Emerald Competitiveness Review

Government influence on national competitiveness (Evidence from the COVID era)

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Abstract

Purpose

The article examines how government policy and institutions affect national competitiveness. A combined microeconomic and institutionalist model of competitiveness is applied. This structure is suitable for incorporating factors considered by global competitiveness rankings. The article proposes that there are various possible government policy "configurations" leading to similar competitiveness outcomes, but different resilience outcomes during a crisis.

Methodology

Using the IMD competitiveness rankings, covering 62 countries, between 2010-2019 we first build clusters based on observed "government policy configurations". These clusters show an interpretable pattern: except for a few outliers, individual clusters contain countries that are economically and culturally similar. Then we examine how different clusters, with similar overall competitiveness scores, have performed differently in 2020-2021 during the COVID pandemic.

Originality

The article connects an institutionalist and microeconomic view of competitiveness in a unique model and embeds government policy in this structure. It shows that a similar level of competitiveness is possible through different government policy “configurations” and exploits the COVID shock to analyse resilience of these “configurations”.

Findings

Our analysis shows that government efficiency is correlated with other factors of overall competitiveness. It shows that while similar levels of competitiveness are possible with different government "configurations", it provides evidence that more welfare-oriented government "configurations" during the crisis led to a higher resilience of national competitiveness.

1. Introduction

The importance of institutions in the success of economies has received a lot of attention in the past two or three decades. A review of the recent winners of the Nobel Memorial Prize demonstrates this and numerous empirical studies support the proposition (Acemoglu *et al.*, 2004; Ménard, 2010; Buitrago-Camaro, 2021; Dell, 2024). However, it would be difficult to find a more suitable opportunity to prove the significance of institutional behavior than when an all-encompassing shock shakes the world, the main characteristics of which are of the same nature in all countries. The COVID-19 crisis was one such shock. National institutions, cultures, and norms led to different reactions in different countries, and these differences were markedly reflected in the policy of the most significant institutional factor, the national government.

Every country has a complex institutional structure with many elements. They all play a role in competitiveness analyses, but of course not with equal weight. Both experience and research indicate that national governments play the biggest role. This naturally follows from their mission and is especially strongly manifested at a time when the nation must face a general shock effect. The main elements of the institutional system do not change often and affect the competitiveness of the given country in the long term. Changes in the economy, especially major shocks, however, force governments to adapt. As a consequence, short-term policy changes that adapt to the situation and apply for the duration of the shock may take place.

COVID-19 had such an effect. The aim of our article is to examine to what extent the different behavior of the governments of each country during the pandemics affected the competitiveness of the countries.

According to analyses of government policies followed during the pandemic (International Monetary Fund, 2021; Urban Institute, 2022; Rodriguez-Vives and Olsson, 2023; European Central Bank, 2023; Karim *et al.*, 2024) these policies can be classified into two basic groups:

- a *welfare state-like*, focusing directly on improving the population's living standards involving more government intervention to provide social services, and

- a *market liberal,* taking an indirect approach, aiming to enhance the economy's operational efficiency, which in turn, is expected to improve living conditions with limited government involvement, focusing more on free-market mechanisms.

Both types of policies aim to overcome the pandemic and maintain competitiveness with as little social loss as possible and then to recover as quickly as possible. The success of these strategies mainly depends on how well they align with the country's current situation and their institutional setting.

Our thesis examines the countries with what characteristics the application of one or the other type of policy proved to be more successful. We show that this largely depends on how competitive the country was before COVID. Both the methodology and the results of our research can be used in analysis for the preparation of government decisions.

Our methodology involves analysing the IMD competitiveness rankings of 62 countries from 2010- 2019 to form clusters based on long-term government policies. The study then looks at how these clusters fared during the years 2020-2022 during and following the COVID pandemic.

The rest of the article is organised as follows: after the literature review and the analytical framework we discuss the empirical methodology and the IMD data used; then interpret the results and describe how resilience to shock were conditional on the institutional setting or on government 'configuration'; and end with conclusions.

2. Literature review

2.1. National competitiveness

Since the 1970s, 'competitiveness' has been a popular term in economics and economic policy and the notion is still intensively studied today (Bruneckienė *et al.*, 2023; Dabbous *et al.*, 2023; Linsi, 2020). Nevertheless, an *agreed upon* definition of competitiveness is still lacking, as the term is used with different meanings, even in similar contexts (Aiginger *et al.*, 2013; Benítez-Márquez *et al.*, 2022; Buitrago R. *et al.*, 2023; Falciola *et al.*, 2020; Kiseľáková *et al.*, 2018). Initially, the debate centered on macroeconomic perspectives (Boltho, 1996; Davies and Ellis, 2000; Krugman, 1994), but it has expanded to include national, state, regional, and firm levels

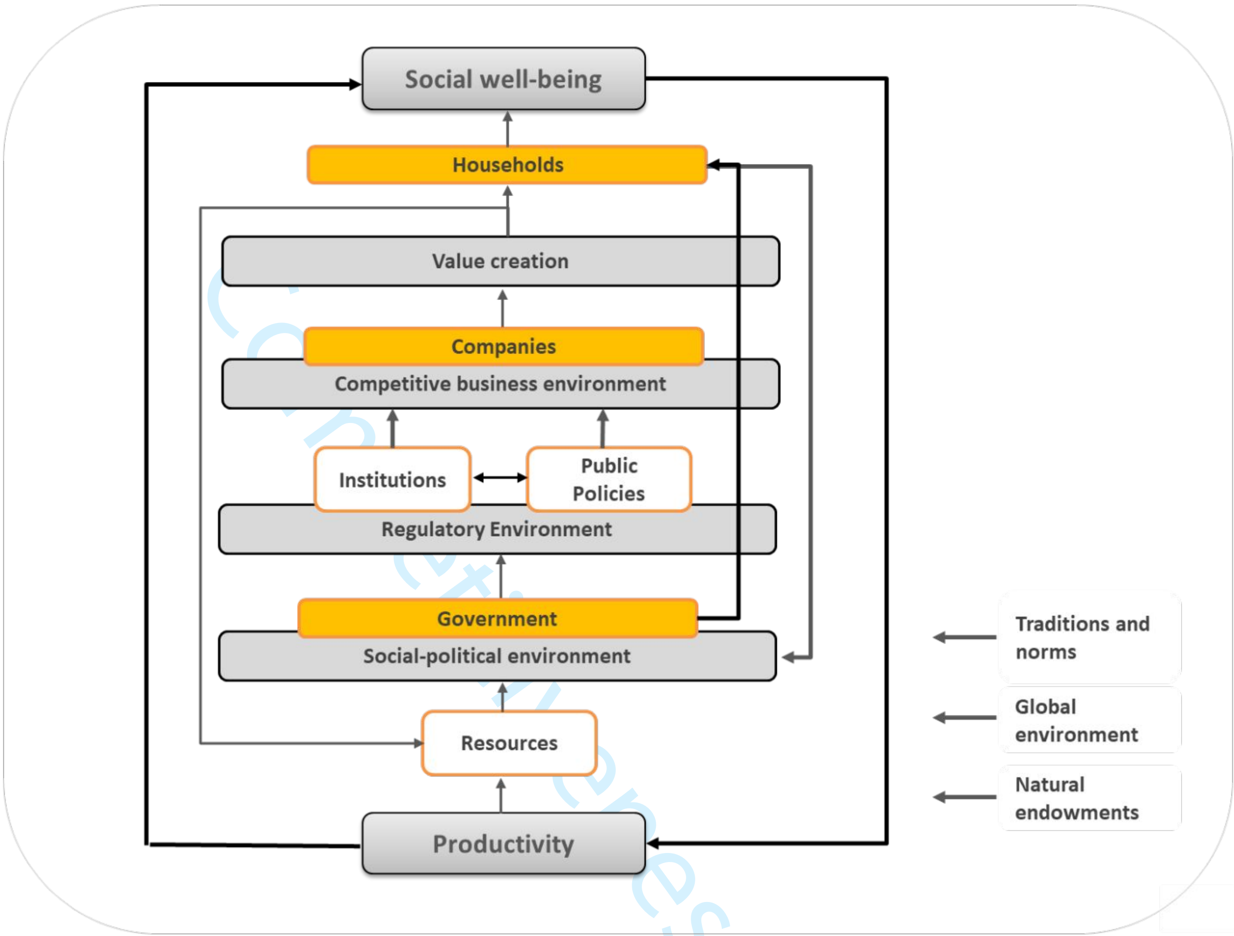
(Buitrago R. *et al.*, 2023; Linsi, 2020; Hodges and Anderson, 2022). Our research (with a focus on the role of the government) is by nature at a national level, but pays attention to the structural components of the macro phenomena.

Most scholars agree (Amaral and Salerno, 2019) that the overall measure of macrolevel competitiveness needs to be some indicator of national development (Buitrago *et al.*, 2023), as it is insufficient to judge competitiveness from a solely economic point of view (Hodges and Anderson, 2022). It is also probably the reason why competitiveness indices have enjoyed substantial popularity: they consider multiple aspects beyond the economic (Kaplan, 2003; Oral and Chabchoub, 1996).

