spatial variables.

Once I described diffusions models and internal determinants separately, it is a cue to illustrate the final product of Berry and Berry, which brought both approaches to the common denominator of adoption:

$ADOPT_{i,t} = f(MOTIVATION_{i,t}, RESOURCES/OBSTACLES_{i,t}, OTHERPOLICIES_{i,t}, EXTERNAL_{i,t})$ (Berry & Berry, 2006, p. 237)

Adoption is the outcome of the policy diffusion, the policy output of the process. *Motivation* and *resources/obstacles* were conceptualised in the previous paragraph about the internal determinants; the *external* element was explained in the diffusion models sub-section, the only uncovered part is the *other policies*. By the *other policies,* Berry and Berry understand the policies, which somehow create incentives to adopt the innovation policy in question. Moreover, there is a typology of other policies: (1) independent; (2) complementary; (3) contingent; (4) substitutes (Berry & Berry, 2006, pp. 238–239). This typology exhaustively describes the scenarios during policy adoption, so there is no need to use an additional theoretical layer.

Since the theory's main assumptions are laid out, I would like to recap this block by presenting the "policy diffusion" theory in the COVID-19 context more evidently, because this is necessary for the comprehension of the paper. *Adoption* is the set of policies enacted by the state either preventively or during the breakout of COVID-19. However, I am interested in the level of stringency of responses adopted, which the government sets; four interconnected categories of variables shape this level of stringency. *Motivation* is the desire of officials to deal with the external shock, which is the pandemic, with minimal costs for the society, e.g., reducing the number of cases and deaths (Amri & Drummond, 2020). This interpretation does not contradict the original theses by Berry and Berry since the quality of response is directly related to the type of regime from which the *motivation* derives and following electoral constraints. The second section of *resources/obstacles* is precisely about the capacities available to the government of a country and the specifications constituted by the demography of the population (Capano, 2020). The general logical assumption is that more diverse *resources* and less specific *obstacles* would result in an adequate response to the COVID-19 without going extreme with the introduction of mandatory stay-at-home orders and national lockdowns, which could jeopardise economies of low- and middle-income countries. *Other policies* is another significant source of impact on the potential stringency since the government could enable 'caretaker' function by implementing policies, which would ease the circumstances of mandatory measures related to the COVID-19. Finally, *external* effects ("fixed-region model") — COVID-19 is a relatively new fast-paced phenomenon in terms of scale and potential danger, thus countries were not ready for it. So, now, during the

policy-stringency adoption, they have to refer to the experience of neighbours from the same regions in a limited period of time, restating the example of China and Ukraine.

While describing the core theory of "policy diffusion", I have tried to show the ambiguity in the formulations stemmed from the original descriptions of elements of the adoption equation. Berry and Berry did not strive to categorize each and every indicator, either external or internal, to a respective category. However, I would like to expand the list of variables relevant to the categories with characteristics, which are significant in the context of the policy response to the COVID-19. At the same time, since the authors did not leave any particular guidelines on how to topologize variables, I will refer to the other theories, which are connected to the parts of the equation. These theories, in the particular order, "external shock" theory (Birkland, 1998; Kingdon, 2014), "state capacity" theory (Andersen, Møller, Rørbæk, et al., 2014; Evans et al., 1985), and "diffusion of innovations" (Rogers, 1983).

2.2. Carrying democracies and indifferent autocracies

The first element of the equation, which requires an additional explanatory framework, is the *motivation* to adopt a new COVID-19-related policy. The original article by Berry and Berry listed only three elements, like the 'electoral cycles', 'support', and the 'potential danger of the problem' in question. The last indicator seems to be the most relevant to the issue of COVID-19-mitigation measures; that is why I use the revised version of the "external shock theory" without the economic aspects, which were and still are the mainstream aspect of the theory (Abere & Akinbobola, 2020; Lakemann et al., 2020). COVID-19 meets all prerequisites to be labelled an external shock since it is an international pandemic event, which affects every country, either directly by infecting the citizens or indirectly by undermining the production cycles and international trade routes. Here I try to dissociate external shocks from the economic context in order not to mix the variables with indicators in the *resources/obstacles* category by applying the more optimal definition of the external shocks and referring to the public policy theories, i.e. Multiple Streams Framework by John Kingdon (2014), the revisited version by Nikolaos Zahariadis (Sabatier, 2007, Chapter 5), and the focusing events by Thomas Birkland (1998, 2004).

The definition for the *motivation* category is provided by Anna Dekalchuk (2014) in her historically chronological literature review of the term 'external shock', partly based on Birkland's perception of the focusing events. External shock — is a "crisis or a disaster in the certain political field, that is sudden; relatively uncommon; can be reasonably defined as harmful or revealing the possibility of potentially greater future harms; has harms that are concentrated in a particular

geographical area or community of interest; and that is known to policy-makers and the public simultaneously" (Birkland, 1998, p. 54). Moreover, this geographically localised crisis should be exogenous, or in other terms, external to the field of politics in question, both from important and geographical points of view" (Dekalchuk, 2014, p. 223). This elaborate definition enhanced the plausibility of COVID-19 being an external shock for the countries, even for China, for whom it could be perceived as an internal shock. Since I want to conceptualise the *motivation* to implement COVID-19 measures via the external theory, this is the most optimal definition because it is based on the notions from the Advocacy Coalition Framework (Sabatier, 2007, pp. 189–223) and Multiple Stream Framework (Zahariadis, 2016), however, here I can work and adjust the external shock independently from sub-systems and political, policy streams respectively. To put it simply, the definition is narrower than the one stemmed in the Advocacy Coalition Framework and substantially similar to the focusing events, which Birkland and Kingdon explain.

Since the motivation to implement the new COVID-19 response might be measured as a problem severity, this external shock framework expands the operationalisation borders since Kingdon uses three parameters to explain the effect of an external shock on agenda-setting and decision-making. Those are: *focusing events, feedback, and indicators* (Kingdon, 2014, pp. 90–110); let me deconstruct the motivation from this perspective.

Focusing events in this context are the sub-unit of external shock, for example, COVID-19 is a general premise of an external shock, while situations in the US, the UK, and India during the spring-summer period (e.g., national lockdowns, stay-at-home measures, the collapse of healthcare, etc.) are the focusing events with increased values in indicators of this crisis. These events drew international attention not only to the problem of the coronavirus but also to the fact that even the most prepared states, in terms of healthcare capacities (Dalglish, 2020), cannot handle the pressure from the virus. These cases force "witnesses" to accelerate the development of policy response; the COVID-19 response instantly gets into the spotlight of all officials because taking preventive measures is more convenient than dealing with the torrent of infected citizens and other costs (Baniamin et al., 2020; Jamieson, 2020). The agenda-setting effect of focusing events is multiplied by the absence of feedback from the taken measures, since there is a time lag of five weeks (Cho, 2020, p. 325), and by the individuality of each country — there is no one-size-fits-all model for the COVID-19 virus (Yan et al., 2020).

Motivation is a desire of officials to manage with the implementation of a new policy response to the COVID-19, which instantly falls within the questions of agenda, attention span, and problem selection. One of the most straightforward ways to evaluate the hazard level is to look at the *indicators*, numbers produced by the external shock (e.g., lethality rare, case number, etc.).

Electronic sources, which regularly update the number of cases and deaths for each country, even this monitoring mechanism can signal the scale of the issue. The most optimal way to operationalise *indicators* is the number of COVID-19 cases and a number of COVID-19 related deaths. Since more than a year has passed after the initial COVID-19 breakout, academia has produced dozens of papers, which do assess the effectiveness of COVID-19 policies; however, they did not come to a consensus (it could be the result of a small-N and few-N researches with a vivid geographical bias since the results of these paper cannot be extrapolated on the whole world).

At the moment, we have two latently conflicting camps: those, who do not associate the number of cases and deaths with high stringency, and on the other side — researchers who proved the presence of correlation. For instance, lockdowns in Africa, at least in Nigeria, did not show the expected level of effectiveness because, despite the high stringency, the population did not increase the physical distancing (Carmody et al., 2020). A low degree of compliance is a question for another paper, and yet we have a precedent when high values of stringency are not a reactive measure to the increase in a number of cases. Another ambiguous case is New Zealand since, at the moment of writing (13.02.2021), there are 45 active cases, of which only one was found in the community (*COVID-19: Current Cases | Ministry of Health NZ*, n.d.), but it still receives some critique in the literature. In the article, Gibson (2020a) unleashed his discontent regarding the responses by New Zealand, because, in his analysis of US counties, he found out that policies with high stringency (e.g., lockdowns) do not reduce coronavirus-related deaths, this result he projected on the case of New Zealand. The final methodologically peculiar illustration is the text dedicated to the comparison of Turkey with five European countries (i.e., Italy, Spain, France, the UK, Germany), in which author states that the number of cases is affected by the timeliness of the implemented measures, not by their stringency — Turkey initiated COVID-19 measures as soon as possible, while Germany, for example, postponed them and in 2020 the number of cases was peaking (Kaçak & Yıldız, 2020).

I do have my doubts about the plausibility of these abovementioned results; however, the opposite side has more valid arguments favouring high stringency in response to the severity of the COVID-19 situation. Armstrong and Lucas (2020) discovered the same logic of actions on the municipal level in Canada: "…aggressiveness of municipal COVID-19 policy responses … is strongly related to municipal population size and case totals" (Armstrong & Lucas, 2020, p. 227). The same pattern of stringency increase with the growth in the number of cases was proven for Europe in general (Bargain & Aminjonov, 2020), on the counterexample of Sweden (Cho, 2020). Additionally, 'strength', another common term used to describe state response's stringency level, is an effective tool to decrease death tolls (Dergiades et al., 2020). What is more important, the

sample of Dergiades and colleagues' work included 32 countries, which exceeded the scope of Europe by including Japan, South Korea, Philippines, thus I can assume that this is more or less a global trend. Especially once we include the post-soviet space, at least partially, which was done by Gleason and Baizakova (2020), once they introduced Uzbekistan, Kyrgyzstan, Tajikistan in the discussion and found the same pattern between stringency and the effective curbing of the coronavirus in terms of the declining number of new cases. Considering this variety of sources, which state the presence of a positive association between stringency level and the number of cases and deaths on various samples, I do state the first hypothesis for the global sample, which is partly supported by H. Lee et al. (2020):

H1. A more severe spread of the coronavirus leads to an increased stringency in terms of response

A couple of words should be noted regarding the integrity of the statistics in the autocratic states and about the differences in tallying the deaths from the COVID-19 virus across the world. Cepaluni, Dorsch and Branyiczki (2020) brought up a crucial aspect, which is addressed in the news but usually overlooked in academic sources — the fact of underreporting or quality of statistics in non-democracies (Alon et al., 2020). Authors tried to mitigate the potential impact of this factor, while I am intentionally relying on the data available on the Internet, mostly due to the fact that this is not the only variable in the research, and additionally due to the limited resources. Besides the underreporting cases, there is another crucial aspect: how COVID-19-related deaths are tallied across all regimes and what is labelled as COVID-19 death. I will not dive into the semantic and terminology of the COVID-19 statistics, Marta Henriques (*Coronavirus: Why Death and Mortality Rates Differ - BBC Future*, n.d.) has done a fantastic job describing all the specifications. What matters is that the logic "a patient dies from COVID-19 means that this is a COVID-19 death" does not work across all countries (Goswami et al., 2020), and again, I have zero intentions to unify the statistics, within this paper, I take it for granted.

Another variable, which I attribute to the *motivation* is the regime type. The rationale behind this is that the response to the external shock might vary across the regimes, and this variance is captured in the literature. As I stated in the introduction, the results of pre-research showed that post-soviet democracies are more stringent than post-soviet autocracies, which contradicts the patterns observed on larger samples (Cepaluni et al., 2020; Sebhatu et al., 2020) and supported by Brodeur et al., who states that "Stringent social distancing measures are implemented in countries with …, greater degrees of democratic freedom, more international

travelling…" (Brodeur et al., 2020, pp. 14–15). Articles by Cepaluni et al. as well as by Sebhatu et al. do make sense to the extent that democracies are more accountable to the population via the regular electoral cycles, which can easily dismiss officials who sacrificed people's life. Nevertheless, liberal democracy does imply freedom of movement and other unalienable rights and freedoms, which the democratic regime cannot violate, and still should to ensure safety for the population.

However, in autocracies, the most widespread is China, the accountability mechanism does not work, elections are merely one of the legitimation tactics, so this unties officials' hands, they can behave in whatever manner they desire — their *motivation* transform into something else (Ang, 2020; Baniamin et al., 2020; He et al., 2020). Moreover, reality shows that autocracies tend to be stricter in terms of COVID-19 responses, hence more effective due to the 'authoritarian advantage' (Clegg et al., 2018; Kroenig, 2020, pp. 36–49): an ability to mobilise all sorts of resources to achieve a particular goal. Additionally, autocratic officials do not face the dilemma between showing respect to human rights and introducing stringent COVID-19 responses, the second option always outweighs the former because autocracies need people for further legitimisation (Levy, 2012; Weeks, 2008).

Since the situation with democracies is not crystal clear, I will formulate the hypothesis in the following way:

H2. Autocracies will introduce more stringent COVID-19 responses than democracies

2.3. Carte blanche or lack of resources

The same state of things as with the *motivation* occurs with the *resources/obstacles*. Berry and Berry mentioned only three variables affecting the adoption process, which are also exclusively social and economic: financial resources, education, and the urbanisation rate (2006, pp. 236–237). This set of variables does not exhaust the question of resources available to the state and government, neither it lists all possible impediments for the policy innovation adoption.

This situation is easily adjusted once we study the aspect of resources and obstacles via the "state capacity" paradigm, which was initially formulated and reintroduced to the political science discourse by Theda Skocpol, in her introductory chapter of Evans and colleagues' book (1985, pp. 3–44). Since science took a pivotal turn to study societies under the aegis of behaviouralism at the end of the XX century, Skocpol put all her effort to shift the focus back to the states. During the efforts, she brought up the term of 'state capacities', which are associated with "sheer sovereign

integrity and the stable administrative-military control of a given territory are preconditions for any state's ability to implement policies… loyal and skilled officials and plentiful financial resources are basic to state effectiveness in attaining all sorts of goals" (Evans et al., 1985, p. 16). However, she did not conceptualise separate branches of state capacities, but she provided boundaries for the upcoming concepts. To put it simply, 'state capacity' is not a list of function, but an overall "ability of a state institution [despite their nature and specialisation] to implement official goals and policies" (Croissant & Hellmann, 2018, p. 8; Evans et al., 1985, p. 8).

Nowadays, state capacities are associated with divided but interconnected sub-capacities, each with a particular agenda: coercive, administrative, and extractive capacities[6].

Coercive state's function is self-explanatory to the extent of the term; it is mainly related to the realist perception of the world order and Weberian 'monopoly on violence' — defence of physical borders, maintaining state's integrity, and repelling potential threats to ensure citizens' safety (Andersen, Møller, Rørbæk, et al., 2014; Andersen, Møller, & Skaaning, 2014). This capacity is executed by the institutions of police and military forces.

Administrative capacity is also embedded in the Weberian culture, but not the one devoted to the wielding of violence, rather to the quality of bureaucracy: "indicating the degree to which state agencies are governed by meritocratic recruitment and formally institutionalised rules, rather than by forms of particularism such as corruption, clientelism, nepotism, cronyism, or patronage" (Croissant & Hellmann, 2018, p. 9). Here, the burden of decision-making and policy formulation is placed on the shoulders of bureaucracy, which should be accountable to the state's political control to stay effective (Andersen, Møller, & Skaaning, 2014, p. 1209).

The final branch of capacities is the extractive capacity, which functionally resembles the extractive institutions from Acemoglu and Robinson's "Why Nations Fail" (*'Why Nations Fail: The Origins of Power, Prosperity and Poverty' -- Daron Acemoglu - YouTube*, n.d.). The main goal of extractive capacity is to ensure the income to the government budget with the help of fiscal mechanisms (e.g., fees, taxes). Once the income is collected, it should be redistributed to both coercive and administrative capacities to guarantee efficacy (Hanson, 2018).

From this theoretical sketch, one can notice that not all three types of capacities are relevant to the question of COVID-19 response stringency. The state's coercive capacity does not add up to the explanation of causality between independent variables and the stringency since the

[6] As a side note, while working on this part of the theoretical framework, I have come across Michael Main's classification of capacities, which is limited by two branches: infrastructural and coercive, neglecting the capacity of resource base replenishing (Fortin-Rittberger, 2014), which is crucial for my theoretical narrative, thus I will use Skocpol's version.

COVID-19 is not a feasible, tangible "enemy", which can be fought with the conventional means of warfare. Moreover, since the paper is not focused on the COVID-19 policy compliance, the role of police officers in policy enforcement is not included in the research agenda. Thus, I will use only administrative and extractive capacities in the section of *resources/obstacles*. However, I would like to expand the definition of extractive capacity to fit it not only in the fiscal resources but to the institutional and political assets.

2.3.1. Administrative capacities

As a result of a theoretical sketch, I have two categories of *resources* and *obstacles*, where the former is studied via the "state capacity" framework, leading to administrative and extractive capacities, both constituting political and policy capacities of a state (Capano, 2020; Woo, 2020). The latter category of *obstacles* does not require additional explanation since it lists socio-demographic variables, which should be considered by the decision- and policy-makers. The purpose of this and the following sections is to conceptualise variables under administrative and extractive branches according to the literature.

From a theoretical viewpoint, administrative capacities conceptualise the effectiveness of bureaucratic apparatus, and coincidentally, the government effectiveness in the context of COVID-19 is well-studied in the literature. However, the main statement is recapped by Lin for a natural disaster, with which COVID-19 shares some common characteristics: "strong state capacity mitigates the effect of a disaster on a population" (2015, p. 1). One can interpret "strong" as "effective, decisive" administrative capacities since the bureaucracy is responsible for the policy formulation and implementation, which will organise the population's routine. What is more indicial is that citizens are ready to sacrifice their rights and freedoms in exchange for COVID-19 curbing, which does signalise to the bureaucracy that their pool of actions is not limited by liberal tactful repertoire (Amat et al., 2020; Toshkov et al., 2020) — the ends justify the means, once the threat for human lives appears. So, the consequent assumption is:

H3. High government effectiveness is associated with a high stringency level

The existing theoretical analysis provokes one crucial methodological moment, how to measure 'government effectiveness', especially in the context of response stringency. As I stated earlier in the text, the question of policy stringency is overlooked, and there is a preponderance of articles devoted to the effectiveness assessment. What they say is that democracies with their high values of government effectiveness are not effective in COVID-19 containment, mostly due to the

elaborate system of 'checks and balances', accountability-transparency, and absence of 'authoritarian advantage' (Ang, 2020; Cepaluni et al., 2020). Usually, authors refer to Worldwide Governance Indicators, which involve: (1) Voice and Accountability, (2) Political Stability and Absence of Violence, (3) Government Effectiveness, (4) Regulatory Quality, (5) Rule of Law, (6) Control of Corruption (*WGI 2020 Interactive > Home*, n.d.). Most of the indicators could be found in the literature, for example, accountability is perceived as a stimulating variable for the increased effectiveness, because the street-level bureaucracy does understand its tasks (Carter & May, 2020; Davidovitz et al., 2020), citizens realise the danger of coronavirus (Ang, 2020); corruption somehow leads to higher stringency (Cepaluni et al., 2020); and at the same time, Cronert (2020) found that slower decision-makers characterise higher government effectiveness. Within this paper I will not divide 'accountability' from 'effectiveness' and will mostly focus on government effectiveness.

2.3.2. Extractive capacities

As I mentioned in the concluding paragraph of the "state capacity" theoretical part, I would like to reinterpret the concept of extractive capacities. Skocpol implied it to be a revenue gaining function of a state, while I would like to change it into a redistributive function: not only the state should collect taxes and fees from the population, but it should also redistribute them into GDP and healthcare. Moreover, these two variables are studied in the texts. The general mechanism is obvious, no country would like to implement draconian measures to sabotage its economy, despite their relative effectiveness in COVID-19 containment, so either the state desires to postpone the national lockdown and implementation of other policy measures, or it will refer to liberal responses to reduce the economic aftermaths (Amat et al., 2020; Brodeur et al., 2020; Gleason & Baizakova, 2020; Teixeira da Silva & Tsigaris, 2020). Jack Walker stated: "It would seem likely that the great cosmopolitan centres in the country, the places where most of the society's creative resources are concentrated, would be the most adaptive and sympathetic to change, and thus the first to adopt new programs." (J. L. Walker, 1969, p. 884). The same idea was interpreted by Berry and Berry and confirm that wealthy countries are more "adaptive and tolerant for change" (Berry & Berry, 2006, p. 237). Both statements add up to the narrative about the effect of strict responses on the economy since I can assume that states with high values of economic resources will be more eager to introduce stringent measures and turn a blind eye to the potential drawbacks, mostly because there are enough resources to enable safeguards and avert the economic crisis.

H4. Higher economic welfare results in higher stringency

The second line of argumentation in the context of extractive-redistributive capacities is what part of the revenue is spent on healthcare, thus creating healthcare capacities, which are available to the state. The role of healthcare against the COVID-19 cannot be overestimated, and again, retrospectively, we can evaluate the preparedness of different states for this external shock. The most striking finding is that level of pre-pandemic preparedness does not correlate with the actual level of response (Braithwaite et al., 2020), especially when the report by World Economic Forum showed the high level of 'health' development across all regions (Schwab, 2019, p. 4). Moreover, the more specialised Global Health Security index depicted that the overall preparedness of the US and the UK can be categorised as "most prepared"; however, the reality does not match with theoretical perception (Dalglish, 2020; Kandel et al., 2020). These findings mean one thing — healthcare capacities are necessary and yet not sufficient factor in explaining COVID-19 responses and their stringency.

Once we covered the retrospective aspect of healthcare, it is compulsory to overview what academia has to say about the association between health institution capacities and stringency. The predictable conclusion is that higher healthcare capacities lead to higher effectiveness: the primary purpose of the adopted policy response to the COVID-19 is to "flatten the curve" — "reduce the number of new cases related to COVID-19 from one day to the next in order to halt exponential growth and hence reduce pressure on medical services**"** (Brodeur et al., 2020, p. 2; *New Cases of COVID-19 In World Countries - Johns Hopkins Coronavirus Resource Center*, n.d.). So, if the healthcare capacities are decent and sufficient, then the response might be more lenient, more liberal (Banik et al., 2020; Capano, 2020; Toshkov et al., 2020).

H5. Higher healthcare capacities lead to less stringent non-pharmaceutical interventions

2.4. Obstacles during the decision-making

This section will be dedicated solely to the conceptualisation of main assumptions, supported by the academic sources, which can be described as *obstacles*. Semantically, *obstacles* in the context of policy adoption are aspects, which should be taken into account while the policy formulation and diffusion occur. Thus, I attribute five variables, which should be considered whenever the government works on non-pharmaceutical interventions and their stringency.

