Institut Barcelona d'Estudis Internacionals

Academic Year 2019-2021

REGIONAL COMPETITIVE DISPARITIES ACROSS THE VISEGRAD FOUR

Does culture make a difference?

Dissertation submitted by

MICHELLE MAGVASI

in partial fulfilment of the requirements for the degree of

ERASMUS MUNDUS MASTER'S PROGRAMME IN PUBLIC POLICY
(MMAPP)

Supervisors: Andrew Cartwright (CEU) and Adam Holesch (IBEI)

Budapest, 31 July 2021

Signature page

Author's name and surname(s): *Michelle Magvasi*

DNI or passport number: *Y8446260-F*

As the author and sole copyright holder over an original piece of work, a final master thesis,

on *regional competitiveness*,

entitled "*Regional competitive disparities across the Visegrad Four: does culture make a difference?"*

I hereby certify that this dissertation contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

I hereby authorize IBEI to include the aforementioned piece of work in the website or in other IBEI's communications media, or others in which IBEI participates, within the scope of its normal, non-profit activities, including other IBEI digital platforms, or in which IBEI participates, of free access via Internet.

I therefore authorize IBEI to take such measures as may be necessary for the purposes of adding the piece of work in question to the media referred to above, preserving it and providing public access thereto. IBEI shall not be required to reproduce the piece of work in its original formats or resolutions. The rights that IBEI require to undertake all the aforementioned measures are granted to them indefinitely, universally, free-of charge, and non-exclusively; I am therefore free to publish the piece of work anywhere else.

I hereby declare that neither my signature of this authorization nor the content of the piece of work places me in breach of any rights held by third parties in relation to intellectual property, industrial property, commercial secrecy or any other matter. I therefore exempt IBEI from any obligation or liability corresponding to any legal action to which the deposited piece of work may give rise.

Signature: 

Place and date: *Budapest, 31 July 2021*

Word count: 13,189

Table of contents

List of figures

List of tables

Abstract

Purpose – This thesis aims to uncover whether cultural differences impact regional innovative outcomes across the Visegrad Four group (V4) constituted by Czechia, Hungary, Poland, and Slovakia.

Hypothesis – Based on differences in historical experiences, the divergent paths of contemporary democratic development, and cultural indices by Hofstede and Inglehart, the countries are separated into groups of (1) Czechia and Slovakia, and (2) Hungary and Poland, with the assumption that culture in the first group is better able to facilitate regional innovation than the other.

Methodology – The study employs a quasi-experimental design, allowing to associate differences across the two groups with cultural differences. It uses regression analysis to examine correlations between the enablers (human capital, market size, governance) and outcomes of innovation (number of patent applications) in the period 2000-2018.

Findings – On average, the correlations are stronger in Czechia and Slovakia as a group, individually, as well as in their lowest-income regions than in Hungary and Poland, suggesting that cultural differences matter for innovation.

Originality/value – (I) The study investigates the relationship between culture and innovation on a regional level, (II) across V4 countries, (III) offering a long-term perspective on innovative development as a function of culture.

1. Introduction

1.1. Context

The V4 is an alliance between Czechia, Hungary, Poland, and Slovakia established in 1991, resting on regional, political, and cultural ties (V4 2021). Following the fulfilment of its original rationale of integrating into the European Union (EU) in 2004, the objective of the V4 has become focused on regional stability in Central Europe (V4 2021). However, this aim is in contradiction with the group's dynamics, with Hungary and Poland seeking "to destroy the free media, to undermine independent institutions, and to muzzle the opposition" (Eatwell and Goodwin 2018). The parallel provocation of anti-Semitic, xenophobic, or anti-gender sentiments is paving the way for political extremism (Melzer and Serafin 2013). The democratically regressive path Hungary and Poland have been pursuing throughout the last decade is not only generating turmoil internally, but also encourages right-wing attitudes within the EU. Populist waves spreading from these countries swept through Central Eastern Europe[1] (CEE) and have also impacted mature democracies such as Austria, France, Italy, and the United Kingdom (Müller 2018). Though democracy has been preserved notwithstanding, it has become more fragile across Europe (Buti and Pichelmann 2017). While support for similar parties is substantially lower and has been decreasing in Czechia and Slovakia (Boros et al. 2018), the V4 as a group constitutes a threat to stability in and beyond Central Europe, rather than acting as an equilibrating force.

Part of the democratic challenges to the EU's integrity is explained by disparities across its countries. Due to substantial income disparities among Europe's Western and Eastern territories, feelings of second-order in CEE countries have been identified among the factors fuelling Euroscepticism (Valásek 2019). Yet part of the reason of lower-income member states' failure to converge concerns disparities within their own territories, which are particularly acute in the CEE region, including the V4 (Widuto 2019). Countries' lower-income regions often exhibit lower rates in education, employment, and health, and higher in mortality and crime (Cörves and Mayhew 2021). These trends are intergenerational due to severely limited rates of upward social mobility, and thus become graver over time, with Hungary and Poland having been listed among the least fluid societies in Europe (Bukodi et al. 2017). The low-development cycle is further exacerbated by heavy outmigration to metropolitan regions or abroad, hence an

[1] Bulgaria, Croatia, Cyprus, Czechia, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, and Slovenia.

increasing share of regions become characterised by low-skilled ageing populations (Rodríguez-Pose et al. 2015). The divide between regions besides raising human rights concerns associated with the standards of living and the lack of opportunities, is also increasingly unsustainable economically (Floerkemeier et al. 2021). The underutilisation of human talent, conducting production in more capital-intensive areas, and the fiscal transfers the maintenance of low-productivity regions necessitate create economic inefficiencies and hence culminate in impeding aggregate development (Bárcena et al. 2018).

The rate of national economic progress is further inhibited by regions' inability to absorb external shocks, which can destabilise entire economies, the most recent example being the COVID-19 pandemic. Death rates have been disproportionately higher in lower-income regions, with national health systems unable to manoeuvre the excess inflow of patients generated by regional systems' incapability (OECD 2020c). The incidence of the 2008 financial crisis was likewise asymmetric, with several regions' already uncertain road to recovery prolonged by the current crisis. In addition to economic and public health shocks, climate change is expected to bring about increasingly extreme and unpredictable weather events along with an influx of climate refugees, requiring urgent steps to enhance regions' adaptive and absorptive capacities (Kraler et al. 2020). In sum, regional disparities have become too socially unjust, politically dangerous, and economically unsustainable to ignore (The Economist 2016).

1.2. Rationale

The broader purpose of this thesis is to contribute to uncovering the factors lying behind CEE countries' failure to remedy territorial inequalities, despite receiving substantial additional support from the EU under its Cohesion Policy (CP) (Maucorps et al. 2020). The CP's predominant "one-size-fits-all" approach of infrastructural investments does not yield the aspired trigger effect (Iammarino et al. 2017). Thus, different, context-sensitive approaches are needed to allow the CP-funded roads facilitate economic in addition to physical connectivity between regions. Looking primarily at differences across societies rather than differences in structural conditions that enable economic activity may be a promising avenue.

For the preliminary analysis for this thesis, investigating whether differences in democratic quality across the V4 may be related to differences in economic outcomes, I found that the regions of Czechia and Slovakia have been developing more competitively than those of Hungary and Poland (Annex F). Literature supporting the relationship between democracy and economic development is extensive (*e.g.* Przeworski 2000, Heo and Tan 2001). The general

argument is that people are more autonomous in decision-making with institutions being more accountable to people and less centralised than in non-democratic contexts (Doucouliagos and Ulubaşoğlu 2008). Hence, freer people are more likely to generate a diverse and dynamic economy with government officials being more driven to engineer economic success to avoid being replaced. Moreover, institutional decentralisation is linked to more effective public services locally, as well as reduction in corruption through bringing governance closer to the people which have been shown to favour development (M'Cormack 2011).

The real question however is not whether democracy as an apparatus is more favourable for development to occur than non-democracies; instead, I argue that the focus should be on the demos. Democracies do not create development – they create *a* framework for development, not necessarily excluding the possibility of other frameworks also being able to facilitate progress. Nevertheless, democracy, or more specifically, its quality becomes relevant for development in reflecting the nature of the people it is constituted by. Schwartz (2006) and Welzel (2007) argue that the state of a democracy represents general attitudes towards equality, justice, and progress. The puzzle thus lies within the question whether certain features in which democracies differ are relevant for development, and more broadly, though out of the scope of this research, whether these features in non-democracies can mitigate constraints on freedom and similarly facilitate economic development.

1.3. Approach

A comparative analysis of the V4 carries significant potential in this regard. Despite sharing historical, territorial, political, and economic ties which rendered them on similar development paths, the democracies of Czechia and Slovakia have proven to be more stable and progressive than Hungary's and Poland's, which potentially contributes to their regions being more competitive. Derived from the state of democracies, the underlying hypothesis is that the cultures of Czechia and Slovakia are similar to each other and fundamentally different from the culturally more similar Hungary and Poland. However, the hypothesis that will be assessed is that the former group's culture is more conducive to innovation, based on the finding that their regions are more competitive.

Approaching competitiveness from an innovation perspective is worthwhile for two reasons: first, continuously generating innovation is the most the most sustainable path to establish and maintain competitiveness (Goktan and Miles, 2011, Naqshbandi 2016). This is because innovation makes production more efficient and thereby enhances growth, making a region's

economy able to produce at an increasing rate – essentially rendering it competitive (Howells 2005, Fagerberg et al. 2010). Hence, innovation is a promising tool for reducing regional disparities, making it an important area of investigation within the V4 who all suffer from long-term territorial imbalances.

The second reason for innovation being insightful in assessing cultural differences across the V4 is that cultural theory suggests that differences in innovative outcomes, similar to democratic outcomes, are among the most important indicators of cultural differences as they manifest peoples' attitudes towards rules, success, or their peers (Hofstede 2001, Schwartz 2004, Inglehart 2016). The V4 countries fair similarly in key social, such as research and high-tech employment (Annex C) or education levels (Annex D), and economic dimensions, such as labour market performance that enable innovation (Annex E). Therefore, if their innovation rates in spite of these similarities are higher, then some features of their culture render them more conducive to development. Shall this be the case, further research identifying which cultural elements in which contexts drive innovation can offer a novel layer to territorial cohesion policy.

The remainder of this thesis will be structured as follows; Section 2 elaborates the theoretical link between innovation, competitiveness, and territorial cohesion. Section 3 reviews the literature on the two most prominent cultural measures developed by Inglehart (1971) and Hofstede (1983). Section 4 outlines the research design: the cultural measures, due to unsuitability for small-sample time-series analyses, will not be directly applied in the calculations. However, they constitute important pillars for justifying the case selection, which complemented by a brief description of historical mechanisms in light of contemporary trends. This will be followed by the hypotheses which revolve around the argument that the primary determinants of innovation are cultural rather than socioeconomic factors. Hence, I expect the calculations testing the structural and institutional determinants of innovation to yield stronger correlations in Czechia and Slovakia. The discussion of the results will be preceded by describing the data and methodology, as well as a summary of the main findings. Following an outline of limitations, Section 5 concludes the thesis.

2. Theoretical framework

2.1. Concepts

I posited that innovation enhances regional competitiveness through enhancing its ability to produce. Implicit in the ability to produce is the capability to enable production. For a region to be productive, it must be attractive for business, resting primarily on the intertwined pillars of the quality and size of the market and human capital, and the quality of institutions (Aiginger et al. 2013).

Market size and quality, or the population size and its purchasing power matters for entrepreneurial decisions in assessing how profitable producing goods or services in a region would be (Nistotskaya et al. 2015) The size and quality of human capital matter from an efficiency perspective. First, a high-skilled and large local labour force means that a company does not need to import labour externally at higher costs; second, skills increase the probability of innovation (Toner 2011). Innovation is a multi-stage process, from acquiring skills, through generating ideas and transforming them into improved or new processes, services, or products (Baregheh et al. 2009). Inventions in production or products both enhance a company's competitiveness, as under the first scenario, production grows with the same input, while under the second, given the novelty of the product, there is no competition temporarily. Therefore, through innovation, companies ensure that they can continue to compete in the market. Institutions matter for competition in determining the legal and regulatory environment for conducting business, including the patent rights that determine for how long an innovation can enjoy monopoly. Well-functioning institutions are necessary to establish an environment both of legal and strategic certainty to ensure that property rights are enforced, and economic conditions remain stable (Csuka 2010).

Following this logic, regional competitiveness is the ability to attract business, *i.e.* the ability to establish "competitive advantages" (Porter 1990) that make a region more desirable for investment than others predominantly based on these three pillars. To maintain competitive advantages, growth must be sustained to secure continuous development of markets and human capital – best achieved through innovation (Brem et al. 2016). Regional competitiveness is thus defined as a region's capability to enable innovation. Territorial cohesion in turn is an economic condition under which regions within a country possess comparable levels of competitiveness. Without territorial cohesion, there are disparities among regions due to some regions' failure to realise competitive advantages. However, innovation, by propelling growth through enhanced

productivity, can remedy these differences. Endogenous growth theory identifies three channels through which innovation can facilitate cross-regional convergence: functional, governmental, and legal (Porter 1990, Mankiw 1995).

2.2. Functional channel

The functional aspect concerns knowledge spillover (Serban 2020) which has two parallel routes: knowledge sharing and technology transfer (Barros et al. 2020). The first assumes that knowledge disperses through exposure to new ideas, such as in the form of scientific or business collaborations or sharing them via publications or the internet which entrepreneurs in less developed regions can exploit to their own advantage (Soto-Acosta et al. 2014). This is possible due to the incomplete excludability of knowledge (Audretsch and Belitski 2013). While the outcome of knowledge production in the form of innovations can be appropriated to prevent it from public use, knowledge as a by-product cannot (Foss et al. 2008). Therefore, external actors benefit from knowledge produced as they can build on it and further develop it to create the next innovation without incurring the costs of producing the knowledge. In Gerschenkron's (1962) terms, the "advantage of backwardness" of less competitive regions is that they can leapfrog the processes of knowledge creation and adopt innovative solutions straightaway. Thus, knowledge as a positive externality spills over from more to less advanced regions, thereby reducing gaps in competitiveness through enabling innovation (Solow 1956, Swan 1956). The second assumes that knowledge will spill over, or more accurately, will be transferred to less affluent areas because of constant or diminishing returns of investment in prosperous regions due to increasingly high land and labour costs (Pack 1993). In other words, investment, bringing along technologies, is eventually expected to target less developed regions as well because profit margins will be higher. In turn, productivity increases and further innovations also become more likely to be produced in lagging areas, facilitating territorial cohesion (King and Robson 1994).

2.3. Governmental channel

However, the functional dimension of endogenous growth is ought to be complemented by government intervention on two principal frontiers: effectiveness and equity (Iammarino et al. 2017). On the one hand, the presence of an externality, in this case in the form of knowledge spillover, will always yield suboptimal market outcomes (Verspagen 1992). One side to this is associated with the non-appropriable nature of knowledge rendering the private rate of return of innovation below that of the social (López 2009). This leads to businesses underinvesting in

research. The other side concerns an economy's absorptive capacity (Coccia 2007). For the growth rate to be optimal, the size and quality of human capital must be able to follow the rate of change (Andersen 2015). Therefore, government both needs to stimulate its country's tangible assets of innovation, mainly firms and universities, and intangible assets constituted by its skill and knowledge base. Government can promote research investment and the accumulation of human capital through providing direct and indirect fiscal incentives in the form of direct funding, subsidies, tax allowances or credits (Liu 2013). By reducing the relative costs of research investment and training, governments make up for the deadweight loss created by the suboptimal private utility from innovation, lifting the aggregate growth rate of the economy closer to the optimum.

To reach the optimum, the equity dimension in governance must also be given consideration. Spontaneous knowledge spillovers and market mechanisms in fostering technology transfers to less advanced areas are insufficient to trigger cohesion on their own (Andersen et al. 2020). A large part of this market failure is explained by less developed regions' inability to establish a competitive advantage that would make them more desirable for investment than their more prosperous counterparts (EC 2017). Without government imposing corrective measures to make up for the market favouring some regions over others, despite some degree of knowledge and technology spillover, regional disparities increase as the rate of growth in more advantaged regions is higher due to higher concentration of production.

Government intervention can aid territorial development in becoming more equitable by a mix of policies that can engineer competitiveness endogenously. Within a framework of an innovation strategy that is sensitive to territorial differences in capacities to absorb and create knowledge, investing in education and health systems, complemented by fiscal incentives that attract investment with more intense research funding helps enabling innovation from within (OECD 2010). Policies should also be aimed at creating a market for innovation by stimulating early demand for high-tech products and improving labour market conditions to enhance populations' purchasing power (Porter 1990). The cumulative effect of these policies leads to improved competitiveness with stronger innovative capacity (Czarnitzki and Toivanen 2013). These shall translate into enhanced growth rates, due to higher inflow of investment and augmented productivity (Doraszelski and Jaumandreu 2013). Thus, government intervention by counteracting the divergences in regional growth rates caused by market mechanisms can bring the national equilibrium growth rate closer to the optimum.

2.4. Legal channel

Government is also fundamental in fostering a legal environment under which innovation can thrive. If an innovation would be legally available for public use, then there would be no rational reason for a private actor to invest in its development, as compared to those who free-ride on its advantages, the producers will be left worse-off, as their investments will not pay-off in this sense (Varsakelis 2001). This effect can be prevented by patent systems that create temporary monopolies – the exclusive right to exploit the invention commercially (EC 2021e) – and thus incentives for undertaking innovative activities (Verspagen 1992). It follows that the key legal determinant of innovation is the existence of a patent system. The role of government is to create a patent system design which while incentivises inventions, minimises the social costs related to the monopoly it grants (Encaoua et al. 2006). Weak patent rights may cause low innovation rates, whereas if too strong they can create excessive monopoly distortion slowing the rate of technological change (Encaoua et al. 2006). Government thus needs to find an equilibrium that is most effective in facilitating growth in less developed regions (Caillaud and Duchene 2011).