To analyse the competitiveness consequences of government policy, we elaborated on research that combines institutional and microeconomic approaches. Out of these two approaches the related microeconomic approach (Barney, 1991; Kor and Mahoney, 2004; Porter, 1990, 2004) is far more established, but research on the role of institutions is also emerging (Aiginger *et al.*, 2013; Buitrago and Barbosa Camargo, 2021; Campbell and Pedersen, 2007; Esser *et al.,* 1996; Meyer-Stamer, 2006; Park, 2012; Pedersen, 2010, Chisadza *et al.*, 2021).

For our analysis we find Chikán (2008) the most appropriate framework. This model (detailed in *Figure 1* and further elaborated in *Figure A1* in the Appendix) is based on microeconomic and institutional theories. It defines national competitiveness as a nation's ability to produce, use, and sell goods and services in the global market, enhancing citizen well-being and resource yields sustainably, supported by favourable government conditions and incentives.

Figure 1. Framework for analysing national competitiveness. Source: Chikán, 2008. Edited by authors.



We further posit that there is a necessary precondition linking competitiveness to the performance of other factors of the national economy: a precondition of competitiveness is that the government provides favourable conditions and appropriate incentives for the effective use and renewal of resources. These conditions and incentives connect the macro- and microsphere, as well as public- and economic policies.

In our model, the two interconnected drivers of competitiveness are the well-being of the population and resource productivity, which continuously influence each other. The system aims to improve the well-being of the population (presented by households), as households with higher well-being are expected to contribute more productive labour to the economy.

The three main actors in this system – households, firms, and the government – are interconnected through market mechanisms and operate according to the logic of IO (Industrial Organization) studies. The fundamental logic linking the macro and micro spheres is based on the double value creation principle (Chikán, 2008). This principle states that firms aim to create value for both shareholders and consumers simultaneously. This approach connects the business sphere with the social objective of well-being (via customer satisfaction) and with productivity (the effective use of resources).

National competitiveness is affected by external factors such as social norms, traditions, global economic changes, and natural and geographical conditions. These factors significantly impact how national economies operate (see Lee and Karpova, 2018). In typical competitiveness analyses, these factors are considered exogenous because they are not directly controlled by individual national economies.

2.2. Measuring national competitiveness

The main actor of institutionalized influence on society (and on competitiveness) is the national government, making analysing government behaviour/actions a convenient proxy for studying institutions' impact on factors of competitiveness. Main channels of impact are the economic and social policy measures of the government and their characteristics, and direct interventions of the state (Mazzucato, 2021). To capture these factors and their contribution to overall competitiveness several indicators, mostly composite indicators have been proposed. These indicators often combine "objective" and "subjective" data to present a comprehensive view of national competitiveness, employing both national statistics and survey-based methods.

The most cited indices are those compiled by the WEF and IMD (Benítez-Márquez *et al.*, 2022; Bowen and Moesen, 2011; Buitrago R. *et al.*, 2023; Buitrago R. and Barbosa Camargo, 2021; IMD, 2020, 2021; Kaplan, 2003; Kiseľáková *et al.*, 2018; Kramulová and Jablonský, 2016; Oral and Chabchoub, 1996; Schwab *et al.*, 2020). The table below presents the matching of the pillars of the IMD and the WEF to the key elements of our above model framework. For the analysis to follow, we used the IMD competitiveness dataset.

Table 1. Matching of the pillars of the IMD and the WEF to the key elements of our model framework

Corresponding pillars of the IMD competitiveness ranking	**Key factors of our framework for analysing national competitiveness**	**Corresponding pillars of the WEF competitiveness ranking**
Basic Infrastructure Domestic Economy Scientific Infrastructure Technological Infrastructure	**Resources**	Infrastructure Market size Technological readiness
Attitudes and Values Education Health and Environment	**Social-political environment**	Health and primary education Higher education and training
Business Legislation *Institutional Framework* *Public Finance* *Tax Policy* *Societal Framework*	***Government and Regulatory environment***	*Institutions* *Macroeconomic environment*
Employment Finance International Trade International Investment Labor Market Prices	**Competitive business environment**	Financial market development Goods market efficiency Labor market efficiency
Management Practices Productivity and Efficiency	**Companies and Value creation**	Business sophistication Innovation

2.3. COVID as an external shock

Since institutions and their impacts usually do not change overnight, it is particularly useful if we can study a situation where an external shock interacts with the existing institutional system of the countries in question. The COVID-19 pandemic has been such a shock and, with its prolonged consequences, remains a key concern of policy makers as well as businesses (Barrett *et al.*, 2023; Kiss-Dobronyi *et al.*, 2023). Valuable research on the effects of COVID-19 related government interventions on competitiveness have already been published focusing on the importance of institutions (Chiplunkar and Das, 2021), the effectiveness of national policies in given countries (Ohrimenko *et al.*, 2021; Sharma *et al.*, 2022), affecting specific industries (Fernandez *et al.*, 2021) and on upgrading the definition of competitiveness (Clinch-Ketels, 2020). Compared to these works, this paper holds a more holistic approach focusing on the effects on wider national competitiveness performance in interaction with institutions.

3. Methodology

3.1. Data used

This paper uses the IMD competitiveness dataset, as it contains comparable data both before and after the pandemic. Since the focus is on the impacts of governments on national competitiveness during the pandemic, special focus is given to the government efficiency pillar of the database (for the contents of the government efficiency indicator see ‘Government and Regulatory environment’ row in *Table 1*).

3.2. Analytical approach

Our analytical approach employs the following steps:

(1) we cluster countries based on the policy choices and performance of their governments in several dimensions in the decade before COVID-19 (between 2010-2019), to group similar government policy “*configurations*” together,

(2) we analyse whether country groups with statistically similar competitiveness scores before COVID-19 but with different government policy *configurations*, have reacted differently to the pandemic, i.e., whether change in their competitiveness was dependent on the structure of how countries in the cluster are governed.

We defined a *configuration* of government based on the countries’ governments’ performance on indicators representing fields of government performance. These indicators supply us with a basis for clustering (discussed in detail in the next section). Two essentially different *configurations* might be (i) a case where performance in social policy is strong, and tax policy is weak, while another might be (ii) a case where tax policy is strong and social policy is not so substantial. *Figure A1* in the Appendix shows how these steps relate to the overall model presented before. Relevant terms in the context of competitiveness metrics are used based on the IMD’s definition (2021).

Importantly, our study is a post-study by design, with data collected in 2023. Historically, the pre-treatment period ('before COVID-19') covers the years 2009-2019 (inclusive). The "treatment" happens in 2020, and post-treatment entails data for 2021 and 2022. Whilst we admit it is hard to say we have fully got back to a post-COVID world by 2021, the key differences in government performance we are interested in materialized in the year of the treatment, allowing for considering 2020, 2021 and 2022 as post-treatment observation points.

As it has been stated, in this paper we work with the national competitiveness indices compiled by IMD (2021). We make slight adjustments to the IMD scores (z-score transformation), to be able to treat them as a panel dataset (see further details in Appendix 1.3). As a first step of the analysis, we further transform the IMD overall national competitiveness score, to exclude the government efficiency sub-pillar as we want to use this sub-pillar as an independent variable (further details in Appendix 1.4).

3.3. Clustering based on the structure of government efficiency

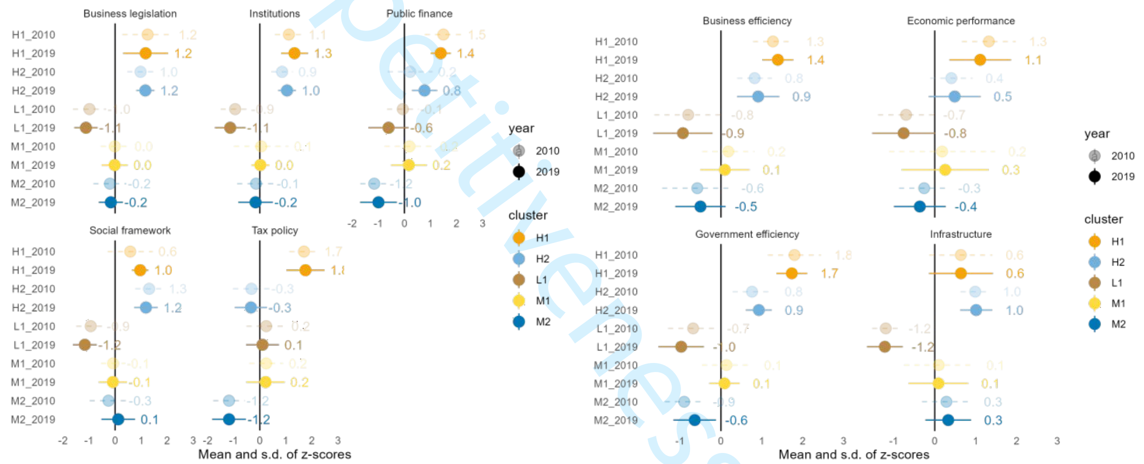
We posit that different structures ('configurations') of government policy can result in similar levels of competitiveness. While it has been shown that government efficiency *in general* is linked to overall national competitiveness (see Appendix 1.5 for details), there are multiple ways, i.e. multiple *configurations* of government structure, which can lead to similar overall outcomes (i.e., competitiveness score), but differing various important specificities.