The first concept is the age structure of society. The media has spread the information that older people are more susceptible to the COVID-19, or to be more precise, the probability of a lethal outcome is higher for more people in their late 50s and above (*Older Adults and COVID-19*

| *CDC*, 2021; *Why Are Older People More at Risk of Coronavirus?*, 2020). The government should narrow down the high-risk group to enable mechanisms that address this particular cohort's behavioural patterns. Otherwise, if this selective approach is not applicable, the government could merely introduce policies with higher output stringency. The rationale behind these actions can be found in the academic literature. Firstly, since the main purpose of non-pharmaceutical interventions is to reduce the number of social interactions, higher stringency would affect the behaviour of the elderly, who does not differ much in terms of mobility from younger people, at least in the US (Canning et al., 2020). Secondly, as displayed in the media outlets, higher stringency could prevent severe symptoms and serious illnesses related to or provoked by the coronavirus, to which senior citizens are more vulnerable (Cao et al., 2020; Imtyaz et al., 2020; Pandey & Saxena, 2020; Teixeira da Silva & Tsigaris, 2020; Tisdell, 2020). Thirdly and finally, since the practice of traditional family is still prevalent among the population, higher stringency will have an impact on the groups at higher risks (i.e., elderly), who are more compliant with restrictions (Charoenwong et al., 2020; Wirz et al., 2020), and thus it would decrease the overall spread of disease. This three-fold rationalisation recaps that:

H6. A higher proportion of older citizens leads to higher stringency

However, I assume it would make more sense to focus this research not solely on the proportion of senior citizens but also on the specificity of society's age structure in general. There may be other causal mechanisms concealed, so I will emphasise the connection between elderly and stringency, but models will include 'children' and 'middle-aged' populations.

The second socio-demographic aspect is population density. In my opinion, this is a more relevant concept than the 'population' because it is associated with an issue of social distancing, while 'population' value just states the number of people in the country. This logic places me on the same page with the authors, who argue about the effect of this concept. Stojkoski et al. (2020) did not find the statistical significance of 'density' interaction with the spread of COVID-19 cases, while Sebhatu et al. (2020) and Oto-Peralías (2020) proved on different samples that higher density predicts higher stringency and higher coronavirus transmission. The basic logic implies that higher density undermines an ability to guarantee the minimal requirement of physical distancing; however, higher stringency can increase the potential compliance, thus:

H7. States will introduce higher stringency in the case of high population density

The third independent variable is cultural practices. This is the most complicated concept to conceptualise and operationalise, especially for the large-N analysis, since it may be interpreted via various dimensions, and yet it has high explanatory potential. In their paper, van Holm with colleagues (2020), used the ideological distinction between 'liberals–conservatives' and found out that the former are more compliant with state decision than the latter, thus they do not provoke higher stringency from the government. Cao et al. (2020) used two different cultural paradigms: 'loose–tight' and 'individualism–collectivism'. As a result of the analysis of the Chinese population, "loose and individualistic cultures led to faster increases in PR [prevalence rate] and CMR [crude mortality rate] and higher CFR [case fatality rate]" (Cao et al., 2020, p. 939). The notion of national culture ('loose–tight') was also mentioned by Yan et al. (2020) but on the more significant sample (i.e., Sweden, China, France, and Japan).

Nevertheless, even in the conceptualisation section, I should notify the reader that due to the lack of aggregated and unified data, I cannot use the concept of 'loose–tight' or 'individualism–collectivism' culture. I have to substitute it with another measurement, as it was done in the pioneer paper. In the pre-research, I thought that proportion of the urbanised population would be a proper alternative, as was "hinted" by Lipset and Rokkan (1967, pp. 1–64) in their 'cleavage' theory — the urbanised population would be more individualistic, while rural would represent collectivist values. In this paper, I would like to move aside from this distinction and use the level of education, which, theoretically, would combine cultural practices, values and 'urban–rural' binarity. Moreover, the education concept is discussed in the literature because it can influence the attitude toward the pandemic itself and the sources from which a person draws information, and the overall level of awareness (H. Lee et al., 2020; Somma et al., 2020; Wirz et al., 2020).

H8. A higher level of education attainment would lead to lower stringency

At the same time, I realise that 'education level' is not an identical substitution, and yet, in my opinion, it is the most proximate indicator.

The fourth parameter is connected with household income and can be conceptualised as economic sacrifices since the introduction of non-pharmaceutical interventions with high stringency is associated with the disruption of the routine life of the population, especially in economic terms. The result of high-stringency policy decisions would lead to job closures, hence leaving the population without a stable source of income (AlKhaldi et al., 2020; Benítez et al., 2020; Pandey & Saxena, 2020). In the pre-research paper, I have used the 'household income' concept since I assumed that it would allow me considering the savings accumulated in families.

However, the abovementioned academic works propose to focus on the 'unemployment rate', which is a more sensitive and transparent indicator because it is more evident for decision-makers. It would be even more jeopardising to implement high stringency policies at the point when the unemployment rate is spiking, since the population does not have resources to maintain the living standard, as a result:

H9. If the state has a high unemployment rate, it will not introduce strict policies

The fifth and final *obstacle* is the institutional trust of the population. The notion of trust in the COVID-19 context stems from the aspect of compliance to the state's coronavirus responses. Harring et al. (2021) emphasise the significance of "reciprocal trust, both horizontally among people and also vertically between governments and the population, is a key component in building collective action capital." (Harring et al., 2021, p. 3). Citizens should trust each other, for instance, in terms of using personal protective equipment or following 'stay-ay-home' recommendations. At the same time, the population should have trust in the government's policy outputs in order to comply with them (Hartley & Jarvis, 2020; Kushner Gadarian et al., 2020; Petridou, 2020; Toshkov et al., 2020). In this paper, I am interested in 'vertical trust' since the whole framework is built around the state-centric aspects, thus:

H10. In the case of low institutional trust, the state has to increase the stringency level

2.5. Complementary policies

As with *obstacles*, *other policies* do not require an additional theoretical level since Berry and Berry elaborated on the types of other policies in relation to the policy in question, which is being adopted. There are four types of *other policies*:

(1) Independent — the policy course is not associated with the innovation, and yet it hastes the process of adoption;

(2) Complementary — already existing course steadily leads or connected to the adoption of the innovation;

(3) Contingent — gatekeeping case, when the innovation cannot be adopted until another policy is not formulated and implemented;

(4) Substitutes — the innovation completely replace the already existing policy (Berry & Berry, 2006, pp. 238–239).

Whenever we speak about non-pharmaceutical interventions and their various levels of stringency, the first *other policy*, which springs to one's mind, is economic support from the state: official payments from the state to the households for possible costs related to the lockdowns and debt reliefs policies. From the perspective of Berry and Berry's description, this economic support policy is a complementary policy to the responses to COVID-19 since they are associated with the general idea of NPIs, and yet they are aimed to ease the consequences of lockdown and other restrictive measures. Additionally, the authors also point out the significance of state help to the population in times of crises, especially as severe as this one. The paragraph devoted to the unemployment rate description mentioned the idea of people being unable to stop their economic activity because they have rent to pay and food to buy; that is why the goodwill gesture from the state is necessary (Barnett-Howell & Mobarak, 2020). Not only will it increase the compliance level in the society, but also it will allow conducting stricter coronavirus-related policies (Benítez et al., 2020).

H11. The presence of economic support policy is associated with a higher level of stringency of non-pharmaceutical interventions

2.6. Regions and Rogers' theory of the diffusion of innovations

The final part of the theoretical framework is the explanation of *external* influence, or in other words, the effect of diffusion of innovation per se.

Berry and Berry brought in several models of diffusion, which I have mentioned in the general description of an overall theory. However, only one of them is applicable to the coronavirus context — the fixed-region spatial model (Berry & Berry, 2006, pp. 228–229). Its central premise is 'belonging to the same region', which dictates the behaviour of the state during the adoption process. If this prerequisite is met, then the adoption process should follow the same way as it is within the region. In the context of COVID-19 responses, states in the same region due to the diffusion process (i.e., since no one knows how to act during such pandemic, except the Asian states, countries will "look around", seeking for the success-stories, which could be borrowed and implemented) will have the same level of stringency:

H12. States within the same region should have the same level of stringency

What is more important in this case is not the spatial dimension of diffusion since it is well-expected, while the temporal question draws almost all the attention. The role of time in the decision- and policymaking is more or less apparent in the context of effectiveness — states, which introduced any sort of response to the COVID-19 breakout as soon as possible, have a smaller number of cases and deceases (Jamieson, 2020; Park & Chung, 2021). However, academia does not know if there a connection between early reaction and high stringency as an illustration of overreaction or vice versa. In order to answer this question, I will refer to the theory of "diffusion of innovations" by Everett Rogers (1983). While Berry and Berry are primarily focused on adoption indicators, Rogers indicates that time is one of the most crucial aspects of his four-tier theory.

Nevertheless, let us start from the beginning, the basic conceptualisation. The first term which appears in the text is *innovation*, here authors do not have any double-readings, for both it is "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers, 1983, p. 11). Restating, in the context of the paper, innovation is a policy response to the COVID-19, which involves a certain dynamic level of stringency.

The second notion is the *communication* or *communication channels,* through which the knowledge and experience are exchanged between the countries (e.g., national media platforms, private interpersonal channels), thus leading to the gradual diffusion of the idea (Rogers, 1983, p. 17). I do insist that this concept is irrelevant to the paper due to the large-N nature of the analysis; I doubt that it is possible to trace every major and minor channel of communication between countries. However, this could be one of the perspectives for further analysis.

Time is the third concept, which has a positive connection with the adoption, resulting in the S-curve — the more time passes, the higher is the rate of adoption (Rogers et al., 2019). Moreover, in order to have a more systematised approach towards time-tracking, Rogers introduces five groups of adopters: innovators, early adopters, early majority, late majority, and laggards (Rogers, 1983, p. 22). These labels will allow me to categorise countries in parallel with their regional division, and thus I could observe some patterns of stringency from the time-related stance. Moreover, I deliberately neglect the innovation-decision process, including knowledge-persuasion-decision-implementation-confirmation stages, which is happening during the limited time period. The purpose is to reduce this sophisticated and complex parameter to a minimum of one valid and reliable variable — time. Hence, operationalisation is an essential part of the hypotheses of this type:

H13. States which introduced early policy responses tend to have higher stringency

The fourth term is the *social system*, which is "a set of interrelated units that are engaged in joint problem solving to accomplish a common goal" (Rogers, 1983, p. 24). This term I conceptualised via the Berry and Berry theory as units belonging to the same region, so there is no need to introduce redundant hypotheses.

Summarising, by deconstructing the complex theoretical framework of this paper, I have accomplished one of the research objectives mentioned in the introduction. The purpose of the framework is two-fold: in the first place, it allowed me to structure existing literature on the subject of non-pharmaceutical intervention's effectiveness and how it relates to the stringency. The literature review produced 13 hypotheses, the majority of which are one-tailed, which are associated with different categories of policy diffusion. Secondly, what is more important, as an answer to the state-of-art, I have constructed and offered a cohesive framework¸ which is based on public policy theories, both old and their revisited versions, which shed light on the policy adoption and diffusion process in more segmented processes. This version of the framework is open to the critique, and yet all this theoretical effort illustrates the longevity and undervaluation of "policy diffusion" by Berry and Berry; their theory, which was used for minor policy issues, can be applied to large global concerns. Moreover, this theoretical framework, the final version of which is presented in Figure 2, is flexible to revaluation and reconfiguration since the indicators can be replaced with more relevant or more precise ones. Even in this case, the framework still will be able to produce a coherent result for global policies adoption.

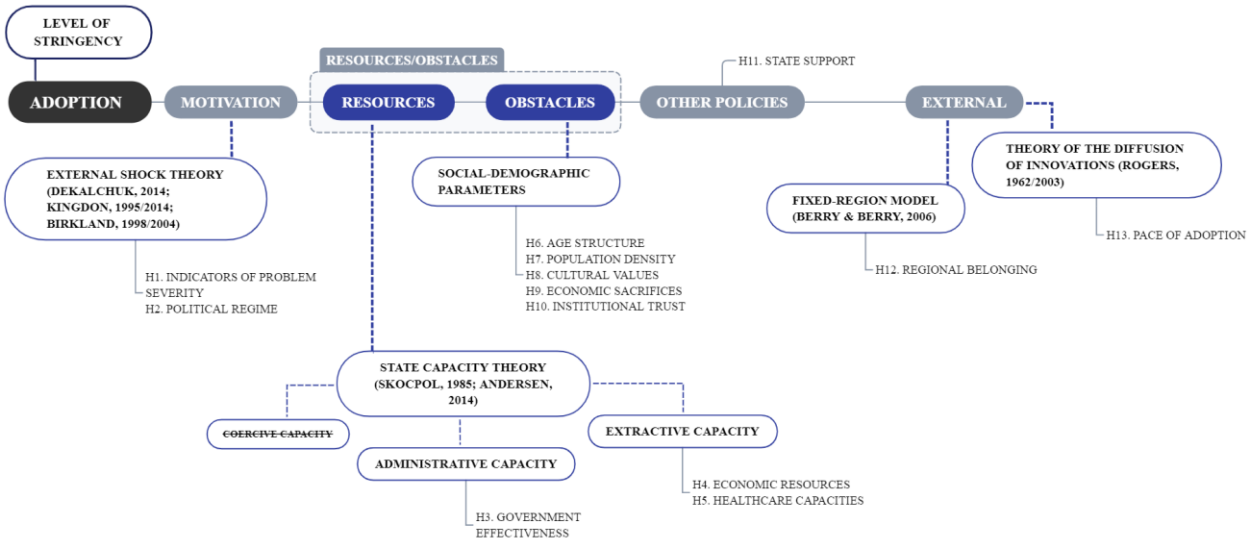


Figure 2. The conceptualised version of the complex theoretical framework

In the following sections, the general research design will be presented, and also all concepts in 13 hypotheses will be operationalised with valid and easily measured indicators.

Chapter 3. Methodology

3.1. Empirical design

As a result of meticulous theoretical analysis, I have 13 hypotheses presented once again in a table-wise version, Table 1.

Table 1. The summary of all hypotheses within the research

H1.	Increased coronavirus prevalence leads to a policy response with high stringency	*MOTIVATION*
H2.	Autocracies due to institutional arrangements tend to produce COVID-19 policies with higher stringency	
H3.	Governments with a higher degree of effectiveness implement higher stringency	*RESOURCES*
H4.	Due to the flexibility, states with higher economic resources will use policies with higher stringency	
H5.	To flatten the curve, countries with insufficient healthcare capacities tend to refer to policies with higher stringency	
H6.	Since population 65+ is a risk group, the higher its proportion is, the higher the stringency will be	*OBSTACLES*
H7.	Countries with higher density to ensure the social distancing will increase the stringency level	
H8.	Lower education among the population forces the government to establish higher stringency	
H9.	A higher rate of unemployment as an inability to survive economic sacrifices leads to lower stringency	
H10.	If citizens trust their government, the latter will establish policies with higher stringency	
H11.	The availability of state economic support allows the government to increase the stringency level	*OTHER POLICIES*
H12.	States in the same regions will have the same level of stringency	*EXTERNAL*
H13.	Faster implementation of response will lead to higher stringency	

The overall research design is a quantitative large-N analysis, the sample of which includes 185 countries. The only eliminating principle was the data availability for the dependent variable, the stringency index (*Coronavirus Government Response Tracker | Blavatnik School of Government*, n.d.-a). In order to test induced hypotheses, mostly quantitative methods will be used, at the same time, the significant empirical contribution is the use of Bayesian Networks, which are not frequently used in political science in general, and public policy in particular. Bayesian Networks belong to the Artificial Intelligence and Machine Learning family, which is popular in COVID-19-related studies; for example, they are being used to model the consequences for the second wave of coronavirus (Vaid et al., 2020) and to predict what measures should be taken to

reduce the number of cases and deaths (Uddin et al., 2020). The more elaborated description will be presented in Chapter 4, in which the analyses will be conducted.

Before moving to the operationalisation of variables, I would like to present the timeline of COVID-19, which is used in the research, Figure 3.

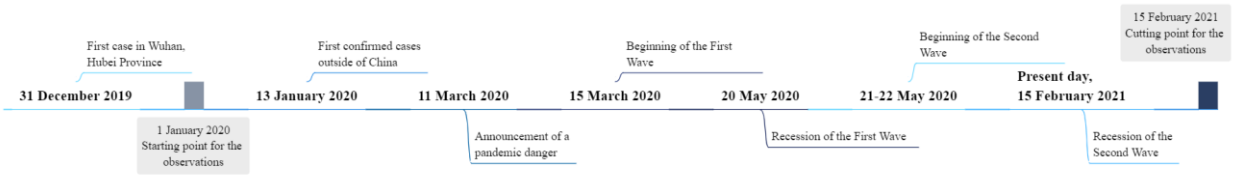


Figure 3. The timeline of the COVID-19 development, with an indication of 1st and 2nd waves

This timeline serves a two-fold purpose; in the first place, it limits the time frame for the data collection since the number of cases-deaths and stringency index is updated on a daily basis. So, the paper uses data from the 1st-2nd of January 2020 and until the 15th of February 2021 for particular variables. Secondly, this timeline allows considering the variance of policy responses among two waves, which could illustrate the lesson-drawing and increased awareness over the situation, which was not found in the published academic articles.

Regarding the duration of the waves, initially, I thought that I would rely on academic sources; however, the prevalence of case studies, which would indicate the starting and endpoints of waves, does not help with the global situation (Iftimie et al., 2020). In that case, I have decided to use the global data on new cases per million for all countries (*Coronavirus (COVID-19) Cases - Statistics and Research - Our World in Data*, n.d.-a) with a continent division. The data visualisation on the Out World in Data website did not fulfil this agenda. The result of visual statistics presented in Figure 4.

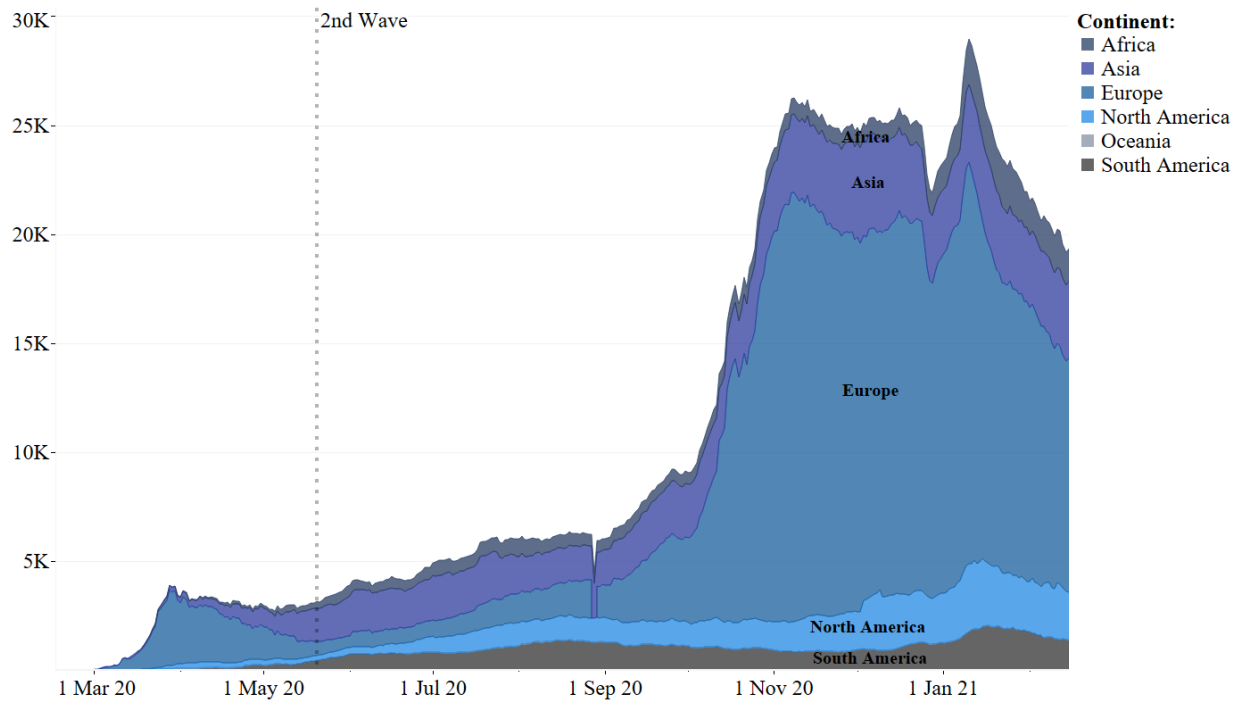


Figure 4. The daily distribution of new cases per million with continental distinction and with identification of juncture between the Waves (dashed line)

Source: Coronavirus (COVID-19) Cases—Statistics and Research—Our World in Data. (n.d.). Retrieved 16 February 2021, from https://ourworldindata.org/covid-cases?country=IND~USA~GBR~CAN~DEU~FRA

As can be seen from the area chart, especially in Europe, there is a plateau around June, on the 20th of May, to be precise. I will not argue that 'Waves' is a subjective term, which can vary from country to country, and for example, for Americas 20th of May could be perceived as a beginning of the first wave, as well as for Africa and Asia. Yet this presupposition is nothing more than a technical distinction between the first and the second Waves of COVID-19 spread.

3.2. Operationalisation of variables

Since all variables are conveniently divided into categories, I will structure the operationalisation description in the same manner.

Adoption

The most crucial variable in the whole research is the level of stringency of the policy response to the COVID-19. This complex indicator was developed by the Blavatnik School of Government (*Coronavirus Government Response Tracker | Blavatnik School of Government*, n.d.-a). The final index consists of 19 parameters to measure the dependent variable of the *level of*

stringency (stringency), which is adopted during policy diffusion. However, I will use only the "containment and closure" group (e.g., school and workplace closure, cancellation of public events, etc.)[7], so the more these policies are implemented in a compulsory manner, the higher is the stringency. This index ranges from '0' as the most liberal response to '100' as the country with the stringiest response. Hence, this paper will rely on the level of strictness, updated on a daily basis, which is already collected in Coronavirus Government Response Tracker (*Coronavirus Government Response Tracker | Blavatnik School of Government*, n.d.-a).

Motivation

This category included a number of cases and deaths, as well as the type of regime. In terms of operationalisation, these are the most straightforward variables since they are commonly operationalised in the literature, and there are several electronic resources-databases, which collect data on the number of cases and deaths. Since the number of confirmed cases and deaths is also a daily updated variable, as it is with stringency, there will be two versions: first is a daily observation of cases and deaths in every country (*cases_ conf / deaths_ conf*); second, aggregated indicator, which is based simultaneously on cased and deaths: "case fatality rate [for the COVID-19] … the number of confirmed deaths divided by the number of confirmed cases" (Brodeur et al., 2020, p. 10) and the number of cases per capita (*CPC*), which is the number of cases normalised by the population (*population*), which is available on the World Bank Indicators dataset for 2019 (Population, Total | Data, n.d.). Case fatality rate (*CFR*) will be computed for the whole duration of a pandemic. Again, the first variable is convenient for the visual statistics (as was shown in Figure 4 with new cases for each continent), while the second is more appropriate for quantitative tests.