The effectiveness of patent systems is theoretically linked to democratic apparatus in that in democracies, the protection of intellectual property can be more entrusted than in non-democratic regimes (Doucouliagos and Ulubaşoğlu 2008). More broadly, democracies provide more fertile grounds for innovation because their legal systems tend to be more reliable and perspicuous, offering a better environment for business (Csuka 2010). Approached differently, individuals in democracies may also be theoretically more innovative, as considering that their freedoms are protected by democratic law, they may be freer and thus more creative in their thinking, besides being exposed to ideas that may be prohibited in non-democracies (Campbell 2019). However, while it is true that the bulk of the global share of innovation comes from democracies (Wood 2021), some non-democratic cultures, such as China, are also leading innovators. Therefore, though propositions linking democracy to innovation through the independence of policymaking from political interference (Grillo and Nanetti 2016) and officials' accountability to people (Iammarino et al. 2017) are theoretically sound, they are likely to be incomplete. Not only because it is difficult to account for non-democratic successes, but also because within these frameworks, explaining differences in innovative outcomes across democracies with similar socioeconomic structures is problematic.

As posited by endogenous growth theorists, structural factors such as the education or legal systems, as well as the quality and size of human capital, the size of the market, and the quality

of governance are important determinants and enablers of innovation, which is widely supported by empirical evidence (*e.g.* Nelson 1993, Bottazzi and Peri 2003, Guellec and De La Potterie 2007, Qian 2007, Bilbao-Osorio and Rodríguez-Pose 2004). However, governments, regions, or countries are not the producers of innovations – people are. Therefore, the way people collectively behave in an economy may have significant implications on innovative output, and on aggregate economic performance. While economic theories rightly presume that material self-interest is the most important driver of production, they fail to consider the variance in populations' relationship towards material self-interest or production (Collier 2017). This may generate a dysfunctional equilibrium preventing economies from reaching their optimum which is difficult to explain from a purely economic perspective (Akerlof and Kranton 2011). I therefore argue that culture as a fourth channel is key in facilitating innovation, and thus a crucial determinant of regional competitiveness.

3. Literature review

3.1. Culture

Defining the phenomenon of culture has attracted vast scholarly debate due to its inherently complex nature (*e.g.* Hall 1976, Hofstede 1983, Parboteeah and Cullen 2003, Schwartz 2004). However, most approaches revolve around the notion that culture is an intertemporal pattern specific to a group, influencing members' thoughts, feelings, reactions, and interactions, rooted in shared values, beliefs, and norms, distinguishing them from another group (*e.g.* House et al. 2002, Bik 2010, Hofstede et al. 2010). Culture is ubiquitous, acting as a quotidian stimulus with an inevitable effect on individual behaviour socialised under a particular cultural atmosphere, rendering it comparable to the collective (Schwartz 2006, Tian et al. 2018). In attempting to explain differences in development rates across societies, the relationship between culture and innovation has become a focus of academic inquiry (*e.g.* Porter 1990, Shane et al. 1995, Tellis et al. 2003, Schmoch et al. 2006), as many countries continue to fail in generating innovation, despite investing in endogenous assets (Andrijauskiene and Dumciuviene 2017). The shared assumption in which cross-cultural studies are grounded is that certain cultural features may be more conducive to innovation (Taylor and Wilson 2012, Bukowski and Rudnicki 2018).

3.2. Frameworks

However, culture is notoriously difficult to measure (Schwartz 2004), and hence there are only limited quantified data available. The most influential attempts to capture cultural differences

across countries include Inglehart's (1971, 1990, 1997 and with Welzel 2005) cultural map, Hofstede's (1980, 2001, and with Hofstede and Minkov 2010) cultural dimensions, Scwhartz's (1990, 2004) cultural value orientation, Trompenaars's (1993 and with Hampden-Turner 1998) waves of culture, and House et al.'s (2004) culture and leadership across the world. These studies are based on large-sample international surveys. Albeit the methodologies differ according to the theoretical frameworks employed in research, the dimensions they seek to quantify share considerable overlaps as the models are inspired by one another (Welzel 2013). For example, the concepts of Inglehart's survival-self-expression, Hofstede's collectivism-individualism, Schwartz's embeddedness-autonomy, and Trompenaars's communitarianism-individualism all revolve around the divide between favouring group or individual interests (House et al.'s project uses extended versions of the Hofstede indices). Due to later attempts heavily resembling the earliest models developed by Inglehart and Hofstede, furthermore due to greater data availability for these authors' indices, their works are the most widely used in cross-cultural research (Hsu et al. 2013, Beugelsdijk and Welzel 2018, Kaasa 2021).

3.2.1. The Inglehart-Welzel cultural map

The dimensions in the frameworks can be divided into two grand themes of either being practice- or value-oriented (House et al. 2004). In Inglehart's two-dimensional model, the survival-self-expression nexus is the more practice-oriented, while the traditional-secular pillar is the value-oriented. Survival values prioritise security with an ethnocentric outlook, while self-expression values are characterised by a desire for accomplishment, active participation in economic and political life, and promotion of equality (Inglehart and Welzel 2005). Traditional values embrace religion, family, and national pride, while in secular values these are less pronounced (Inglehart and Welzel 2005). Divorce, abortion, euthanasia, suicide, and queer relationships are generally accepted, with science prevailing over religious convictions (Inglehart and Welzel 2005). Inglehart and Welzel (2005) cluster countries into eight cultural zones (African-Islamic, Catholic Europe, Confucian, English-Speaking, Latin America, Orthodox Europe, Protestant Europe, West and South Asia). Their location on the graph is determined by their score on the horizontal survival-self-expression axis and the vertical traditional-secular axis.

Countries with low scores in secular and self-expression values include African-Islamic cultures, and those with higher scores in self-expression are Latin American (WVS 2021). With similar, relatively high scores in secular values but low scores in self-expression are Orthodox European cultures, and with increasingly higher scores in self-expression are West and South

Asian, followed by Catholic European, and English-Speaking cultures (WVS 2021). Confucian cultures score relatively low in self-expression but high in secular values, with Protestant European cultures scoring highest in both (WVS 2021). According to the authors, innovation is associated with higher scores in self-expression and secular values (Inglehart and Welzel 2005).

Muralidharan and Pathak (2020) and Khosrowjerdi and Bornmann (2021) confirm that self-expression is positively correlated with innovation rates. The general argument is that the desire to express oneself drives creative thought which is the cornerstone of innovation (Shane 1993, Rinne et al. 2012). Adding to this argument, Allred and Swan (2004) find that the greater the extent to which individuals within a culture can explore and express themselves, the more likely innovations will emerge. Regarding the other dimension, Bénabou (2013) and Okulicz-Kozaryn (2015) find that traditional values, mainly strong religiosity, impact innovation negatively. Dollinger's (2007) explanation is that innovations tend to require challenging traditions and rules which is generally not an accepted behaviour in traditional societies. The argument that non-conformists are better innovators is supported by the findings of Schwartz and Huismans (1995), Brenkert (2009), and Gino and Wiltermuth (2014).

3.2.2. Hofstede's cultural dimensions

Hofstede conceptualises culture as six-dimensional. Initially, however, he only used four: power distance, individualism, masculinity, and uncertainty avoidance (Hofstede 1983). The substance of his more value-oriented indices, power distance and individualism, and Inglehart's traditional-secular values are similar (Welzel 2013). Power distance captures the extent to which members of a society expect and accept that power is distributed unequally (Hofstede et al. 2010). High scores in this index suggest a respect for and adherence to traditional hierarchy, while lower scores indicate demands for equality (Hofstede 2001). Lower scores in individualism translate to collectivism characterised by conformist behaviour as people seek acceptance by their groups, as well as prioritise the group's interests over their own (Hofstede 2001). Higher scores imply challenging the status quo and valuing personal over collective gains (Hofstede 2001). Countries with low power distance and high individualism are generally those included in Inglehart's English-Speaking and Protestant European cultures (Kapoor et al. 2021).

A parallel can also be drawn between Hofstede's two original practice-oriented indices, masculinity and uncertainty avoidance and Inglehart's survival-self-expression values

(Schwartz 2004). Higher scores in masculinity indicate that a society is driven by competition and achievement, as opposed to focusing on relationships and the quality of life; high scores in uncertainty avoidance translate to preferring rules and order, with avoiding taking risks and difficulty dealing with ambiguity (Hofstede 2001). Countries with high scores in masculinity and low in uncertainty avoidance are roughly those that score high in Inglehart and Welzel's self-expression scores (Minkov 2010). Hofstede et al. (2010) added two new practice-oriented dimensions constructed from the World Values Survey coordinated by Inglehart and Welzel: long-term orientation and indulgence. The culture map has received critique for being overly reductionist and not being able to capture the developments different cultures underwent relative to Western cultures (Jasny 2013). The former index, indicating the level of pragmatism and proactiveness of societies was predominantly included in Hofstede's framework to account for Confucian cultures' innovativeness, as suggested by its original name Confucian dynamism (Hofstede et al. 2010). The latter is also a dimension that is not generally attributable to specific cultures, such as individualism being more prevalent in Western societies and collectivism in Eastern cultures (Triandis and Suh 2002, Krassner et al 2018). High scores in indulgence are associated with the enjoyment of life and low control of impulses, whereas low scores indicate restraint and low manifestations of emotions (Guo et al. 2018).

As to the different dimensions' empirical implication, Shane (1993), Varsakelis (2001), Efrat (2014), and Xie and Paik (2018) find that low power distance facilitates innovation better due to challenging the existing social order. Erez and Nouri (2010), Kaasa and Vadi (2010), and Bradley et al. (2013) argue that breaking down power structures generates more enthusiasm, as well as allows for more ideas to be taken into consideration. Individualism is also associated with higher creativity (Erez and Nouri 2010, Griffith and Rubera 2014, Desmarchelier and Fang 2016) and innovation (Rinne et al. 2012, Sarooghi et al 2015, Bukowsi and Rudnicki 2018) as people are more motivated to stand out (Goncalo and Staw 2006) and more independent in decision-making (Allred and Swan 2004). However, several Asian cultures which are characterised by hierarchic and collectivist apparatus are becoming increasingly innovative challenging the dominant view (Tian et al. 2018), with the studies of Waarts and Van Everdingen and Waarts (2003), Lin (2009), and Engelen et al. (2014) not identifying any relationship between individualism and innovation.

Masculinity is also contested. Jones and Davis (2000) and Rhyne et al. (2002) find that the higher the level of masculinity, the higher the level of innovation rates. Efrat (2014) suggests that masculine cultures have a stronger sense of initiative and confidence, thus are more prone

to seeking innovative approaches. Khan and Cox (2017) and Prim et al.'s (2017) studies oppose this notion, as femininity through its cooperative feature was found to be key in facilitating innovation. Nevertheless, there is agreement around low uncertainty avoidance being fundamental for innovation as it necessitates willingness for risk and change (Shane 1993, De Mooij and Hofstede 2010, Chen et al. 2017). Similarly, long-term orientation has also been consistently found to affect innovation positively (Rhyne et al. 2002, Rujirawanich et al. 2011, Rossberger 2014, Prim et al. 2017). Hofstede et al. (2010) argue that innovation requires long-term planning and investment, furthermore, necessitates proactiveness to ensure adaptability to unforeseen events (Van Everdingen and Waarts 2003). Higher scores on indulgence also affect innovation positively (Griffith and Rubera 2014, Khan and Cox 2017, Prim et al. 2017). Syed and Malik (2014) suggest that innovating may act as a stimulus for the desire to satisfy one's impulses, however few studies investigated this dimension (Tian et al. 2018).

3.3. Critique

In sum, synthesising the two frameworks with the supporting empirical evidence, one can conclude that strong orientation towards secular values, accompanied by practices associated with proactivity and risk-taking are fundamental cultural features for achieving high innovation rates. Other dimensions that could offer a more informed understanding as to which cluster of values and practices generate the most fertile sociocultural grounds for innovation to thrive fail to yield consistent results. Gallego-Álvarez and Pucheta-Martínez (2021) argue that cultural indices will inevitably exert varying effects on innovation in different countries because the global context is not uniform, as Hofstede assumes in his methodology. McSweeney (2002) suggests that to effectively capture the variance across cultures, politics and institutions should also be integrated into to the models, enhancing the comparability of intrinsically different cultures relative to innovation.

However, the explicit inclusion of institutional cultures in either of the models would necessitate substantial revisions in their theoretical foundations. Inglehart's framework was developed along the lines of modernisation theory (Inglehart 1997). He theorises that in the first, industrial phase, technological change gives rise to a shift from traditional to secular values as education levels and incomes rise (Inglehart 2016). With existential security, societies then enter the post-material phase, under which the desire for individual autonomy will be increasingly pronounced, shifting cultures towards self-expression (Inglehart 2016). The institutional equivalent of enhanced autonomy and self-expression is democratic transition (Inglehart 1997). For him, therefore, differences in institutional contexts are understood in

terms of democracy and are associated with a country's level of development – which is a function of innovation (Inglehart 1997). In Hofstede's framework, national generalisations are derived from corporate environments, with the assumption that private organisational structures on average reflect a nation's institutional architecture (Hofstede 1983). For him, organisational culture is the chief determinant of innovation, with differences in organisational culture reflecting differences in national institutional apparatus.

I argue that both theoretical approaches are correct, however, offer a more complete relationship between culture and innovation when combined. As Inglehart posits (1997), innovation is key to development, which in turn shapes values and practices, which then shape how corporate environments are organised with enabling and constraining features on employees' capability to innovate, as put forward by Hofstede (2001). Nevertheless, their interpretation of institutions is too narrow and implicit to allow the indices to capture how different institutional cultures act as enabling or constraining factors of innovation in different sociocultural and economic contexts, which is why findings vary depending on the sample. In addition, Inglehart's concept of post-materialism reduces the distinct paths of (post-)authoritarian liberalism and post-material idealism that various Eastern and Western cultures are experiencing into one (Flanagan 1987, Welzel 2007). Moreover, his scores vary considerably over time with their trend quite often not according to the variance in countries' socioeconomic development (WVS 2021). Furthermore, his indices are criticised for being highly convergent, capturing the same dimension (Li and Bond 2010, Beugelsdijk and Welzel 2018).

Hofstede's power distance and individualism indices received similar doubts, as empirically they give the opposite poles of the same dimension (Smith et al. 1996). Brewer and Venaik (2011) and Minkov (2018) question the validity of dimensions' labels relative to their content, as for instance, collectivism is based on less favourable working conditions and opportunities to excel, rather than on in-group dynamics (Schwartz 1990, Singer and Voronov 2002). The data used to construct the indices raise further issues. His samples consist of IBM employees (Hofstede 1983), thus are predominantly male and of higher class than the national averages (Javidan et al. 2006), with his two latest indices constructed ex-post based on Inglehart and Welzel's World Values Survey with a different methodology (Hofstede et al. 2010). The reliability of the survey data used in both studies may potentially be further confounded by varying understandings and evaluations of values and situations across countries (Hanel et al. 2018).

Lastly, data availability is heavily limited (five editions available for Inglehart and three for Hofstede). Hence, studies employing these indices draw conclusions on the relationship between culture and innovation based on a sample of countries and their associated scores in a given dimension of culture, regressed on innovative output generally approximated by the number of patents per capita (*e.g.* Shane 1992, Taylor and Wilson 2012, Jang et al. 2016). They cannot assess how cultural changes affect changes in innovation within or across countries – they can only generalise how different dimensions of culture are related to innovation based on the differences in rates across a sample of countries and their scores (Kaasa and Vadi 2010). They are thus neither applicable for meaningful cross-country time-series analyses, nor for providing insight how culture as a whole influences innovation, only for how its particular dimensions are associated with innovation on a large scale.

This thesis aims to contribute to the literature on culture and innovation on three frontiers. First, it offers a long-term outlook on how differences in cultural dynamics drive innovation across countries without reducing it to dimensions. Second, it expands the general focus on aggregate innovative output to the regional level. By mitigating the bias in national innovation rates caused by capital and metropolitan regions, it offers a more holistic view of how culture affects innovation within a country. Third, the sample consists of CEE countries, which as a cluster attracted less scrutiny in the field compared to Western and Asian regions (Kaasa and Vadi 2010, Smale 2016). Due to the limitations in the indicators' methodologies and data availability, cultural indicators will not be directly applied in the analysis, though they will be considered when making assumptions on cultural differences within the sample.

4. Research design

4.1. Case selection

The V4 offers and ideal sample to mitigate the limitations outlined above. Nevertheless, the justification for the suitability of these countries for comparison is not V4 membership per se. Rather, it lies in the structural ties they share based on which the formation was established. All four are Catholic countries closely located geographically, each sharing a border with one another except for Hungary which only neighbours Slovakia. Throughout history, however, there has been considerable overlap between Czech, Hungarian, Polish, and Slovak societies both territorially and jurisdictionally (Halecki 1944) as they shared rulers (Jagiellonians and Habsburgs) and endured the Soviet regime together. Today, they are all members of the European Union which they entered on 1 May 2004. Thus, the religious, territorial, historical,

and political bonds, as well as their similar levels in key dimensions of development (Table 1) and socioeconomic enablers of innovation (Table 2) render them comparable.

Country	Life expectancy at birth	Expected years of schooling	GNI per capita (2017 PPP$)	Human Development Index value
Czechia	79.4	16.8	38,109	0.900
Hungary	76.9	15.2	31,329	0.854
Poland	78.7	16.3	31,623	0.880
Slovakia	77.5	14.5	32,113	0.860

Table 1. Key dimensions of human development. Source: own compilation based on data of the United Nations Development Programme (UNDP 2020).

Country	Tertiary education (%)	Unemployment (%)	R&D employment (%)	Hight-tech employment (%)
Czechia	15.25	5.20	1.05	4.20
Hungary	17.00	6.90	0.74	4.50
Slovakia	17.70	11.50	0.65	3.85
Poland	20.90	9.70	0.51	2.10

Table 2. Socioeconomic enablers of innovation (median values). Source: own compilation based on data from Eurostat (2020b).

Within Inglehart's framework, as the four countries share similar levels of socioeconomic development achieved through similar development paths with similar democratisation processes dictated by the EU, the general trend given by their scores available for 4-6 years for the sample will offer reliable grounds to assess underlying cultural differences. Therefore, as institutional development mechanisms have been similar, the Hofstede indices should also better capture the role culture plays in these contexts relative to innovation, rather than reflecting cultural differences as differences in social setting, as an analysis between Czechia and Vietnam would yield, for instance. In other words, this sample is suitable for both cultural indices to indicate qualitative cultural differences in innovative capabilities broadly, though not applicable in the present analysis for reasons specified earlier. However, before turning to the indices, I will describe the historical trends I argue contributed to cultural differences and cluster the countries into two groups of Hungary and Poland on the one hand, and Czechia and Slovakia on the other. I will avoid elaborating in detail to maintain the focus of the paper.