We use a K-means clustering algorithm (Hartigan and Wong, 1979) to generate country-clusters based on the average government sub-pillar scores of the countries through 2010-2019. We use the scores of all five sub-pillars of the 'Government efficiency' main pillar of the IMD scoring. To filter out annual fluctuations, we use average scores across the years in the sample. The five sub-pillars are: (1) Public finance, (2) Tax policy, (3) Institutional framework, (4) Business legislation, and (5) Societal framework (for our conceptual framework, see *Figure A1* in the Appendix, for the structure of the IMD pillars see Figure A2). We choose five for the number of clusters based on minimum BIC-value across the possible cluster numbers (Schubert, 2023). The five clusters are generated using the K-means method, with 100 iterations for the center points, hence limiting the stochastic element in the final clustering (Broder *et al.*, 2014).

4. Results

Results of the clustering can be seen below in *Figure 2* and in Appendix 1.6. The figure shows the mean and standard deviation values of the clusters for 2010 and for 2019. Membership of the countries is listed in Appendix *Table A5*. Between the sum of squares to the total sum of squares, the ratio is 67.8%, indicating a sufficient fit.

Figure 2. Average and standard deviation of z-scores in the clusters: government component scores (left chart); IMD competitiveness component scores (right chart)



We name the clusters H1 and H2 (H standing for high), M1 and M2 (M standing for medium) and L (L standing for low), signalling the clusters' competitiveness qualification.

We observe that:

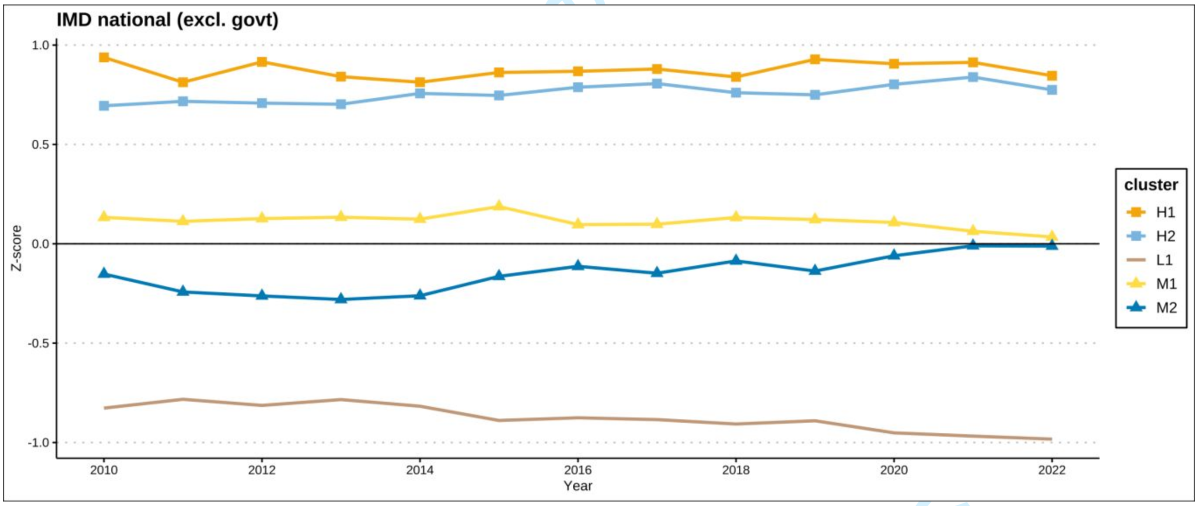
- H1 consists of six highly competitive economies. They are all small, technologically advanced economies. The name of the group is: *Small advanced economies.*
- H2 is a cluster of the economically most developed countries with related cultures. We name this cluster *Scandinavian, Northwestern European and Commonwealth economies.*
- M1 includes *Developed non-EU economies and East Central European economies.* This is a very diverse group: one third is from northeastern European ex-soviet

economies, one third from Southeast Asia and one third from the rest of the world, including the USA.

- M2 collects two culturally related groups and is named the *Southern and East Central European economies* cluster, with Japan being the exception.
- L1 is the most mixed group consisting of the least competitive countries of the IMD sample. This is the cluster of *Developing economies.*
- It is important to note that the applied clustering approach created clusters consisting of culturally close subgroups of countries - see the Inglehart-Welzel Cultural Map's 2023 version (World Values Survey Association, 2023).

We then test whether IMD scores were similar in the past for the clusters. We do this for the IMD overall competitiveness without the government component indicator (*IMD_constructed,* for detailed discussion see Appendix 1.4). See *Figure 3*.

Figure 3. Average IMD scores through the period



The left-hand-side axis indicates that with regards to the *IMD_constructed* variable, the difference between H1 and H2 and the difference between clusters M1 and M2, respectively, are not significant through all years (see *Table A4* in the Appendix). This observation indicates that the clusters capture country groups where, as we have posited before, different government *configurations* result in similar competitiveness performance.

The two cases we identify are between clusters H1-H2, which are *Scandinavian, Northwestern European and Commonwealth economies* mostly in the EU (H2) and *Small advanced economies* (H1); and between clusters M1-M2, which are the *Southern and East Central European economies* (M2) and a mixed category, the cluster of the *Developed non-EU and East Central European economies* (M1). We note that cluster L1 is significantly lagging in terms of competitiveness. It is excluded from further analysis – as it lacks a group with similar competitiveness score, but different government *configuration*.

Clustering of the countries reveals two insights: *the same level of overall competitiveness can be achieved with different configurations of governmental policy* (i.e., different focus areas). We have seen that these structures (as measured in the IMD) can differ quite a bit between the clusters, however a common pattern was a generally higher *infrastructure* component score in the case of European countries, with generally lower scores on *public finance* and *tax policy* and higher scores on *social framework*.

This result is in line with the general understanding of the cultural characteristics of the respective groups of countries: infrastructure (including human infrastructure) is well-developed in Europe and generally seen as being an advantage, but European countries also have stronger redistribution and role of government, translating to higher tax rates (tax policy) and higher public debt (public finance) (see Girdenas *et al.*, 2013). In contrast with fast developing, small, advanced economies: these states have much less regulation, higher business efficiency and often a generous tax policy. Nevertheless, this also means less redistribution, less of a "welfare" state, which can be noticed in the lower societal framework score.

While this is necessarily a simplification, we can understand the results as pointing towards two competing structures: (1) *the welfare state* with a strong infrastructure stock (including human infrastructure and knowledge), higher levels of redistribution, and a strong societal framework, (2) *the market liberal state* with beneficial tax rates, low public debt, in general a smaller government that has economic superiority, but ranks lower in scores of its societal framework. With the 2-2 pairs of clusters, we can further differentiate between highly competitive (H1 and H2) and moderately competitive (M1 and M2) country groups. See *Table 2* - note that these classifications are not connected at this point to the COVID-19 crisis.

Table 2. Classification of clusters based on national competitiveness level and configuration of government performance

		National competitiveness	
		Mid-range	High
Configuration of government performance	Market liberal	M1	H1
	"Welfare" state	M2	H2

4.1. The impact of COVID-19 conditional on government configuration

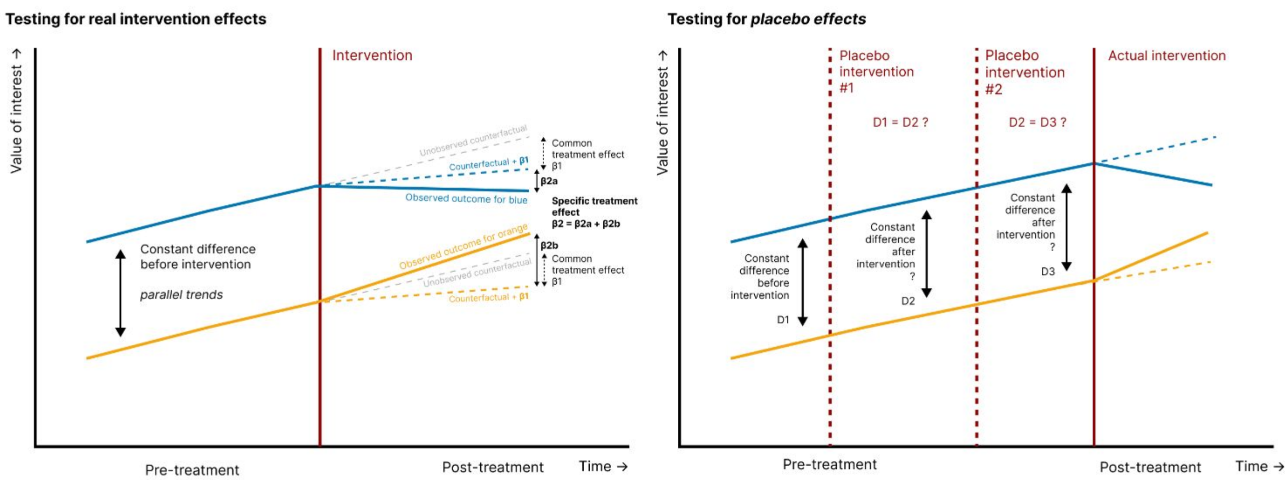
We established that similar levels of competitiveness can be achieved with different government policy *configurations*. Now we focus our attention on whether these different configurations produced differing outcomes during the emergence of an exogenous shock: COVID-19.