Regarding the sources, the information for the number of cases and deaths per country will be taken from the "Our World in Data" project (Coronavirus (COVID-19) Cases - Statistics and Research - Our World in Data, n.d.). Case fatality rate will be calculated on the basis of the same data.

The second variable for *motivation* is the regime type. In order to control for different measurements of regime type, I will use three types of indices: categorical variable by the Freedom House (*fh_regime*) and interval index of 'electoral democracy' (*elect_dem*), both are stored in the

[7] For more detailed description I will refer reader to the codebook of an index (*Covid-Policy-Tracker/Interpretation_guide.Md at Master · OxCGRT/Covid-Policy-Tracker · GitHub*, n.d.)

V-dem dataset (Data Version 10 | V-Dem, n.d.), and the third one is the interval Polity IV (*polity_reg*) index (*INSCR Data Page*, n.d.).

Resources

As I stated in the theoretical framework description in the section on administrative capacities, researchers have been using separate indicators of government effectiveness, which could undermine the wholeness of the concept and the cohesiveness of analysis. So, in this operationalisation, I would like to speculate on this topic for a bit.

Government effectiveness is usually operationalised via the Worldwide Governance Indicators 2019 (*WGI 2020 Interactive > Home*, n.d.). There are six indicators, (1) Voice and Accountability, (2) Political Stability and Absence of Violence, (3) Government Effectiveness, (4) Regulatory Quality, (5) Rule of Law, (6) Control of Corruption. This is not the first time I encounter them; there is a multicollinearity issue among some variables (Table 2.)

Table 2. Correlation analysis for the Worldwide Governance Indicators

	Voice and Accountability	Political Stability and Absence of Violence	Government Effectiveness	Regulatory Quality	Rule of Law	Control of Corruption
Voice and Accountability	—	0,685**	*0,722***	0,773**	0,785**	0,770**
Political Stability	*0,685***	—	*0,761***	0,705**	0,797**	0,773**
Government Effectiveness	*0,722***	0,761**	—	***0,940****	***0,943****	***0,921****
Regulatory Quality	*0,773***	0,705**	***0,940****	—	***0,930****	0,883**
Rule of Law	*0,785***	0,797**	***0,943****	***0,930****	—	***0,945****
Control of Corruption	*0,770***	0,773**	***0,921****	0,883**	***0,945****	—

**. Correlation is significant at the 0.01 level (1-tailed).

Due to that technical issue, I will not include several indices from the Worldwide Governance Indicators in the same models. Thus, I will use '*government effectiveness*' (*effectiveness*) as an operationalisation for the effectiveness concept. Additionally, despite the fact that the '*voice and accountability'* (*accountability*) mechanism is embedded in the regime variable, I will include it for the sake of triangulation.

The operationalisation of extractive capacities has resulted in economic resources and healthcare capacities. Former resources will be measured as tax revenue (*tax_rev*), 2017-2019[8] (% of GDP) (*Tax Revenue (% of GDP) | Data*, n.d.-a) and GDP per capita (*GDP_pc*), 2017-2019 (*GDP per Capita (Current US$) | Data*, n.d.) itself, both variables contain the principles of extractive and following redistributive capacities.

Healthcare capacities are measured as the number of hospital beds (*hospital_beds*) in 2016-2019 (*Hospital Beds (per 1,000 People) | Data*, n.d.) and the expenditures on the healthcare (*health_exp*) in 2018 (*Current Health Expenditure (% of GDP) | Data*, n.d.).

Obstacles

Obstacles category from the policy diffusion in this framework has the largest number of concepts; however, they are easily operationalised.

1. The age structure of the society should represent the proportion of people in each age cohort, so I use three variables from the World Bank data indicators: the proportion of the population, belonging to 0-14 years group (*age0_14*) (*Population Ages 0-14 (% of Total Population) | Data*, n.d.), 15-64 years (*age15_64*) (*Population Ages 15-64 (% of Total Population) | Data*, n.d.), and 65+ (*age_65*) (*Population Ages 65 and above (% of Total Population) | Data*, n.d.).
2. Initially, I thought that population density (*pop_density*) I will have to calculate by dividing the population by the area, but fortunately, World Bank has already counted the population density for countries (*Population Density (People per Sq. Km of Land Area) | Data*, n.d.).
3. As I explained in the theoretical part, I reckon that the most appropriate operationalisation of national culture is the level of education[9], since it latently explains the sources of information for a person, his or her attitude to life, etc. One can find Hofstede's cultural dimensions theory and the 'index of individualism' (*Geert Hofstede: Dimension Data Matrix*, n.d.) being mentioned in articles, scrutinising the COVID-19 topic (Frey et al., 2020). This 'collectivism-individualism' dichotomy is plausible but was not computed for every country in the sample (the dataset has information in 112 countries), thus I had to find an alternative indicator. So, the most

[8] Missing cases for all indicators are presented in Appendix 5.
[9] The idea of World Value Survey (*WVS Database*, n.d.) has crossed my mind, especially, since the new wave of survey was realised, however, the main drawback is that the number of countries, involved in the analysis, is limited by 49 units.

valid operationalisation of a more narrowed understanding of culture is a categorical variable with different levels of acquired education, which could be found in the V-dem dataset (*V-Dem Dataset V10 | V-Dem*, 2020): 'primary', 'secondary', and 'tertiary' (self-titled variables).

4. As a sub-variable of compliance and thus level of stringency, I will measure unemployment among the population (*unemployment*) (without the gender distinction) with the same respective indicator, obtained from the World Bank website, values taken are valid for 2020 (*Unemployment, Total (% of Total Labor Force) (Modeled ILO Estimate) | Data*, n.d.).
5. Finally, the operationalisation of trust, since I exclude interpersonal level from the analysis, I am interested in institutional trust, which I operationalise as performance legitimation (*perf_legitim*), collected in the V-dem dataset (*V-Dem Dataset V10 | V-Dem*, 2020). This categorical variable answers the question, "To what extent does the government refer to performance (such as providing economic growth, poverty reduction, effective and non-corrupt governance, and/or providing security) in order to justify the regime in place?" (Coppedge, 2020, p. 209).

Other policies

Other policies are represented by the economic support from the state (*econom_support*), which is measured as a set of indices in the Government Response Tracker under the category of "economic policies", which includes exactly what is needed for the analysis: "direct cash payments", "freezing of financial obligations", etc. (*Covid-Policy-Tracker/Codebook.Md at Master · OxCGRT/Covid-Policy-Tracker · GitHub*, n.d.). However, I will exclude the "international support" from the final variable since it may cause distortion from a theoretical perspective since all external influence is stored in the following category of policy diffusion.

External

The last category is measured within two dimensions: spatial and temporal/time-related. From the region-fixed diffusion model, I borrow the principle of regional division, the paper will use the ten-fold regional division, which was developed by the University of Gothenburg, or at least used in their dataset (Teorell et al., 2021). This division includes ten categories of countries: (1) Eastern Europe and post-Soviet Union, which is especially crucial for the novelty of research;

(2) Latin America; (3) North Africa & the Middle East (4) Sub-Saharan Africa; (5) Western Europe and North America; (6) East Asia; (7) South-East Asia; (8) South Asia; (9) The Pacific; (10) The Caribbean, (Teorell et al., 2021, p. 331). More detailed distinction 'region-country' can be found in Appendix 1. Moreover, in order to test another regional distinction, additionally, I will refer to the UN 17-pieces categorisation: (1) Northern Africa; (2) Northern America; (3) Eastern Asia; (4) Southern Asia; (5) South-eastern Asia; (6) Southern Europe; (7) Australia and New Zealand; (8) Melanesia; (9) Micronesia; (10) Polynesia; (11) Central Asia; (12) Western Asia; (13) Eastern Europe; (14) Northern Europe; (15) Western Europe; (16) Sub-Saharan Africa; (17) Latin America and the Caribbean. This one does not have a separate 'post-Soviet' sample but has a more meticulous division, which might be helpful not to overload the graphs with excessive amount of information.

While from a temporal stance, I will use one particular measurement: the number of days between the first case and until the response was introduced (*days_response*). This measurement might be negative in the cases when COVID019 responses were introduced before the first case was reported. On the basis of results for the *days_response* variable, I categorise all the countries into five categories, which are introduced by Rogers in "diffusion of innovations" (1983). These are in decreasing order of adoption pace (number of days before or after the first COVID-19 case): (1) innovators, (2) early adopters, (3) early majority, (4) late majority, (5) laggards (Rogers, 1983, p. 22). So that is why I have only one hypothesis for the *time* variable, because the mechanism of codification is almost identical, and yet Rogers' is more descriptive, Figure 5.

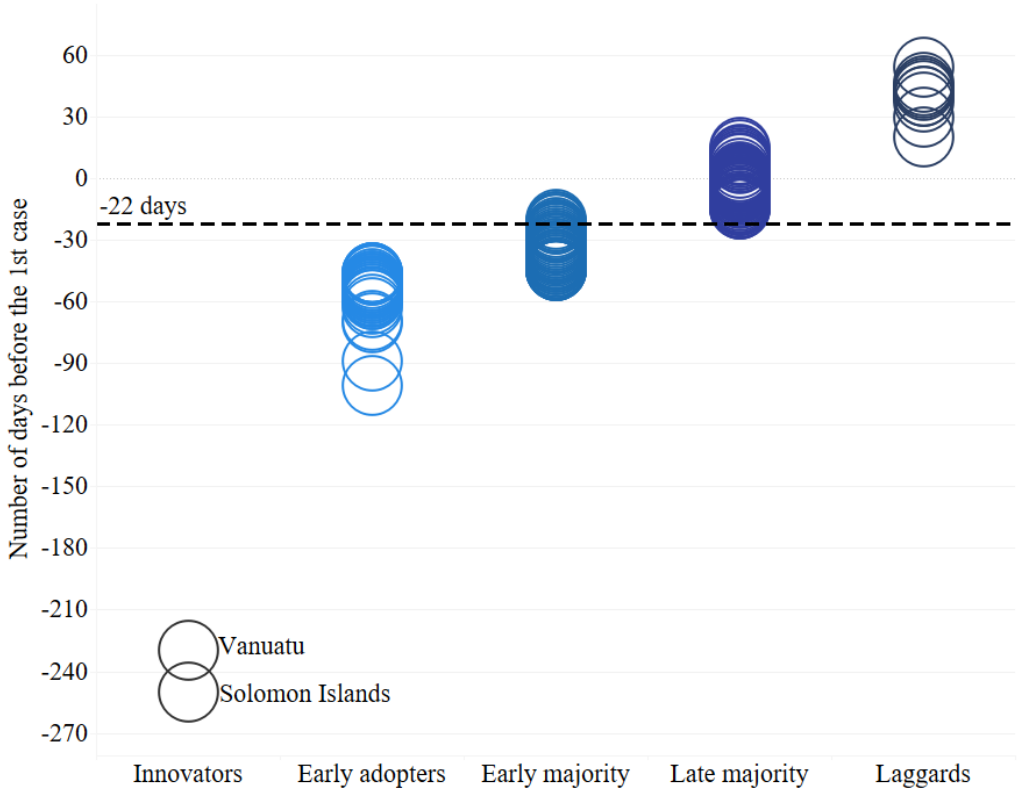


Figure 5. The distribution of countries in terms of adoption speed

In Figure 5, we can see the pattern in which states have implemented initial responses to the COVID-19. Unexpectedly, Vanuatu and Solomon Islands engaged in COVID-19 mitigation for about eight months before the first confirmed case was detected. These are clear outliers, and their behaviour cannot be explained. The other four categories are more reasonable and predictable. According to Rogers' model, we have 'early adopters' within the range of two months before the first case; 'early majority', who introduced restrictions in one month before; 'late majority' ranges between several days before and after the first case were confirmed; the last group is 'laggards' who has responded only after the coronavirus was found on the state's territory.

To summarise, it may seem that thesis has excessively complex and redundant operationalisation since there are more variables than there are hypotheses. If so, I have tried to recap the process of operationalisation on the same theoretical framework but with variables instead of concepts, Figure 6.

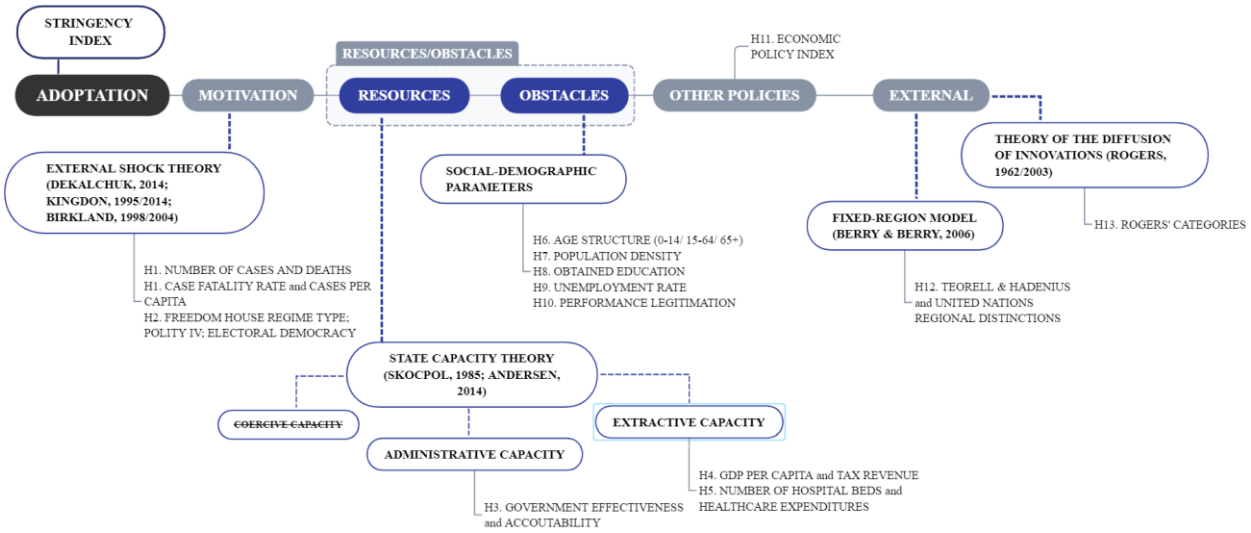


Figure 6. The operationalised version of a theoretical framework with an indication of hypotheses to which the variables are attributed

Additionally, the operationalisation process is encapsulated within the table, presented in Appendix 2, as well as the descriptive statistics for all the variables used in the analysis — Appendix 6.

3.3. Categorical recalibration of variables for Bayesian Networks

Since Bayesian networks require categorical data, this section aims to shed light on the principles of data recalibration, which are applied to the data operationalised in the previous paragraphs.

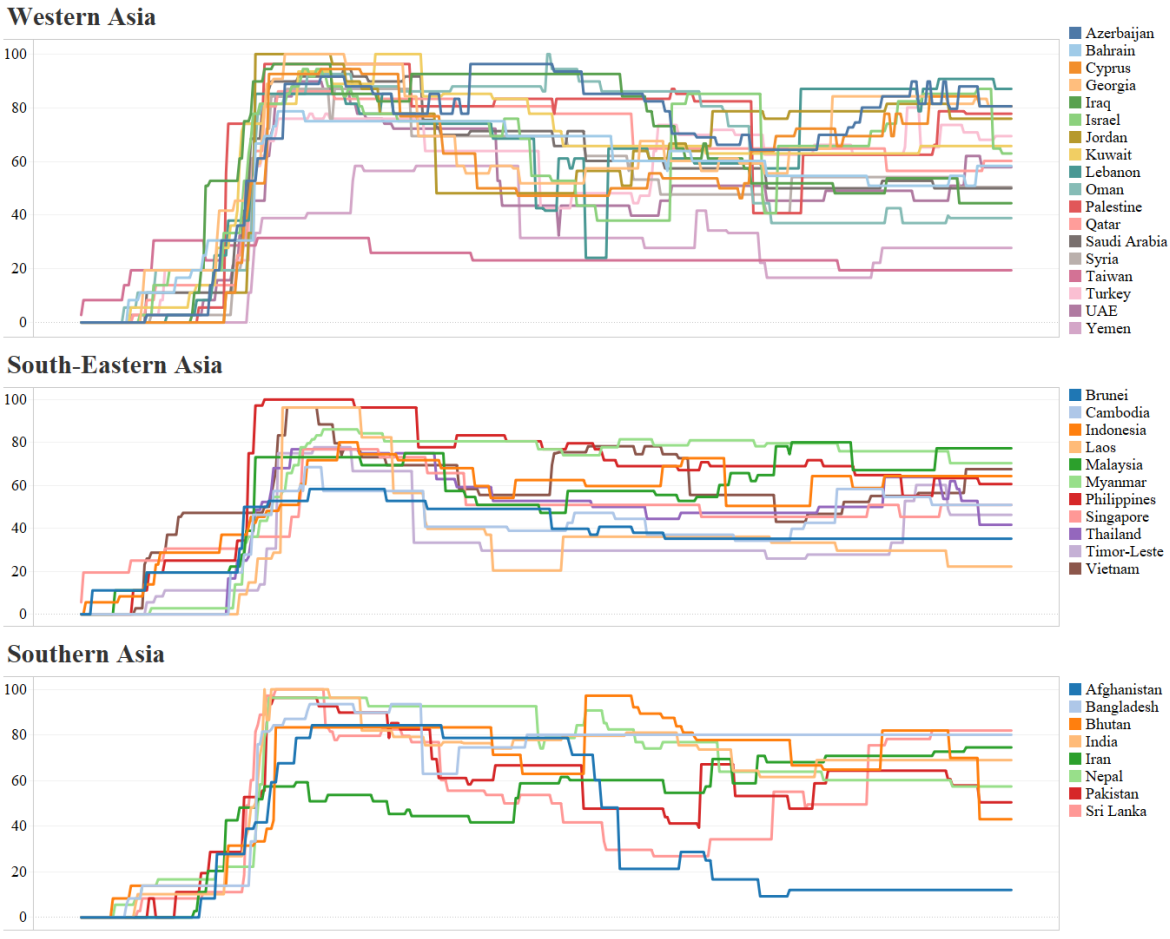
In the operationalisation segment, I have obtained a dataset with 24 independent variables, and the majority of them should be converted into categorical. I say majority since not all of them will be involved in the Bayesian tests, for example, *sub-regional division*, both by the United Nations and Teorell and Hadenius', because they have 17 and 10 levels respectively, which is too many for the analysis. All other variables were converted into categorical and binary on the basis of either logical justification, median values, or the categorisation via the cluster analysis. The median value was selected since, firstly, there is no significant difference between mean and median values; secondly, the sample consists of units with large differences between values that would affect the average values. Detailed calibration is presented in Chapter 4.4. and Appendix 3.

Chapter 4. Empirical analysis

This section will mostly consist of tables and graphs, aiming to answer the research question and prove or falsify the hypotheses. The general idea is to use the deductive manner of narration in this section: I would like to start with the general depiction of the situation with stringency in the world, which is the sample of this paper, with the help of visual statistics; the following section will bring in even more statistical notion with the correlations, coefficients of significance and preliminary linear regressions; the OLS regressions are the most common analytical tool, accompanying the correlations — this paper is not an exception, all findings from the correlation analysis will be tested with regressions; the analysis will be concluded with the Bayesian Networks, as a robust check, which put a full stop in this conversation about stringency.

4.1. Visual statistics

The primary purpose of this section, dedicated to visual statistics, is to restate the relevancy of the policy stringency topic and, what is more important, to draw general conclusions for the regions. Within this part, on the basis of the United Nations17-items regional distinction, I have drawn several graphs, which illustrates the trend of stringency development across the whole period of the coronavirus outbreak.



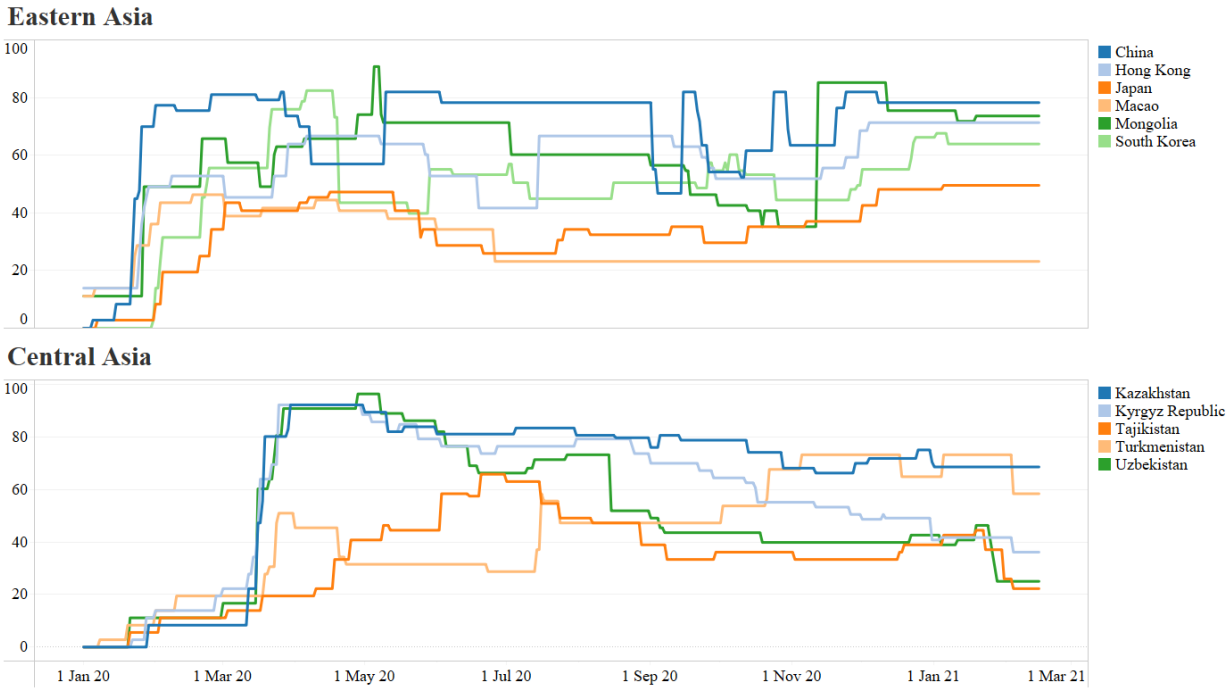
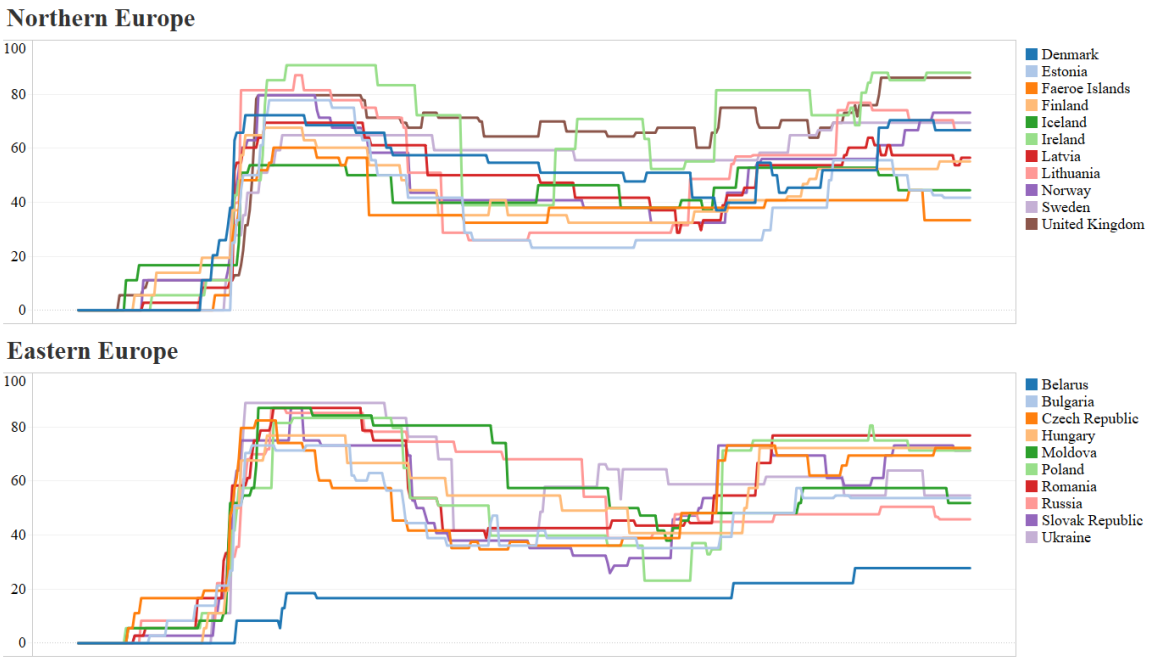


Figure 7. The development of the level of stringency in sub-regions of Asia

Figure 7 depicts the most striking and yet expected observation — countries in the Eastern Asia sub-region (e.g., Hong Kong, Mongolia, Macao) reacted faster and more decisively than their neighbours in the region. This can be explained by their physical proximity to China, the epicentre of the pandemic. At the same time, post-soviet countries in the Central Asia sub-region experienced some sort of delay in the response, despite their by-the-border neighborship with China, however, Hubei province is relatively far from Kazakhstan and the Kyrgyz Republic. Other sub-regions have a typical pattern of stringency diffusion.