4.1.1. Historical dynamics

The unique Hungarian-Polish "friendship" dates to the 10th century, potentially grounded in the family ties between Hungary's and Poland's founders; the mother of Hungarian Stephen I was

the sister of Polish Mieszko I (Homza 2017). However, there is little evidence that this relationship would have been preceded by tribal connections, as Poles originate from Slavic tribes whereas it remains ambiguous which tribe Hungarians belong to (Sandor and Steele 2015).[2] The societies shared a border until the First Partition of Poland in 1772, during which they engaged in personal unions to join themselves three times (Louis I 14th century, Wladyslaw III 15th century, Stefan Bathory 16th century) (Dvornik 1962). The two nations have also consistently supported each other: most notably, in the 12th century Poles helped Hungarians fight against German invasion, in the 14th century they fought together against Tatars, and in the 19th they united against Austria to fight for their independence (Dowell 2021). The mutual support continued during the 1920 Polish-Bolshevik war, the 1939 Soviet invasion of Poland, and the revolutions of 1956 and 1989 (Kovács 1972, Zsinka 2013). They have only been on the opposite side when Hungary was a Nazi ally, however even then, when Hitler intended to deploy German troops from Hungarian soil to attack Poland (1939), Hungary resisted (Kolakowska 2020). Their companionship is marked by a national holiday since 2007.

The relationship between the Czechs and Slovaks has been similarly close. Slovaks and Czechs both originate from closely akin Slavic tribes (Halecki 1944). The Slovaks were incorporated into the Hungarian crown in the 11th century and have been subjected to second-class citizenry until the dissolution of the Austro-Hungarian Empire in 1918 (Péter 2003). The Czech-populated Bohemia and Moravia were administered by the Habsburgs from 1620 (EC 2019). In 1918, the union of Czechs and Slovaks under the name of Czechoslovakia emerged as a partnership grounded in overlapping national identities (Radl 1944) and strategy with respect to the aftermath of World War I to avoid falling prey to a foreign power once more (Bradley et al. 2016). It lasted until the peaceful divorce of 1993 which largely took place as there was no functional need for the federation anymore; however, the relationship has only continued to strengthen since (Bradley et al. 2016).

These historical dynamics not only created two cluster within the V4, but also primed and/or generated differences in their socio-political cultures. Slovaks never developed into an aristocratic society given that upon their arrival to their land they have been overruled by Hungarians who did not recognise them as equals, with Czechs losing their native aristocracy in the 1620 battle with Austria (Medvec 1991). This had two crucial implications on their collective behavioural development. First, they evolved into generally passive societies (Pech

[2] According to a recent study using genetic analysis, Hungarians do have Slavic predecessors, however they also share genetic ties with Turkic, Finno-Ugric, and Caucasian tribes (Fóthi et al. 2020).

1958, Rice 1985, Spiesz et al. 2006) in the sense that when faced with oppression, they opted for passive dissent rather than overt opposition (Taborsky 1961). Consequently, they may have become long-term oriented in decision-making, as for example, the plans of Czechoslovakia have already been on the agenda early in the 19th century (Pražák 1927), however, the general agreement was to wait until both the Czechs and Slovaks were organised enough to separate.[3] Passivity continued to characterise these societies until the 1968 revolt against the communist invasion (Medvec 1991).

Second, having been oppressed for centuries and then entering the industrial era as predominantly peasant societies, the promotion of social justice and egalitarianism in Czechoslovak politics was intrinsic, which may explain their attraction towards socialism (Brisch and Volges 1979, Vecernik 1996, Krejcí and Machonin 1998). On the other side, both Hungarian and Polish societies were historically characterised by strong hierarchical structures with native dynasties. Furthermore, they were both notorious for engaging in battles, choosing death over retreat when there was no chance for victory, for example the battles under the "Polish Thermopylae" or Hungary's 1526 battle against the Turks (Medvec 1991, Dudeková Kováčová 2017).[4] However, for Hungary this battle marks losing its independence to the Habsburgs who helped them liberate from the Ottoman Empire (Kristóf et al 2000). Poland has been divided between the Russian Empire, the Kingdom of Prussia, and the Habsburg Empire in 1795, with the former two imposing denationalisation policies, while the Habsburgs granted considerable autonomy for Poles in their jurisdiction (Lukowski and Zawadzki 2019). Poles nevertheless relentlessly revolted against oppression (Wandycz 1974). Hungarians were autonomous under Habsburg rule, except for the period after the failed independence fight of 1848 until the 1867 establishment of the Austro-Hungarian Empire marking the success of Hungarian resistance in claiming equal rights (Kristóf et al. 2000). A century later, Hungarians under Soviet occupation succeeded again through the 1956 revolution in demanding reforms after which they enjoyed substantially higher living standards than others in the region. However, in Poland, the economic conditions were dire, with all its revolts (1956, 1970, 1976, 1980-81) brutally defeated (Medvec 1991). Nevertheless, the movements leading to the regime's 1989 fall originate from these two countries (Frentzel-Zagorska 1990). In sum,

[3] This was interrupted once as a result of the nationalistic wave sweeping through Europe during which Slovaks, following Hungarians, also attempted an uprise in 1848 which failed within a few days.
[4] The "Polish Thermopylae" is a named used after the Battle of Thermopylae (480 BC), in which the vastly outnumbered Spartans fought until death, to describe the battles Poles fought in a similar vein (Brzozowska 2017).

Hungarian and Pole societies have been historically more hierarchical and prone to resist than Czechs and Slovaks.

4.1.2. Contemporary dynamics

Assessing the current political and institutional climate in the V4 countries in light of these processes, interesting parallels can be drawn, though I wish to emphasise that I do not seek to establish direct links. However, given the intertemporal nature of culture, I do argue that differences in sociocultural development paths are relevant when analysing contemporary trends. For instance, considering the question of equality in Czechia and Slovakia whose cultures have historically been more egalitarian compared to the traditionally more hierarchical societies of Hungary and Poland, significant divergences can be observed. Both Czechia and Slovakia outperform Hungary and Poland in female political empowerment (WEF 2021), with Slovakia's president being a woman. Whereas Hungary's 12.6 percent share of female parliamentarians score lowest in the Eastern Europe and Central Asia region, with Poland's share of female ministers experiencing the fourth largest drop in the world since 2019 after India, Indonesia, and Colombia, from 27.3 to 4.8 percent (WEF 2021). Acceptance of abortion, divorce, and homosexuality are also substantially lower in Hungary and Poland (WVS 2020). Czechia's 80 percent support for LGTBQI+ rights (Pew 2013) and 67 percent support for same-sex marriage are among the highest globally (Median 2020), whereas both Hungary and Poland are actively and increasingly targeting the community (ILGA 2021).

Institutionally, when examining the income tax structure, it is progressive in Czechia and Slovakia whereas in Hungary and Poland the economic incidence of tax declines as incomes rise (PwC 2021). Regarding the judiciary, while the systems are undergoing profound reforms in Czechia and Slovakia (EC 2021a, EC2021d), their independence is actively undermined in Hungary and Poland (EC 2021b, EC 2021c). Moreover, political elitism, the domination of a small powerful group who exploit the institutional system for their own benefit, is the prevalent form of political rule in Hungary and Poland (Krekó et al. 2018). These may be some of the contemporary implications of historically different attitudes towards equality and social justice. From the aspect of the general passivity which characterised Czechs and Slovaks as opposed to the historically more rebellious nature of Hungarian and Polish cultures, the changes taking place in the aftermath of the 2008 financial crisis are intriguing. There has been a general sense of deceit around the then new members of the CEE region who felt that the EU failed to keep its promise of stability and prosperity (Flamm 2012). However, Eurosceptic sentiments have been among the strongest in Hungary and Poland (Csehi and Zgut 2020). Their politics took a

U-turn, with their institutions' democratic quality regressing since, demonstrating active dissent towards the EU (Ilonszki and Dudzinska 2021). Whereas the economic downturn after 2008 did not have comparable effects on social and institutional progress in Czechia and Slovakia (Cisar 2017, Malová 2017).

Although these differences cannot be reduced to different historical experiences, the divergent impacts history had on cultural development cannot be neglected when interpreting contemporary socio-political mechanisms. Inglehart and Welzel's cultural map (Figure 1) also indicate long-term divergences across the two group's cultural development.

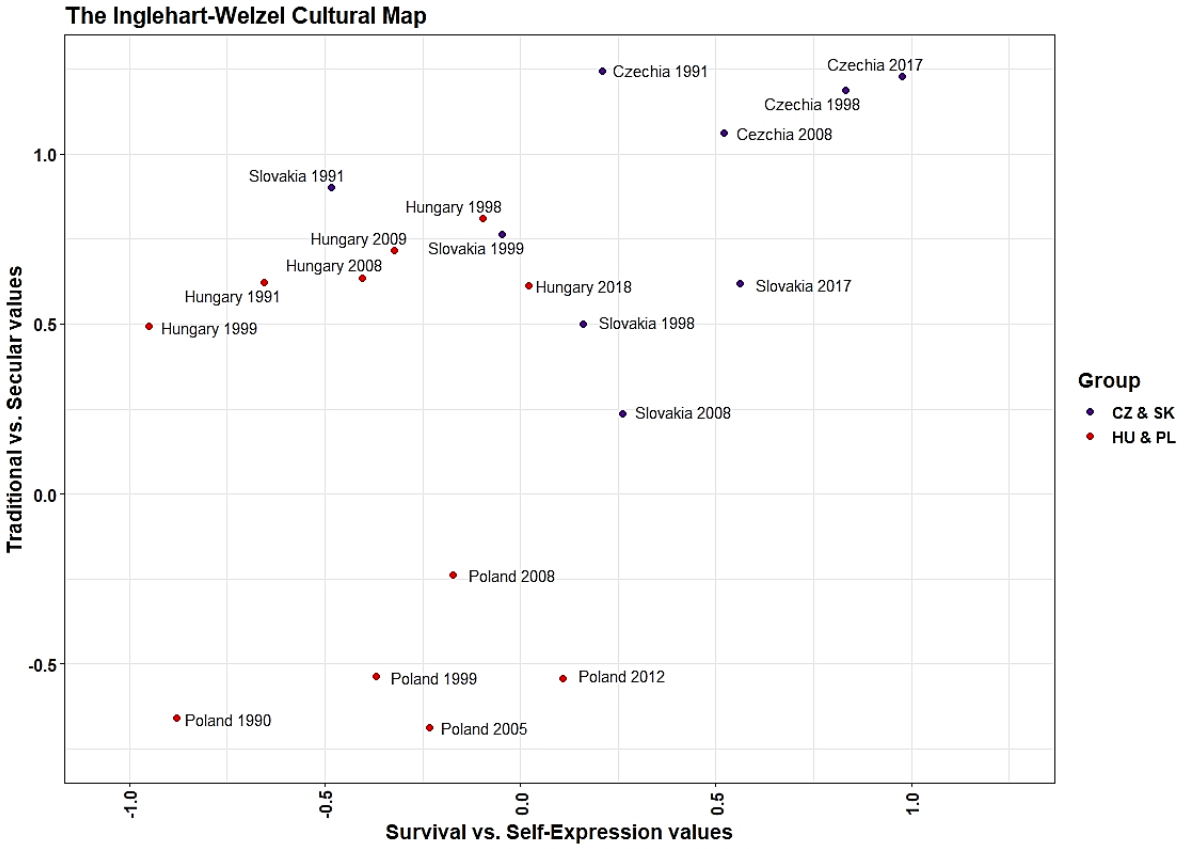


Figure 1. Time-series scatterplot of the Inglehart-Welzel indices. Source: own compilation based on World Values Survey data (WVS 2020).

The distribution of the scatterplot suggests that traditional and survival values are more prevalent in Hungary and Poland, whereas secular and self-expression values have been more dominant in Czech and Slovak cultures.

Hofstede's cultural dimensions assessing the probability of certain behaviours in organisational contexts further point towards underlying differences in culture (Figure 2). Czechia's and Slovakia's higher scores in long-term orientation and lower in individualism with the opposite applying to Hungary and Poland align with their historical features, considering that the former group has been historically more egalitarian, strategic and future-oriented than the elite-dominated Hungarians and Poles who tended to act on impulse (Medvec 1991). However, Hungary's and Poland's low scores in indulgence and Czechia's and Slovakia's lower scores in uncertainty avoidance point towards cultural changes, at least in corporate contexts. In Inglehart's framework, Czechia and Slovakia's higher scores in uncertainty avoidance is likely to be a characteristic appropriated following 1989, associated with greater sense of security due the prospect of EU accession. Considering the empirical literature in cross-cultural psychology, higher scores in secular and self-expression values, and in the long-term orientation and uncertainty avoidance dimensions translate into greater innovativeness. Thus, based on different historical experiences, differences in contemporary socio-political mechanisms, and differences in the culture indices, I not only hypothesise that there are inherent cultural differences among the two groups, but also that the cultural traits of Czechs and Slovaks render them more innovative.

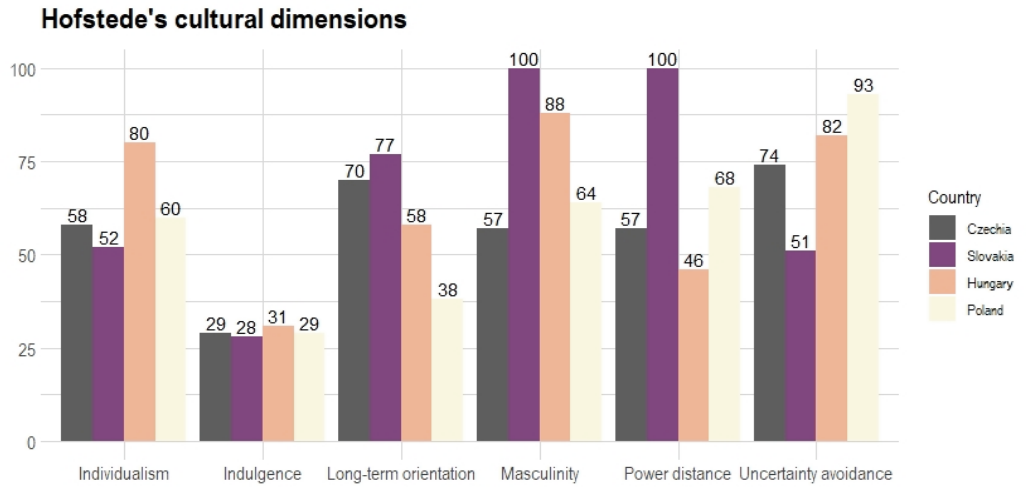


Figure 2. Bar chart of the Hofstede cultural dimensions. Source: own compilation based on data from the Hofstede insights (Hofstede 2021).

4.2. Hypotheses

The research question therefore this thesis seeks to answer is: do cultural differences matter for regional innovativeness in V4 countries? The main hypothesis is that the cultures of Czechia and Slovakia are more prone to innovation. The empirical base of this assumption is that the regions of Czechia and Slovakia have been found to develop more competitively than those of Hungary and Poland (Annex F). According to endogenous growth theory on the one hand, sustained competitiveness can only be achieved through continuously generating innovation (Arrow 1962, Lucas 1988, Romer 1990, Aghion and Howitt 1992, Grossman and Helpman 1994). On the other hand, cultural theory suggests that certain cultural features render some societies more conducive to innovation than others (Schwartz 2004, Inglehart and Welzel 2005, Hofstede et al. 2010). Empirical evidence established a link between secular values and practices associated with self-expression, long-term orientation, and uncertainty avoidance (Khan and Cox 2017, Prim et al. 2017, Bukowski and Rudnicki 2018, Kapoor 2021, Espig et al. 2021). Czechia and Slovakia outperforming Hungary and Poland in these aspects provides further theoretical support for the assumption.

If the regions of Czechia and Slovakia are more competitive because they are more innovative, furthermore are more innovative because their cultures are more fertile for innovating, then the relationship between the enablers/facilitators of innovation – human capital, market size, governance quality, and research and innovation (R&I) policy – and innovation shall be stronger in their cases. The following subhypotheses will be tested:

In Czechia and Slovakia on average,

SH1: regional innovative capacity;

SH2: the relationship between regional innovation and competitiveness;

SH3: the relationship between regional structural conditions and innovation;

SH4: the relationship between national governments' quality and regional innovation;

SH5: the relationship between national governments' quality and research and innovation policy;

SH6: the relationship between research and innovation policy and regional innovation

will be stronger than in Hungary and Poland.

4.3. Methodology

The lack of sufficient data quantity for the culture indices makes them inapplicable for time-series analysis, with the variations in the dimensions to provide any insight necessitating large sample sizes. As this thesis is a small-sample comparative time-series analysis, culture indices cannot be employed. Nevertheless, the countries constituting the sample are comparable on the bases of religious, historical, and territorial ties, furthermore, are all EU members, thus their structures are subject to the same exogenous political, economic, and regulatory forces, with all of them participating in the Cohesion programme receiving similar amounts of development funds normalised by population size (Darvas et al. 2019). They moreover share comparable levels in the socioeconomic determinants of innovation (Table 2). Therefore, the analysis will rely on a quasi-experimental design. As the countries are roughly homogenous, should there be significant and persistent differences detected across the two groups, they are likely to be predominantly associated with culture. To ensure that the findings are reliable, countries will also be assessed individually, as well as without their more prosperous regions to account for bias.

Testing will be divided into four blocks:

(I) testing whether there is a difference between groups' innovative capacities; and whether innovation affects competitiveness

Grounded in neoclassical growth theory, the expectation is that the regions of Czechia and Slovakia are more competitive than those of Hungary and Poland because they are more innovative. The testing of this assumption will be conducted in two parts: first, an (1) ANOVA test will be applied, to detect any statistical differences between the means of the four countries' R&I proxies regionally. Second, the relationship between innovation and competitiveness will be tested with a 5-year lag[5] using (2) regression analysis. Based on the assumption that culture is more conducive to innovation in Czechia and Slovakia, I expect the correlation between the two indices to be positive and significant. Whereas in the case of Hungary and Poland, I expect no statistically significant relationship, given that the assumption is that their regions are not innovative, thus the variance in innovation should not vary with competitiveness.

$$F = \frac{\sum nj\left(\overline{X}j - \overline{X}\right)^2/(k-1)}{\sum\sum(X - \overline{X}\,j)^2/(N-k)} \tag{1}$$

$$GVA = \beta_0 + \beta_1 RI_5 + \varepsilon \tag{2}$$

(II) testing whether the structural conditions in endogenous growth theory affect innovation

The second set (3) of calculations revolve around the predication that structural conditions, predominantly human capital (RD_{emp}; HT_{emp}) and market size (SS_5), are key to catalyse innovation. I expect that the relationship will be stronger in Czechia and Slovakia, as I assume that the employees in research and high-tech sectors are culturally more innovative, hence the size of the market shall also be more relevant for facilitating innovation in their regions. In the other group's case, given the assumption that they are not as innovative, I do not expect the size of either the market or human capital to impact innovation in Hungary and Poland as strongly as in the other group's case. In these regressions, a proxy capturing market size will be lagged by 5 years. To enhance the robustness of the findings, the variables employed in the multivariate model will also be regressed individually.