We employ a modified version of the difference-in-differences (DiD) method (Wooldridge, 2013) between clusters which had **similar national competitiveness scores** before COVID. Basically, we test whether differences between groups (which differences were insignificant) have changed due to COVID. Comparisons are made therefore between H1-H2 and M1-M2 clusters, respectively.

DiD is a method that mimics experimental research design by studying the effect of a "treatment" on the differences between two groups that before the treatment had identical trends (as in slope of growth) (Huntington-Klein, 2023; Wooldridge, 2013). Now, generally the

DiD method is applied with a control and a treated group (i.e., one group is affected by the treatment while the other is not); in our case the setup is slightly different, because *both* of our groups are treated. What this means is that we will not be able to interpret the estimated DiD coefficient as we would do it in a standard DiD application[1], however we will be able to tell if the difference between the two groups has changed. What we will not be able to tell is the composition of that change, i.e., whether one of the groups did better or the other did worse, or both at the same time. Figure 4 graphically represents the main idea of the method.

Figure 4. Graphical representation of the modified difference-in-differences (DiD) method



For this to be a valid estimation we need some assumptions to hold. Most importantly we need the groups to have parallel trends without the intervention, i.e., we need to be sure that the change in difference is not due to some naturally occurring trend. While we cannot directly test the presence of parallel trends (Huntington-Klein, 2023) we can employ a method like that of described by Lima and Silveira Neto (2018) testing *anticipatory effects* or the *placebo effect* (Huntington-Klein, 2023). We test whether differences are significant with *random treatment periods* before the actual treatment: we modify the data in a way that we assume that the

[1] In such an application the parameter of interest, the DiD coefficient would tell us about the ATE (the average treatment effect) of the treatment (Wooldridge, 2013).

"treatment" has happened in random periods in the past and we analyse whether we get false-positive results (Huntington-Klein, 2023).

We test this for the overall competitiveness indicator as well as for the four main pillars of IMD competitiveness (Infrastructure, Business efficiency, Economic performance, and Government efficiency) (see *section 1.7.2 in the Appendix*). *Figure 5* shows the test results for the pre- and post-treatment periods. To capture an impact due to the treatment (COVID) we expect the parallel trends assumption to hold pre-treatment (i.e., that there is no significant difference with the "fake" treatment periods) and to have a significant parameter estimate in the DiD estimation post-treatment – this is what we mean and report by "test results" in the table.

Figure 5. Pre-treatment and post-treatment test results

	IMD overall national competitiveness*	IMD infrastructure	IMD business efficiency	IMD economic performance	IMD government performance
H1 vs H2	X Pre-treatment X Post-treatment	X Pre-treatment ✓ Post-treatment	X Pre-treatment X Post-treatment	X Pre-treatment ✓ Post-treatment	✓ Pre-treatment X Post-treatment
M1 vs M2	X Pre-treatment ✓ Post-treatment	X Pre-treatment X Post-treatment	X Pre-treatment X Post-treatment	X Pre-treatment ✓ Post-treatment	✓ Pre-treatment X Post-treatment

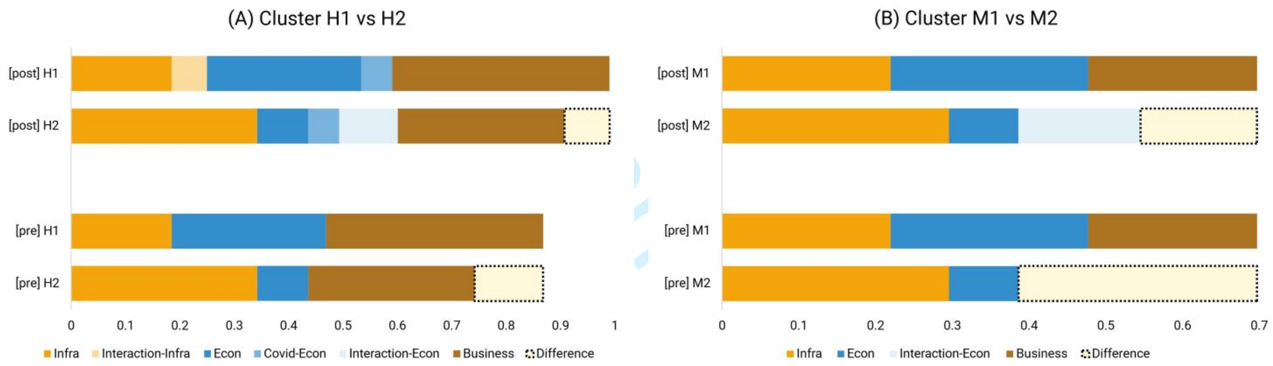
Note: for pre-treatment lack of significant difference is indicated with an x (X) while significant difference in the pre-treatment period is indicated with a tick (✓); for the post-treatment period a significant difference is indicated with a tick (✓), * excludes government performance

In the case of cluster H1-H2 we see that the parallel trends assumption holds for the overall competitiveness, but we detect no effect of the treatment in the post-treatment period. This can be either due to the lack of impact or two opposing impacts offsetting each other. When we analyse the components, we see that parallel assumption holds for infrastructure, business efficiency, and economic performance. It does not hold for government efficiency, which is expected as we did the clustering based on this. In the case of infrastructure and economic performance we also see post-treatment impacts, i.e., that the difference in differences is not the same after the treatment as it was before.

In the case of clusters M1-M2, we see that the parallel trends assumption holds for both the overall competitiveness measure and for its components too. However, the treatment only has impacts on the overall indicator and with regards to economic performance. Hence, the overall competitiveness difference is driven by the difference in economic performance. Cluster M2, the group of "mid-range" European welfare states performs better during COVID than cluster M1 in terms of economic performance, which then drives the better overall competitiveness result based on our analysis.

4.2. Disentangling component differences

Figure 6. Cluster H1-H2 and M1-M2 composition of overall competitiveness score (excluding government efficiency) and its estimated changes



The high competitiveness groups (H1 and H2)

For clusters H1-H2, the groups with the highest competitiveness performance, the parallel trends assumption holds for overall competitiveness and infrastructure, as well as business efficiency and economic performance. In the post-treatment (COVID) period, however, they show new significant differences in terms of infrastructure and economic performance. We have discussed that these component-level impacts might be offsetting each other, hence we see no significant effect in overall competitiveness.

Given the DiD cluster H1-H2 numerical results (*Table A7* in the *Appendix*) we see this playing out in the numbers: the estimated interaction effect (covid x clusterH2) for the H1 cluster in terms of infrastructure is +0.19, while for economic performance it is negative: -0.45. Applying the relevant weights, we get what is presented in *Figure 6*. While overall competitiveness of cluster H2 is still lower in the post-treatment period than cluster H1's, there is a (non-significant) shrinkage of the difference driven by competing forces. The COVID impact, in interaction with the clusters' relevant policy and institutional structure, increases relative economic performance for H2, while it increases relative performance in infrastructure for cluster H1.

The medium competitiveness groups (M1 and M2)

For clusters M1-M2, a different picture emerges (see Appendix *Table A8* for numerical results). There are no significant impacts for most sub-components but there is a significant increase in terms of economic performance for cluster M2. This feeds into the overall competitiveness score. Eventually, this leads to a narrowing gap between overall competitiveness of M2 and cluster M1, with cluster M2 improving after treatment (but still behind). *Section 1.7.3* in the Appendix details the drivers of these effects further; in short, the performance of cluster M2 is considerably better in both employment and international investment terms relative to cluster M1 during the COVID period.

5. Discussion and implications

This paper analysed how different long-term government policies, institutions or government ‘configurations’ can reach similar competitiveness outcomes and how those different ‘configurations’, at the same time, can lead to dissimilar outcomes when it comes to reacting to an external shock. The originality of the article lies in its combination of institutionalist and microeconomic views of competitiveness, considering the importance of government policy and the influence of institutions not just on long-term competitiveness, but on short-term reactions to shocks. The findings indicate a correlation between government efficiency and competitiveness, and provide evidence that governments with a welfare orientation were more resilient , maintaining national competitiveness during the crisis.

Institutions and government policies are linked with national competitiveness - our research supports this connection. We show that countries can reach similar levels of competitiveness with different "configurations" (approaches) of government policy. By analysing IMD’s competitiveness rankings we identified two main types of government policy-mixes in both highly competitive and medium competitive countries, which correspond to the countries’ long-term institutional setting:

- a welfare state-like involving more government intervention to provide social services; and
- a market liberal with more limited government involvement, focusing more on free-market mechanisms.

Further analysis suggests that some countries (H1) achieve higher competitiveness by emphasizing stronger market elements, others (H2) attain slightly lower but still strong competitiveness performance via welfare state policies. The exogenous economic shock caused by COVID-19 allowed us to study how these different groups react to shocks. Our findings indicate that the COVID shock did not have a significant effect on the difference between the two high competitiveness (welfare, and market liberal) groups. Most likely, that is because these states had stronger social support systems in place, which helped cushion the economic impact of the pandemic. However, the shock did influence difference between countries in the medium competitiveness group. In terms of competitiveness our results indicate that the welfare-oriented states were more resilient.