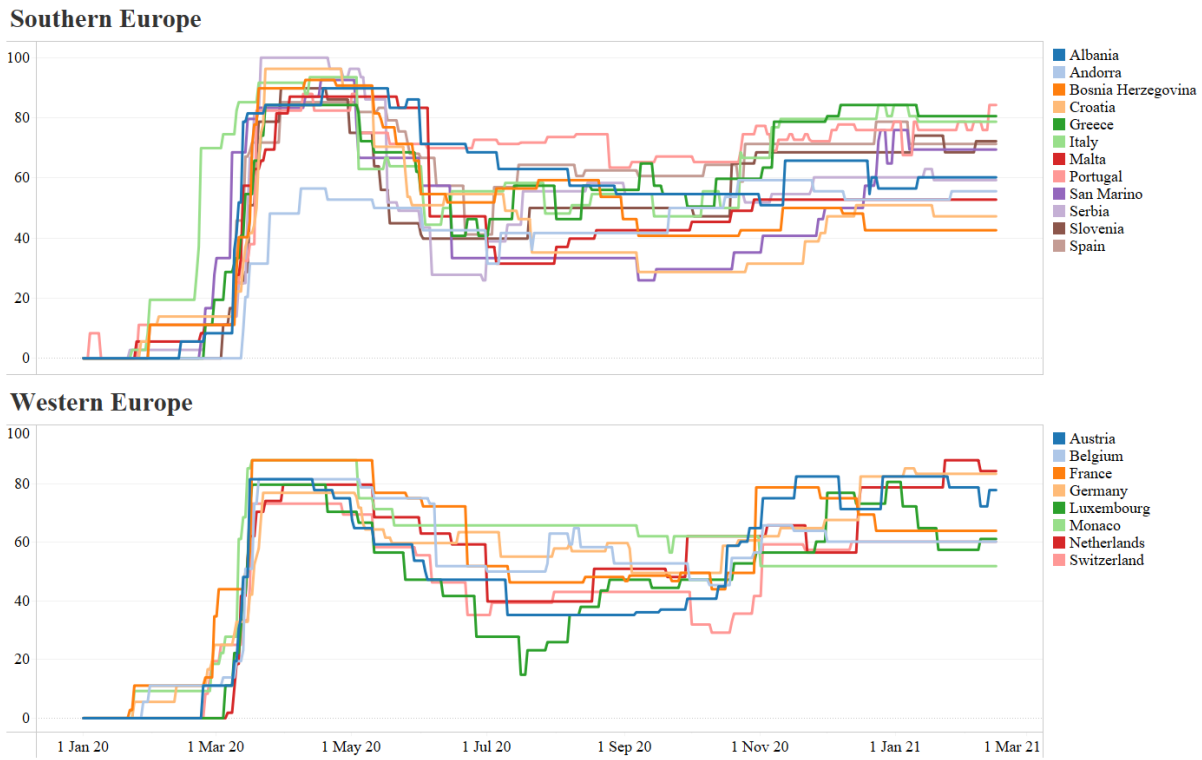


Figure 8. The development of the level of stringency in sub-regions of Europe

Yan with the colleagues, wrote that "there is no one-size-fits-all strategy that can be used to combat COVID-19 on a global scale" (Yan et al., 2020, p. 766). Nevertheless, according to Figure 8, it seems that the expanded European region tried to "fit in" the common strategy since the initial superficial overview shows that the response to COVID-19 was harmonised across the European sub-regions. The strict response in March lasted for a month, and then there was a gradual decrease in the level of stringency, which could be observed until October-November. Initially, two unique cases announced that they would not introduce draconic reactive measures: Belarus and Sweden. If the former instance has more immediate issues to deal with, apart from the COVID-19, especially since the president did not see any flying viruses to introduce any measures (*What Virus? Belarus Rejects Strict Measures against Pandemic*, n.d.), the former example had to follow the general agenda in the region, and now it is barely distinguishable from other countries in Northern Europe.

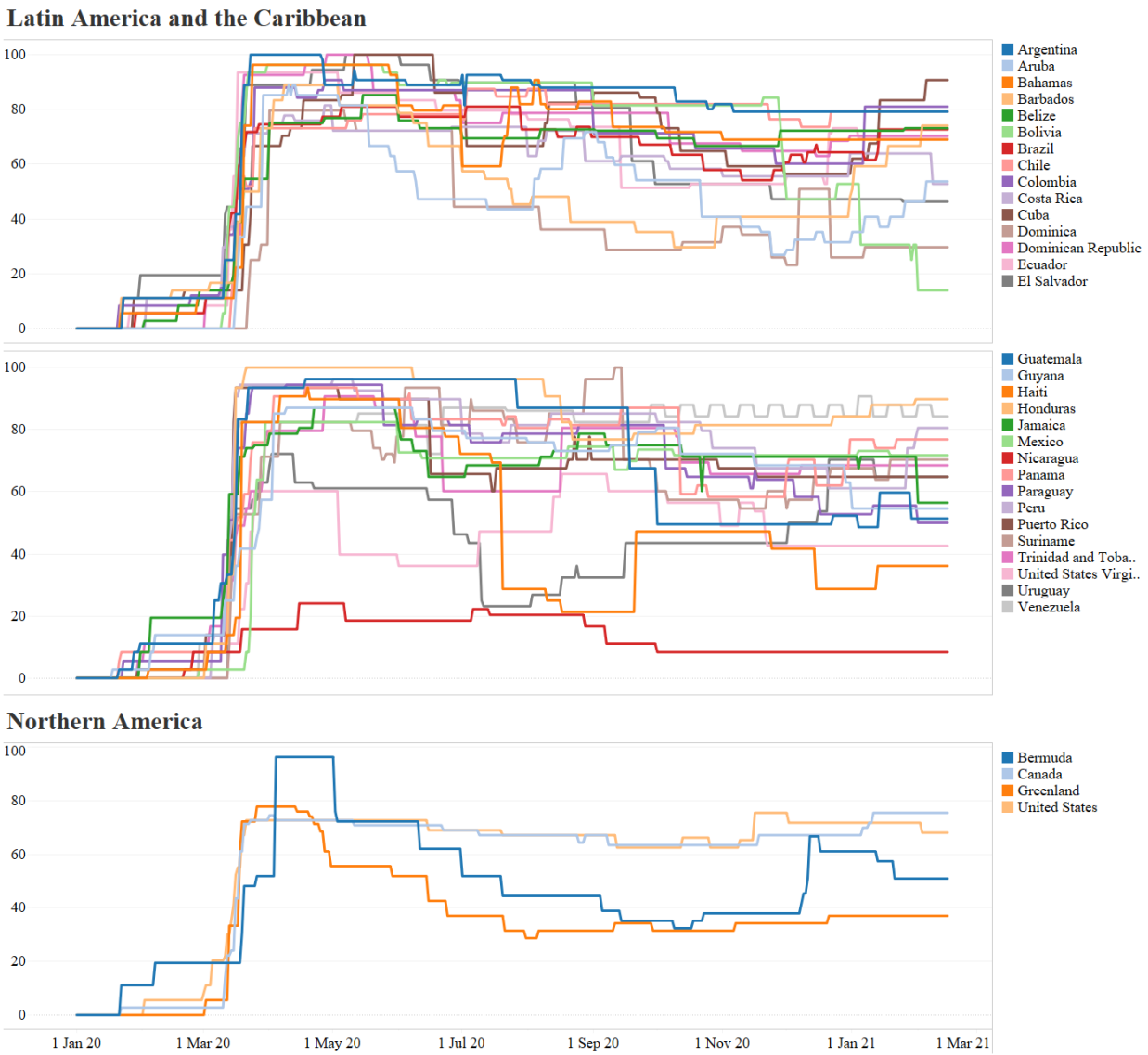


Figure 9. The development of the level of stringency in the sub-regions of the Americas

Figure 9 illustrates the most controversial and the most discussed region is America, the North one in particular, which has relatively high stringency up to the present day (i.e., Canada and the United States). In comparison to Greenland, Bermuda has vividly experienced the second way in December (*Bermuda Coronavirus: 699 Cases and 12 Deaths - Worldometer*, n.d.), which can also be traced by the spike in the stringency level.

Latin America and the Caribbean are all over the graph. Their responses do not constitute a cohesive and comprehensible pattern: in February, Bolivia almost lifted all non-pharmaceutical interventions, while Cuba is maxing out the stringency simultaneously; also, Nicaragua did not cross the line of 25 in terms of its stringency. If Europe, intentionally or not, chased the united response to the coronavirus, Americas decided to apply the “rollercoaster” method to the COVID-19 mitigation.

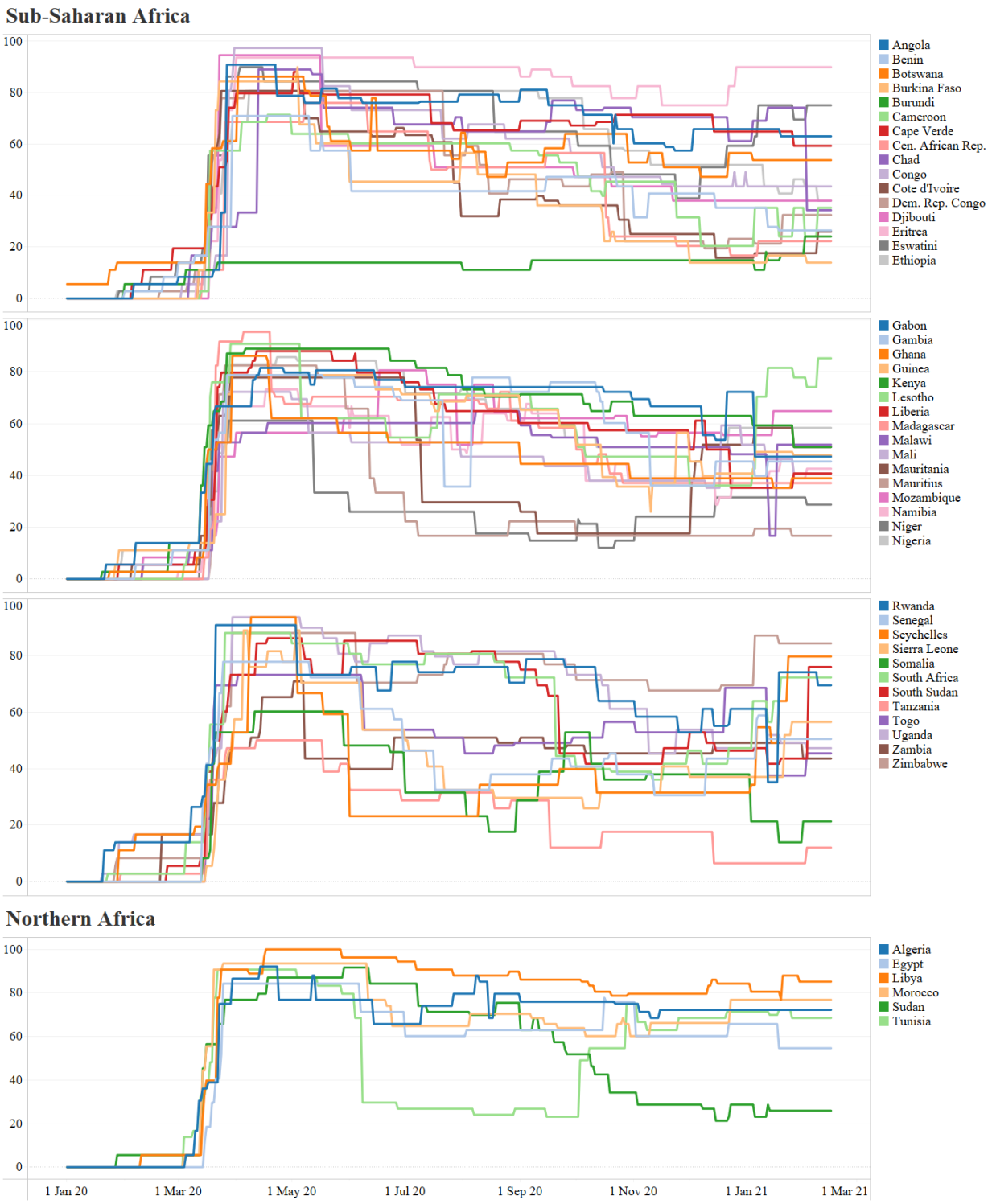


Figure 10. The development of the level of stringency in sub-regions of Africa

Africa is a unique region with various concealed mechanisms of state- and decision-making. The context of COVID-19 has proven it once again. As opposed to the Americas, which did not show any regularity, according to Figure 10, Sub-Saharan Africa has a pattern in not only fighting COVID-19 but also in not fighting it: Mauritania, Mauritius, Niger, Tanzania, Seychelles, and Somalia have almost identical levels of stringency — they have introduced restrictive measures at the same time as the majority of countries in the region, and then lifted lockdowns at

spring. Other states in the region did not make any haste decision and thus kept stringency at the mediocre-medium level.

In the Northern part of Africa, Tunisia is an 'outlier' of some sort since, at the end of May, it has reduced its stringency by about 50 points, and in two months, have returned to the previous level of stringency. Meanwhile, neighbours kept it stable and did not make such a drastic change in policy responses.

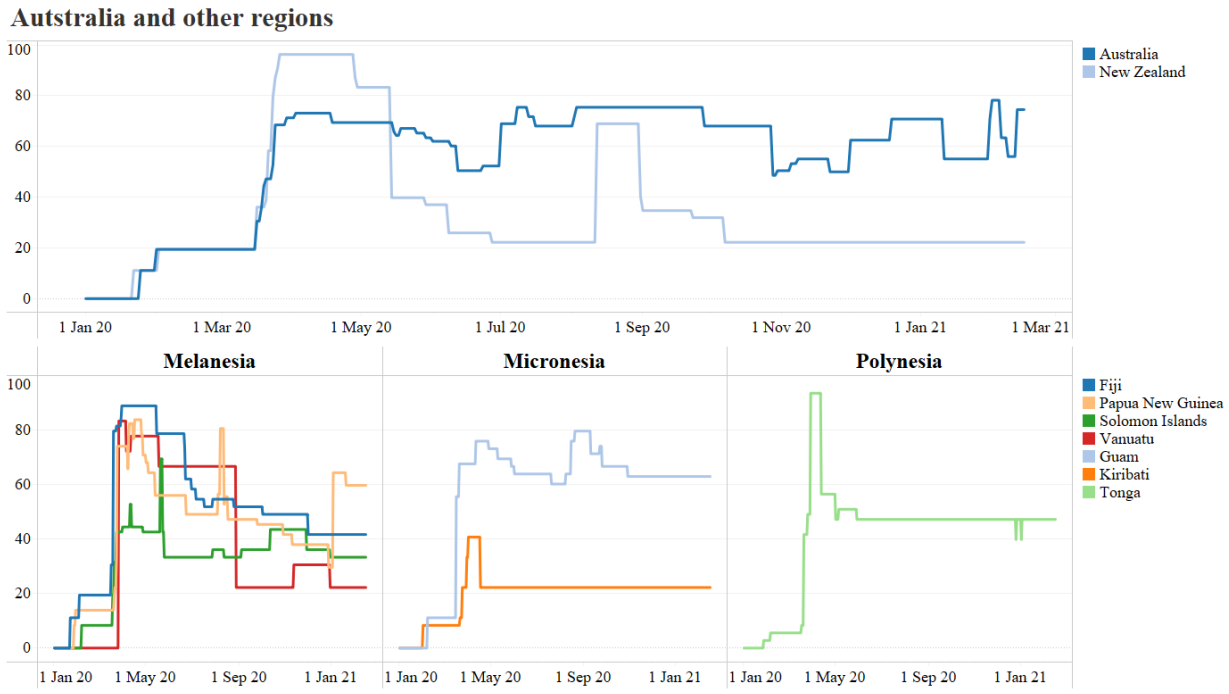


Figure 11. The development of the level of stringency in sub-regions of Australia, Melanesia, Micronesia, and Polynesia

New Zealand has made it to the headlines once it eradicated the COVID-19 virus and reduced the number of recorded cases to zero (*How Did New Zealand Become Covid-19 Free? - BBC News*, n.d.; *The First Countries That Eradicated COVID-19 - BORGEN*, n.d.; *Which Countries Have Zero Cases of Coronavirus and Is It Because They Aimed for Elimination? - ABC News*, n.d.). The 'flatline' is an optimistic tendency since the government did not become arrogant and still keeps an ear on the ground.

Figure 11 shows that countries in Melanesia, Micronesia, and Polynesia sub-regions all differ from each other in terms of stringency, and in general, this section showed that the level of stringency has been bifurcating in all regions throughout the year and a month. Still, we do not have an answer to the question, what factors have affected the stringency of policy response, but at least we know the 'personal' reactions of states.

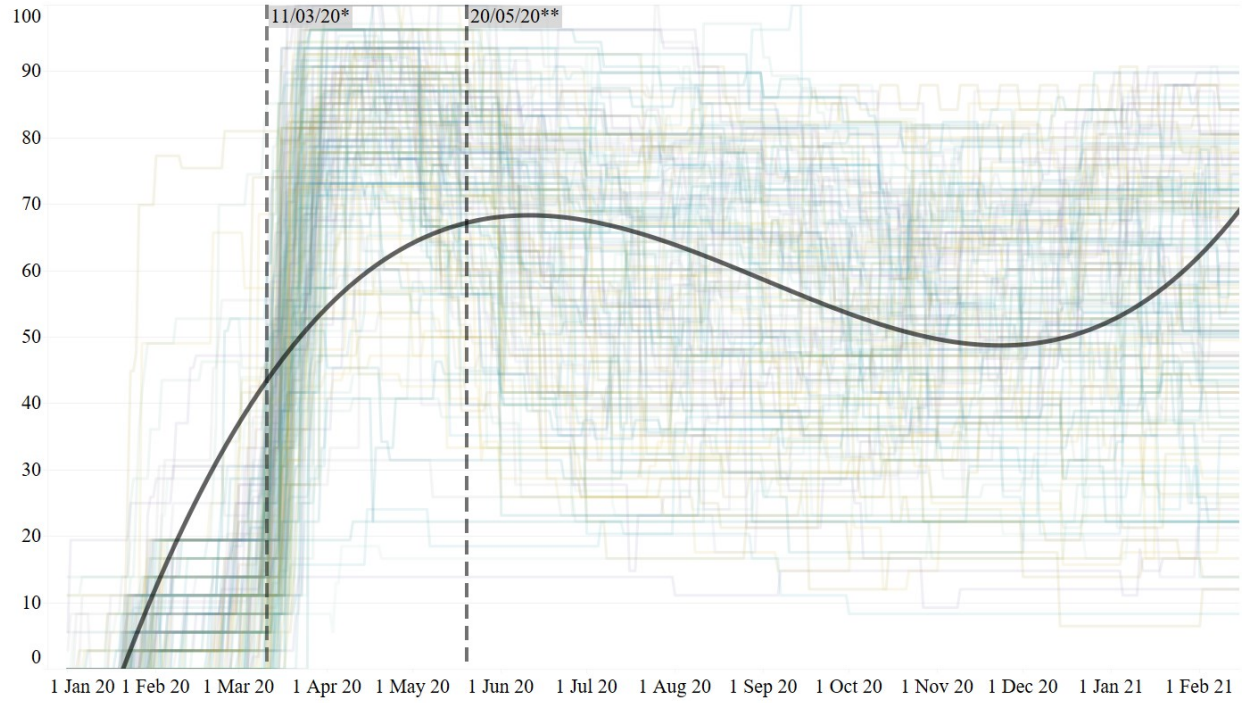


Figure 12. The general polynomial model for stringency level of COVID-19 responses
* 11 March 2020 — WHO announced the coronavirus to be a pandemic threat;
** 20 May 2020 — the approximate decline of the 1st wave of COVID-19.

Such an elaborated description of regional specificities in coronavirus responses provide us with an overall pattern of policy output, Figure 12: around 11th of March, all states initiated the decisive anti-COVID-19 measures, literally from 0 to almost 100 within the period of one month; as the 1st Wave was on the wane so was the level of stringency; after the June we can observe the 'disturbance' in responses since each state strives to individualise the set of policies to mitigate the costs, brought by the 1st Wave; and since the 2nd Wave has arrived, level of stringency rises again with a room for citizens to "brief" when initial measures were partly lifted.