[5] Generally, it is argued that for institutional changes to impact socioeconomic circumstances, there is a 5-to-20-year lag; considering data availability, I will resort to 5 years (De Haan and Sturm 2003, Geddes 1999, Rodrik and Wacziarg, 2005).

$$TSI = \beta_0 + \beta_1 RD_{emp} + \beta_2 HT_{emp} + \beta_3 SS_5 + \varepsilon \quad (3)$$

(III) testing whether governance quality affects innovation; and whether it affects R&I policy

In the third block (4; 5; 6) the calculations concentrate on the role of government in endogenous growth. I hypothesise that since governance quality (GQ) in Czechia and Slovakia has been improving, it will have a positive and significant relationship both with innovation (TSI – technology share intensity) and R&I policy ($GERD$ – government expenditure on research and development; Tax – tax incentives). Regarding the other group, I also expect a positive, though insignificant relationships. Governance will be lagged by 5 years in relation to innovation, but not for the policy indicators as the assumption is that governance quality has an immediate effect on decision-making. Furthermore, the governance quality indicators (government effectiveness, regulatory quality, and the rule of law) will not be assessed jointly due to multicollinearity. This means that the variables are correlated with each other, therefore in a multivariate model, they would undermine each other's effect on the dependent variables.

$$TSI = \beta_0 + \beta_1 GQ_5 + \varepsilon \quad (4)$$

$$GERD = \beta_0 + \beta_1 GQ + \varepsilon \quad (5)$$

$$Tax = \beta_0 + \beta_1 GQ + \varepsilon \quad (6)$$

(IV) testing whether R&I policy affects innovation

In the final block (7; 8) I will test how R&I policy, *i.e.* government expenditure on R&I and tax incentives affect regional innovation. I assume regional populations in Czechia and Slovakia to be more sensitive to innovation policy and better able to exploit its advantages. Thus, I expect the correlations between the innovation policy indicators and innovation to be stronger than in Hungary and Poland.

$$TSI = \beta_0 + \beta_1 Tax_5 + \varepsilon \quad (7)$$

$$TSI = \beta_0 + \beta_1 GERD_5 + \varepsilon \quad (8)$$

4.4. Data and variables

The dataset covers the period from 2000 to 2018. Regional R&I-related data were gathered from the RISIS-KNOWMAK dataset collected under the Horizon 2020 programme (RISIS-KNOWMAK 2019). Data on competitiveness, human capital, market size, and government expenditure on R&I were downloaded from Eurostat (Eurostat 2020b). Data on R&I tax incentives were retrieved from the OECD (2020b), and governance data from the World Bank's World Governance Indicators dataset (World Bank 2020). The latter two are country-level, the rest are regional NUTS-2 level[6].

(a) Research and innovation

To capture the R&I capacity of regions, I constructed a proxy, following the variables used in the literature, from the mean of technology share intensity (transnational and national patent applications) (*e.g.* Allred and Swan 2004) and science share intensity (number of scientific publications, number of publications in the top 10 percent cited, number of international scientific collaborations, number of EU-FP coordination and number of EU-FP participation) (*e.g.* Efrat 2014) normalised by population for each region. When only testing innovation, I use the variable technology share intensity.

(b) Competitiveness

To approximate a region's competitiveness, gross value added (GVA) has been used, normalised by population. Gross domestic product (GDP) and related indicators, such as GVA, have attracted controversy in terms of their ability to represent economic development and competitiveness, as for instance, they are not adequate to capture crucial dimensions of social characteristics, environmental circumstances, or health (Coyle 2016). However, the reason why these indicators are the most widely used for purposes as this thesis' is that economies with similar production levels have many key structural characteristics in common. When normalised by population, they are able to portray the interaction of demography, labour-force participation and productivity fairly accurately (Iammarino et al. 2017). I argue that GVA is a better proxy to measure regional competitiveness than GDP. It offers a better insight into the performance of the economy as it adjusts GDP by the impact of taxes and subsidies on products, facilitating understanding better as to how much value each region adds to the economy.

[6] The Nomenclature of Territorial Units for Statistics (NUTS) is a geocode standard for subdividing countries according to the population size of a territorial unit – the minimum and maximum population threshold under the NUTS-2 level is 800,000 and 3,000,000 (Eurostat 2020a)

(c) Human capital and market size

Human capital regarding innovation is generally understood in terms of research and high-tech employment (Veugelers 2021). Research employment is measured as the percentage of researchers in all sectors (business, higher education, government) of total employment within a region, with employment in high-tech sectors (high-tech manufacturing and knowledge-intensive sectors) also measured as the share of total employment. Market size in terms of innovation means the demand for high-tech products. I constructed a 'social structure' proxy, taking the mean of the share of people with primary education or less and unemployment rate of the active population. The argument is that the more educated the population becomes in a region in combination with increasing employment rates, the higher the demand for and ability to afford high-tech products. While from an investment perspective, the more attractive the social structure becomes. This number is then subtracted from 100 given the hypothesised positive relationship between market size and innovation.

(d) Government quality, government expenditure on R&I, and tax incentives

Government quality includes government effectiveness, regulatory quality, and rule of law. These indicators are widely used in the literature to assess government performance (*e.g.* Esser 2007, Zhuang et al. 2010, Rodríguez-Pose and Di Cataldo 2015). Government effectiveness encapsulates the quality of public services and their political independence, as well as the quality of decision-making and the ensuing policies. Regulatory quality captures the extent to which government can promote private sector development. Rule of law refers to the quality of contract enforcement and property rights, and to the degree to which people trust and follow the rules of society. Government expenditure on R&I is given in purchasing power standard per inhabitant at constant 2005 prices, and R&I tax incentives as a percentage of GDP.

4.5. Summary of the results

Block 1

As expected, the regions of Czechia and Slovakia are more innovative on average than those of Hungary and Poland. The ANOVA output below shows that the statistical differences between the countries within the same group are not significant. However, between the two groups, *i.e.* between Czechia and Poland, and Czechia and Hungary on the one hand, and Slovakia and Poland, and Slovakia and Hungary on the other are significant at the 0.001 level. Therefore, the risk of falsely rejecting the null hypothesis of the means being equal among the groups is negligible.

Countries	Difference	Lower bound	Upper bound	Adjusted p-value
HU – PL	0.02125	-0.06152	0.10403	0.91122
CZ – PL	0.24559	0.16654	0.32464	0.00000***
SK – PL	0.26465	0.16838	0.36092	0.00000***
CZ – HU	0.22433	0.13658	0.31208	0.00000***
SK – HU	0.24340	0.13986	0.31208	0.00000***
SK – CZ	0.01906	-0.08152	0.11965	0.96159

Table 3. ANOVA output: mean differences in regional R&I across V4 countries.

The boxplot offers a visual representation of the differences among the countries. Though there are outliers, especially in the case of Poland, and substantial disparities across regions, as Slovakia's box indicates, it clearly shows that the median R&I values are higher in both Czechia and Slovakia than in Hungary and Poland.

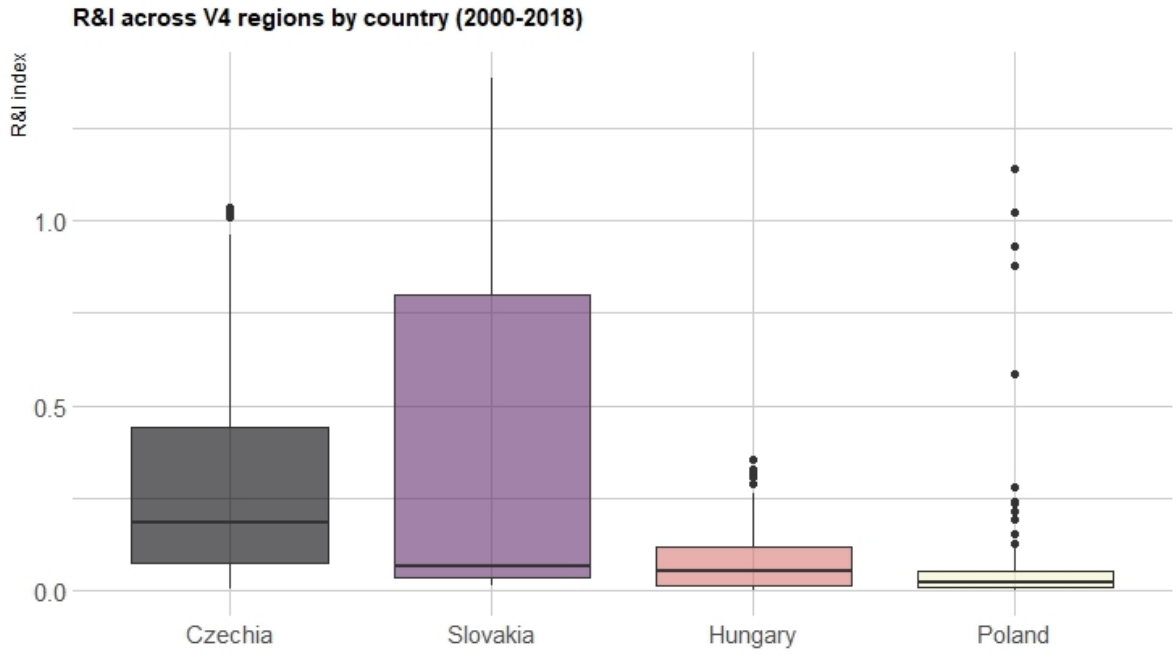


Figure 3. Boxplot: visualisation of regional R&I in V4 countries. Source: own compilation based on data from the RISIS-KNOWMAK dataset (RISIS-KNOWMAK 2019).

R&I and GVA: The group analysis supports the hypothesis, because the effect of R&I is stronger on GVA in Czechia and Slovakia. This remark is valid, as when prosperous regions are removed, the effect remains stronger in Czechia and Poland. In Czechia, Slovakia, and Poland, R&I has a stronger positive effect on GVA in their lowest-income regions. In Hungary, the overall effect is negative, with weakening in its poorest regions. What ran contrary to

expectations was the weakness of the effect R&I has on GVA in Slovakia, though when prosperous regions are removed, the effect is remarkably strong.[7]

R&I	V4	CZ&SK	HU&PL	CZ	SK	HU	PL
Aggregate	1.385*	1.759*	0.7535	3.127**	0.0001	-1.313	0.9999
Low-income	1.363	0.912	0.286	3.188*	36.851	-0.668	5.966

Table 4. Regression output: the relationship between innovation capacity ang Gross Value Added.

Block 2

Human capital and innovation: The group analysis partially supports the hypothesis. As expected, the effect research employment has on patent applications is stronger in Czechia and Slovakia. Contrary to expectations, market size correlates more strongly with innovation in Hungary and Poland. Both observations remain stable when eliminating outliers. Further robustness checks have been performed by regressing the variables individually. Both conclusions hold in all the models. However, except for these cases, correlations varied across groups and countries, most notably in the instance of high-tech employment which has a negative effect in multivariate models but generally positive in bivariate.

Market size		V4	CZ&SK	HU&PL	CZ	SK	HU	PL
Aggregate	*M*	0.003**	0.002	0.003***	-0.001	0.002	0.003**	0.008***
	B	0.005***	0.008***	0.002*	0.005*	0.009*	0.002*	0.002*
Low-income	*M*	0.003***	0.003	0.003*	0.001	0.001	0.002	0.007*
	B	0.005***	0.007**	0.003**	0.002	0.0001	0.003*	0.005*
R&D emp.								
Aggregate	*M*	0.057***	0.095***	0.005	0.096***	0.059**	-0.025	-0.044*
	B	0.067***	0.057***	0.094***	0.059***	0.052***	0.062	0.096***
Low-income	*M*	0.176***	0.219***	0.078**	0.211***	0.262*	0.011	-0.003
	B	0.182***	0.203***	0.103***	0.181***	0.245***	0.114**	0.182***
High-tech emp.								
Aggregate	*M*	-0.010*	-0.036**	-0.008*	-0.03	-0.013	-0.023**	0.002
	B	0.030***	0.031***	0.024***	0.034***	0.030***	-0.017**	0.067***
Low-income	*M*	-0.012	-0.025	-0.013*	-0.027	0.004	-0.031**	0.011
	B	0.020**	0.078**	-0.014*	0.075***	-0.016	-0.034***	0.014

Table 5. Regression output: the relationship between market size, human capital, and innovation.

Block 3

Government quality and innovation: The group analysis partially supports the hypothesis. The effect of government quality is stronger on innovation in Czechia and Slovakia, without

[7] It is important to bear in mind that R&I indicators are normalised by population, thus the values are small; a unit increase in these indicators may thus translate to substantial rises in growth rates.

prosperous regions as well. However, contrary to my assumption, the trends do not align between Hungary and Poland. In the former, the effect is generally negative, with the opposite holding for Poland. Furthermore, the effect in Poland is stronger than in Slovakia, both generally and in its poorest regions, with the rule of law having a negative effect in Slovakia's low-income regions.

Rule of law	**V4**	**CZ&SK**	**HU&PL**	**CZ**	**SK**	**HU**	**PL**
Aggregate	0.153***	0.219***	0.059	0.221*	0.025	0.029	0.193*
Low-income	0.234***	0.347***	0.049	0.229	-0.006	-0.042	0.255*
Gov. effectiveness							
Aggregate	0.138***	0.308***	-0.028	0.207	0.235	-0.041	0.057
Low-income	0.209***	0.377**	-0.038	0.212	0.038	-0.096	0.062
Regulatory quality							
Aggregate	0.168***	0.256***	0.035	0.240**	0.096	-0.054	0.314*
Low-income	0.194***	0.323**	-0.007	0.255*	0.048	-0.068	0.231

Table 6. Regression output: the relationship between governance quality and innovation.

Government quality and R&I expenditure: The group analysis supports the hypothesis. The effect of government quality on R&I expenditure is stronger in Czechia and Slovakia than in Hungary and Poland. This holds for the lowest-income regions as well. However, contrary to expectations on the country-level, not all dimensions of government quality are positive in Czechia and Slovakia. As in the previous case, Hungary and Poland vary when considered individually. In Hungary, government quality has a consistently negative effect generally and in its poorest regions. The opposite applies to Poland.

Rule of law	**V4**	**CZ&SK**	**HU&PL**	**CZ**	**SK**	**HU**	**PL**
Aggregate	256.471***	336.962***	-31.939	782.760**	345.181	-181.407***	64.199
Low-income	461.914***	715.583***	6.819	951.517*	48.818	-86.816***	85.29
Gov. eff.							
Aggregate	366.307***	558.221**	52.293	407.253	199.97	-223.536***	263.638***
Low-income	486.381***	1.171.12***	33.434	516.722	-1.554	-103.523***	161.065**
Reg. qual.							
Aggregate	223.332***	137.945	-38.165	-138.277	-198.529	-200.445***	246.263***
Low-income	386.832***	539.637*	12.418	-173.914	-151.663***	-72.716***	194.824**

Table 7. Regression output: the relationship between governance quality and R&I expenditure.

Government quality and tax incentives: The group analysis partially supports the hypothesis. The effect of government quality on tax incentives is stronger overall in Czechia and Slovakia. However, in the lowest-income regions, the effect is stronger in the other group. On a country level, contrary to expectations, there are some negative effects of government quality on tax

incentives in Slovakia both in general and poor contexts. The positive effects are strongest in Czechia and Hungary, which inflate the group effects.

Rule of law	**V4**	**CZ&SK**	**HU&PL**	**CZ**	**SK**	**HU**	**PL**
Aggregate	0.072***	0.076***	0.111***	0.013***	0.012	0.104***	-0.006***
Low-income	0.070***	0.078***	0.117***	0.135***	0.01	0.104***	-0.006**
Gov. effectiveness							
Aggregate	0.072***	0.049***	0.152***	0.019	-0.014**	0.129***	0.002
Low-income	0.071***	0.050***	0.158***	0.019	-0.011	0.129***	0.003
Regulatory quality							
Aggregate	0.032**	0.113***	0.131***	0.103***	-0.012	0.162***	0.006***
Low-income	0.029	0.116***	0.140***	0.103***	-0.009	0.162***	0.006**

Table 8. Regression output: the relationship between governance quality and R&I tax incentive.

Block 4

R&I expenditure and innovation: The group analysis partially supports the hypothesis. The effect of R&I expenditure on innovation, as expected, is stronger in the group of Czechia and Slovakia. It holds when removing outliers, as well as on a country level. Contrary to expectations, the effects are strongest in the lowest-income regions of Hungary and Poland.

Tax incentives on innovation: The group analysis partially supports the hypothesis. The effect of tax incentives on innovation are stronger in Czechia and Slovakia, which also holds for the poorest regions. On a country-level, however, the effect is negative in Slovakia. In Hungary, the effects are negative, whereas positive in Poland.

R&I	**V4**	**CZ&SK**	**HU&PL**	**CZ**	**SK**	**HU**	**PL**
Aggregate	0.0002***	0.0002***	0.0001**	0.0001**	0.0003***	0.0002*	0.0001
Low-income	0.0003***	0.0002***	0.0004***	0.0001*	-0.0002	0.0002	0.001***
Tax							
Aggregate	-0.103	1.944***	-0.082	1.338	-6.431	0.095	-0.971
Low-income	-0.069	2.514**	0.025	0.872	-1.55	0.197	-3.925

Table 9. Regression output: the relationship between R&I policy and innovation.