In this group (medium competitiveness) states that focused on supporting society and had strong social systems in place have been more resilient at handling the economic / competitiveness problems caused by COVID. But generally, having a strong social framework and investing in public services is costly and might mean substantial redistribution. Therefore, we cannot suggest that in “normal times” these policies would also lead to higher competitiveness than their market liberal counterparts, but we do show that in times of crisis they might induce higher resilience.

A common notion related to the shock is the trade-off between efficiency and resilience. For an illustration an example from inventory management may be useful: some businesses follow a lean system by keeping only the minimum necessary inventories. Meanwhile others, keeping extensive local inventories, focus more on resilience. This idea can also apply to nations: one fares better due to the lower costs and higher efficiency in normal times, but an efficient system is also more vulnerable in times of shock. We see this effect being replicated here on a macro-scale. Societal investments in social policy or healthcare pay-off in times of crisis, even though they bear costs in “normal times”. Notably, these effects were only visible for medium but not for the high competitiveness countries, further indicating that these differences might disappear at a higher level of development and competitiveness.

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Online Appendix
"Government influence on national competitiveness (Evidence from the COVID era)"

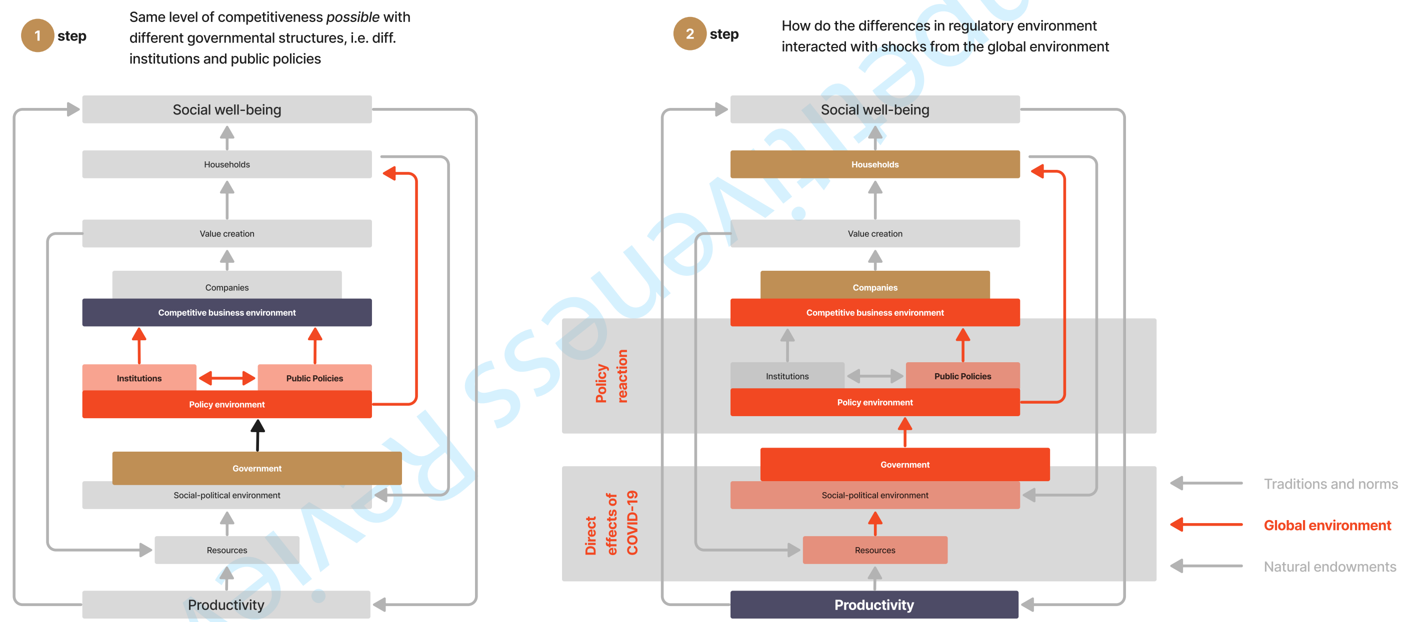
1 Online Appendix

Online Appendix to the paper "Government influence on national competitiveness (Evidence from the COVID era)".

Contents

1.1 Linkage of the steps of the analytical process to the theoretical model

Figure A1: Linkage of the steps of the analytical process to the overall model: (1) establishing relationship between government performance and components of competitiveness, (2) clustering countries based on components of their governmental performance, (3) testing whether countries with similar competitiveness, but different governmental structure have performed differently during the COVID-19 crisis



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1.2 Pillars of the IMD and the WEF competitiveness rankings and our model framework

Table A1: Matching of the pillars of the IMD and the WEF to the key elements of our model framework

Corresponding pillars of the IMD competitiveness ranking	**Key factors of our framework for analyzing national competitiveness**	**Corresponding pillars of the WEF competitiveness ranking**
Basic Infrastructure, Domestic Economy, Scientific Infrastructure, Technological Infrastructure	**Resources**	Infrastructure, Market size, Technological readiness
Attitudes and Values, Education, Health and Environment	**Social-political environment**	Health and primary education, Higher education and training
Business Legislation, Institutional Framework, Public Finance, Tax Policy, Societal Framework	**Government and Regulatory environment**	Institutions, Macroeconomic environment
Employment, Finance, International Trade, International Investment, Labor Market, Prices	**Competitive business environment**	Financial market development, Goods market efficiency, Labor market efficiency
Management Practices, Productivity and Efficiency	**Companies and Value creation**	Business sophistication, Innovation

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Figure A2: Structure of the IMD competitiveness score and its subsequent pillars, this figure has been reproduced from the IMD World Competitiveness Yearbook 2021 edition, the page numbers shown correspond to the page numbers in the report; detailed content of the pillars is described here

1.3 Adjustments to the IMD competitiveness score

The composition of IMD scores applied in our analysis changes slightly from year-to-year, therefore the raw scores are not directly comparable across years. To alleviate this discrepancy, we standardize scores in each year and exclude outlier countries with extreme values (Argentina and Venezuela). The Z-score method (Glantz et al., 2016) is applied, where x is the observed value, $\hat{x}$ is the mean of the variable, S is the sample deviation:

$$z = \frac{x - \hat{x}}{S} \quad (1)$$

Figure Figure A3 and Figure A4 below presents the distributions of main variables before and after normalization. Similar transformations are used in the literature to obtain comparable scores (Kiseľáková et al., 2018).

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Figure A3: IMD scores and component scores across years before and after normalization as described in the text - before