Undoubtedly, the region-specific description pinpointed that this model does not apply to every state, but yet this graph partly falsifies Yan and colleagues' thesis about the absence of 'one-size-fits-all' model: there is a general, vague model, but we need to know which factors incentivise countries to follow it, to follow the way of high-medium stringency. I will try to figure it out in the following sections.

4.2. Correlation analysis

The premise of correlation analysis is quite simple; I would like to identify the presence or absence of association without identifying the direction of this connection between the daily stringency level and the independent variables. The correlation analysis uses the indicators pinpointed in the previous chapter. Additionally, since this paper is based on a complex framework with several concepts with detailed operationalisation, I have to split up the correlation output into several smaller, for the sake of simplicity, on the basis of the 'adoption equation'. Hence, there will be seven correlation models (i.e., *motivation*, *resources*, *obstacles*, etc.), and each will have 'stringency' as a dependent variable.

Several technical moments about the correlation. First of all, since this panel/time-series data is non-parametric, I use Spearman's correlation. For the clearer visualisation, I used the 'pairs.panels' function in the 'psych' package for the R software; not only does it show the coefficients of statistical significance, but it also presents the variable's distribution on the diagonal. Below the diagonal, there are scatter plots and fitted lines (*Pairs.Panels Function - RDocumentation*, n.d.).

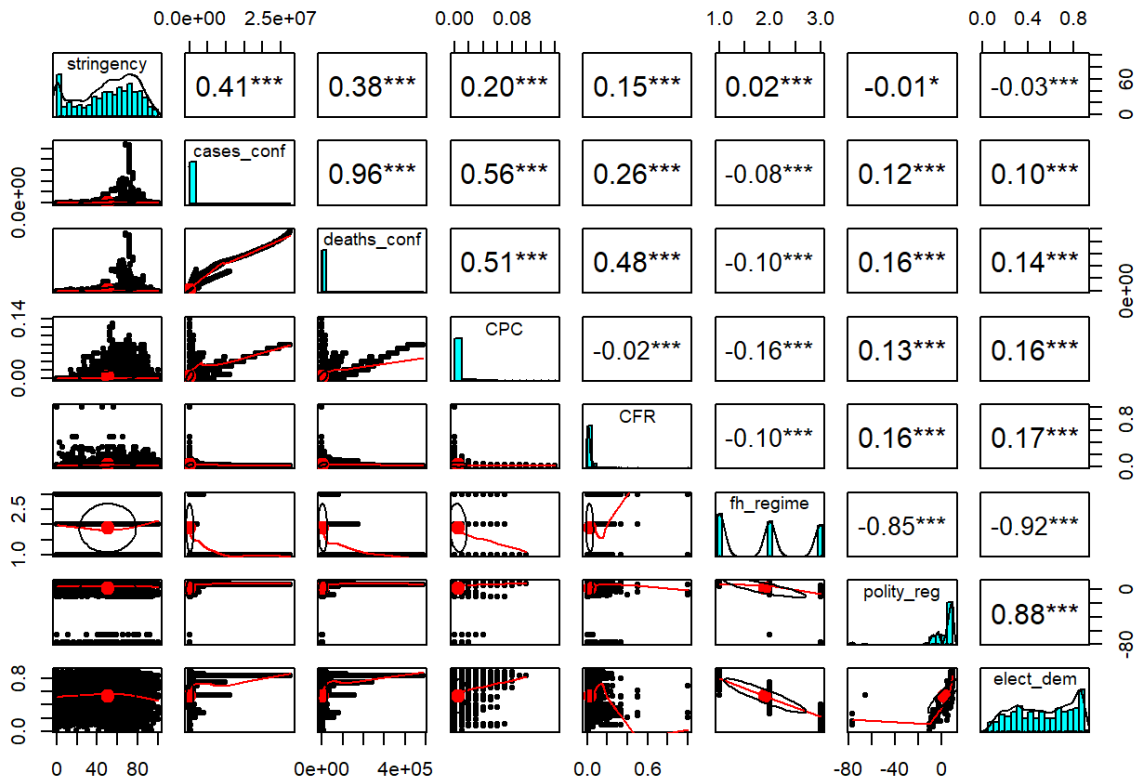


Figure 13. The correlation output for the *motivation* variables

Figure 13 pinpoints the first observation: all the variables in the model are statistically significant, but they drastically vary in terms of association power. For instance, the strongest association exists between all four variables, which were categorised as 'external shock's salience': number of confirmed cases (*0.41*) and deaths (*0.38*); cases per capita (*0.20*), and case fatality rate (0.15). Thus, the most straightforward conclusion is that the stringency of the COVID-19 response is positively associated with the indicators of the external shock in question. The 'regime' concept proves the anticipated connection between autocracies and increased stringency: Polity IV (*-0.01*) and electoral democracy (*-0.03*) indices show a relatively weak and still significant association between autocratic states and higher stringency. The same pattern is proved by the Freedom House measurement (*0.02*); it has another direction of the association because of the codification ('1' – 'Free' — '3' – 'Not Free'). At the same time, we might say that this regularity of autocracies producing more stringent COVID-19 policies is not so entrenched since the coefficients are relatively low, approach zero. Nevertheless, hypotheses 1 and 2 were proven by this preliminary correlation analysis.

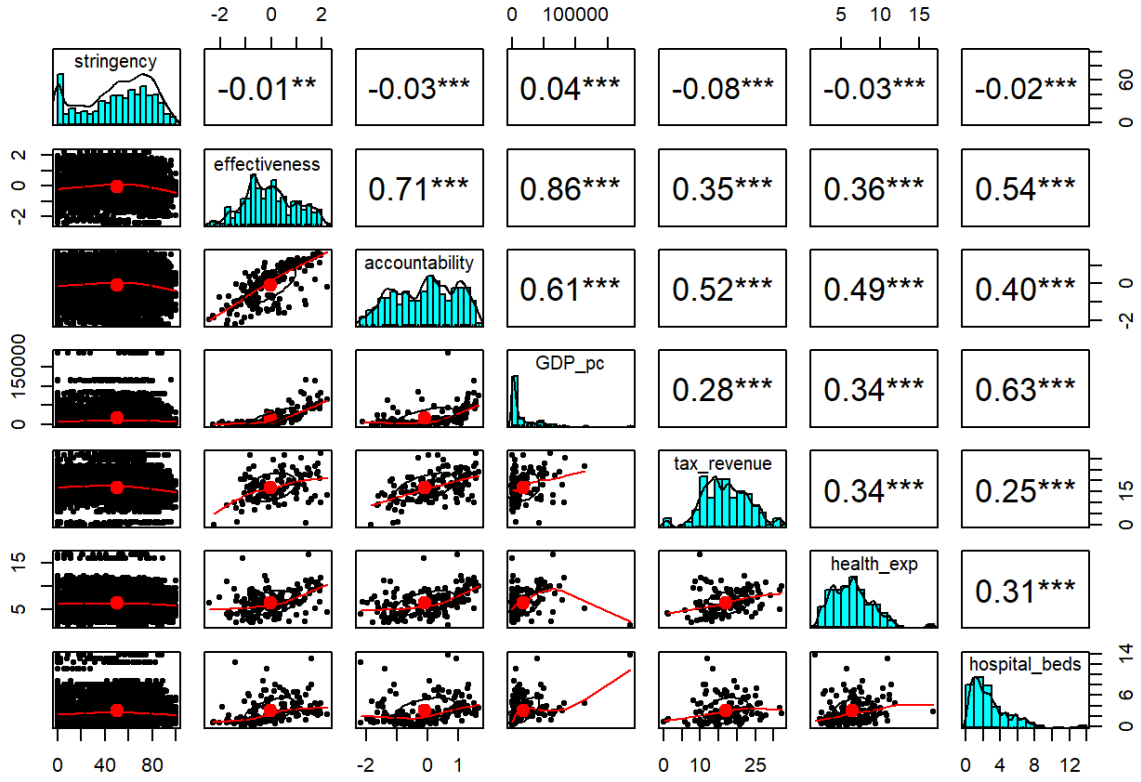


Figure 14. The correlation output for the *resources* variables

As with the *motivation*, the *resource* variables are also significant, but their significance is undermined by the low coefficients and contradicting results. For example, 'GDP per capita' and

'tax revenue', these variables are supposed to be the measurement for the same phenomenon of 'extractive capacities', and yet they illustrate different results: higher GDP is associated with higher stringency (*0.04*) (which goes in accordance with theory), simultaneously, higher tax revenue leads to less stringent responses (-0.08, the highest value of coefficient). This ambivalence requires additional scrutiny of the indicators and their nature.

Other variables are not so intricated: 'effectiveness' and 'accountability', besides their similarity, state that countries with higher government effectiveness (*-0.01*) or accountability (*-0.03*) tend to implement lenient coronavirus policies. The same logic applies to the 'healthcare capacities': a higher number of healthcare expenditures (*-0.03*) or hospital beds (*-0.02*) results in a lower stringency level since these capacities to manage with the number of infected. Regarding the *resources,* only one thing can be said for sure: their association with the COVID-19 policy-making is lower than the *motivation.* However, almost all mechanisms are in line with the theoretical assumptions.

Figure 15. The correlation output for the *obstacles* variables

Figure 15 has the first variable so far, which is not significant in the model — the primary education enrolment. While we are speaking about the level of education, measuring the cultural values, secondary (*0.04*) and tertiary (*0.03*) levels are connected with the higher stringency, which falsify hypothesis 8.

Society's age structure was frequently mentioned in the literature, and the correlation analysis proves the presence of an association between the more considerable proportion of older people (*0.05*) and a high level of stringency to protect them. At the same time, the prevalence of the middle-aged population also associated with higher stringency (*0.14*), almost thrice as much as it is with older people. The different expectancy of life might explain this.

The last three variables are 'population density' (*0.02*), which has a positive association with stringency; 'performance legitimation' (*0.03*) as a substitute for the institutional trust does also show a positive association with the dependent variable. However, the third variable goes against the theoretical explanation: a higher unemployment rate (*0.05*) is positively connected with the higher stringency — the most counterintuitive finding so far. Why would any state increase the stringency level when the citizens experience difficulties in the labour market?

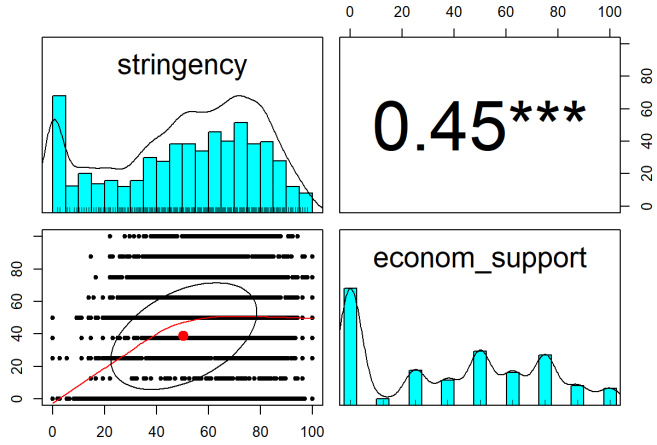


Figure 16. The correlation output for the *other policy* variable

Figure 16 is a small matrix because the *other policy* category has only one variable, this is economic support from the state. This variable (*0.45*) has a strong positive connection with stringency. Apart from the desire of a state to express care for its citizens, one of the theoretical explanations is the endogeneity, which is embedded in the COVID-19 policy-making. However, there are two counterarguments: firstly, even the distribution of variables shows the difference in their development; secondly, on the theoretical and operationalisation levels, these variables differ.

As a preliminary recap, the majority of hypotheses in *motivation*, *resources*, *obstacles*, and *other policies* segments were proven by the correlation analysis, however, assumptions about the 'effectiveness', 'tax revenue', 'education', and 'unemployment' were falsified. Despite the direction of the association, the 'strongest', having the largest value of the coefficient, variables

are the ones describing the severity of the external shock, the number of cases and deaths. This association can be better traced once visualised, Figure 17:

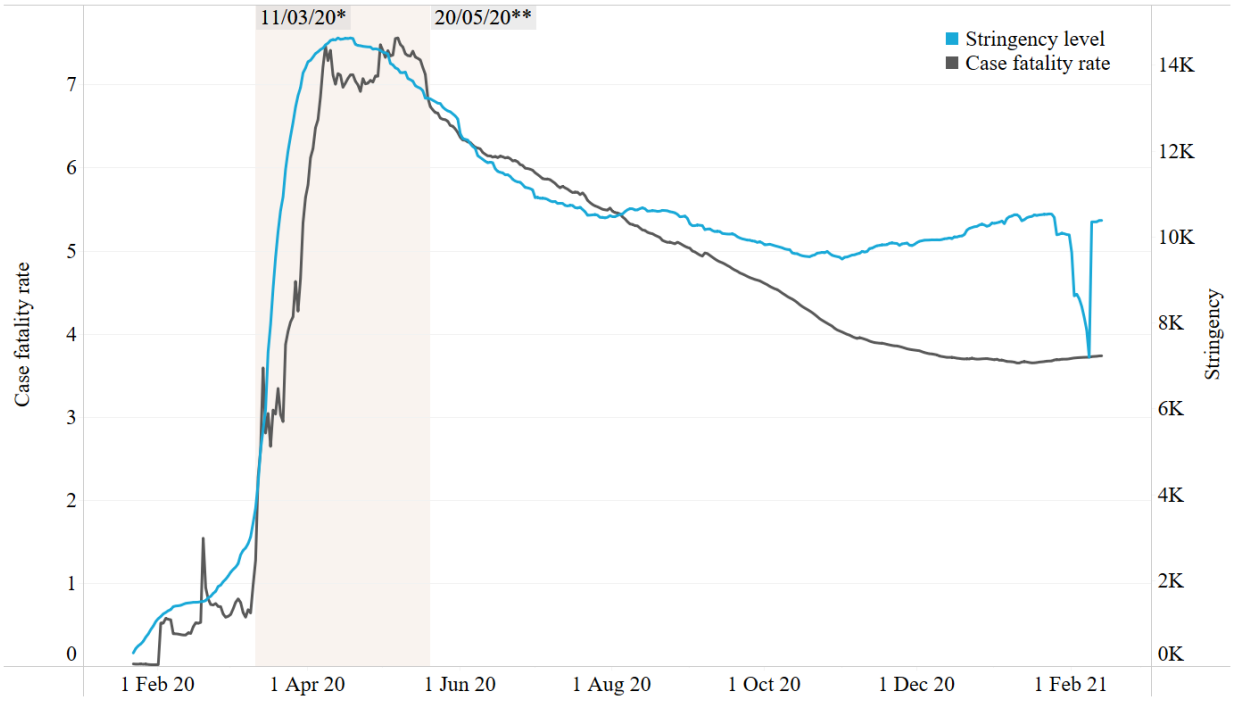


Figure 17. The correspondence of case fatality rate to the level of stringency throughout the COVID-19 pandemic

* 11 March 2020 — WHO announced the coronavirus to be a pandemic threat;

** 20 May 2020 — the approximate decline of the 1st wave of COVID-19.

Figure 17 made with the stringency level and case fatality rate (because a cumulative number of cases, deaths does not show dynamic, apart from a constant growth) makes the association even more apparent. The whole world reacts simultaneously to the increasing number of cases and deaths, and in order to prevent them, the global community introduce stringent response measures. What is more interesting is the "tail" of the graph: despite the decrease in the number of deaths per case, countries prefer not to lift the restrictions. Now let us move to the spatial and temporal dimensions, and since they have from 10 to 17 categories, I narrowed down the correlation analysis only to coefficients and 'stars'.

Table 3. The output of correlation analysis for *external* (regional division by Teorell and Hadenius) variables

No region	Eastern Europe and post-Soviet Union	Latin America	North Africa & the Middle East	Sub-Saharan Africa	Western Europe and North America
-,035**	-,037**	,135**	,078**	-,087**	-0,004
	East Asia	South-East Asia	South Asia	The Pacific	The Caribbean
	-,028**	-,028**	,060**	-,097**	,052**

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

The results for Teorell and Hadenius regional variables can be categorised into two groups: regions, which tend to have a stricter response, and those that do not want to limit their citizens' liberties. In the former category, I can place Latin America (*0,14*), North Africa and the Middle East (*0,08*), South Asia (*0,06*), and the Caribbean (*0,05*). Latin America has the biggest correlation coefficient, thus countries in this sub-region tend to have higher stringency level.

While in the latter: Eastern Europe and post-Soviet Union (*-0,04*), Sub-Saharan Africa (*-0,09*), Western Europe and North America (*-0,004*), East Asia (*-0,03*), South-East Asia (*-0,03*), The Pacific (*-0,097*). The low values of coefficients undermine the reverse association with the stringency, it seems that there are states within these sub-regions who did not respond harshly, despite the policy diffusion from the neighbours.

Table 4. The output of correlation analysis for *external* (regional division by the United Nations) variables

No region	Northern Africa	Sub-Saharan Africa	Latin America and the Caribbean	Northern America	Central Asia	Eastern Asia	South-eastern Asia	Southern Asia
-,047**	,055**	-,088**	,135**	-,013**	-,008*	-,018**	-,028**	,055**
Western Asia	Eastern Europe	Northern Europe	Southern Europe	Western Europe	Australia and New Zealand	Melanesia	Micronesia	Polynesia
,084**	-,039**	-,060**	-0,001	0,000	-,021**	-,060**	-,049**	-,034**

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Personally, I was primarily interested in the United Nations regional distinction since, for them, I have a separate segment on visualisation, this section might provide me with a more vivid picture of stringency in 18 units.

When I was speaking about Africa, I mentioned that visually, countries in the regions have a pattern in both increasing and decreasing the stringency, and now it is supported by the correlation analysis: Northern Africa (*0,06*) tend to be stricter than Sub-Saharan Africa (*-0,09*). In

this model, Latin America has a relatively big positive coefficient value (*0,14*), as was already shown in the previous model. At the same time, Northern America shows a negative association (*-0,01*); this might be caused by the relatively low level of stringency from Greenland and Bermuda.

Asia is a region with different responses, as I predicted in the visual speculation part, Eastern Asia, despite the early response, did not show a positive association with stringency (*-0,02*), it might be explained with effective measures taken by China, leading to the overarching control over the territory. That is why Eastern, Central (*-0,01*), and South-eastern (*-0,03*) sub-regions of Asia do not raise the level of stringency — the situation is under control. Meanwhile, Southern (*0,06*) and Western Asia (*0,08*) insist on introducing more stringent measures.

In general, according to the model, Europe is lenient in its response to the COVID-19m since all four sub-regions have a negative association with the level of stringency (*-0,04* and *-0,06* for Easter and Northern Europe, respectively), however, there are two sub-regions with insignificant statistic associations: Southern (*-0,001*) and Western Europe (*0,00*).

Finally, the last set of sub-regions has a negative association with stringency, and in general, this trend can be seen with the naked eye (Figure 11): Australia and New Zealand have a negative association since New Zealand has won the fight against coronavirus (*-0,02*); Melanesia (*-0,06*), Micronesia (*-0,05*), Polynesia (*-0,03*) have a negative connection with a degree of stringency.

As for summarising remarks, the results for the regions presented by the correlation analysis do match the speculations on the graphs in the first part of the empirical chapter. Moreover, what is more critical, both types of regional categorisation do not vary in their results. Additionally, they also consider the ‘tail’ of the graphs, which drastically differ from the initial response to the outbreak, they alleviate the overall degree of stringency.

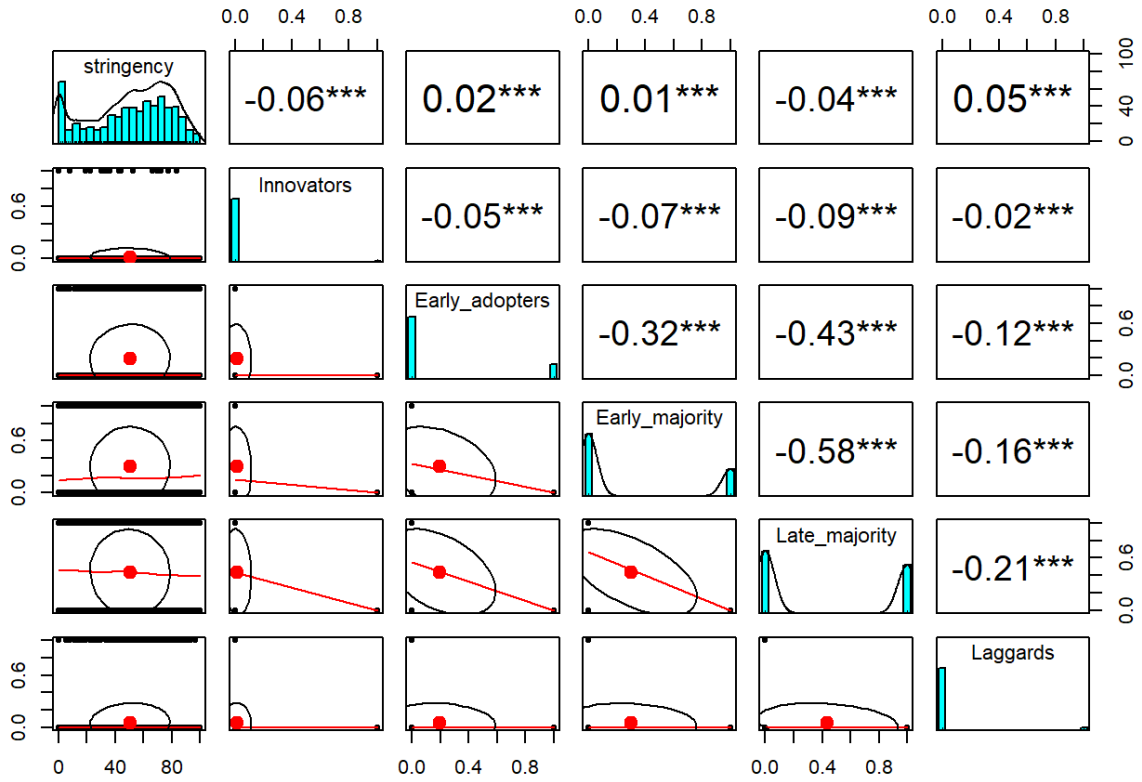


Figure 18. The output of correlation analysis for *external* (time-related aspect by Rogers' categories of adopters) segment of the policy diffusion equation

Once the effect of macro-variables and regional belonging was discussed, it is time to move to the time-related parameters — the final part of the correlation analysis is presented in Figure 18. All in all, correlation output shows that on the contrary, 'innovators' (*-0.06*) are associated with the lower stringency, but this conclusion can be ignored because I have shown in Figure 5, the 'Innovators' category has only two cases. Nevertheless, the initial hypothesis about the early response cannot be proven by the Rogers' categories because the 'late majority' (*-0.04*) cluster also has a negative association with the stringency.