4.6. Discussion

The main hypothesis drawn from endogenous growth theory, *i.e.* that the regions of Czechia and Slovakia are more competitive on average because they are more innovative are supported by the findings, even when their most prosperous regions are removed from the analyses. The descriptive statistics provide further validity (not including capital regions to allow a more general insight into the regional circumstances). The mean score of the regions' R&I indices

between 2000 and 2018 is 0.29 in Czechia, 0.27 in Slovakia, 0.09 in Hungary, and 0.03 in Poland. In this order, the percentage changes in innovative capacity in this period are 147.74, 132.58, 32.84, 7.06 on average (Annex A). Hence, the findings indicate that culture in Czechia and Slovakia are indeed better able to facilitate innovation.

However, when the relationship between R&I and GVA growth is investigated, the findings are ambiguous. Although they indicate, as expected, that the correlation is stronger in Czechia and Slovakia, two important aspects must be considered. First, the overall effect in Slovakia is unexpectedly weak. Examining the data, the reason behind this is that R&I in the capital region Bratislavsky kraj decreased by 12.09 percent between 2000 and 2018, while at the same time its economy grew the most compared to its other three regions (RISIS-KNOWMAK 2019). This phenomenon substantially weakens the correlation, which is supported by the results yielded by the lowest-income regions, where the effect increases from 0.0001 percent to a 36.85 percent in GVA with a one-unit increase in the R&I index.

The second problematic aspect to this dimension of the hypotheses is that despite the relationship being stronger between R&I and GVA growth in Czechia and Slovakia, the statistics indicate that they fail to translate this advantage into relative advantages in productivity. Average GVA growth is 2.102 percent in Czechia, 3.926 in Slovakia, 2.362 in Hungary, and 3.441 in Poland. Regional prosperity, measured by purchasing power standard at constant 2005 prices further indicate that R&I intensity does not contribute to growth to the extent as expected. V4 countries started from similar levels in 2000, between 7466.67 and 7833.33, with Czechia's 11,500 being higher. According to the most recent, 2019 data, levels continue to be similar. Czechia's remains the highest with 19,366.7, although with the least average growth of 106.03 percent. Slovakia's 17,780, Hungary's 16,916.67, and Poland's 19325 mean 127.23, 126.56, and 148.15 percent increases respectively (Annex B). Thus, not only are the levels similar, but the growth rates as well.

Evidently, there are other factors behind growth, nonetheless Czechia and Slovakia should be performing significantly better according to endogenous growth theory. A probable explanation to this failure is governance. The results also point to this direction, because albeit government effectiveness has a substantially stronger effect on innovation in the group of Czechia and Slovakia, when analysing its effect on a country-level, it is not significant in any case. Furthermore, this is the dimension of governance that has improved the least compared to 2000 in Czechia, Slovakia, and Poland as well, and in Hungary where all pillars deteriorated, this has experienced the starkest decline (Table 10). Moreover, as the results concerning government

quality are only consistently positive in Czechia and Poland, though only in a few cases significant, there is a strong indication that the lack of effective governance is behind the inability of innovation to ensue in the expected growth rates. The overall negative effect of tax incentives of innovation in the V4 further suggests this. Hence, governance needs substantial improvements in promoting innovation in a way that translates into enhanced growth.

	Czechia				Slovakia			
	2000	**2018**	**Diff.**	**% change**	**2000**	**2018**	**Diff.**	**% change**
Rule of law	0.637	1.045	0.408	64.050	0.342	0.529	0.187	54.678
Gov. effectiveness	0.649	0.922	0.273	42.065	0.606	0.707	0.101	16.667
Regulatory quality	0.756	1.276	0.52	68.783	0.567	0.809	0.242	42.681
	Hungary				**Poland**			
	2000	**2018**	**Diff.**	**% change**	**2000**	**2018**	**Diff.**	**% change**
Rule of law	0.906	0.555	-0.351	-38.742	0.714	0.427	-0.287	-40.196
Gov. effectiveness	0.983	0.487	-0.496	-50.458	0.606	0.663	0.057	9.406
Regulatory quality	1.090	0.575	-0.515	-47.248	0.754	0.885	0.131	17.374

Table 10. Governance indicators. Source: own compilation based on World Bank data (World Bank 2020).

Another important suggestion of the results with respect to governance is the seemingly opposite trend in Hungary and Poland. Nevertheless, the results are generally negative and significant in Hungary because while innovation has on average improved since 2000, all dimensions of government quality dropped drastically. Whereas in Poland, only the rule of law declined substantially, yet the other two aspects somewhat improved as of 2018. Hence, slight progress in government quality parallel to an overall slight progress in innovation translate to a positive relationship. However, as both their regional R&I indices and their government quality indicators are fairly uniform, except for the overall trend in governance progression, the results in this aspect are misleading without further consideration.

As to structural conditions, the results suggest that market size is more imperative for innovation in Hungary and Poland than in Czechia and Slovakia, indicating the opposite for research employment. A potential explanation is if innovations in Hungary and Poland predominantly originated from multinational companies operating in their territories. As discussed earlier, for private actors, market size and socioeconomic conditions are indisputably crucial when making investment decisions. Thus, it would analytically be sound if this was the reason behind a stronger correlation between social structure and R&I in Hungary and Slovakia, especially considering that in the CEE region foreign investment promotion was the key policy

to promote growth, and remains a dominant, albeit increasingly obsolete tool (Szent-Iványi, 2017).

Using OECD data (2020a) on the number of multinational companies nationally and normalising them by population suggests that if external sources of innovation are more prevailing in Hungary and Poland, it is not because they are more concentrated in these countries. The ratio of multinational companies and population is 6E-05 in Hungary, 2E-05 in Poland, 5E-05 in Czechia, and 4E-05 in Slovakia.[8] Rather, the relationships are most likely stronger between social structure and innovation in the multivariate model because of the relationship between research employment and innovation in Hungary and Poland. Put differently, the correlations are not strong because the social structure is effectively able to facilitate innovation; they are strong because research employment is unable to, as the negative relationships indicate in the multivariate model. This also explains why high-tech employment is generally negative across all countries in multivariate models on innovation, and generally positive in bivariate. Hence, in Czechia and Slovakia the relevance of research employment somewhat cancels out that of the other two variables, whereas in Hungary and Poland the most relevant aspect is the social structure because the other two are inconsequential in comparison.

This insight provides compelling support for the underlying assumption of the differences in innovation being rooted in latent differences in socio-political culture. The assumption is further reinforced by the summary statistics on regional socioeconomic conditions. The populations of V4 countries are similar on all education levels in both sexes and all age groups, with unemployment rates also being similar disaggregated by sex and age. High-tech employment is lower on average in Poland, nevertheless in the other three countries these levels are close to identical for both sexes. The share of research employment is also remarkably similar across all countries across all sectors and sexes, though the average of the total share of research employment is slightly higher in Czechia and Poland. The minimum and maximum values, however, are roughly equal (Annex C, D, E).

Therefore, given that the social structural and the economic conditions are all eminently similar, furthermore considering that the impact governance has on innovation is rather ineffective in the V4 as indicated by the results, it follows that the hidden explanatory variable to account for the divergences in innovation across V4 regions is likely to be associated with culture as that facet constitutes the only sharp contrast between the groups. If all circumstances are

[8] In 2019, 573 multinational companies were operating in Czechia, 232 in Slovakia, 554 in Hungary, and 765 in Poland (OECD 2020a).

approximately analogous, yet the regions of Czechia and Slovakia are more innovative than those of Hungary and Poland, then there hardly exists a better explanation than their populations culturally being more prone to innovation, suggested most compellingly by the strength of the relationship between research employment and innovation.

4.6.1. Limitations

However, although the assumption seems to be valid, this research suffers from several limitations. It must be acknowledged that for the assumption that culture is a relevant component in determining innovative outcomes in the V4, the research only yielded further assumptions. I assume that the hypothesis is true, because the theoretical link between culture and innovation is supported by literature and because these countries are relatively similar in all aspects but one: the state of democracy. Additional support is provided by culture indices complemented by analytical explanations as to how certain cultural traits affect economic behaviour. However, I cannot offer direct evidence to support my claims.

Furthermore, there may exist alternative explanations. Perhaps the differences in innovation are by chance in the sense that the share of labour force participation opportunities that are generally associated with more innovative potential may be higher in Czechia and Slovakia, without necessarily being driven by culture. Yet even in this case, it is impossible to separate culture from how society and the economy are organised. It could also be the case that innovation policies in Czechia and Slovakia are better able to synthesise economic opportunities with regional potential, and hence are more effective without the cultures necessarily being more prone to produce innovations, despite the findings indicating otherwise. Or perhaps these countries foster more sustainable relationships with the international private sector, or for some other reason may offer a more certain market for investment. Deeper investigation would be required to endorse these potential explanations.

Apart from the challenges connected to validating the findings, from a methodological point of view, the quality and appropriateness of the data used raises further issues. The NUTS-2 regions CZ02 and HU12 are not included in RISIS-KNOWMAK, though this is mitigated by low-income regional analyses, as both missing regions are relatively wealthy (Eurostat 2020b). Besides this deficiency, coverage, though generally adequate, varies across regression models, with the proxies fundamentally not being able to offer an accurate representation of innovation, market size, or the level of development. Lastly, albeit it is theoretically convenient to claim that the countries under examination are roughly homogeneous for reasons discussed earlier,

the truth to this assumption is bounded in reality. Social organisms are intrinsically complex phenomena which cannot be reduced to such simplistic representations without losing what renders each region and country distinctly and essentially unique. Nevertheless, one can only seek to interpret the world by "assuming the simplest law that can be made to harmonise with our experience" (Wittgenstein 1922). The trade-off between simplicity and accuracy is although inevitable in social scientific research, it does offer valuable insight. In this instance, despite its limitations, the study suggests that culture matters for innovation in V4 countries, which if investigated more thoroughly in the future, can have important policy implications.

5. Conclusion

This research aimed to uncover whether sociocultural differences account for differences in regional innovative outcomes in V4 countries. Based on a pairwise comparison of Czechia and Slovakia on the one hand, and Hungary and Poland on the other, the findings strongly suggest that culture is associated with innovation. By testing factors endogenous growth theory posits as underlying for technological change (R&I intensity, socioeconomic structure, and governance), in line with expectations I found that the regions of Czechia and Slovakia are not only more innovative on average, but the effects of the determinants are more powerful on innovation in these cases. Culture thus matters in explaining regional competitive disparities.

The findings have three important policy implications. First, innovation is a promising tool for promoting territorial cohesion in V4 countries given its strong relationship with growth in low-income regions. Second, the quality of innovation governance must be improved, considering that innovative activity across V4 regions fails to translate into enhanced levels of growth. Contrary to expectations, the regions of Czechia and Slovakia progress at similar rates as those of Hungary and Poland, whereas their innovative advantage should materialise in more robust growth in comparison. The results indicate that tax policy could be a fruitful avenue for improving government effectiveness with regards to innovation. Third, interventions targeting culture could offer a novel long-term approach to sustainably generating innovation, and thus a new layer to regional policy.

However, extensive future research would be necessary for culture to get on the regional policy agenda. To begin with, a regionally disaggregated cultural index needs to be constructed with an unbiased methodology that can capture the most relevant dimensions of culture for socioeconomic development, allowing to compare territorial units and countries. The index could expand measurement from corporate to other social contexts, such as school or

government to offer a more holistic view on interactions within different institutional settings. Consequently, a place-sensitive approach could identify which cultural traits may potentially constrain regional productivity and prosperity relative to institutional setting. Programmes could seek to alter these aspects by mainstreaming carefully designed interventions into education or workplace policy, for instance.

Nevertheless, for any culture-related policy reform to take place not with the purpose of promoting and conserving the traditional conceptions and symbols of national culture, the general understanding of culture must move beyond this scope. Most crucially, societies need to recognise that the relationship between cultural change and a nation's identity is not zero-sum; they evolve symbiotically to adapt to global changes. Gender- or ethnicity-sensitive education are reactive culture polices to such trends. An innovation-sensitive culture reform would be a proactive strategy boosting societies' ability to adapt to changes and challenges yet unknown – especially concerning lagging regions.

Bibliography

Aghion, P. and Howitt, P. (1992) A Model of Growth through Creative Destruction, *Econometrica*, 60(2): 323-51.

Aiginger, K., Bärenthaler-Sieber, S., and Vogel, J. (2013) Competitiveness under New Perspectives, Working Paper no. 44, *WWWforEurope*. Available at : https://www.oecd.org/economy/Competitiveness-under-New-Perspectives.pdf [Accessed 27 July 2021].

Akerlof G.A. and Kranton R.E (2011) *Identity Economics: How Our Identities Shape Our Work, Wages, and Well-Being*. Princeton, NJ: Princeton University Press

Allred, B.B. and Swan, K.S. (2004) Global Versus Multidomestic: Culture's Consequences on Innovation, *Management International Review*, 44(Special): 81-105.

Andersen, T.M. (2015) *Human Capital, Inequality and Growth*. Luxembourg: Publication Office of the European Union.

Andersen, T.M., Fallow, M.A., Jorgensen, A., de Neergaard, M., and Nielsen, R.S. (2020) Cohesion in the Local Context: Reconciling the Territorial, Economic and Social Dimensions, *Social Inclusion*, 8(4): 178-182.

Andrijauskiene, M. and Dumciuviene, D. (2017). Hofstede 's cultural dimensions and national innovation level. *DIEM: Dubrovnik International Economic Meeting*, 3(1): 189–205.

Arrow, K. (1962) Economic Welfare and Allocation of Resources for Invention, in *The Rate and Direction of Inventive Activity: Economic and Social Factors*, 609–626, NJ: Princeton University Press.

Audretsch, D. B., and Belitski, M. (2013) The missing pillar: The creativity theory of knowledge spillover entrepreneurship, *Small Business Economics*, 41(4): 819–836.

Ballas, D., Dorling, D. and Hennig, B. (2017) Analysing the regional geography of poverty, austerity and inequality in Europe: a human cartographic perspective, *Regional Studies*, 51(1): 174-185.

Banu, G.A. and Miles, G. (2011) Innovation speed and radicalness:are they inversely related? Management Decision, 49(4): 533-547.

Bárcena, A., Cimoli, M., García-Buchaca, and Pérez, R. (2018) The Inefficiency of Inequality, Thirty-Seventh Session of ECLAC. Available at: https://repositorio.cepal.org/bitstream/handle/11362/43567/4/S1800301_en.pdf [Accessed 27 July 2021].

Baregheh, A., Rowley, J., and Sambrook, S. (2009) Towards a multidisciplinary definition of innovation, Management Decisions, 47(8): 1324-1339.

Barros, M.V., Ferreira, M.B., Prado, G., Piekarski, C.M., and Picinin, C.T. (2020) The interaction between knowledge management and technology transfer: a current literature review between 2013-2018, *Journal of Technology Transfer*, 45(1): 1585-1606.

Bénabou, R. (2013) Groupthink: Collective Delusions in Organizations and Markets, *Review of Economic Studies*, 2013(80): 429–462.

Beugelsdijk and Welzel (2018) Dimensions and Dynamics of National Culture: Synthesizing Hofstede with Inglehart, *Journal of Cross-Cultural Psychology*, 49(10): 1469–1505.

Bik, O. (2010) *The Behavior of Assurance Professionals: A Cross-cultural Perspective.* Delft: Eburon.

Bilbao-Osorio, B. and Rodríguez-Pose, A. (2004) From R&D to innovation and economic growth in the EU, *Growth Change*, 35(4): 434-455.

Boros, T, Freitas M, Laki, G., and Stetter, E. (2018) State of Populism in Europe, *Foundation for European Progressive Studies.* Available at: https://www.feps-europe.eu/attachments/publications/web_state%20of%20populism%20in%20europe%202018.pdf [Accessed 26 July 2021].

Bottazzi L and G. Peri (2003) Innovation and Spillovers in Regions: Evidence from European Patent Data, *European Economic Review*, 47(4): 687-710.

Bradley, F., Gao, Y. and Sousa, C. (2013) A natural science approach to investigate cross-cultural managerial creativity, *International Business Review*, 22(5): 839-855.

Bradley, John F.N., Zeman, Z.A.B., Hauner, M., Odlozilik, O., and Wiskemann, E. (2016) Czechoslovak history, *Encyclopedia Britannica.* Available at: https://www.britannica.com/topic/Czechoslovak-history [Accessed 24 July 2021].

Brem, A., Maier, M.A., and Wimschneider, C. (2016) Innovation as a source of competitive advantage: the case of Nespresso, European Journal of Innovation Management, 19(1): 133-148.

Brenkert, G. (2009) Innovation, rule breaking, and the ethics of entrepreneurship, *Journal of Business Venturing*, 24(5): 448-464.

Brewer, P. and Venaik, S. (2011). Individualism-collectivism in Hofstede and GLOBE. *Journal of International Business Studies*, 32(1): 436-445.

Brisch, H. and Volges, I. (1979) *Czechoslovakia: The Heritage of Ages Past.* CO: Westview Press.

Brzozowska, S. (2017) Światopoglądy młodopolskie w teatralnym lustrze XXI wieku: "Termopile polskie" Tadeusza Micińskiego i Jana Klaty, *Folia Litteraria Polonica*, 33(3): 345-360.

Bukodi, E., Paskov, M., and Nolan, B. (2017) Intergenerational Class Mobility in Europe: A New Account and an Old Story, *INET Oxford Working Paper no. 2017-03.* Available at: https://www.inet.ox.ac.uk/files/Social_Mobility_Europe_final_April_2017.pdf [Accessed 27 July 2021].

Bukowsi, A. and Rudnicki, S. (2018) Not Only Individualism: The Effects of Long-Term Orientation and Other Cultural Variables on National Innovation Success, *Cross-Cultural Research*, 53(2): 119–162.

Buti, M, and Pichelmann, K. (2017) European integration and populism: addressing Dahrendorf's quandary, *European Commission, Directorate-General for Economic and Financial Affairs.* Available at: https://ec.europa.eu/info/sites/default/files/jan2017-populism.pdf [Accessed 27 July 2021].

Caillaud, B. and Duchene, A. (2011) Patent office in innovation policy: Nobody's perfect, *International Journal of Industrial Organization,* 29(2): 242-252.

Chen, Y., Podolski, E. J., and Veeraraghavan, M. (2017), National culture and corporate innovation, *Pacific-Basin Finance Journal*, 43(1): 173–187.

Cisar, O. (2017) Czech Republic: From Post-Communist Idealism to Economic Populism, *International Policy Analysis, Friedrich Ebert Stiftung*. Available at: https://library.fes.de/pdf-files/id-moe/13079-20170119.pdf [Accessed 24 July 2021].