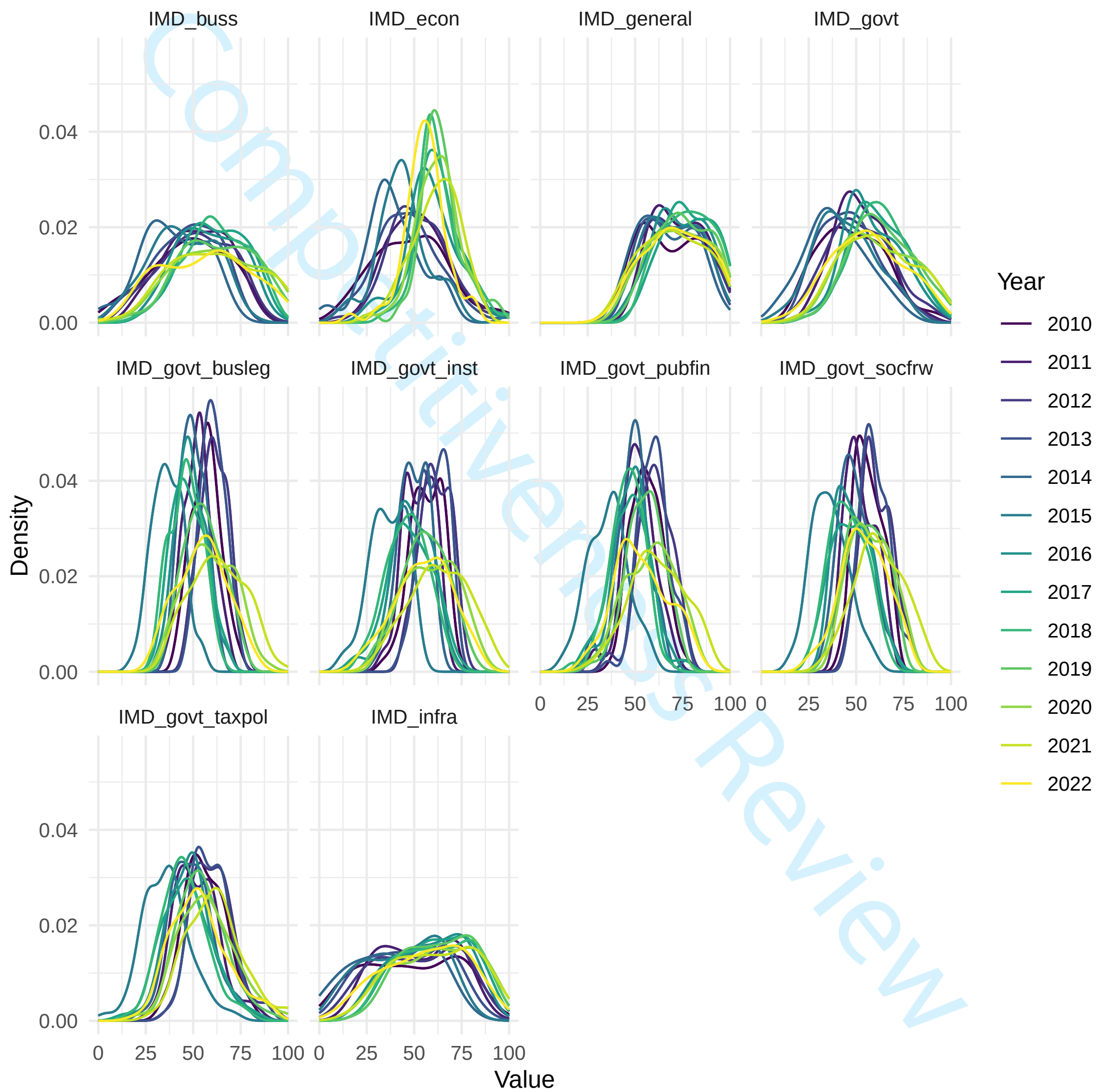

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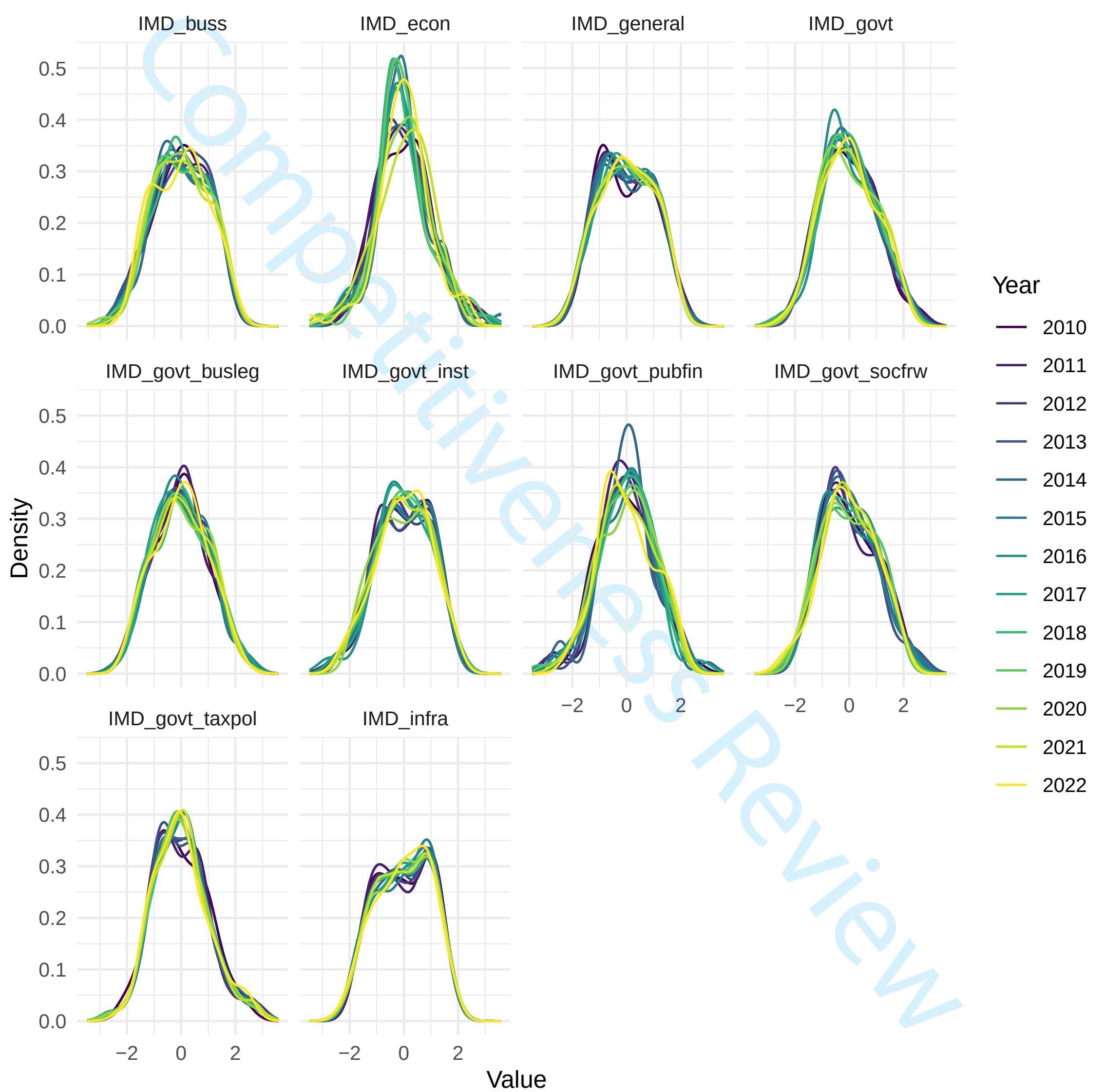
Figure A4: IMD scores and component scores across years before and after normalization as described in the text - after



1.4 Constructing national competitiveness scores excluding government efficiency

We construct the national competitiveness scores excluding government efficiency by running a simple OLS regression, where the dependent variable is the overall national competitiveness score, while the independent variables are the components. Table A2 shows the results.

Table A2: Regression results used for determining component weights

Dependent Variable:	IMD overall score (z-score)
Model:	(1)
Variables	
Constant	-2.64×10^{-16}
	(0.0053)
Business efficiency (z-score)	0.3228***
	(0.0032)
Government efficiency (z-score)	0.2687***
	(0.0027)
Infrastructure (z-score)	0.3359***
	(0.0020)
Economic performance (z-score)	0.2365***
	(0.0019)
Fit statistics	
R^2	0.99845
RMSE	0.03904
F-test	30,265.9
Wald (joint nullity)	30,265.9

IID standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Results of the regression yields weights for the now normalized factor scores (i.e., the weight of government efficiency Z-score is 0.2687 in the overall IMD score), with a high explanatory power (R^2=0.998). See the regression results in Figure A4 in the Annex. The overall score, excluding government efficiency (accounting for the other three key pillars only: business efficiency, infrastructure, economic performance) is derived using the estimated parameters:

$$y = z_{buss} \times .3228 + z_{infra} \times .3359 + z_{econ} \times .2365 \quad (2)$$

where y is the new IMD competitiveness score, excluding the government efficiency pillar, z_{buss} is the z-score transformed competitiveness index of the business efficiency pillar, z_{infra} is the score of the infrastructure pillar, while z_{econ} is the score of the economic performance pillar. The defined new y variable has a 0.9852 correlation with the original IMD competitiveness score across all years as shown below on Figure A5.

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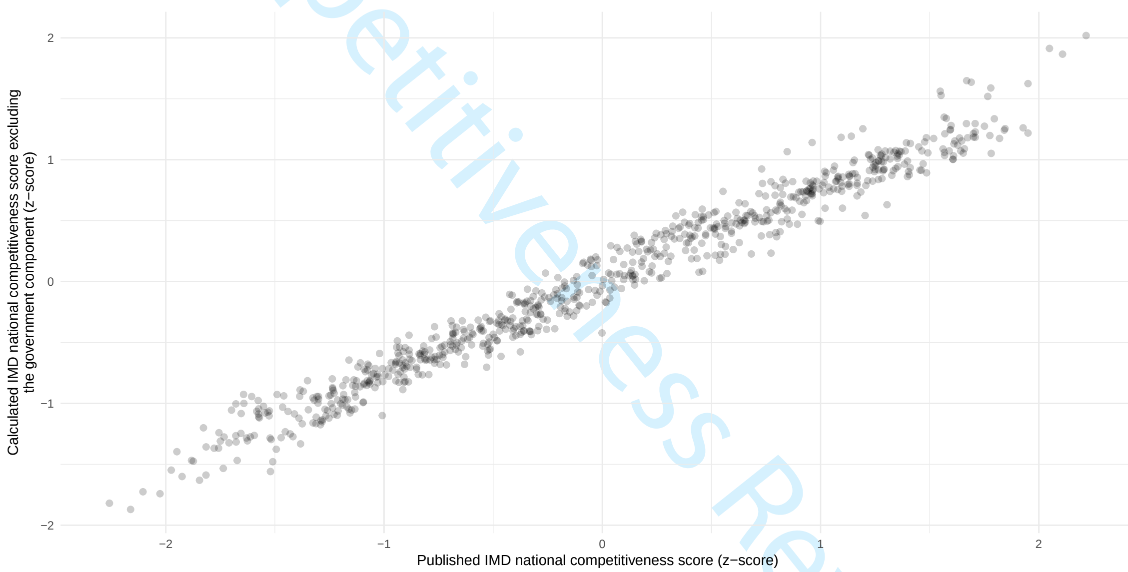
Figure A5: Correlation between the original IMD competitiveness score (Z-score, x-axis) and the competitiveness score excluding the government efficiency component (y-axis), all relevant years



1.5 The connection between government efficiency and national competitiveness

As a first step of the analysis, we transform the overall national competitiveness index to exclude the government efficiency sub-pillar and establish that there is a stable and positive relationship between perceptions of national competitiveness and government efficiency. However, government efficiency itself is a component of the overall IMD national competitiveness score in the IMD rankings. Therefore, we construct an indicator that excludes Government efficiency from the overall IMD competitiveness score (*IMD_constructed*) and accounts only for the other components instead: Business efficiency, Infrastructure, and Economic performance. Description of how we built this indicator is detailed in the Appendix (see Section 4.2).