However, if I change the dependent variable to the stringency on the 100th recorded case and omit the outliers, I will get the following image, Figure 19:

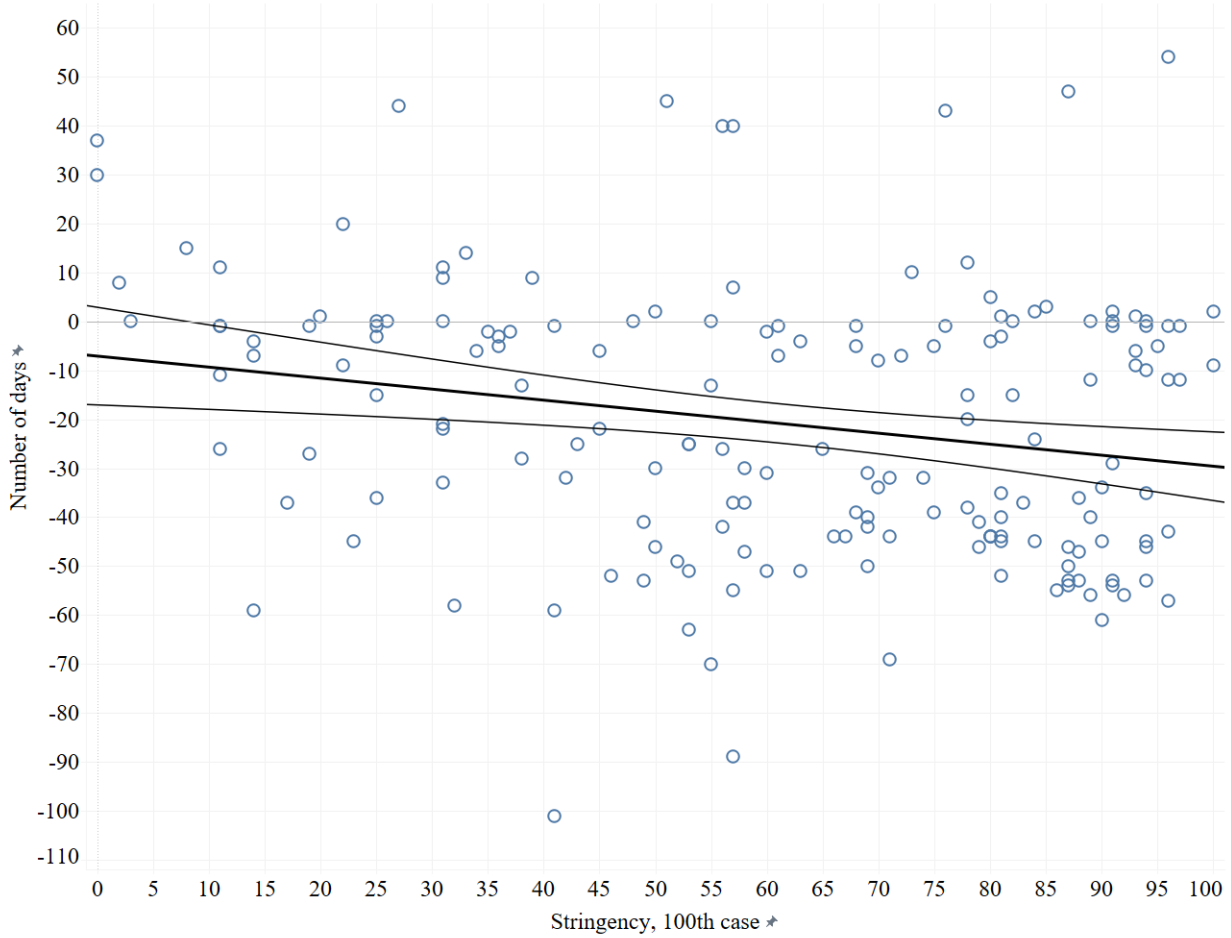


Figure 19. The scatter-dot plot with a trend line and confidence bands

The trend line is a linear trend model, predicting the stringency, its output is presented in the table.

Table 5. The output for the regression model, used in Figure 19

Coefficients	**Value**	**StdErr**	**p-value**
intercept	56,7942	2,52303	< 0,0001
days_before_response	-0,218714	0,07328	0,0032528

This binary linear regression model supports the visual explanation of the association between the variables: earlier response leads to a more stringent response to the COVID-19 (*-0,278*). This strong connection is significant on the level of 0,003. So, another hypothesis has been proven, but not for Rogers' categories.

As a result, so far, I have conducted the visual-descriptive analysis for the regional distinction and then tried to complement it with correlation analysis. Even these two tests provide me with enough information to prove or falsify the hypotheses in question. In general, the most common *motivation* variables have the highest degree of association with the level of stringency,

especially the number of cases, deaths, and derived measurements (i.e., case fatality rate and cases per capita). Other variables have much weaker correlation coefficients, thus indicating a smaller association with the stringency.

4.3. Regression analysis

Since correlation analysis is applied to test the presence or absence of the association between the variables, it cannot state the causal mechanism between them. For instance, the previous models showed that the level of stringency and the healthcare capacities are negatively connected; however, this is not the indication of how one variable changes under the effect of another. Moreover, presented correlation models do not consider the effect of other variables within the model — what if regions variables have the highest explanatory potential? For the sake of quantitative integrity and in order to eliminate the abovementioned shortcomings, the correlation analysis will be backed up by the regression analysis, the Ordinary Least Squares method. So, the narrative will be structured in the following order: firstly, a couple of words will be dedicated to the technical aspect of OLS regression on the panel data; secondly, I will present and elaborate on several models with different sets of variables, which serves as triangulation for visual and correlation analyses.

4.3.1. Technical aspects

Coronavirus pandemic is a high-speed crisis, the aftermaths of which were measured on a daily basis. This includes the number of cases/deaths, and what is more crucial for the paper is the level of stringency. As a result, the regularly updated indicator as ‘stringency’ is not independent of the timeframe, thus creating a ‘day-country’ panel dataset — “having both a cross-sectional and a time-series dimension, differs in some important respects from an independently pooled cross-section” (Wooldridge, 2012, p. 448). The most widespread technical issue for this sort of data is ‘autocorrelation’: the next value of stringency might depend on the previous value, and in order not to convert this paper into the technical explanation what is the issue with the dataset, I will show only three graphs, Figure 20-21.

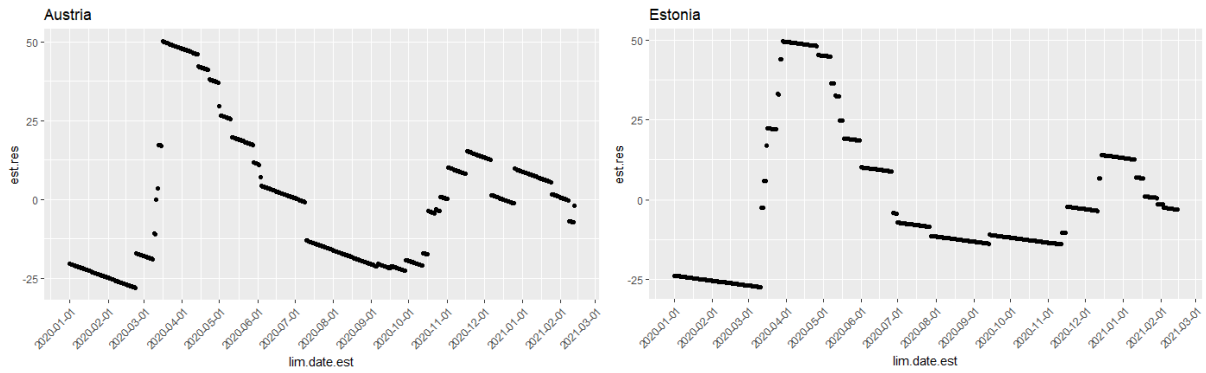


Figure 20. The distribution of residuals for the 'Austria' and 'Estonia' cases

The graphs in Figure 20 illustrate the pattern of residuals' distribution for two random cases. The distribution for Austria and Estonia almost identical with minor divergences. Even this visualisation indicated that the autocorrelation issue exists for individual countries since the pattern for stringency is similar.

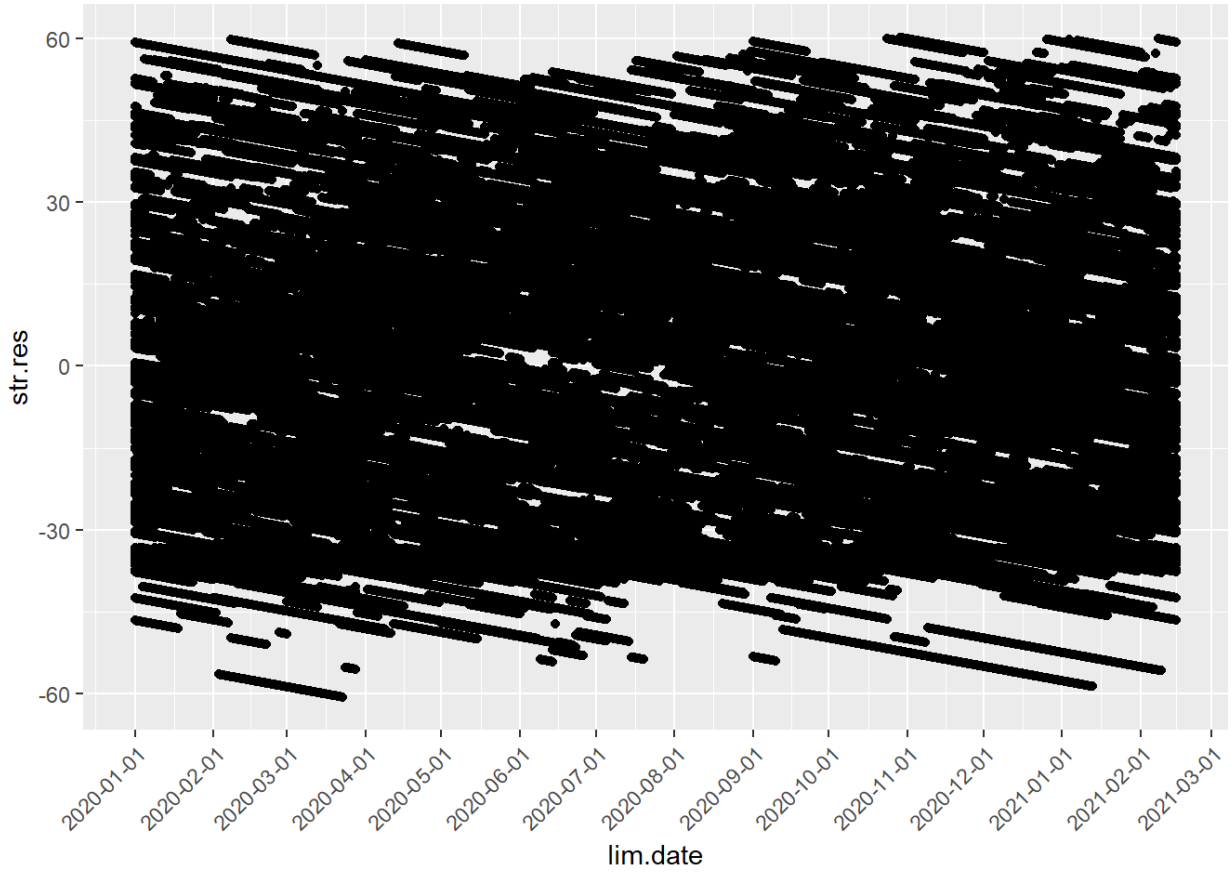


Figure 21. The distribution of residuals for all 185 cases in the dataset

However, Figure 21 shows that this patterned distribution of residuals does not occur on the whole sample, thus the OLS regression is applicable; at least, the sewn-in autocorrelation does not undermine the reliability and plausibility of the results. Additionally, my methodological

design has never implied the control for fixed-country effects, only for regional effects. That is why the following regression analysis will revolve around OLS regressions.

4.3.2. Regression models

Table 6. The regression output for Models 1-4. Dependent Variable: 'stringency level'

	Model 1	**Model 2**	**Model 3**	**Model 4**
Predictors	*Estimates*	*Estimates*	*Estimates*	*Estimates*
(Intercept)	5439.82 *	1604.63	9872.84 ***	15917.99 ***
cases_conf	-0.00 ***	-0.00	-0.00 **	-0.00 ***
deaths_conf	0.00 ***	0.00 **	0.00 ***	0.00 ***
CPC	542.30 ***	520.65 ***	505.74 ***	539.60 ***
CFR	45.45 ***	22.00 ***	47.45 ***	60.43 ***
fh_regime	1.24 *	2.69 ***	6.04 ***	4.03 ***
polity_reg	0.89 ***	1.11 ***	1.13 ***	0.78 ***
elect_dem	-7.69 ***	-8.63 ***	-12.55 ***	-5.32 **
effectiveness	1.18 **	6.21 ***	2.34 ***	2.29 ***
accountability	-4.09 ***	-1.56	4.11 ***	-2.29 *
GDP_pc	-0.00 ***	-0.00 ***	-0.00 ***	-0.00 ***
tax_revenue	-0.20 ***	-0.20 ***	-0.24 ***	-0.13 ***
health_exp	-0.36 ***	-0.92 ***	0.03	-0.55 ***
hospital_beds	-0.83 ***	-0.37 ***	-0.33 *	-1.10 ***
age0_14	-41.53	-2.48	-85.51 ***	-146.39 ***
age15_64	-41.65	-3.09	-86.06 ***	-146.53 ***
age_65	-42.45	-4.30	-87.02 ***	-147.21 ***
pop_density	-0.00 ***	0.00 ***	0.00 ***	-0.00 ***
primary	0.09 ***	0.11 ***	0.10 ***	0.18 ***
secondary	0.01	-0.10 ***	-0.03 **	-0.04 ***
tertiary	0.05 ***	-0.03 ***	-0.05 ***	0.07 ***
unemployment	0.17 ***	0.15 ***	-0.05	0.06
perf_legitim	0.64 ***	1.00 ***	1.08 ***	0.41 *

econom_support	0.32 ***	0.34 ***	0.32 ***	0.32 ***
date	-0.07 ***	-0.07 ***	-0.07 ***	-0.07 ***
Eastern_Europe_post_Soviet_Union	—	14.51 ***	—	—
Latin_America	—	14.21 ***	—	—
North_Africa_the_Middle_East	—	11.88 ***	—	—
Sub.Saharan_Africa	—	-9.84 ***	—	—
Western_Europe_and_North_America	—	31.22 ***	—	—
South.East_Asia	—	-2.84 ***	—	—
Northern_Africa	—	—	0.59	—
Sub.Saharan_Africa.	—	—	-25.32 ***	—
Latin_America_and_the_Caribbean	—	—	-8.67 ***	—
Northern_America	—	—	-8.21 ***	—
Central_Asia	—	—	-5.33 ***	—
South.eastern_Asia	—	—	-20.63 ***	—
Southern_Asia	—	—	-17.65 ***	—
Western_Asia	—	—	-3.34 **	—
Eastern_Europe	—	—	-14.64 ***	—
Northern_Europe	—	—	-8.53 ***	—
Southern_Europe	—	—	-2.23	—
Western_Europe	—	—	-8.58 ***	—
Early_adopters	—	—	—	8.55 ***
Early_majority	—	—	—	8.44 ***
Late_majority	—	—	—	1.76 ***
Observations	26012	26012	26012	26012
R^2 / R^2 adjusted	0.299 / 0.299	0.361 / 0.360	0.349 / 0.348	0.315 / 0.315

- *p<0.05 ** p<0.01 *** p<0.001*

The final result of the OLS regression analysis is the models presented in Table 6. Since the initial output is too bulky, this table has only β-coefficients for the determinants and their statistical significance, which is marked with stars (*)[10].

The four models differ in the number of variables in them. Model 1 has variables, which can be attributed to *motivation*, *resources*, *obstacles*, and *other policies.* Model 2 has additional variables about Teorell and Hadenius' regional division (6 indicators). Consistently, Model 3 has coded the UN's regional distinction (12 indicators). Finally, Model 4 introduces Rogers' categories to the analysis (3 indicators).

Regarding the results, the only sensible way to interpret the regression output is across all four models, and if the direction of the variable's effect change, then the corresponding hypothesis cannot be fully proven. Hence, following the correlation analysis, the indicators for crisis' salience positively impact the level of stringency with relatively high coefficients: effect of 'Cases Per Capita' varies from *505* to *542* for a single unit, while for 'Case Fatality Rate' — from *22* to *60*. These variables do not lose their significance across the models even after the introduction of other variables.

Regime variables are stable across the models; however, their influence is not so univocal as it was in correlations. Freedom House categorical index (*1.24 — 6.04*) and 'electoral democracy' index (*-5.32 — -12.55*) states that autocracies do produce high-stringency COVID-19 responses, while 'Policy IV' (*0.78 — 1.13*) insists that the opposite is true. Nevertheless, since former indicators have lower values of coefficients and two out of three regime variables prove that autocracies are more stringent, this will be taken for granted but mentioned in the limitations section.

Governance indicators — 'effectiveness' and 'accountability' — provide more curious results in comparison to correlations. The former indicator (*1.18 — 6.21*) states that higher effectiveness results in higher stringency, which goes along with the theoretical assumptions, while the latter variable (*-1.56 — 4.11*) is not so consistent: 'accountability' has a significant negative connection with the stringency only in Models 1 and 4, while in Model 3 it changes its direction. As I stated in the operationalisation section, this mechanism of 'accountability' is embedded in the regime variables; thus, the theoretical framework did not any hypothesis about the separate mechanism of transparency, but this might be another direction for research about trust and accountability.

[10] More detailed regression output can be provided upon request.

Economic wellbeing was supposed to create a safety bag in case of stringent policies implementation, both for authorities and citizens. However, this mechanism is not witnessed in the regression model: an increase in the revenue from the taxation system (*-0.13 — -0.24*) leads to decreasing level of stringency. This paradox cannot be explained at this level of research.

At least with healthcare capacities, everything is clear. The more capacities there are at the state's disposal, the lower is the stringency level because the healthcare system can manage the influx of patients. Every quantitative test of this paper supports this association.

The society's age structure constitutes another chaotic interpretation because all three variables have the same fluctuation and almost the same coefficients across the models: age is insignificant in Models 1 and 2, and then it has a significant negative association with the stringency in Models 3 and 4. This might indicate the necessity to recalibrate the models or the operationalisation of the variable.

The education variable does not shed light on the question of stringency due to the inconsistency in the output: the higher spread of only primary education (*0.09 — 0.18*) leads to higher stringency; the opposite is true to the secondary education (*-0.03 — -0.1*); as for tertiary education, it has a positive association in Models 1 (*0.05*) and 4 (*0.07*), and negative in Models 2 (*-0.03*) and 3 (*-0.05*).

In the same manner, as during the correlation analysis, the unemployment rate insists on the positive connection (*0.15 — 0.17*) with the stringency level, thus violating the initial presupposition.

The last variable in the *obstacles* part is the institutional trust, which is operationalised as the 'performance legitimation'. The regression analysis states that states with a higher degree of trust (*0.41 — 1.08*) have higher stringency. This statement is proven across all four models.

The only indicator, which can be attributed to the category of '*other policies*', is the state's policies, providing economic support. Their impact is constantly positive (*0.32 — 0.34*).

An additional indicator, which serves as a control variable, is the 'date', and after correlation analysis, the negative association (-0.07) is not perceived as a surprise. Not only the state cannot maintain a high level of stringency for long periods, but also it does make sense that in the course of time, a state might reduce the stringency after the possible 'overreaction'.

There is not much sense to interpret the regional and adaptation categories variables due to their control nature and dummy codification. Ideally, these binary variables should be additionally studied via the logistic regression method in order to estimate the probability of getting into

different categories of stringency. The last substantial technical aspect is the R^2, the coefficient of determination. In simple terms, this parameter indicates the percentage of cases, which the models can explain, and this coefficient is almost homogeneous across all four models: Model 1 — 0.29 (30%); Model 2 — 0.36 (36%); Model 3 — 0.35 (35%); and Model 4 — 0.32 (32%). Model 2 has the highest explanatory potential.

As a recap for regression models, first of all, it was a necessary analytical step, complementing the results of correlation analysis. The main hypotheses were supported once again, and some side-assumptions were exposed (i.e., accountability, age structure). The more substantial interpretation of those will be provided in the 'Discussion' section regarding the other findings.

4.4. Bayesian Networks

In order to conduct the robust check for the abovementioned results and finding, I will conduct another test with the help of Bayesian Networks. Additionally, I will try to show how political science and policy analysis branches can benefit from the use of Bayesian Networks. In my prospectus, I have described the Networks method as a combination of Qualitative Comparative Method and Logistic (Polynomial and Ordinal) Regressions, but which are more straightforward in terms of interpretation.

Before moving to the method itself, and since the calibration of variables was already described in the respective section of the thesis, a couple of words should say about the data for these methods. In all previous tests, I was using panel data with the 'country-day' unit of analysis; for this method, I have collected and aggregated data in a format where one country was one observation. Thus, I have changed the dependent variable from the 'daily level of stringency' to the 'mean level of stringency'. Additionally, I had to omit some of the variables since, in the new format of data, they have an excessive number of missing data, and known tools of data imputation could not be applied[11]. Also, since the method of Networks seeks to find causality between every variable in question, I have excluded redundant indicators[12]in order to reduce the number of possible iterations within the model.

[11] These variables are: level of primary (31 case of missing data), secondary (55 cases), tertiary (61 cases) educations.
[12] These indicators are: 'index of electoral democracy' and 'Polity IV index', which duplicated the 'Freedom House categorisation'; 'accountability', because the initial hypothesis revolves around the concept of 'effectiveness'; 'proportion of population 0-14/15-64', since the initial hypothesis was formulated to the influence of elderly population on the stringency; 'confirmed cases/deaths', since the are well captured by the 'cases per capita' and 'case fatality rate'.

Since Bayesian Networks are the part of Machine Learning ('black box' type) and Probability Graphical Modelling, there are three ways of construction: the first one is the one which is constructed without machine intervention, solely be the researcher — the most biased approach; the second option is the opposite scenario, in which machine compiles the structure and parameters by itself — this alternative has high chances of turning into a barely connected mess, in which I cannot even control the DV and IVs; finally, the third way, which will be used in the paper, combination of the theoretical framework and machine learning — nodes and structure will be given to the machine, while the connection between nodes will be established based on data (Chai et al., 2020, p. 3). The result of the constraint graph modelling is presented in Figure 20.