Coccia, M. (2007) Spatial mobility of knowledge transfer and absorptive capacity: analysis and measurement of the impact within the geoeconomic space, *Journal of Technology Transfer*, 2008(33): 105-122.

Collier, P. (2017) Culture, Politics, and Economic Development, *Annual Review of Political Science*, 2017(20): 111-125.

Cörves, F. and Mayhew, K. (2021) Regional inequalities: causes and cures, *Oxford Review of Economic Policy*, 37(1): 1-16.

Coyle, D. (2016) Economics: GDP in the dock, *Nature*, 534(1): 472-474.

Csehi, R. and Zgut, E. (2020) 'We won't let Brussels dictate us': Eurosceptic populism in Hungary and Poland, *European Politics and Society*, 22(1): 53-68.

Csuka, Gy. (2010) The Competitiveness of Central and Eastern European Countries: an analysis of the legal environment, in Gorzelak, G., Bachtler, J., and Smętkowski, M. (Eds.), *Regional Development in Central and eastern Europe*. Routledge: London.

Czarnitzki, D. and Toivanen, O. (2013) *Innovation Policy and Economic Growth*. Luxembourg: Publication Office of the European Union.

Darvas, Zs., Collin, A.M., Mazza, J., and Midoes, C. (2019) Effectiveness of cohesion policy: Learning from the project characteristics that produce the best results, *Directorate General for Internal Policies*. Available at: https://www.bruegel.org/wp-content/uploads/2019/06/cohesionpolicyep.pdf [Accessed 20 July].

De Haan, J. and Sturm, J-E. (2003) Does more democracy lead to greater economic freedom? New evidence for developing countries, *European Journal of Political Economy*, 19(3): 547-563.

De Mooij, M. and Hofstede, G. (2010) The Hofstede model: applications to global branding and advertising strategy and research, *International Journal of Advertising*, 29(1): 85-110.

Desmarchelier, B. and Fang, E. (2016) National culture and innovation diffusion, *Technological Forecasting and Social Change*, 105(4): 121-128.

Dollinger, S.J. (2007) Creativity and conservatism, *Personality and Individual Differences*, 43(5): 1025-1035.

Doraszelski, U. and Jaumandreu, J. (2013) R&D and Productivity: Estimating Endogenous Productivity, *The Review of Economic Studies*, 80(4): 1338-1383.

Doucouliagos, H. and Ulubaşoğlu, M.A. (2008) Democracy and economic growth: a meta-analysis, American Journal of Political Science, 52(1): 61-83.

Dowell, S. (2021) Today is Polish and Hungarian Friendship Day. But what is it that makes this relationship so special? *The First News.* Available at: https://www.thefirstnews.com/article/today-is-polish-and-hungarian-friendship-day-but-what-is-it-that-makes-this-relationship-so-special-20738 [Accessed 24 July 2021].

Dudeková Kováčová, G. (2017) The Silent Majority: Attitudes of Non-prominent Citizens at the Beginning of the Great War in the Territory of Today's Slovakia, *Revue des études slaves*, 1914(4): 699-719.

Dvornik, F. (1962) *The Slavs in European History and Civilization*. NJ: Rutgers University Press.

Efrat, K. (2014). The direct and indirect impact of culture on innovation, *Technovation*, 34(1): 12-20.

Eatwell, R. and Goodwin, M. (2018) *National Populism: The Revolt Against Liberal Democracy.* London: Pelican Books.

Encaoua, D., Guellec, D., and Martínez, C. (2006) Patent systems for encouraging innovation: Lessons from economic analysis, *Research Policy*, 35(9): 1423-1440.

Engelen, A., Schmidt, S., Strenger, L. and Brettel, M. (2014) Top management's transformational leader behaviors and innovation orientation: a cross-cultural perspective in eight countries, *Journal of International Management*, 20(2): 124-136.

Erez, M. and Nouri, R. (2010) Creativity: the influence of cultural, social, and work contexts, *Management and Organization Review*, 6(3) 351-370.

Esser, F.C. (2007) The Link between Innovation Performance and Governance. Luxembourg: Publication Office of the European Union.

Espig, A., Mazzini, I.T., Zimmermann, C., and Castro de Carvalho, L. (2021) National culture and innovation: a multidimensional analysis, *Emerald Insight.* Available at: https://www.emerald.com/insight/content/doi/10.1108/INMR-09-2020-0121/full/pdf [Accessed 24 July 2021].

European Commission (2017) Final Report: Economic Challenges of Lagging Regions, *Directorate-General for Regional and Urban Policy*. Availabe at: https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/challenges_lagging/econ_challenges_lagging_en.pdf [Accessed 27 July 2021].

European Commission (2019) Czech Republic: Historical Development. Available at: https://eacea.ec.europa.eu/national-policies/eurydice/content/historical-development-21_en [Accessed 24 July 2021].

European Commission (2021a) 2020 Rule of Law Report: Country Chapter on the rule of law situation in Czechia. Available at: https://ec.europa.eu/info/sites/default/files/2021_rolr_country_chapter_czechia_en.pdf [Accessed 27 July 2020].

European Commission (2021b) 2021 Rule of Law Report: Country Chapter on the rule of law situation in Hungary. Available at: https://ec.europa.eu/info/sites/default/files/2021_rolr_country_chapter_hungary_en.pdf [Accessed 27 July 2020].

European Commission (2021c) 2021 Rule of Law Report: Country Chapter on the rule of law situation in Poland. Available at: https://ec.europa.eu/info/sites/default/files/2021_rolr_country_chapter_poland_en.pdf [Accessed 27 July 2020].

European Commission (2021d) 2021 Rule of Law Report: Country Chapter on the rule of law situation in Slovakia. Available at: https://ec.europa.eu/info/sites/default/files/sk_rol_country_chapter.pdf [Accessed 27 July 2020].

European Commission (2021e) Patent protection in the EU. Available at: https://ec.europa.eu/growth/industry/policy/intellectual-property/patents_en [Accessed 24 July 2021].

Eurostat (2020a) NUTS – Nomenclature of Territorial Units for Statistics: Principles and Characteristics." European Commission. Available at:

https://ec.europa.eu/eurostat/web/nuts/principles-and-characteristics [Accessed 27 July2021].

Eurostat (2020b) Regional Statistics by NUTS classification. Available at: https://ec.europa.eu/eurostat/web/regions/data/database [Accessed 24 July 2021].

Fagerberg, J. and Srholec, M. (2010) Innovation and Economic Development, *University of Oslo*, Working Papers on Innovation Studies no. 20090723. Available at: https://www.researchgate.net/publication/266265812_Innovation_and_Economic_Development/figures?lo=1 [Accessed 20 July 2021].

Flamm, L. (2012) The Crisis and Euroscepticism in Central and Eastern Europe, *L'Europe en Formation*, 2(364): 305-321.

Flanagan, S. (1987) Value change in industrial society, *American Political Science Review*, 81(1): 1303-1319.

Floerkemeier, H., Spatafora, N., Venables, A., Cashin, P., and Cerra, V. (2021) Regional Disparities, Growth, and Inclusiveness, IMF Working Paper. Available at: https://www.elibrary.imf.org/view/journals/001/2021/038/article-A001-en.xml []Accessed 27 July 2021.

Foss, N.J., Klein, P.G., Kor, Y.Y., and Mahoney, J.T. (2008) Entrepreneurship, subjectivism, and the resource-based view: toward a new synthesis, *Strategic Entrepreneurship Journal*, 2(1): 73–94.

Fóthi, E., Gonzalez, A., Fehér, T., Gugora, A., Fóthi, A., Biró, O., and Keyser, C. (2020) Genetic analysis of male Hungarian Conquerors: European and Asian paternal lineages of the conquering Hungarian tribes, *Archaeological and Anthropological Sciences*, 12(31): 1-21.

Frenzel-Zagorska, J. (1990) Civil Society in Poland and Hungary, *Soviet Studies*, 42(4): 759-777.

Gao, Y., Zang, L., Roth, A., and Wang, P. (2017) Does democracy cause innovation? An empirical test of the popper hypothesis, *Research Policy*, 46(7): 1272–1283.

Geddes, B. (1999) What do we know about democratization after twenty years? *Annual Review of Political Science*, 2(1): 115-144.

Gerschenkron, A. (1962) *Economic Backwardness in Historical Perspective: A Book of Essays*. MA: Harvard University Press.

Gino, F. and Wiltermuth, S.S. (2014) Evil Genius? How Dishonesty Can Lead to Greater Creativity, *Psychological Science*, 25(4): 973-981.

Griffith, D. and Rubera, G. (2014) A cross-cultural investigation of new product strategies for technological and design innovations, *Journal of International Marketing*, 22(1): 5-20.

Grillo, F. and Nanetti, R.Y. (2016) *Innovation, Democracy, and Efficiency: Exploring the Innovation Puzzle within the European Union's Regional Development* Policies. London: Palgrave Macmillan.

Grossman, G.M. and Helpman, E. (1994) Endogenous Innovation in the Theory of Growth, *The Journal of Economic Perspectives*, 8(1): 23-44.

Guellec, D. and de la Potterie, B.v.P. (2007) *The Economics of the European Patent System.* Oxford: Oxford University Press.

Guo, Q., Liu, Z., Li, X., and Qiao, X. (2018) Indulgence and Long Term Orientation Influence Prosocial Behavior at National Level, *Frontiers in Psychology.* Available at:

https://www.frontiersin.org/articles/10.3389/fpsyg.2018.01798/full [Accessed 24 July 2021].

Halecki, O. (1944) The Historical Role of Central and Eastern Europe, *The Annals of the American Academy of Political and Social Science*, 232(3): 9-18.

Hall, E.T. (1976) *Beyond Culture*. NY: Anchor Books/Doubleday.

Hanel, P.H.P., Maio, G.R., Soares, A.K.S., Vione, K.C., de Holanda Coelho, G.L., Gouveia, V.V., Patil, A.C., Kamble, S.V., and Manstead, A.S.R. (2018) Cross-Cultural Differences and Similarities in Human Value Instantiation. *Frontiers in Psychology*. Available at: https://www.frontiersin.org/articles/10.3389/fpsyg.2018.00849/full [Accessed 24 July 2021].

Heo, U. and Tan, A.C. (2001) Democracy and economic growth: a causal analysis, Comparative Politics, 33(4): 463-473.

Hofstede, G. (1983) National cultures in four dimensions: a research-based theory of cultural differences among nations, *International Studies of Management and Organization*, 13(1): 46-74.

Hofstede, G. (2001*) Culture's Consequences: Comparing Values, Behaviors, Institutions and Organizations Across Nations*. Tilburg: Tilburg University Press.

Hofstede, G. Hofstede, G. and Minkov, M. (2010) *Cultures and Organizations: Software of the Mind: Intercultural Cooperation and its Importance for Survival.* NY: McGraw-Hill.

Hofstede Insights (2021) Country Comparison. Available at: https://www.hofstede-insights.com/country-comparison/ [Accessed 24 July 2021].

Homza, M. (2017) *Mulieres suadentes - Persuasive Women: Female Royal Saints in Medieval Eastern and Central Europe.* The Hague: Brill.

House, R., Hanges, P., Javidan, M., Dorfman, P. and Gupta, V. (2004) *Culture, Leadership, and Organizations: The GLOBE Study of 62 Societies*. CA: Sage Publications.

House, R., Javidan, M., Hanges, P. and Dorfman, P. (2002) Understanding cultures and implicit leadership theories across the globe: an introduction to project GLOBE, *Journal of World Business*, 37(1): 3-10.

Howells, J. (2005) Innovation and regional economic development: A matter of perspective? *Research Policy*, 34(8): 1220-1234.

Hsu, S-Y., Woodside, A.G., and Marshall, R. (2013) Critical Tests of Multiple Theories of Cultures' Consequences: Comparing the Usefulness of Models by Hofstede, Inglehart and Baker, Schwartz, Steenkamp, as well as GDP and Distance for Explaining Overseas Tourism Behavior, *Journal of Travel Research*, 52(6): 679–704.

Iammarino, S., Rodríguez-Pose, A., and Storper, M. (2017) *Why Regional Development matters for Europe's Economic Future.* Luxembourg: Publications Office of the European Union.

Ilonszki, G. and Dudzińska, A. (2021) Opposition behaviour against the third wave of autocratisation: Hungary and Poland compared, *European Political Science*, 32(1): 1-14.

Inglehart, R. (1971) The silent revolution in Europe: Intergenerational change in post-industrial societies, *American Political Science Review*, 65(1): 991-1017.

Inglehart, R. (1990). Culture shift in advanced industrial society. Princeton, NJ: Princeton University Press

Inglehart, R. (1997) *Modernization and postmodernization: Cultural, economic, and political change in 43 societies*. NJ: Princeton University Press.

Inglehart, R. (2016) Modernization, Existential Security and Cultural Change: Reshaping Human Motivations and Society, in Gelfand, M., Chiu, C.Y., and Hong Y-Y. (Eds.), *Advances in Culture and Psychology*. Oxford: Oxford University Press.

Inglehart, R. and Welzel, C. (2005) *Modernization, Cultural Change and Democracy: The Human Development Sequence.* NY: Cambridge University Press.

International Lesbian, Gay, Bisexual, Trans and Intersex Association (ILGA) (2021) Country Ranking, Rainbow Europe. Available at: https://rainbow-europe.org/country-ranking#eu [Acessed: 3 July 2021].

Jang, Y., Ko, Y., and Kim, S.Y. (2016) Cultural correlates of national innovative capacity: a cross-national analysis of national culture and innovation rates, *Journal of Open Innovation: Technology, Market, and Complexity*, 2(23): 1-16.

Jasny, L. (2013) Relational Political Culture: A Critique of Inglehart's Post-Materialist Thesis, *American Political Science Association Annual Meeting.* Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2301583 [Accessed 24 July 2021].

Javidan, M., House, R.J., Dorfman, P.W., Hanges, P J., and de Luque, M.S. (2006) Conceptualizing and measuring cultures and their consequences: A comparative review of GLOBE's and Hofstede's approaches, *Journal of International Business Studies*, 37(1): 897-914.

Jones, G. and Davis, H. (2000) National culture and innovation: implications for locating global R&D operations, *Management International Review,* 40(1): 11-39.

Kaasa, A. (2021) Merging Hofstede, Schwartz, and Inglehart into a Single System, *Journal of Cross-Cultural Psychology*, 52(4): 339-353.

Kaasa, A. and Vadi, M. (2010) How does culture contribute to innovation? Evidence from European countries, *Economics of Innovation and New Technology*, 19(7): 583-604.

Kapoor, H., Ticku, A., Tagat, A., and Karandikar, S. (2021) Innovation in Isolation? COVID-19 Lockdown Stringency and Culture-Innovation Relationships, *Frontiers in Psychology*. Available at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.593359/full [Accessed 24 July 2021].

Khan, R. and Cox, P. (2017) Country culture and national innovation. *Archives of Business Research*, 5(2): 85–101.

Khosrowjerdi and Bornmann (2021) Is culture related to strong science? An empirical investigation, *Journal of Infometrics*, 15(4): 1.15.

King, M.A. and Robson, M.H. (1993) A Dynamic Model of Investment and Endogenous Growth, *Scandinavian Journal of Economics*, 95(4): 455-466.

Kolakowska, A. (2020) Hungarians towards the German aggression on Poland, *Przystanek Historia*. Available at: https://przystanekhistoria.pl/pa2/tematy/english-content/75481,Hungarians-towards-the-German-aggression-on-Poland.html [Accessed 24 July 2021].

Kovács, E. (1972) Hungarian-Polish Relations between the Two World Wars, *Acta Historica Academiae Scientiarum Hungaricae,* 18(2): 161-169.

Kraler, A., Katsiaficas, C., and Wagner, M. (2020) Climate Change and Migration, *Policy Department for Citizens' Rights and Constitutional Affairs Directorate-General for*

Internal Policies. Available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2020/655591/IPOL_STU(2020)655591_EN.pdf [Accessed 27 July 2021].

Krassner, A.M., Gartstein, M.A., Park, C., Dragan, W.L.., Lecannelier, F., and Putnam S.P. (2018) East-West, Collectivist-Individualist: A Cross-Cultural Examination of Temperament in Toddlers from Chile, Poland, South Korea, and the U.S, *European Journal of Development Psychology*, 14(4): 449-464.

Krejcí, J. and Machonin, P. (1998) *Czechoslovakia, 1918-92: A laboratory for social change.* London: Palgrave Macmillan.

Krekó, P., Molnár, Cs, Juhász, A., Kucharczyk, J., and Pazderski, F. (2019) Beyond Populism: Tribalism in Poland and Hungary, *Political Capital Institute.* Available at: https://www.politicalcapital.hu/pc-admin/source/documents/pc_beyond_populism_study_20180731.pdf [Accessed 26 July 2021].

Kristóf, Gy., Barta, J., and Gergely, J. (2000) *Magyarország története előidőktől 2000-ig.* Budapest: Pannónia Kiadó.

Li, L.M.W. and Bond, M. H. (2010) Value change: Analyzing national change in citizen secularism across four time periods in the World Values Survey, *The Social Science Journal*, 47(1): 294-206.

Lin, L. (2009) Effects of national culture on process management and technological innovation, *Total Quality Management and Business Excellence*, 20(12): 1287-1301.

Liu, Z. (2013) The research tax credit in the policy mix for innovation: the French case, *Journal of Innovation Economics and Management*, 2(12): 199-223.

López, A. (2009) *Innovation and Appropriability: Empirical Evidence and Research Agenda, in World Intellectual Property Organization.* WIPO Publications Office: Geneva.

Lucas R. (1988) On the Mechanics of Economic Development, *Journal of Monetary Economics*, 22(1): 3-42.

Lukowski, J. and Zawadzki, H. (2019) *Part II – Poland, after 1795.* Cambridge: Cambridge University Press.

Malová, D. (2017) Transformation Experiences in Slovakia: Governing Uncertainty, *International Policy Analysis, Friedrich Ebert Stiftung*. Available at: https://library.fes.de/pdf-files/id-moe/13081.pdf [Accessed 24 July 2021].

Mankiw, N.G. (1995) The Growth of Nations, *Brookings Papers on Economic Activity*, 1995(1): 275-326.