The approach of isolating the Government efficiency pillar presupposes that the experimental variable (different governmental configuration) is responsible for the observed differences, whilst the rest of the environment (the other components of competitiveness) remains largely unchanged at least in terms of to focus of our analysis. It is assumed that the five pillars together capture all drivers of competitiveness performance; therefore, by isolating one of them whilst keeping the others unchanged (which are affected by impacts common to all countries in the year of the treatment) we can assess the explanatory power of different governmental configuration in isolation.

We specify two models where the *IMD_govt* score explains the constructed indicator score (*IMD_constructed*), noting that what we measure here is a correlation between the variables rather than causality. Model (1):

$$IMD_{i,t} = \alpha + \beta_1 IMD^{govt}_{i,t} + \epsilon \tag{3}$$

where $IMD_{i,t}$ is the national IMD competitiveness score (normalized, as described in subsection 1.3) in country i for year t, α is the intercept in the pooled OLS, ϵ is the residual. Finally, $IMD^{govt}_{i,t}$ is the government efficiency pillar score of country i for time period t. And then model (2):

$$IMD_{i,t} = \mu_t + \gamma_i + \beta_1 IMD^{govt}_{i,t} + \epsilon_{i,t} \tag{4}$$

where $IMD_{i,t}$ is once more the national IMD competitiveness score; μ_t is the year fixed-effect, γ_i is the country fixed-effect. Model (1) is a pooled OLS model of the panel dataset, while (2) is a fixed effects model, allocating an individual intercept to each of the countries (and years), therefore accounting for country-specific time-invariant effects and effects common to all countries in a single year (i.e., common effects of a global event).

We estimate the models on the full panel and get a positive coefficient in both models for the *IMD_govt* variable, hence indicating that the *IMD_govt* score, even when accounting for constant differences across countries and year-specific common effects, has a strong positive correlation with other components of the overall IMD score. The pooled OLS effect can be understood as a comparison between countries (and time-steps): if a country in general has a higher competitiveness score it is likely to have a higher *IMD_govt* score too (average effect 0.61). While the fixed-effect model can be understood as changes between years in the observed countries, i.e., if the *IMD_govt* score increases across years in a country then the average increase in overall IMD score is expected

Table A3: Panel regressions between the constructed indicator (*IMD_constructed*) and the IMD Government efficiency score (*IMD_govt*) with and without fixed-effects

Dependent Variable:	*IMD_constructed*	
Model:	(1)	(2)
Variables		
Constant	-1.05×10^{-16}	
	(0.0171)	
IMD_govt	0.6085***	0.3845***
	(0.0173)	(0.0377)
Fixed-effects		
Country		Yes
Year		Yes
Fit statistics		
Observations	769	769
R^2	0.61783	0.96684
Within R^2		0.36045
RMSE	0.47448	0.13977
F-test	1,239.9	136.81
Wald (joint nullity)	1,239.9	104.02
F-test, p-value	2.29×10^{-162}	5.55×10^{-40}
F-test (projected), p-value		2.19×10^{-69}
Wald (joint nullity), p-value	2.29×10^{-162}	5.69×10^{-23}

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

to increase by about 0.38 too. We take this as an indication that the connection between perceived government efficiency and perceived national competitiveness (based on non-Government efficiency-related factors of competitiveness) is strong in the sample. Although causality cannot be determined, the correlation between the variables is observable and significant. Detailed results of the regressions are shown in Table A3.

1.6 Further supporting calculations of the analysis

1.6.1 T-tests of difference between groups

Table A4: T-tests of difference between the mean of the groups, number of years between 2010-2022 where the t-tests produce non-significant p-value (>0.1) results

		H2	L1	M1	M2	H1
1	H1	13	0	0	0	
2	H2		0	0	0	13
3	L1	0		0	0	0
4	M1	0	0		13	0
5	M2	0	0	13		0

Number of years where means difference T-test p-value is higher than 0.1

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1.6.2 Allocation of individual countries to clusters

Table A5: Allocation of individual countries to clusters

Small advanced economies	Scandinavian, Northwestern European and Commonwealth economies	East Central European and Developed non-EU economies	Southern and East Central European economies	Developing economies
H1	**H2**	**M1**	**M2**	**L1**
Hong Kong	Australia	Chile	Austria	Brazil
Qatar	Canada	China	Belgium	Bulgaria
Singapore	Denmark	Czech Republic	France	Colombia
Switzerland	Finland	Estonia	Greece	Croatia
Taiwan, China	Germany	Iceland	Hungary	India
UAE	Ireland	Israel	Italy	Indonesia
	Luxembourg	Kazakhstan	Japan	Jordan
	Netherlands	Korea Rep.	Portugal	Mexico
	New Zealand	Lithuania	Slovenia	Peru
	Norway	Malaysia	Spain	Philippines
	Sweden	Poland		Romania
	UK	Thailand		Russia
		USA		Slovak Republic
		Latvia		South Africa
		Cyprus		Turkey
		Saudi Arabia		Ukraine
				Mongolia

1.6.3 Comparison of clusters

Figure A6: East Central European and Developed non-EU economies (M1) and Southern and East Central European economies (M2) comparison

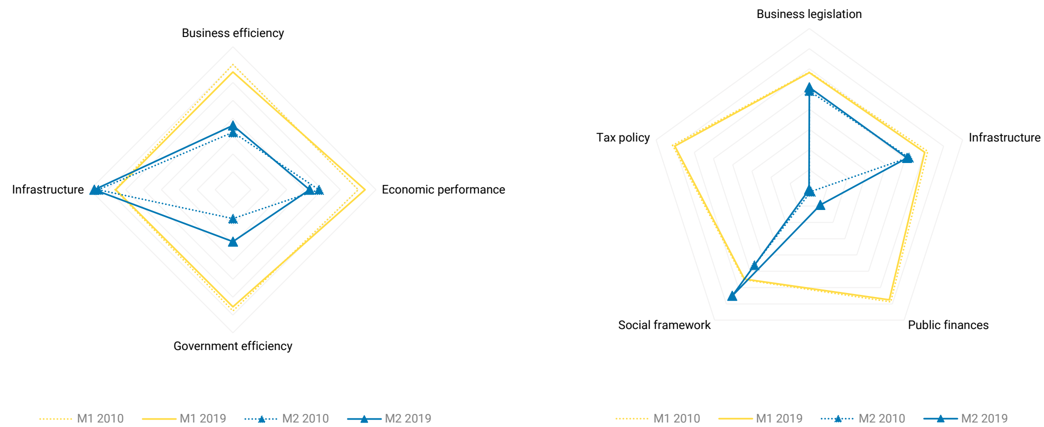
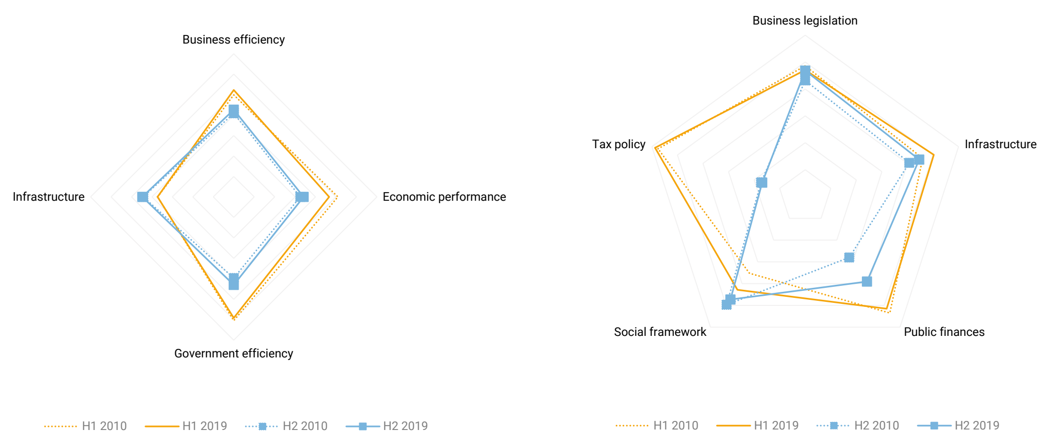


Figure A7: Scandinavian, Northwestern European and Commonwealth economies (H2) and Small advanced economies (H1) comparison



1.7 Difference-in-differences further regression results

The following tables present detailed estimation results for the modified difference-in-differences (DiD) models investigated. The setup of the models is as follows:

$$y_{i,t} = \beta_1 covid_t + \beta_2 covid_t \times cluster_i + \gamma_i + \epsilon_{i,t} \tag{5}$$

where $y_{i,t}$ is the dependent (LHS) variable of interest that can be overall competitiveness ($IMD\_constructed$) or one of the pillar scores; $covid$ is a dummy variable indicating COVID years, such as $covid = 1$ in years where COVID is present and $covid = 0$ in preceding years, γ_i is the fixed-effect term for the individual countries, while ϵ is the residual. Finally, $covid_t \times cluster_i$ is the interaction term between the presence of COVID and cluster membership, or the modified DiD coefficient. The below table (Table A6) demonstrates what values this dummy variable can take:

Table A6: Explanation table for the interaction dummy

		Cluster membership	
		Cluster 'A'	Cluster 'B'
COVID year	Yes	**covid_A = 1**	covid_A = 0
	No	covid_A = 0	covid_A = 0

1.7.1 Results for main components of competitiveness

Table A7: Regression results of the modified DiD method for clusters H1-H2 across main components

Dependent Variables:	IMD overall[1]	Infrastructure	Government efficiency	Business efficiency	Economic performance
Model:	(1)	(2)	(3)	(4)	(5)
Variables					
COVID year (*covid*)	0.0248	0.1989**	-0.0738	0.0290	-0.2173
	(0.0664)	(0.0727)	(0.0876)	(0.0679)	(0.2490)
DiD interaction term	0.0377	-0.1881**	0.1806	-0.0157	0.4478*
(*covid* × *clusterH2*)	(0.0868)	(0.0815)	(0.1125)	(0.1283)	(0.2559)
Fixed-effects					
Country	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	233	233	233	233	233
R^2	0.70597	0.95902	0.83710	0.59046	0.74756
Within R^2	0.01836	0.15457	0.03410	0.00079	0.06624
RMSE	0.16340	0.11351	0.21808	0.29803	0.35834
F-test	20.409	198.93	43.681	12.255	25.171
F-test, p-value	3.03×10^{-5}	1.61×10^{-12}	2×10^{-7}	0.00051	8.29×10^{-6}

Clustered (Country) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*
[1] *also reported as IMD_constructed.*

Table A8: Regression results of the modified DiD method for clusters M1-M2 across main components

Dependent Variables:	IMD overall[1]	Infrastructure	Government efficiency	Business efficiency	Economic performance
Model:	(1)	(2)	(3)	(4)	(5)
Variables					
COVID year (*covid*)	-0.0201	0.0122	-0.0251	0.0501	-0.1709
	(0.0682)	(0.0566)	(0.0935)	(0.1324)	(0.1335)
DiD interaction term	0.1776*	-0.0134	0.2792**	0.0723	0.6713***
(*covid* × *clusterM2*)	(0.0962)	(0.0736)	(0.1258)	(0.2020)	(0.1722)
Fixed-effects					
Country	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	321	321	321	321	321
R^2	0.89466	0.95644	0.78941	0.77614	0.87169
Within R^2	0.05522	0.00086	0.05554	0.01161	0.15390
RMSE	0.17680	0.13832	0.28300	0.33923	0.34135
F-test	106.16	274.44	46.856	43.338	84.924
F-test, p-value	6.06×10^{-13}	9.75×10^{-18}	3.49×10^{-9}	7.49×10^{-9}	7.13×10^{-12}

Clustered (Country) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*
[1] *also reported as IMD_constructed.*

1.7.2 Testing of pre-treatment parallel trends

Figure A8: Testing of pre-treatment parallel trends for the overall competitiveness indicators between the relevant groups (H1-H2)

(a) Time-series of IMD score (b) Placebo treatment effects

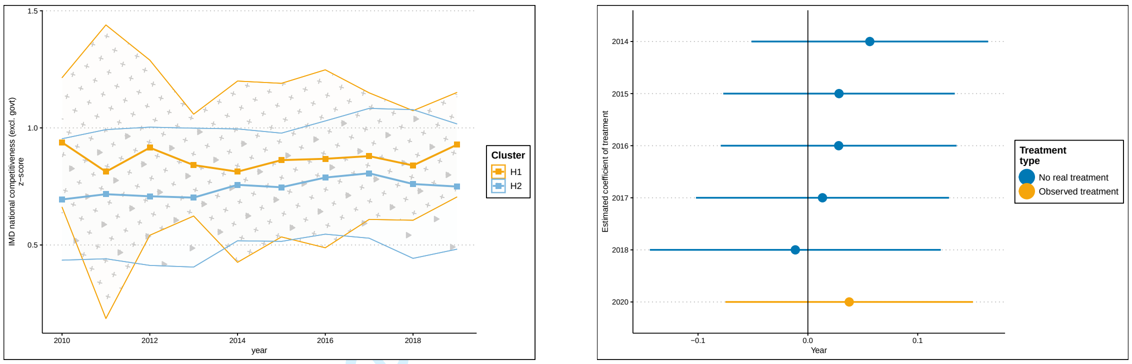
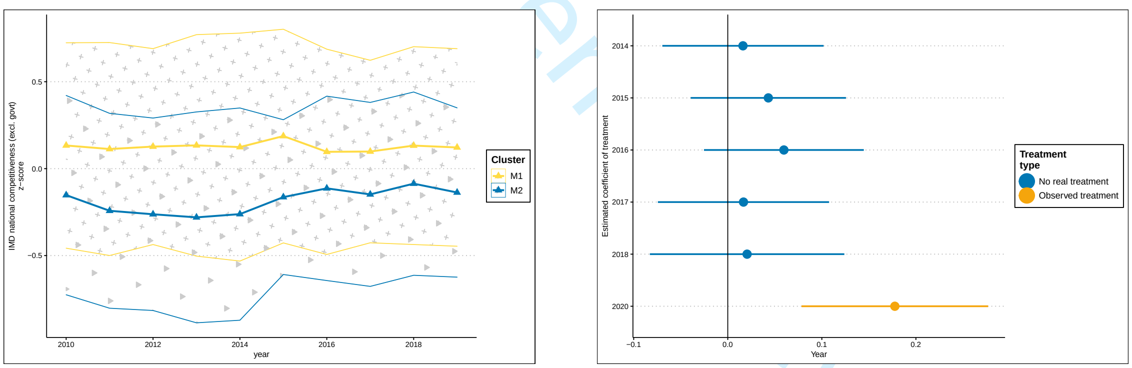


Figure A9: Testing of pre-treatment parallel trends for the overall competitiveness indicators between the relevant groups (M1-M2)

(a) Time-series of IMD score (b) Placebo treatment effects



1.7.3 M1-M2 economic performance

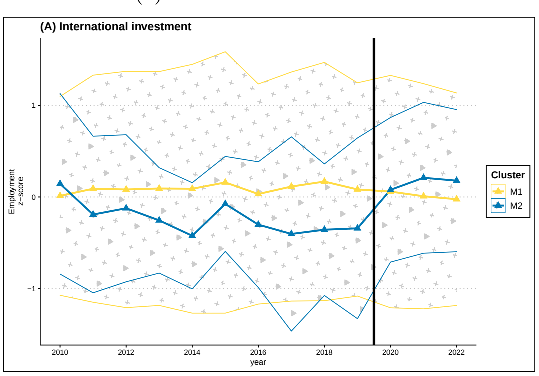
Table A9: Regression results of the modified DiD method for clusters M1-M2 across sub-components of the economic performance sub-component

Dependent Variables:	Domestic economy[1]	International trade[1]	International investment	Employment	Prices
Model:	(1)	(2)	(3)	(4)	(5)
Variables					
COVID year (*covid*)	-0.0195	-0.2616**	-0.1358	0.0061	-0.1621
	(0.1320)	(0.1240)	(0.1228)	(0.1775)	(0.1304)
DiD interaction term	0.2499	0.5565***	0.5242***	0.5701**	-0.0723
(*covid* × *clusterM2*)	(0.1727)	(0.1457)	(0.1800)	(0.2232)	(0.1647)
Fixed-effects					
Country	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	321	321	321	321	321
R^2	0.83864	0.69002	0.83243	0.83823	0.71517
Within R^2	0.02135	0.06965	0.06340	0.13276	0.03247
RMSE	0.42054	0.42830	0.43584	0.39485	0.45098
F-test	64.967	27.825	62.096	64.768	31.386
F-test, p-value	1.25×10^{-10}	4.38×10^{-7}	2.01×10^{-10}	1.29×10^{-10}	1.52×10^{-7}

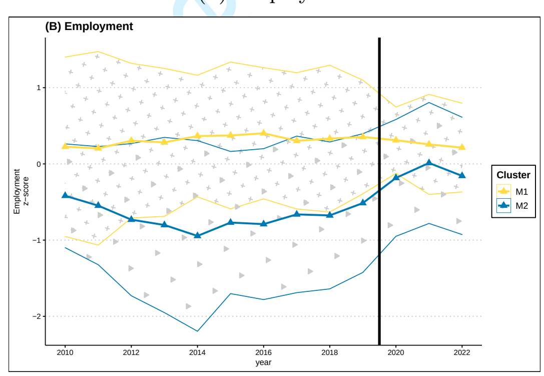
Clustered (Country) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*
[1] *parallel trends assumption does not hold.*

Figure A10: Sub-components of economic performance pillar over time in clusters M1 and M2, black vertical line indicates COVID starting

(a) International investment



(b) Employment



Online Appendix
"Government influence on national competitiveness (Evidence from the COVID era)"

1.8 References

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