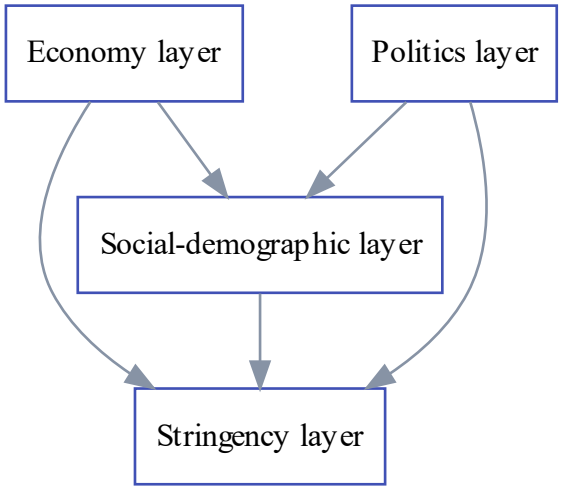


Figure 22. Constraint graph, which delineates sets of variables

So, there are three substantial and one technical layer; the former is 'economy, politics, socio-demographic layers' and the latter is 'mean layer of stringency'. A detailed description of the set of variables belonging to the layers is presented in Appendix 4. The purpose of the graph is to reduce the level of uncertainty in the model, since, judging by the statistical characteristics of the data, the model can make the connection between variables, which are not even related: for example, in some iterations of the model the influence of 'elderly population' on 'political regime' could be seen, which does not make any sense. Ideally, the constraint graphs should be more complex, with self-loops and additional layers; however, this particular structure is sufficient in this illustration of the method.

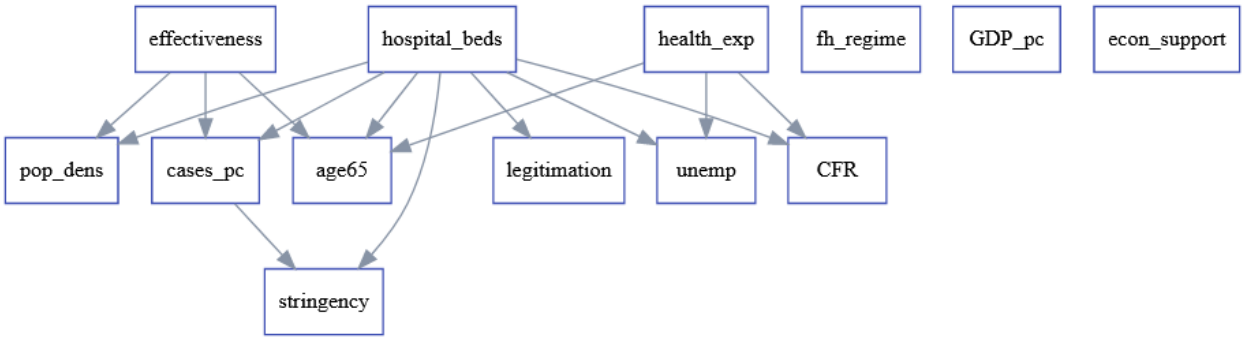


Figure 23. The final model for the relevant variables

As a result of the constrained graph, I have the following state of things, presented in Figure 21. As I stated before, this method is more comprehensible since even unprepared readers can quickly identify the arrows connecting the nods. I would like to draw attention instantly to the dependent variable, the level of stringency, and look at what variables determine it: 'cases per capita' and 'the number of hospital beds'. The graph shows the statistically significant connection between the nods, but we do not know the causality — this is what unites Bayesian Networks with the QCA methods: a set of factors that explain the dependent variable. The causality can be shown via the odds ratio matrix as shown in Tables 6-8.

Table 7. The odds ratio for stringency and hospital beds

	hospital_beds = low	**hospital_beds = high**
lowest	0.039010	0.037432
low	0.167095	0.160382
high	0.211311	0.449318
highest	0.582585	0.352868

In the previous paragraph, I have explained the visual benefit of the Bayesian Networks; now it is time to explain why I compared it with logistic regression. The similarity stems from the categorical nature of the data since, as in logistic regression, the odds ratio matrices in Networks show the chances of getting into the group. For instance, if we look at Table 6, one could observe that countries with 'low' value of hospital beds available have a higher chance to get into the 'highest' category of stringency (*58%*) than in any other. In comparison, countries with a 'high' number of beds will respond in a less stringent manner with a probability of 45%. Within the 'highest' category, we can see that number of beds does explain the regularities in response; at the same time, the difference in odds between 'high' and 'low' groups is about 23%, which can be interpreted as a decent degree of variety. Additionally, the hypothesis about the lower stringency level being predicted by the number of hospital beds is supported by the 'high' group, since the countries with a 'high' number of beds will implement this level of stringency with an almost 50%

chance (*45%*). So, this matrix served as another tool for the triangulation since it has also supported the initial hypothesis: states with more developed and prepared healthcare system tend to react less stringently.

Table 8. The odds ratio for stringency and government effectiveness

	cases_pc = low	**cases_pc = high**
lowest	0.055385	0.013820
low	0.246838	0.045264
high	0.246838	0.364521
highest	0.450939	0.576395

The second variable associated with stringency is the number of cases per capita, or the level of infestation, to put it simply. This substitutive indicator does also prove the assumption about stringent measures being a reactive response to stop the spread of the coronavirus. States, which got into the 'high' category, will implement a policy with 'highest' cumulative stringency with 58% chance, while states with a 'low' degree of cases per capita will follow the same route with only a 45% chance. Moreover, the overall distribution of odds shows that the 'low' spread level is a determinant for the 'low' (*25%*) and 'lowest' (*6%*) responses in terms of stringency. Hence, another hypothesis found support in the Bayesian Networks.

Table 9. The odds ratio for stringency and government effectiveness

	effectiveness = low	**effectiveness = high**
lowest	0.046159	0.027176
low	0.206099	0.115377
high	0.264548	0.305096
highest	0.483194	0.552350

The model showed that the '*government effectiveness*' variable is connected with stringency but not directly. In the case of a model, '*effectiveness'* is a parent variable for '*cases per capita*'; thus, the connection is present, and yet it is indirect — level of stringency can be explained only through the number of cases, which are predicted by the effectiveness. The theoretical framework supports every link of the statements.

As a concluding remark for the Networks section, within this paper, I wanted to show that quantitative political science and related sub-disciplines can be studied not only by correlation and regression analyses, which have shown their reliability, but with some relatively uncommon tools, which do not concede in terms of effectiveness, and what is more critical, clear understanding. Bayesian Networks might be this 'golden mean' with all necessary preparations since it combines

straightforward visualisation with a sufficient degree of statistical underpinning. At the same time, QCA and/or logistic regressions do require a broader background in order to understand truth tables and polynomial logistic regression's output. This is the practical explanation. Regarding the technical rationale to use Bayesian Networks, they should not meet the prerequisite about the independence of determinants, which is crucial in regression and labelled as multicollinearity.

Discussion

This section will be devoted to the elaboration of the hypotheses, which were created with the help of a complex theoretical framework. Thus, if there is any discussion in the 'stringency level' context, it could be tied to the particular mechanism affecting the policy-making process.

Table 10. The status of hypotheses derived from the theoretical framework

H1.	Increased coronavirus prevalence leads to a policy response with high stringency	*MOTIVATION*	*Proven*
H2.	Autocracies due to institutional arrangements tend to produce COVID-19 policies with higher stringency		*Proven*
H3.	Governments with a higher degree of effectiveness implement higher stringency	*RESOURCES*	*Partly proven*
H4.	As a safeguard, states with higher economic resources will use policies with higher stringency		*Partly proven*
H5.	To flatten the curve, countries with insufficient healthcare capacities tend to refer to policies with higher stringency		*Proven*
H6.	Since population 65+ is a risk group, the higher its proportion is, the higher the stringency will be	*OBSTACLES*	*Partly proven*
H7.	Countries with higher density to ensure the social distancing will increase the stringency level		*Proven*
H8.	Lower education among the population forces the government to establish higher stringency		*Falsified*
H9.	A higher rate of unemployment as an inability to survive economic sacrifices leads to lower stringency		*Falsified*
H10.	If citizens trust their government, the latter will establish policies with higher stringency		*Proven*
H11.	The availability of state economic support allows the government to increase the stringency level	*OTHER POLICIES*	*Proven*
H12.	States in the same regions will have the same level of stringency	*EXTERNAL*	*Proven*
H13.	Faster implementation of response will lead to higher stringency		*Partly proven*

Let us start with the hypotheses in the *motivation* section. The first hypothesis has hogged the research cover to itself since the coronavirus prevalence is the most significant variable, explaining higher stringency in correlation and regression analyses. It seems that decision- and policy-makers are myopic to the extent of paying attention solely to the most vivid indicators, thus leaving aside other institutional moments. As a potential consequence, one could speak about the economic crisis and related issues on the labour market (*Civilian Unemployment Rate*, n.d.). The results for the second hypothesis find support in the literature devoted to the COVID-19 pandemic and natural disasters (Hörhager, 2015). Since the external shock of such magnitude affects the

political systems, autocracies need to minimise the number of deaths and other complementary parameters to emerge the winner and stabilise the regime. Due to the fact that higher stringency is an effective tool of coronavirus curbing (Hussain, 2020), autocracies raise policy stringency level higher than democracies.

The following category is *resources*, which the state can use in order to mitigate the COVID-19 pandemic, and the section has hypotheses of all statuses. The effect of the 'government effectiveness' variable depends on the method of analysis: in correlations, it was negative but minimal (*-0.01*), while in regressions, it was positive and more significant (*1.18 — 6.21*). Due to this ambiguity, I cannot state for sure that the association between the effectiveness and stringency is fully proven; hence, this mechanism requires additional studies. Moreover, the 'effectiveness' was accompanied by the 'accountability', which was more constant despite the empirical method. This case supports the 'stringency ~ regime' association because autocracies are characterised by a lower degree of accountability. As for economic resources, the general assumption was that wealthy states could neutralise the negative effects of high stringency policies if needed; however, this assumption was not proven in this paper, since higher GDP per capita led to higher stringency, but the same pattern was not observed for tax revenue. Either the hypothesis is incorrect by itself, or some additional tests with different means of operationalisation should be conducted. The most significant in terms of feasibility hypothesis is about healthcare capacities: if the state has been developing its healthcare system, it is not forced to implement the stringiest COVID-19 responses. This finding is witnessed in correlation, regression analyses and Bayesian Networks.

The *obstacles* section has the most unexpected results because what was perceived as axioms did not pass the empirical tests. For instance, the widely discussed association between stringency and the proportion of the older population, where former would grow in the case of higher values of latter as a gesture of care from the state — this statement was proven in the correlations but was completely falsified in the regressions. The same scenarios occurred for the 'education level': the level of secondary education has different directions of association depending on the model. Hence, the 'age' hypothesis was partly proven, and 'education' one — indeed falsified. At the same time, the axiom about the 'population density' stayed firm: higher density results in higher stringency. Another assumption in the *obstacles* category was constituted around the 'unemployment rate', and its results are also paradoxically falsified: despite the high unemployment rate, the state increased the stringency level, thus worsening the living standard for some citizens. The last variable is the 'institutional trust', which signalise that the population's trust unties the government's hand, which leads to higher stringency.

In the context of these results, series of question arises: why does the state consider density but ignore the proportion of people 65+? Why does the government insist on increasing the stringency level despite the unemployment? This question twice as interesting, especially in the context of 'stringency ~ institutional trust'. Is it because of the 'panic', or this is some sort of trade-off for citizens' safety?

Other policies has only one assumption, which revolves around the state's economic support to the citizens: higher support — higher stringency; this is clear as a day is long. However, I would like to bring up the aspect of endogeneity between these two variables, one could appeal and say that economic support policies are developed simultaneously with the response policies, but in reality, the support was not delivered instantly because no one knew how the COVID-19 pandemic is going to evolve.

I should admit that the *external* section could be addressed in more details within this paper, but nevertheless, at least some progress was made in this direction. The regional aspect was studied and proven to the extent that some patterns exist on the regional level since some regions differ from others in terms of response stringency. What is more curious is that the hypothesis, measured via Rogers' categories, passed the empirical tests only partly. This is curious because, in the literature, the most certain conclusion is that earlier implementation of responses tends to reduce the following number of cases and deaths, however, this logic cannot be fully projected on the categories of adaptation pace.

As a result, out of thirteen hypotheses, only two were falsified, and four were partly proven by the analysis. I would say that this is a decent result for such massive research in terms of units of analysis since this paper relies on the assumptions induced during the case studies and few-N projects. Unfortunately, this framework does not have the necessary capabilities to explain the contradicting findings, but this might be a segue to other research about the stringency: *why effective governments tend to implement less stringent COVID-19 policies? What is the connection between the level of education, compliance, and consequent stringency? Why government implement stringent policies, despite the high unemployment rate? And what is a global trend for the response time?*

Regarding the partly proven hypotheses, I cannot title them ultimately proven either due to the conflict of indicators within the category (i.e., 'GDP per capita' – 'tax revenue', and the age structure of society) or because of variety of categories (i.e., 'adoption pace'). If different living conditions and life expectancy can hastily explain the age structure, the contradiction between the GDP and tax revenue remains unexplainable. The hypothesis about the early response as a signal

for overreaction was not supported for Rogers' categories but was observed for less categorised cases. So, I would say that this research is a 'missing link' in the narrative about the COVID-19 pandemic and a decent starting point for all further papers.

Conclusion

Within this paper, I strived to achieve several goals: the first one is the demonstration that classical theories can be applied to the actual issues, not only one but the fusion of several. For that, I used "policy diffusion" theory (Berry & Berry, 2006) combined with "external shock" (Birkland, 1998, 2004; Kingdon, 2014), "state capacity" (Andersen, Møller, Rørbæk, et al., 2014; Evans et al., 1985), and "diffusion of innovations" (Rogers, 1983; Rogers et al., 2019) theories. If the original theory by Berry and Berry was rather descriptive, the complex theoretical framework embedded in the text of the research provides several theoretical expectations, which can be tested with various quantitative (e.g., correlations, regressions) and qualitative (e.g., interview with decision-makers and experts) methods.

Secondly, I was eager to expand the sample for the COVID-19-related research, which is frequently limited to small- or few-N designs. At this point, I have stated several hypotheses about the development of stringency in particular regions; the use of two distinct regional systems (i.e., by Teorell and Hadenius (2007) and the United Nations Methodology (*UNSD — Methodology*, n.d.)) allowed me to compare them and increase the number of units of analysis for further papers.

Lastly, my empirical agenda revolved around the intentions to expand the analytical toolbox among the scholars in Political Science and Public Policy by implementing the rarely used technique of Bayesian Networks, which is more visual than ordinary linear, logistic, and panel regressions.

Apart from filling in particular caveats in theory and empirical aspects, this project has also shown which determinants affect the stringency level:

1. the strongest association can be observed between the indicators of salient external shock or crisis and the level of stringency;
2. on the global scale, autocracies produce stronger coronavirus policies;
3. despite other parameters, more healthcare capacities are associated with lower stringency;
4. the most straightforward association is between the increased population density and higher stringency;

5. higher institutional trust is connected with the higher stringency, but the causality is not that evident;
6. economic support from the state might lead to higher stringency;
7. states within the same region have a similar pattern of response.

Undoubtedly, these seven statements do not exhaust the question about the stringency of COVID-19 policies, but at least they re-state the necessity to study the stringency question to predict states' behaviour in similar crises. Nevertheless, within the project, I have demonstrated several ways how this topic could be studied in terms of theories and methods. So, what is not exhaustive for the topic of COVID-19 response stringency is more than enough for this particular framework.

Limitations

This project has several methodological limitations and technical shortcomings.

The first vivid theoretical caveat is that the operationalisation could be more narrow, more precise in terms of indicators selection. However, I reckoned that it would benefit the paper if several valid variables were used; unfortunately, they just cause some discrepancy and confusion. The second one is that more attention could be paid to the 1st and 2nd Waves of the coronavirus pandemic. This distinction could illustrate the mechanism of 'lesson drawing' not on someone's experience but on the personal.

Other limitations are primarily technical.

First of all, this stringency data should be scrutinised with the help of not only OLS regression but also with panel regression once all necessary tests are conducted and no technical contradictions are noticed. This type of regression would enlighten the process of stringency development in relation to the temporal variables more precisely than I had done with OLS. The second technical limitation is about the codification of variable for the Bayesian Networks, as with the QCA, the question of threshold arises once again. My rationales for codification stems from the data itself, while ideally, there should be an "external criteria", which would make the codification less data-dependent (Schneider & Wagemann, n.d., pp. 32–34). Nevertheless, this method of the calibration was proven in the pre-research. All these limitations do not neutralise the research's findings but, once considered, would make them even more reliable.

Further perspectives

I have left several clues about the potential side-projects, which could be based on this one. My personal interest is in further studying of regional and temporal regularities with logistic regressions since the regional variables are coded in a binary manner. Maybe the same design could be applied to the particular regions of the most interest, like the Post-Soviet space.

Additionally, what was labelled as a limitation could be developed into a separate paper — the panel regression on the more specified dataset, fewer variables.

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Appendix

Appendix 1.

Table 1.1. A detailed description of regional division by Teorell and Hadenius, introduced by the University of Gothenburg

Name of the region	**Countries included in the region**
No region*	Aruba, Bermuda, Faeroe Islands, Greenland, Guam, Hong Kong, Kosovo, Macao, Palestine, Puerto Rico, United States, Virgin Islands;
Eastern Europe and post-Soviet Union	Albania, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyz Republic, Latvia, Lithuania, Moldova, Poland, Romania, Russia, Serbia, Slovak Republic, Slovenia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan;
Latin America	Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, Venezuela;
North Africa & the Middle East	Algeria, Bahrain, Cyprus, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, Turkey, United Arab Emirates, Yemen;
Sub-Saharan Africa	Angola, Benin, Botswana, Burkina Faso, Burundi, Cape Verde, Cameroon, Central African Republic, Chad, Comoros, Democratic Republic of Congo, Congo, Cote d'Ivoire, Djibouti, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe
Western Europe and North America	Andorra, Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Monaco, Netherlands, New Zealand, Norway, Portugal, San Marino, Spain, Sweden, Switzerland, United Kingdom, United States;
East Asia	China, Japan, South Korea, Mongolia. Taiwan;
South-East Asia	Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste, Vietnam;
South Asia	Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka;
The Pacific	Fiji, Kiribati, Papua New Guinea, Solomon Islands. Tonga, Vanuatu;

The Caribbean	Bahamas, Barbados, Belize, Dominica, Guyana, Jamaica, Suriname, Trinidad and Tobago
*states which the authors did not attribute Source: Standard Dataset | University of Gothenburg. (n.d.). Retrieved 18 February 2021, from https://www.gu.se/en/quality-government/qog-data/data-downloads/standard-dataset	

Table 1.2. A detailed description of regional division by the United Nations

Name of the region	**Countries included in the region**
No region*	Kosovo, Taiwan;
Northern Africa	Algeria, Egypt, Libya, Morocco, Tunisia, Sudan;
Northern America	Bermuda, Greenland, Canada, United States;
Eastern Asia	Hong Kong, Macao, China, Japan, South Korea, Mongolia;
Southern Asia	Iran, Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka;
South-eastern Asia	Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste, Vietnam;
Southern Europe	Albania, Bosnia and Herzegovina, Croatia, Serbia, Slovenia, Andorra, Greece, Italy, Malta, Portugal, San Marino, Spain;
Australia and New Zealand	Australia, New Zealand;
Melanesia	Fiji, Papua New Guinea, Solomon Islands, Vanuatu;
Micronesia	Guam, Kiribati;
Polynesia	Tonga;
Central Asia	Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, Uzbekistan;
Western Asia	Palestine, Azerbaijan, Georgia, Bahrain, Cyprus, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, Turkey, United Arab Emirates, Yemen;
Eastern Europe	Belarus, Bulgaria, Czech Republic, Hungary, Moldova, Poland, Romania, Russia, Slovak Republic, Ukraine;
Northern Europe	Faeroe Islands, Estonia, Latvia, Lithuania, Denmark, Finland, Iceland, Ireland, Norway, Sweden, United Kingdom;
Western Europe	Austria, Belgium, France, Germany, Luxembourg, Monaco, Netherlands, Switzerland;

Sub-Saharan Africa	Angola, Benin, Botswana, Burkina Faso, Burundi, Cape Verde, Cameroon, Central African Republic, Chad, Comoros, Democratic Republic of Congo, Congo, Cote d'Ivoire, Djibouti, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe;
Latin America and the Caribbean	Aruba, Puerto Rico, United States Virgin Islands, Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, Venezuela, Bahamas, Barbados, Belize, Dominica, Guyana, Jamaica, Suriname, Trinidad and Tobago
*states which the authors did not attribute; Source: UNSD — Methodology. (n.d.). Retrieved 20 February 2021, from https://unstats.un.org/unsd/methodology/m49/	

Appendix 2.

Table 2. Operationalisation of the concepts

	Concept	**Measurement**	**Source**
Dependent Variable			
ADOPTION	Level of stringency of responses to COVID-19	Containment and closure policies, which are calculated in one 'Stringency index'	Government Response Tracker project (*Coronavirus Government Response Tracker | Blavatnik School of Government*, n.d.-b);
		The level of stringency is calculated to the 1st and 2nd waves of the pandemic outbreak	Author's calculation
Predictors — Independent Variables			
MOTIVATION	The severity of the external shock	Number of confirmed cases	The number of cases and deaths is taken from "Our World in Data project (*Coronavirus (COVID-19) Cases - Statistics and Research - Our World in Data*, n.d.-b);
		Number of confirmed deaths	
		Case Fatality rate: the number of confirmed deaths divided by the number of confirmed cases	Author's calculation;
		Cases per capita: number of confirmed cases divided by the population (2019)	Author's calculation. Information about the Population:

			World Bank Indicators: (*Population, Total | Data*, n.d.)
	Political regime	Freedom house categorical variable (2018), ranging from democracies to autocracies: 'Free' (1) — 'Partly Free' (2) — 'Not Free' (3)	Data is obtained via the V-dem (ver. 10) dataset (*Data Version 10 | V-Dem*, n.d.)
		Polity IV index (2018)	
		Electoral democracy index (2019)	
RESOURCES	Government effectiveness	Accountability index (2019)	Data is obtained via the V-dem (ver. 10) dataset (*Data Version 10 | V-Dem*, n.d.)
		Government effectiveness index (2018)	
	Economic resources	GDP per capita (2019)	Information about the GDP per capita: World Bank Indicators (*GDP per Capita (Current US$)	Data*, n.d.)
		Tax revenue (% of the GDP) (2018)	World Bank Indicators: (*Tax Revenue (% of GDP)	Data*, n.d.-b)t
	Healthcare capacities	Healthcare expenditures (% of the GDP)	World Bank Indicators: (*Current Health Expenditure (% of GDP)	Data*, n.d.)
		Number of hospital beds (per 1000)	World Bank Indicators: (*Hospital Beds (per 1,000 People)	Data*, n.d.)
OBSTACLES	Age structure	Percentage of population: 0-14 (2019)	World Bank Indicators (*Population Ages 0-14 (% of Total Population)	Data*, n.d.)
		Percentage of population: 15-64 (2019)	World Bank Indicators (*Population Ages 15-64 (% of Total Population)	Data*, n.d.)
		Percentage of population: 65+ (2019)	World Bank Indicators (*Population Ages 65 and above (% of Total Population)	Data*, n.d.)
	Population density	Self-titled parameter (2018)	World Bank Indicators (*Population Density (People per Sq. Km of Land Area)	Data*, n.d.)
	Cultural values	Percentage of enrolment: primary (2019)	UNESCO dataset presented on the World Bank Data website:

			(*School Enrollment, Primary (% Gross)	Data*, n.d.)
		Percentage of enrolment: secondary (2019)	World Bank Data website: (*School Enrollment, Secondary (% Gross)	Data*, n.d.)
		Percentage of enrolment: tertiary (2019)	World Bank Data website: (*School Enrollment, Tertiary (% Gross)	Data*, n.d.)
	Economic sacrifices	Unemployment rate (modelled values for 2020)	World Bank Indicators: (*Unemployment, Total (% of Total Labor Force) (Modeled ILO Estimate)	Data*, n.d.)
	Institutional trust	Performance legitimation (2019)	Data is obtained via the V-dem (ver. 10) dataset (*Data Version 10 | V-Dem*, n.d.)
OTHER POLICIES	State economic support	Cumulative economic policies from the government aimed to support the citizens	Economic policies from the Government Response Tracker (*Coronavirus Government Response Tracker | Blavatnik School of Government*, n.d.-b)
EXTERNAL	Regional belonging	Teorell and Hadenius (2007) regional division (10-items) found in Cepaluni et al. (2020)	"The Region of the Country" parameter from The QoG Standard dataset (*Standard Dataset | University of Gothenburg*, n.d.)
		UN's sub-regional division (17-items)	"Standard Country or Area Codes for Statistical Use" (*UNSD — Methodology*, n.d.)
	Pace of adoption	Days until/after the first recorded case and the response	Author's calculations
		Rogers' categories of adopters	The concepts themselves were found in Rogers (1983)

Appendix 3.