Maucorps, A., Jestl, S., and Römisch, R. (2020) The Effects of the EU Cohesion Policy on Regional Economic Growth:: Using Structural Equation Modelling for Impact Assessment, *The Vienna Institute for International Economic Studies*, Working Paper no. 185. Available at: https://wiiw.ac.at/the-effects-of-the-eu-cohesion-policy-on-regional-economic-growth-using-structural-equation-modelling-for-impact-assessment-dlp-5389.pdf [Accessed 20 July 2021].

M'Cormack, F. (2011) The impact of decentralisation on economic growth, *Governance and Social Development Research Centre.* Available at: http://gsdrc.org/docs/open/hd791.pdf [Accessed 25 July 2021].

McSweeney, B. (2002) Hofstede's model of national cultural differences and their consequences: A triumph of faith – A failure of analysis, *Human Relations*, 55(1): 89–118.

Median Survey (2020) in *Budapest Business Journal*, Czech support for legalizing same-sex marriage up slightly. Available at: https://bbj.hu/budapest/gastronomy/food/czech-support-for-legalizing-same-sex-marriage-up-slightly- [Accessed: 3 July 2021].

Medvec, S.E. (1991) Poland and Czechoslovakia: Can they find that they need each other? *The Polish Review*, 36(4): 451-469.

Melzer, R. and Serafin, S. (2013) Right-win Extremism in Europe. *Friedrich Ebert Stiftung*. Available at: http://library.fes.de/pdf-files/dialog/10031.pdf [Accessed 24 July 2021].

Minkov, M. (2018) A revision of Hofstede's model of national culture: Old evidence and new data from 56 countries, *Cross Cultural and Strategic Management*, 25(1): 231-256.

Müller, J-W. (2018) *The Rise and Rise of Populism?* MA: MIT Open Mind Publishing.

Muralidharan, E. and Pathak, S. (2020) Contextualizing Technology Adoption and Self-Expression for Technology Entrepreneurial Innovation, *International Journal of Innovation and Technology Management*, 17(4): 1-25.

Naqshbandi, M.M. (2016) Managerial ties and open innovation: examining the role of absorptive capacity, Management Decision, 54(9): 2256-2276.

Nelson, R.R. (1993) *National Innovation Systems: A Comparative Analysis.* Oxford: Oxford University Press.

Nistotskaya, M., Charron, N., & Lapuente, V. (2015) The wealth of regions: quality of government and SMEs in 172 European regions, *Environment and Planning: Government and Policy*, 33(5): 1125-1155.

OECD (2010) *The OECD Innovation Strategy: Getting a Head Start on Tomorrow.* Paris: OECD Publishing.

OECD (2020a) Analytical Database on Individual Multinationals and Affiliates. Available at: https://www.oecd.org/sdd/its/measuring-multinational-enterprises.htm [Accessed 24 July 2021].

OECD (2020b) Measuring Tax Support for R&D and Innovation. Available at: https://www.oecd.org/sti/rd-tax-stats.htm [Accessed 24 July 2021].

OECD (2020c) The territorial impact of COVVID-19: the crisis across levels of government, OECD Policy Reponses to Coronavirus (COVID-19). Available at: https://www.oecd.org/coronavirus/policy-responses/the-territorial-impact-of-covid-19-managing-the-crisis-across-levels-of-government-d3e314e1/ [Accessed 27 July 2020].

Okulicz-Kozaryn, A. (2015) *Happiness and Place: Why Life Is Better Outside of the City*. NY: Palgrave Pivot.

Pack, H. (1994) Endogenous Growth Theory: Intellectual Appeal and Empirical Shortcomings, *The Journal of Economic Perspectives*, 8(1): 5-72.

Parboteeah and Cullen 2003,

Pech, S.Z. (1958) Passive Resistance of the Czechs, 1863-1879, Slavonic and East European Review, 36(87): 434-52.

Péter, L. (2003) The Holy Crown of Hungary, Visible and Invisible, *South-East Europe Review for Labour and Social Affairs*, 81(3): 422-510.

Pew Research Centre (2013) The Global Divide on Homosexuality. Available at: https://www.pewresearch.org/global/2013/06/04/the-global-divide-on-homosexuality/ [Accessed: 24 July 2021].

Porter, M. (1990) Competitive Advantage of Nations, *Harvard Business Review*, 68(2): 73-93.

Pražák, A. (1927) Czechs and Slovaks after the Revolution of 1848, *The Slavonic Review*, 6(16): 119-129.

PricewwaterhouseCoopers (2021) Worldwide Tax Summaries Online. Available at: https://taxsummaries.pwc.com/ [Accessed 27 July 2021].

Prim, A.L., Filho, L.S., Zamur, G.A.C., and Di Serio, L.C. (2017) The relationship between national culture dimensions and degree of innovation, *International Journal of Innovation Management*, 21(1): 1-22.

Przeworski, A. (2000) *Democracy and Development: Political Institutions and Well-Being in the World, 1950-1990.* Cambridge: Cambridge University Press.

Qian, Y. (2007) Do national patent laws stimulate domestic innovation in a global patenting environment? A cross-country analysis of pharmaceutical patent protection, 1978-2002, *Review of Economics and Statistics*, 89(3): 436-453.

Radl, O. (1944) Development of Czechoslovak Nationalism, *The Annals of the American Academy of Political and Social Science*, 232(1): 61-70.

Rhyne, L., Teagarden, M., and Van den Panhuyzen, W. (2002) Technology-based competitive strategies: The relationship of cultural dimensions to new product innovation, *The Journal of High Technology Management Research*, 13(1): 249–277.

Rice, C. (1985) *The Soviet Union and the Czechoslovak Army, 1948-1983.* NJ: Princeton University Press.

Rinne, T., Steel, G.D., Fairweather, J. (2012) Hofstede and Shane revisited: The role of power distance and individualism in national-level innovation success, *Cross-Cultural Research*, 46(1): 91-108.

RISIS-KNOWMAK (2019) Explore Knowledge Production in Europe. Available at: https://www.knowmak.eu/ [Accessed 24 July 2021].

Rodríguez-Pose, A. and Di Cataldo, M. (2015) Quality of government and innovative performance in the regions of Europe, *Journal of Economic Geography*, 15(4): 673-706.

Rodríguez-Pose, A. Ketterer, T.D., and Castells-Quintana (2015) Do we follow the money? The drivers of migration across regions in the EU, *Region*, 2(2): 27-46.

Rodrik, D. and Wacziarg, R. (2005) Do domestic transitions produce bad economic outcomes? *American Economic Review*, 95(2): 55-56.

Romer, P.M. (1990) Endogenous Technological Change, *Journal of Political Economy*, 98(5): S71-S102.

Rossberger, R.J. (2014) National Personality Profiles and Innovation: The Role of Cultural Practices, *Creativity and Innovation Management*, 23(3): 331-348.

Rujirawanich, P., Addison, R., and Smallman, C. (2011). The effects of cultural factors on innovation in a Thai SME, *Management Research Review*, 34(1): 1264–1279.

Sandor, F.J. and Steele, D.L. (2015) *Magyar Origins (Third Edition): A 12st Century Look at the Indo-Aryan Origins of Ancient Hungarians and Other Uralic Speakers.* CA: CreateSpace Publishing.

Sanz-Valle, R., Naranjo-Valencia, J.C., and Jimenez-Jimenez, D. (2016) Studying the links between culture, innovation, and performance in Spanish companies, R*evista Latinoamericana de Psicología*, 48(1): 30-41.

Sarooghi, H., Libaers, D., and Burkemper, A. (2015) Examining the relationship between creativity and innovation: a meta-analysis of organizational, cultural, and environmental factors, Journal *of Business Venturing*, 30(1): 714–731.

Schmoch, U., Edler, J., Blind, K., and Frietsch, R. (2006) Motives to patent: Empirical evidence from Germany, *Research Policy*, 35(5): 655-672.

Scwhartz, S. (1990) Individualism-Collectivism Critique and Proposed Refinements, *Journal of Cross-Cultural Psychology*, 21(2): 139-157.

Schwartz, S. (2004) Mapping and interpreting cultural differences around the world. In Vinken, H., Soeters, J. and Ester P. (Eds.), Comparing cultures, Dimensions of culture in a comparative perspective. Leiden, The Netherlands: Brill.

Schwartz, S. (2006) Value orientations: Measurement, antecedents and consequences across nations, in Jowell, R., Roberts, C., Fitzgerald, R., and Eva, G. (Eds.), *Measuring attitudes cross-nationally: Lessons from the European Social Survey*. London: Sage Publications.

Serban, O. (2020) From Endogenous Growth Theory to Knowledge Economy Pyramid: Comparative Analysis of Knowledge as an Endogenous Factor of Development, *Revista Lumen*, 2020(1): 1-21.

Shane, S., Ventakamaran, S., and MacMillan, I. (1995) Cultural differences in innovation championing strategies, *Journal of Management*, 21(1): 931-952.

Shane, S. (1992) Why do some societies invent more than others? *Journal of Business Venturing*, 7(1): 29-46.

Shane, S. (1993). Cultural influences on national rates of innovation, *Journal of Business Venturing*, 8(1): 59–73.

Singer, J. and Voronov, J.A. (2002) The Myth of Individualism-Collectivism: A Critical Review, *The Journal of Social Psychology*, 142(4): 461-80.

Smale, T. (2016) Why national culture should be at the heart of innovation management, *Technology Innovation Management Review*, 6(1): 18–25.

Smith, P.B., Dugan, S., and Trompenaars, F. (1996) National culture and the values of organizational employees: A dimensional analysis across 43 nations, *Journal of Cross-Cultural Psychology*, 27(1): 231-264.

Solow, R.M. (1956) A contribution to the theory of economic growth, *Quarterly Journal of Economics*, 70(1): 65-94

Soto-Acosta, P., Colomo-Palacios, R., and Popa, S. (2014) Web knowledge sharing and its effect on innovation: An empirical investigation in SMEs, *Knowledge Management Research and Practice*, 12(1): 103-113.

Spiesz, A., Bolchazy, L.J., and Caplovic, D. (2006*) Illustrated Slovak History: A Struggle for Sovereignty in Central Europe.* IL: Bolchazy-Carducci Publishers.

Swan, T.W. (1956) Economic growth and capital accumulation, *Economic Record*, 32(2): 334-361.

Syed, H. and Malik, A.N. (2014) Comparative study of effect of culture on technology adoption in Pakistan and USA, *The Business and Management Review*, 5(1): 42–51.

Szent-Iványi, B. (2017) *Foreign Direct Investment in Central and Eastern Europe.* London: Palgrave Macmillan.

Taborsky, E. (1961) *Communism in Czechoslovakia, 1948-1960.* NJ: Princeton University Press.

Taylor, M.Z. and Wilson, S. (2012). Does culture still matter? The effects of individualism on national innovation rates, *Journal of Business Venturing*, 27(1): 234-247.

Tellis, G. J., Stremersch, S., Yin, E. (2003) The international take-off of new products: The role of economics, culture, and culture innovativeness, *Marketing Science*, 22(1): 188-208.

The Economist (2016) Place-based economic policies as a response to populism. Available at: https://www.economist.com/finance-and-economics/2016/12/15/place-based-economic-policies-as-a-response-to-populism?fsrc=scn%2Ftw%2Fte%2Fbl%2Fed%2F [Accessed 25 July 2021].

Tian, M., Deng, P., Zang, Y., and Salmador, M.P. (2018). How does culture infuence innovation? A systematic literature review, *Management Decision*, 56(1): 1088–1107.

Toner, P. Workforce Skills and Innovation: An Overview of Major Themes in the Literature. OECD Education Working Paper Series no. 2001(1). Available at: https://www.oecd.org/sti/inno/46970941.pdf [Accessed 27 July 2021].

Triandis H.C. and Suh E.M. (2003) Cultural influences on personality, *Annual Review of Psychology*, 2002(53): 133–160.

Trompenaars, F. (1993) *Riding the Waves of Culture: Understanding Cultural Diversity in Business*. NY: Random House Business.

Trompenaars, F. and Hampden-Turner, C. (1993) *Riding the Waves of Culture: Understanding Diversity in Business*. NY: Nicholas Brealey Publishing.

United Nations Development Programme (2020) Human Development Reports. Available at: http://hdr.undp.org/en/content/human-development-index-hdi [Accessed 27 July 2021].

Valásek, T. (2019) Why Can't the East and West Work as One? *Carneige Europe.* Available at: https://carnegieeurope.eu/2019/11/08/why-can-t-eu-s-west-and-east-work-as-one-pub-80300 [Accessed 27 July 2021].

Van Everdingen, Y.M., and Waarts, E. (2003) The effect of national culture on the adoption of innovations, *Marketing Letters*, 14(1): 217–232.

Varsakelis, N.C. (2001) The impact of patent protection, economy openness and national culture on R&D investment: a cross-country empirical investigation, *Research Policy*, 30(1): 1059–1068

Večerník, J. (1991) Earning Distribution in Czechoslovakia: Intertemporal changes and International Comparison, *European Sociological Review*, 7(3): 237-252

Verspagen, B. (1992) Endogenous Innovation in Neo-Classical Growth Models: A Survey, *Journal of Macroeconomics*, 14(4): 631-662.

Veugelers, R. (2021) Research and innovation policies and productivity growth, Working Paper 08/2021, *Bruegel*. Available at: https://www.bruegel.org/wp-content/uploads/2021/05/WP-2021-08-100521.pdf [Accessed 24 July 2021].

Visegrad Group (2021) About the Visegrad Group. Available at: https://www.visegradgroup.eu/about [Accessed 27 July 2021].

Wandycz, P.S. (1974) *The Lands of Partitioned Poland, 1795-1918*. WA: University of Washington Press.

Welzel, C. (2007). Are levels of democracy influenced by mass attitudes? International Political Science Review, 28, 397-424.

Welzel, C. (2013).*Freedom rising: Human empowerment and the quest for emancipation.* NY: Cambridge University Press.

Widuto, A. (2019) Regional inequalities in the EU, *European Parliament Briefing*. Available at: https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/637951/EPRS_BRI(2019)637951_EN.pdf [Accessed 27 July 2021].

Wittgenstein, L. (1922) *Tractatus logico-philosophicus.* London: Routledge.

Wood, T. (2021) Global Stars: The Most Innovative Countries, Ranked by Income Group, *Visual Capitalist.* Available at: https://www.visualcapitalist.com/national-innovation-the-most-innovative-countries-by-income/ [Accessed 27 July 2021].

World Bank (2020) Worldwide Governance Indicators. Available at: https://info.worldbank.org/governance/wgi/ [Accessed 24 July 2021].

World Economic Forum (2021) *Global Gender Gap Report 2021*. Geneva: WEF Publishing.

World Values Survey (2021) Findings and Insights. Available at: https://www.worldvaluessurvey.org/WVSContents.jsp [Accessed 23 July 2021].

Xie, G. and Paik, Y. (2018). Cultural differences in creativity and innovation: are Asian employees truly less creative than western employees? *Asia Pacific Business Review*, 25(1): 123–147.

Zhuang, J., de Dios, E., and Langman-Martin, A. (2010) Governance and Institutional Quality and the Links with Economic Growth and Income Inequality: With Special Reference to Developing Asia, *Asian Development Bank Economics Working Paper Series*, no. 193. Available at: https://www.adb.org/sites/default/files/publication/28404/economics-wp193.pdf [Accessed 24 July 2021].

Zsinka, L. (2013) Similarities and Differences in Polish and Hungarian History, in Corvinus University, Magyar-lengyel barátság – történelem, gazdaságpolitika, kultúra. Budapest: Corvinus University Press.

Appendices

Appendix 1.1: Innovative capacity and Gross Value Added

The effect of innovation on GVA (5-year lag)

	Dependent variable:						
	gva						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ri_5	1.385*	1.759*	0.735	-1.313	0.999	3.127**	0.0001
	(0.682)	(0.889)	(1.636)	(6.233)	(1.164)	(1.033)	(1.508)
Constant	2.452***	2.223***	2.593***	1.772*	3.224***	1.037*	4.641***
	(0.229)	(0.414)	(0.277)	(0.715)	(0.229)	(0.450)	(0.803)
Observations	380	169	211	84	127	120	49
R^2	0.011	0.023	0.001	0.001	0.006	0.072	0.000
Adjusted R^2	0.008	0.017	-0.004	-0.012	-0.002	0.064	-0.021
Residual Std. Error	3.706 (df = 378)	3.943 (df = 167)	3.519 (df = 209)	4.633 (df = 82)	2.349 (df = 125)	3.405 (df = 118)	4.480 (df = 47)
F Statistic	4.117* (df = 1; 378)	3.919* (df = 1; 167)	0.202 (df = 1; 209)	0.044 (df = 1; 82)	0.737 (df = 1; 125)	9.155** (df = 1; 118)	0.000 (df = 1; 47)
Note:	(1) V4; (2) CZ and SK; (3) HU and PL; (4) HU; (5) PL; (6) CZ; (7) SK; * p<0.05; ** p<0.01; *** p<0.001						

Appendix 1.2: Innovative capacity and Gross Value Added (low-income regions)

The effect of innovation on GVA (poorest regions, 5-year lag)

	Dependent variable:						
	gva						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ri_5	1.363	0.912	0.286	-0.668	5.966	3.188**	36.851
	(0.894)	(1.162)	(3.776)	(5.590)	(4.770)	(1.174)	(34.720)
Constant	2.230***	2.611***	2.130***	1.414*	2.526***	0.900	3.296
	(0.293)	(0.565)	(0.389)	(0.676)	(0.400)	(0.652)	(1.816)
Observations	207	89	118	56	62	68	21
R^2	0.011	0.007	0.00005	0.0003	0.025	0.101	0.056
Adjusted R^2	0.006	-0.004	-0.009	-0.018	0.009	0.087	0.006
Residual Std. Error	3.491 (df = 205)	3.786 (df = 87)	3.269 (df = 116)	3.927 (df = 54)	2.354 (df = 60)	3.358 (df = 66)	3.930 (df = 19)
F Statistic	2.325 (df = 1; 205)	0.615 (df = 1; 87)	0.006 (df = 1; 116)	0.014 (df = 1; 54)	1.564 (df = 1; 60)	7.377** (df = 1; 66)	1.127 (df = 1; 19)
Note:	(1) V4; (2) CZ and SK; (3) HU and PL; (4) HU; (5) PL; (6) CZ; (7) SK; * p<0.05; ** p<0.01; *** p<0.001						

Appendix 2.1: Human capital and innovation (multivariate, by group)