Table 3. Detailed information on the binary data calibration for Bayesian networks analysis

Name of variable	**Type**	**Threshold/rationale**	**Levels**
GDP_pc	Categorical	Cluster analysis: 261,247-9 946,033 – 25 946,182-66 944,833 – 114 704,594-84 096,396	low – medium – high
health_exp	Binary	Median: 6,301	low – high
hospital_beds	Binary	Median: 2,3	low – high
econ_support	Binary	Median: 62,5	low – high
effectiveness	Binary	Threshold*: 0	low – high
fh_regime	Categorical	Original index division	free – partly free – not free
CFR	Binary	Median: 0,018	low – high
cases_pc	Binary	Median: 1,233	low – high
age65	Binary	Median: 6,586	low – high
unemp	Binary	Median: 5,165	low – high
pop_dens	Binary	Median: 81,062	low – high
legitimation	Binary	Median: 0,875	low – high
stringency (mean value)	Categorical	Cluster analysis: 12-27 – 28-41 – 42-54 – 54-72	low – lowest – high –highest
* Since there are both positive and negative values			

Appendix 4.

Table 4. Detailed information about Bayesian Networks layers' description

Name of layer	**Variables**
Economy layer	GDP_pc; health_exp; hospital_beds; econ_support
Politics layer	effectiveness; fh_regime
Socio-demographic layer	CFR; cases_pc; age65; unemp; pop_dens; legitimation
Stringency layer	stringency

Appendix 5.

Table 5.1. Information about the missing cases in indicators: Quality of Government, regional division

1	Aruba
2	Bermuda
3	Faeroe Islands
4	Greenland
5	Guam
6	Hong Kong
7	Kosovo
8	Macao
9	Palestine
10	Puerto Rico
11	United States Virgin Islands

Table 5.2. Information about the missing cases in indicators: World Bank Indicators

1	Palestine
2	Taiwan

Table 5.3. Information about the missing cases in indicators: V-dem dataset

1	Andorra
2	Aruba
3	Bahamas
4	Belize
5	Bermuda
6	Brunei
7	Cote d'Ivoire
8	Dominica
9	Faeroe Islands
10	Greenland
11	Guam
12	Kiribati
13	Macao
14	Monaco
15	Myanmar
16	Puerto Rico
17	San Marino
18	Tonga
19	United States Virgin Islands

Table 5.4. Information about the missing cases in indicators: Worldwide Governance Indicators

1	Faeroe Islands

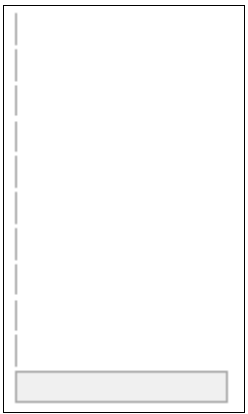
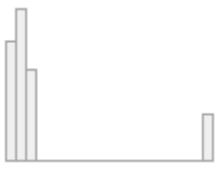
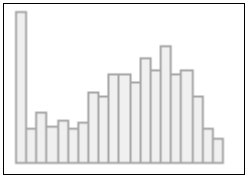
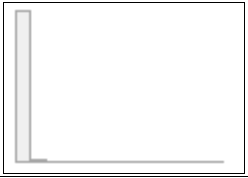
Table 5.5. Information about the missing cases in indicators: UN regional division

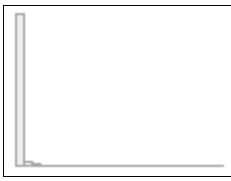
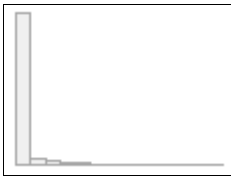
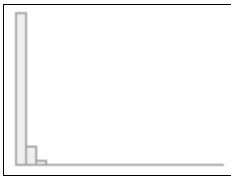
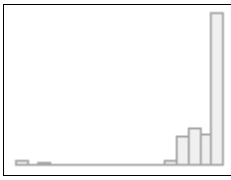
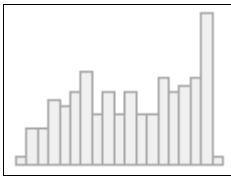
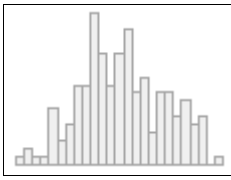
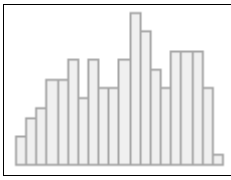
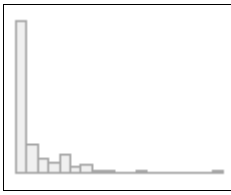
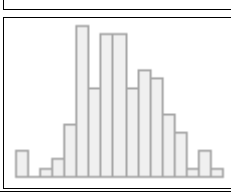
1	Kosovo
2	Taiwan

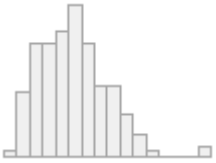
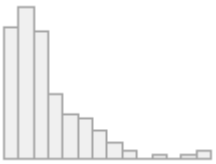
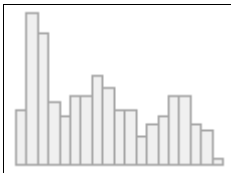
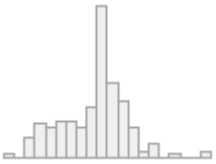
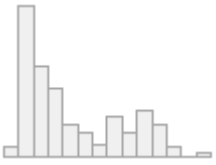
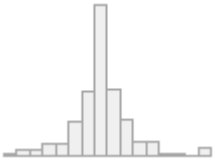
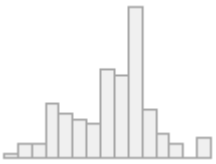
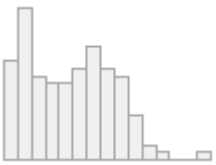
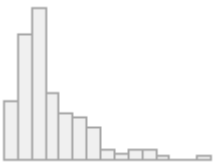
Table 5.6. Information about the missing cases in indicators: Our World in Data

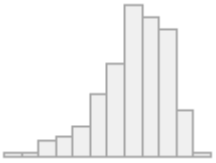
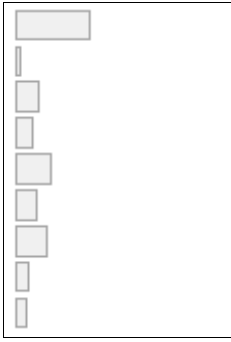
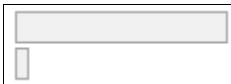
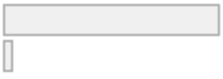
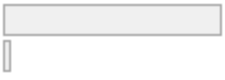
1	Aruba
2	Guam
3	Kiribati
4	Macao
5	Puerto Rico
6	Tonga
7	Turkmenistan
8	United States Virgin Islands

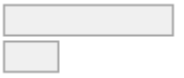
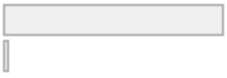
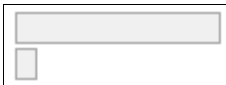
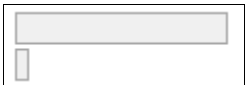
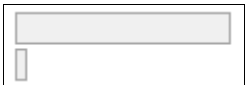
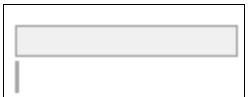
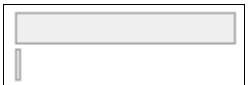
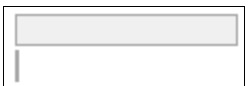
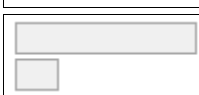
Table 6. Descriptive statistics for the empirical data

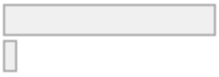
No	Variable	Stats / Values	Freqs (% of Valid)	Graph	Valid	Missing
1	country [character]	1. Afghanistan 2. Albania 3. Algeria 4. Andorra 5. Angola 6. Argentina 7. Aruba 8. Australia 9. Austria 10. Azerbaijan [175 others]	412 (0.5%) 412 (0.5%) 412 (0.5%) 412 (0.5%) 412 (0.5%) 412 (0.5%) 412 (0.5%) 412 (0.5%) 412 (0.5%) 412 (0.5%) 72100 (94.6%)		76220 (100.0%)	0 (0.0%)
2	date.1 [integer]	Mean (sd) : 20201725 (3003) min < med < max: 20200101 < 20200725 < 20210215 IQR (CV) : 691.5 (0)	412 distinct values		76220 (100.0%)	0 (0.0%)
3	stringency [numeric]	Mean (sd) : 50.5 (28.1) min < med < max: 0 < 54.6 < 100 IQR (CV) : 42.6 (0.6)	175 distinct values		74498 (97.7%)	1722 (2.3%)
4	cases_conf [numeric]	Mean (sd) : 167928.7 (996386.2) min < med < max: 0 < 3780 < 27575344 IQR (CV) : 47057.2 (5.9)	32176 distinct values		70798 (92.9%)	5422 (7.1%)

No	Variable	Stats / Values	Freqs (% of Valid)	Graph	Valid	Missing
5	deaths_conf [numeric]	Mean (sd) : 4457.2 (21242.8) min < med < max: 0 < 69 < 484248 IQR (CV) : 830 (4.8)	11051 distinct values		70798 (92.9%)	5422 (7.1%)
6	CPC [numeric]	Mean (sd) : 0 (0) min < med < max: 0 < 0 < 0.1 IQR (CV) : 0 (2.5)	15 distinct values		74984 (98.4%)	1236 (1.6%)
7	CFR [numeric]	Mean (sd) : 0 (0) min < med < max: 0 < 0 < 1 IQR (CV) : 0 (1.3)	42756 distinct values		62723 (82.3%)	13497 (17.7%)
8	fh_regime [numeric]	Mean (sd) : 1.9 (0.8) min < med < max: 1 < 2 < 3 IQR (CV) : 2 (0.4)	1 : 26780 (39.2%) 2 : 2186 (31.9%) 3 : 19776 (28.9%)		68392 (89.7%)	7828 (10.3%)
9	polity_reg [numeric]	Mean (sd) : 2.3 (13.7) min < med < max: -77 < 7 < 10 IQR (CV) : 11 (6.1)	22 distinct values		65508 (85.9%)	10712 (14.1%)
10	elect_dem [numeric]	Mean (sd) : 0.5 (0.3) min < med < max: 0 < 0.5 < 0.9 IQR (CV) : 0.5 (0.5)	77 distinct values		68392 (89.7%)	7828 (10.3%)
11	effectiveness [numeric]	Mean (sd) : 0 (1) min < med < max: -2.5 < -0.1 < 2.2 IQR (CV) : 1.4 (-32.7)	146 distinct values		74984 (98.4%)	1236 (1.6%)
12	accountability [numeric]	Mean (sd) : -0.1 (1) min < med < max: -2.2 < 0 < 1.7 IQR (CV) : 1.6 (-14.2)	134 distinct values		74572 (97.8%)	1648 (2.2%)
13	GDP_pc [numeric]	Mean (sd) : 17854.9 (25701.2) min < med < max: 261.2 < 6359.8 < 185829 IQR (CV) : 21301.9 (1.4)	177 distinct values		72924 (95.7%)	3296 (4.3%)
14	tax_revenue [numeric]	Mean (sd) : 17 (6.4) min < med < max: 0 < 16.8 < 32.3 IQR (CV) : 8.7 (0.4)	120 distinct values		49852 (65.4%)	26368 (34.6%)

No	Variable	Stats / Values	Freqs (% of Valid)	Graph	Valid	Missing
15	health_exp [numeric]	Mean (sd) : 6.4 (2.6) min < med < max: 1.6 < 6.3 < 16.9 IQR (CV) : 3.7 (0.4)	154 distinct values		69216 (90.8%)	7004 (9.2%)
16	hospital_beds [numeric]	Mean (sd) : 3 (2.5) min < med < max: 0.1 < 2.3 < 13.8 IQR (CV) : 2.8 (0.8)	95 distinct values		63448 (83.2%)	12772 (16.8%)
17	age0_14 [numeric]	Mean (sd) : 27.4 (10.4) min < med < max: 12.3 < 26.4 < 49.8 IQR (CV) : 19.7 (0.4)	168 distinct values		71688 (94.1%)	4532 (5.9%)
18	age15_64 [numeric]	Mean (sd) : 63.4 (6.2) min < med < max: 47.6 < 64.6 < 84.9 IQR (CV) : 7.6 (0.1)	167 distinct values		71688 (94.1%)	4532 (5.9%)
19	age_65 [numeric]	Mean (sd) : 9.1 (6.6) min < med < max: 1.2 < 6.6 < 28 IQR (CV) : 11.6 (0.7)	166 distinct values		71688 (94.1%)	4532 (5.9%)
20	pop_density [numeric]	Mean (sd) : 459.7 (2225.2) min < med < max: 0.1 < 83.9 < 20777.5 IQR (CV) : 166 (4.8)	180 distinct values		74160 (97.3%)	2060 (2.7%)
21	primary [numeric]	Mean (sd) : 103 (11.4) min < med < max: 68.4 < 102 < 143.9 IQR (CV) : 7.4 (0.1)	149 distinct values		63448 (83.2%)	12772 (16.8%)
22	secondary [numeric]	Mean (sd) : 87.5 (29.1) min < med < max: 17.1 < 94.7 < 156 IQR (CV) : 37.2 (0.3)	130 distinct values		53560 (70.3%)	22660 (29.7%)
23	tertiary [numeric]	Mean (sd) : 47.7 (30.1) min < med < max: 3.4 < 46.6 < 142.8 IQR (CV) : 51.4 (0.6)	122 distinct values		51088 (67.0%)	25132 (33.0%)
24	unemployment [numeric]	Mean (sd) : 6.6 (4.9) min < med < max: 0.1 < 5.2 < 28.5 IQR (CV) : 5.6 (0.7)	167 distinct values		70864 (93.0%)	5356 (7.0%)

No	Variable	Stats / Values	Freqs (% of Valid)	Graph	Valid	Missing
25	perf_legitim [numeric]	Mean (sd) : 0.8 (1) min < med < max: -2.9 < 0.9 < 2.5 IQR (CV) : 1.4 (1.3)	132 distinct values		68392 (89.7%)	7828 (10.3%)
26	econom_support [numeric]	Mean (sd) : 38.7 (32.9) min < med < max: 0 < 37.5 < 100 IQR (CV) : 62.5 (0.9)	9 distinct values		74386 (97.6%)	1834 (2.4%)
27	No_region [numeric]	Min : 0 Mean : 0.1 Max : 1	0 : 71688 (94.1%) 1 : 4532 (5.9%)		76220 (100.0%)	0 (0.0%)
28	Eastern_Europe_post_Soviet_Union [numeric]	Min : 0 Mean : 0.1 Max : 1	0 : 65920 (86.5%) 1 : 10300 (13.5%)		76220 (100.0%)	0 (0.0%)
29	Latin_America [numeric]	Min : 0 Mean : 0.1 Max : 1	0 : 67980 (89.2%) 1 : 8240 (10.8%)		76220 (100.0%)	0 (0.0%)
30	North_Africa_._the_Middle_East [numeric]	Min : 0 Mean : 0.1 Max : 1	0 : 67980 (89.2%) 1 : 8240 (10.8%)		76220 (100.0%)	0 (0.0%)
31	Sub.Saharan_Africa [numeric]	Min : 0 Mean : 0.2 Max : 1	0 : 57269 (75.1%) 1 : 18951 (24.9%)		76220 (100.0%)	0 (0.0%)
32	Western_Europe_and_North_America [numeric]	Min : 0 Mean : 0.1 Max : 1	0 : 65508 (85.9%) 1 : 10712 (14.1%)		76220 (100.0%)	0 (0.0%)
33	East_Asia [numeric]	Min : 0 Mean : 0 Max : 1	0 : 74160 (97.3%) 1 : 2060 (2.7%)		76220 (100.0%)	0 (0.0%)
34	South.East_Asia [numeric]	Min : 0 Mean : 0.1 Max : 1	0 : 71688 (94.1%) 1 : 4532 (5.9%)		76220 (100.0%)	0 (0.0%)
35	South_Asia [numeric]	Min : 0 Mean : 0 Max : 1	0 : 73336 (96.2%) 1 : 2884 (3.8%)		76220 (100.0%)	0 (0.0%)
36	The_Pacific [numeric]	Min : 0 Mean : 0 Max : 1	0 : 73748 (96.8%) 1 : 2472 (3.2%)		76220 (100.0%)	0 (0.0%)
37	The_Caribbean [numeric]	Min : 0 Mean : 0 Max : 1	0 : 72924 (95.7%) 1 : 3296 (4.3%)		76220 (100.0%)	0 (0.0%)
38	Northern_Africa [numeric]	Min : 0 Mean : 0 Max : 1	0 : 73748 (96.8%) 1 : 2472 (3.2%)		76220 (100.0%)	0 (0.0%)

No	Variable	Stats / Values	Freqs (% of Valid)	Graph	Valid	Missing
39	Sub.Saharan_Africa.1 [numeric]	Min : 0 Mean : 0.2 Max : 1	0 : 57681 (75.7%) 1 : 18539 (24.3%)		76220 (100.0%)	0 (0.0%)
40	Latin_America_and_the_Caribbean [numeric]	Min : 0 Mean : 0.2 Max : 1	0 : 63448 (83.2%) 1 : 12772 (16.8%)		76220 (100.0%)	0 (0.0%)
41	Northern_America [numeric]	Min : 0 Mean : 0 Max : 1	0 : 74572 (97.8%) 1 : 1648 (2.2%)		76220 (100.0%)	0 (0.0%)
42	Central_Asia [numeric]	Min : 0 Mean : 0 Max : 1	0 : 74160 (97.3%) 1 : 2060 (2.7%)		76220 (100.0%)	0 (0.0%)
43	Eastern_Asia [numeric]	Min : 0 Mean : 0 Max : 1	0 : 73748 (96.8%) 1 : 2472 (3.2%)		76220 (100.0%)	0 (0.0%)
44	South.eastern_Asia [numeric]	Min : 0 Mean : 0.1 Max : 1	0 : 71688 (94.1%) 1 : 4532 (5.9%)		76220 (100.0%)	0 (0.0%)
45	Southern_Asia [numeric]	Min : 0 Mean : 0 Max : 1	0 : 72924 (95.7%) 1 : 3296 (4.3%)		76220 (100.0%)	0 (0.0%)
46	Western_Asia [numeric]	Min : 0 Mean : 0.1 Max : 1	0 : 69216 (90.8%) 1 : 7004 (9.2%)		76220 (100.0%)	0 (0.0%)
47	Eastern_Europe [numeric]	Min : 0 Mean : 0.1 Max : 1	0 : 72100 (94.6%) 1 : 4120 (5.4%)		76220 (100.0%)	0 (0.0%)
48	Northern_Europe [numeric]	Min : 0 Mean : 0.1 Max : 1	0 : 71688 (94.1%) 1 : 4532 (5.9%)		76220 (100.0%)	0 (0.0%)
49	Southern_Europe [numeric]	Min : 0 Mean : 0.1 Max : 1	0 : 71276 (93.5%) 1 : 4944 (6.5%)		76220 (100.0%)	0 (0.0%)
50	Western_Europe [numeric]	Min : 0 Mean : 0 Max : 1	0 : 72924 (95.7%) 1 : 3296 (4.3%)		76220 (100.0%)	0 (0.0%)
51	Australia_and_New_Zealand [numeric]	Min : 0 Mean : 0 Max : 1	0 : 75396 (98.9%) 1 : 824 (1.1%)		76220 (100.0%)	0 (0.0%)
52	Melanesia [numeric]	Min : 0 Mean : 0 Max : 1	0 : 74572 (97.8%) 1 : 1648 (2.2%)		76220 (100.0%)	0 (0.0%)
53	Micronesia [numeric]	Min : 0 Mean : 0 Max : 1	0 : 75396 (98.9%) 1 : 824 (1.1%)		76220 (100.0%)	0 (0.0%)
54	Polynesia [numeric]	Min : 0 Mean : 0 Max : 1	0 : 75808 (99.5%) 1 : 412 (0.5%)		76220 (100.0%)	0 (0.0%)
55	No_region.1 [numeric]	Min : 0 Mean : 0 Max : 1	0 : 74984 (98.4%) 1 : 1236 (1.6%)		76220 (100.0%)	0 (0.0%)
56	Innovators [numeric]	Min : 0 Mean : 0 Max : 1	0 : 75396 (98.9%) 1 : 824 (1.1%)		76220 (100.0%)	0 (0.0%)
57	Early_adopters [numeric]	Min : 0 Mean : 0.2 Max : 1	0 : 61388 (80.5%) 1 : 14832 (19.5%)		76220 (100.0%)	0 (0.0%)

No	Variable	Stats / Values	Freqs (% of Valid)	Graph	Valid	Missing
58	Early_majority [numeric]	Min : 0 Mean : 0.3 Max : 1	0 : 53148 (69.7%) 1 : 23072 (30.3%)		76220 (100.0%)	0 (0.0%)
59	Late_majority [numeric]	Min : 0 Mean : 0.4 Max : 1	0 : 42848 (56.2%) 1 : 33372 (43.8%)		76220 (100.0%)	0 (0.0%)
60	Laggards [numeric]	Min : 0 Mean : 0.1 Max : 1	0 : 72100 (94.6%) 1 : 4120 (5.4%)		76220 (100.0%)	0 (0.0%)

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