The effect of human capital on innovation

	Dependent variable:		
	tsi		
	(1)	(2)	(3)
sstr_5	0.003***	0.002	0.003***
	(0.001)	(0.002)	(0.001)
rd_pers_all	0.057***	0.095***	0.005
	(0.008)	(0.018)	(0.014)
ht_emp	-0.010*	-0.036**	-0.008*
	(0.005)	(0.013)	(0.004)
Constant	-0.080*	0.023	-0.039
	(0.033)	(0.096)	(0.035)
Observations	371	167	204
R^2	0.283	0.313	0.079
Adjusted R^2	0.277	0.300	0.066
Residual Std. Error	0.106 (df = 367)	0.125 (df = 163)	0.083 (df = 200)
F Statistic	48.185*** (df = 3; 367)	24.739*** (df = 3; 163)	5.749*** (df = 3; 200)
Note:	(1) V4; (2) CZ and SK; (3) HU and PL; * p<0.05; ** p<0.01; *** p<0.001		

Appendix 2.2: Human capital and innovation (multivariate, by country)

The effect human capital on innovation (by country)

	Dependent variable:			
	tsi			
	(1)	(2)	(3)	(4)
sstr_5	0.003**	0.008***	-0.001	0.002
	(0.001)	(0.002)	(0.003)	(0.002)
rd_pers_all	-0.025	-0.044*	0.096***	0.059**
	(0.053)	(0.021)	(0.024)	(0.021)
ht_emp	-0.023**	0.002	-0.030	-0.013
	(0.008)	(0.009)	(0.019)	(0.014)
Constant	0.065	-0.287***	0.214	-0.077
	(0.073)	(0.073)	(0.142)	(0.117)
Observations	100	104	110	57
R^2	0.138	0.193	0.258	0.488
Adjusted R^2	0.111	0.169	0.237	0.460
Residual Std. Error	0.086 (df = 96)	0.074 (df = 100)	0.138 (df = 106)	0.079 (df = 53)
F Statistic	5.139** (df = 3; 96)	7.974*** (df = 3; 100)	12.289*** (df = 3; 106)	16.870*** (df = 3; 53)
Note:	(1) HU; (2) PL; (3); CZ; (4) SK; * p<0.05; ** p<0.01; *** p<0.001			

Appendix 2.3: Human capital and innovation (multivariate, low-income by group)

The effect of human capital on innovation (poorest regions)

	Dependent variable:		
	tsi		
	(1)	(2)	(3)
sstr_5	0.003***	0.003	0.003*
	(0.001)	(0.002)	(0.001)
rd_pers_all	0.176***	0.219***	0.078**
	(0.017)	(0.028)	(0.028)
ht_emp	-0.012	-0.025	-0.013*
	(0.006)	(0.018)	(0.006)
Constant	-0.162***	-0.142	-0.068
	(0.037)	(0.097)	(0.053)
Observations	180	73	107
R^2	0.484	0.603	0.178
Adjusted R^2	0.475	0.586	0.155
Residual Std. Error	0.094 (df = 176)	0.106 (df = 69)	0.080 (df = 103)
F Statistic	55.007*** (df = 3; 176)	34.985*** (df = 69)	7.459*** (df = 3; 103)
Note:	(1) V4; (2) CZ and SK; (3) HU and PL; * p<0.05; ** p<0.01; *** p<0.001		

Appendix 2.4: Human capital and innovation (multivariate, low-income by country)

The effect human capital on innovation (poorest regions, by country)

	Dependent variable:			
	tsi			
	(1)	(2)	(3)	(4)
sstr_5	0.002	0.007*	0.001	0.001
	(0.001)	(0.003)	(0.003)	(0.001)
rd_pers_all	0.011	-0.003	0.211***	0.262*
	(0.047)	(0.084)	(0.039)	(0.104)
ht_emp	-0.031**	0.011	-0.027	0.004
	(0.009)	(0.033)	(0.026)	(0.013)
Constant	0.087	-0.300*	0.036	-0.171
	(0.075)	(0.129)	(0.165)	(0.107)
Observations	66	41	48	25
R^2	0.300	0.188	0.534	0.314
Adjusted R^2	0.267	0.123	0.503	0.216
Residual Std. Error	0.068 (df = 62)	0.094 (df = 37)	0.126 (df = 44)	0.028 (df = 21)
F Statistic	8.873*** (df = 3; 62)	2.862* (df = 3; 37)	16.836*** (df = 3; 44)	3.202* (df = 3; 21)
Note:	(1) HU; (2) PL; (3); CZ; (4) SK; * p<0.05; ** p<0.01; *** p<0.001			

Appendix 2.5: Human capital and innovation (bivariate, low-income by group)

The effect of human capital on innovation (poorest regions)

	Dependent variable:		
	tsi		
	(1)	(2)	(3)
sstr_5	0.003***	0.003	0.003*
	(0.001)	(0.002)	(0.001)
rd_pers_all	0.176***	0.219***	0.078**
	(0.017)	(0.028)	(0.028)
ht_emp	-0.012	-0.025	-0.013*
	(0.006)	(0.018)	(0.006)
Constant	-0.162***	-0.142	-0.068
	(0.037)	(0.097)	(0.053)
Observations	180	73	107
R^2	0.484	0.603	0.178
Adjusted R^2	0.475	0.586	0.155
Residual Std. Error	0.094 (df = 176)	0.106 (df = 69)	0.080 (df = 103)
F Statistic	55.007*** (df = 3; 176)	34.985*** (df = 3; 69)	7.459*** (df = 3; 103)
Note:	(1) V4; (2) CZ and SK; (3) HU and PL; * p<0.05; ** p<0.01; *** p<0.001		

Appendix 2.6: Human capital and innovation (bivariate, by group)

Human capital on innovation (individual effect, by country)

	Dependent variable:											
	tsi											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
sstr_5	0.002*	0.002*	0.005*	0.009***								
	(0.001)	(0.001)	(0.002)	(0.002)								
rd_pers_all					0.062	0.096***	0.059***	0.052***				
					(0.039)	(0.015)	(0.009)	(0.008)				
ht_emp									-0.017**	0.067***	0.034***	0.030***
									(0.006)	(0.008)	(0.007)	(0.006)
Constant	-0.018	-0.045	-0.134	-0.394***	0.015	-0.010	0.073***	0.006	0.133***	-0.096***	0.005	-0.064*
	(0.042)	(0.048)	(0.143)	(0.087)	(0.031)	(0.015)	(0.019)	(0.016)	(0.026)	(0.025)	(0.035)	(0.029)
Observations	100	127	113	57	106	141	120	67	106	118	124	67
R^2	0.039	0.033	0.039	0.357	0.024	0.234	0.254	0.405	0.072	0.392	0.152	0.308
Adjusted R^2	0.029	0.025	0.030	0.345	0.014	0.229	0.248	0.396	0.063	0.386	0.145	0.297
Residual Std. Error	0.090 (df = 98)	0.076 (df = 125)	0.156 (df = 111)	0.087 (df = 55)	0.089 (df = 104)	0.119 (df = 139)	0.135 (df = 118)	0.089 (df = 65)	0.086 (df = 104)	0.138 (df = 116)	0.144 (df = 122)	0.096 (df = 65)
F Statistic	3.989* (df = 1; 98)	4.285* (df = 1; 125)	4.461* (df = 1; 111)	30.485*** (df = 1; 55)	2.527 (df = 1; 104)	42.518*** (df = 1; 139)	40.215*** (df = 1; 118)	44.290*** (df = 1; 65)	8.100** (df = 1; 104)	74.666*** (df = 1; 116)	21.898*** (df = 1; 122)	28.895*** (df = 1; 65)
Note:	(1, 5, 9) HU; (2, 6, 10) PL; (3, 7, 11) CZ; (4, 8, 12) SK; * p<0.05; ** p<0.01; *** p<0.001											

Appendix 2.7: Human capital and innovation (bivariate, by country)

Human capital on innovation (individual effect, by group)

	Dependent variable:								
	tsi								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
sstr_5	0.005***	0.008***	0.002*						
	(0.001)	(0.002)	(0.001)						
rd_pers_all				0.067***	0.057***	0.094***			
				(0.005)	(0.007)	(0.013)			
ht_emp							0.030***	0.031***	0.024***
							(0.004)	(0.005)	(0.005)
Constant	-0.157***	-0.311***	-0.018	0.021**	0.049***	-0.008	-0.017	-0.011	-0.008
	(0.031)	(0.089)	(0.031)	(0.008)	(0.014)	(0.012)	(0.015)	(0.026)	(0.020)
Observations	397	170	227	434	187	247	415	191	224
R^2	0.144	0.133	0.027	0.263	0.274	0.181	0.145	0.160	0.086
Adjusted R^2	0.142	0.128	0.023	0.261	0.270	0.178	0.143	0.155	0.082
Residual Std. Error	0.114 (df = 395)	0.139 (df = 168)	0.083 (df = 225)	0.116 (df = 432)	0.126 (df = 185)	0.107 (df = 245)	0.136 (df = 413)	0.135 (df = 189)	0.136 (df = 222)
F Statistic	66.651*** (df = 1; 395)	25.704*** (df = 1; 168)	6.324* (df = 1; 225)	154.086*** (df = 1; 432)	69.789*** (df = 1; 185)	54.236*** (df = 1; 245)	70.004*** (df = 1; 413)	35.979*** (df = 1; 189)	20.854*** (df = 1; 222)
Note:									(1, 4, 7) V4; (2, 5, 8) CZ and SK; (3, 6, 9) HU and PL; * p<0.05; ** p<0.01; *** p<0.001

Appendix 2.8: Human capital and innovation (bivariate, low-income by group)

Human capital on innovation (individual effect, poorest regions, by group)

	Dependent variable:								
	tsi								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
sstr_5	0.005***	0.007**	0.003**						
	(0.001)	(0.002)	(0.001)						
rd_pers_all				0.182***	0.203***	0.103***			
				(0.014)	(0.019)	(0.024)			
ht_emp							0.020**	0.078***	-0.014*
							(0.007)	(0.016)	(0.006)
Constant	-0.158***	-0.248	-0.064	-0.054***	-0.054*	-0.013	0.018	-0.168**	0.097***
	(0.043)	(0.138)	(0.041)	(0.013)	(0.020)	(0.018)	(0.024)	(0.060)	(0.019)
Observations	195	74	121	208	80	128	199	81	118
R^2	0.149	0.097	0.068	0.443	0.594	0.130	0.041	0.241	0.046
Adjusted R^2	0.144	0.085	0.060	0.440	0.588	0.123	0.036	0.232	0.038
Residual Std. Error	0.117 (df = 193)	0.157 (df = 72)	0.082 (df = 119)	0.094 (df = 206)	0.103 (df = 78)	0.083 (df = 126)	0.123 (df = 197)	0.140 (df = 79)	0.083 (df = 116)
F Statistic	33.753*** (df = 1; 193)	7.744** (df = 1; 72)	8.712** (df = 1; 119)	163.765*** (df = 1; 206)	113.885*** (df = 1; 78)	18.749*** (df = 1; 126)	8.486** (df = 1; 197)	25.121*** (df = 1; 79)	5.591* (df = 1; 116)
Note:									(1, 4, 7) V4; (2, 5, 8) CZ and SK; (3, 6, 9) HU and PL; * p<0.05; ** p<0.01; *** p<0.001

Appendix 2.9: Human capital and innovation (bivariate, low-income by country)

Human capital on innovation (individual effect, poorest regions, by country)

	Dependent variable:											
	tsi											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
sstr_5	0.003*	0.005*	0.002	0.0001								
	(0.001)	(0.002)	(0.004)	(0.001)								
rd_pers_all					0.114**	0.182***	0.181***	0.245***				
					(0.038)	(0.043)	(0.024)	(0.063)				
ht_emp									-0.034***	0.014	0.075***	-0.016
									(0.007)	(0.031)	(0.019)	(0.009)
Constant	-0.050	-0.200*	0.066	0.025	-0.037	-0.033	-0.007	-0.120**	0.184***	0.027	-0.116	0.081*
	(0.044)	(0.097)	(0.233)	(0.064)	(0.033)	(0.023)	(0.031)	(0.037)	(0.027)	(0.058)	(0.079)	(0.032)
Observations	66	55	49	25	70	58	51	29	70	48	52	29
R^2	0.091	0.110	0.006	0.0003	0.115	0.239	0.531	0.362	0.264	0.004	0.233	0.101
Adjusted R^2	0.077	0.094	-0.015	-0.043	0.102	0.226	0.522	0.339	0.253	-0.017	0.217	0.068
Residual Std. Error	0.076 (df = 64)	0.086 (df = 53)	0.180 (df = 47)	0.032 (df = 23)	0.074 (df = 68)	0.088 (df = 56)	0.121 (df = 49)	0.025 (df = 27)	0.067 (df = 68)	0.096 (df = 46)	0.155 (df = 50)	0.030 (df = 27)
F Statistic	6.430* (df = 1; 64)	6.580* (df = 1; 53)	0.270 (df = 1; 47)	0.006 (df = 1; 23)	8.849** (df = 1; 68)	17.611*** (df = 1; 56)	55.561*** (df = 1; 49)	15.353*** (df = 1; 27)	24.396*** (df = 1; 68)	0.202 (df = 1; 46)	15.163*** (df = 1; 50)	3.050 (df = 1; 27)
Note:												(1, 5, 9) HU; (2, 6, 10) PL; (3, 7, 11) CZ; (4, 8, 12) SK; * p<0.05; ** p<0.01; *** p<0.001

Appendix 3.1: Governance quality and innovation (by group)

The effect of government quality on innovation (5-year lag)

	Dependent variable:								
	tsi								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
row_5	0.153***			0.219***			0.059		
	(0.035)			(0.048)			(0.050)		
goveff_5		0.138***			0.308***			-0.028	
		(0.039)			(0.084)			(0.055)	
regqual_5			0.168***			0.256***			0.035
			(0.042)			(0.067)			(0.057)
Constant	-0.010	-0.0003	-0.066	-0.027	-0.126	-0.134	0.035	0.095*	0.044
	(0.026)	(0.030)	(0.043)	(0.038)	(0.072)	(0.071)	(0.037)	(0.037)	(0.055)
Observations	415	415	415	166	166	166	249	249	249
R^2	0.044	0.029	0.037	0.111	0.076	0.082	0.006	0.001	0.002
Adjusted R^2	0.041	0.027	0.034	0.106	0.070	0.077	0.002	-0.003	-0.003
Residual Std. Error	0.145 (df = 413)	0.146 (df = 413)	0.146 (df = 413)	0.142 (df = 164)	0.145 (df = 164)	0.144 (df = 164)	0.142 (df = 247)	0.143 (df = 247)	0.143 (df = 247)
F Statistic	18.827*** (df = 1; 413)	12.318*** (df = 1; 413)	15.790*** (df = 1; 413)	20.535*** (df = 1; 164)	13.483*** (df = 1; 164)	14.732*** (df = 1; 164)	1.377 (df = 1; 247)	0.260 (df = 1; 247)	0.371 (df = 1; 247)
Note:									(1-3) V4; (4-6) CZ and SK; (7-9) HU and PL; * p<0.05; ** p<0.01; *** p<0.001

Appendix 3.2: Governance quality and innovation (by country)

The effect of government quality on innovation (by country, 5-year lag)

	Dependent variable:											
	tsi											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
row_5	0.029			0.193*			0.221*			0.025		
	(0.055)			(0.093)			(0.090)			(0.119)		
goveff_5		-0.041			0.057			0.207			0.235	
		(0.059)			(0.113)			(0.117)			(0.129)	
regqual_5			-0.054			0.314*			0.240**			0.096
			(0.056)			(0.122)			(0.088)			(0.096)
Constant	0.042	0.097*	0.122*	-0.038	0.051	-0.196	-0.025	-0.018	-0.095	0.064	-0.105	-0.018
	(0.046)	(0.047)	(0.060)	(0.060)	(0.067)	(0.110)	(0.079)	(0.105)	(0.097)	(0.062)	(0.101)	(0.096)
Observations	94	94	94	155	155	155	110	110	110	56	56	56
R^2	0.003	0.005	0.010	0.027	0.002	0.041	0.053	0.028	0.064	0.001	0.058	0.018
Adjusted R^2	-0.008	-0.006	-0.001	0.021	-0.005	0.035	0.044	0.019	0.056	-0.018	0.040	0.0001
Residual Std. Error	0.093 (df = 92)	0.093 (df = 92)	0.093 (df = 92)	0.164 (df = 153)	0.166 (df = 153)	0.163 (df = 153)	0.158 (df = 108)	0.160 (df = 108)	0.157 (df = 108)	0.104 (df = 54)	0.101 (df = 54)	0.103 (df = 54)
F Statistic	0.270 (df = 1; 92)	0.474 (df = 1; 92)	0.930 (df = 1; 92)	4.308* (df = 1; 153)	0.253 (df = 1; 153)	6.585* (df = 1; 153)	6.006* (df = 1; 108)	3.123 (df = 1; 108)	7.417** (df = 1; 108)	0.046 (df = 1; 54)	3.319 (df = 1; 54)	1.006 (df = 1; 54)

Note: (1-3) HU; (4-6) PL; (7-9) CZ; (10-12) SK; * p<0.05; ** p<0.01; *** p<0.001

Appendix 3.3: Governance quality and innovation (low-income by group)

The effect of government quality on innovation (poorest regions)

	Dependent variable:								
	tsi								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
row_5	0.234***			0.347***			0.049		
	(0.045)			(0.072)			(0.050)		
goveff_5		0.209***			0.377**			-0.038	
		(0.051)			(0.122)			(0.055)	
regqual_5			0.194***			0.323**			-0.007
			(0.053)			(0.100)			(0.054)
Constant	-0.071*	-0.054	-0.095	-0.109	-0.164	-0.186	0.029	0.089*	0.072
	(0.034)	(0.039)	(0.054)	(0.058)	(0.106)	(0.107)	(0.037)	(0.037)	(0.052)
Observations	224	224	224	87	87	87	137	137	137
R^2	0.108	0.070	0.057	0.214	0.101	0.110	0.007	0.004	0.0001
Adjusted R^2	0.104	0.066	0.053	0.205	0.090	0.099	-0.0003	-0.004	-0.007
Residual Std. Error	0.133 (df = 222)	0.136 (df = 222)	0.137 (df = 222)	0.155 (df = 85)	0.166 (df = 85)	0.165 (df = 85)	0.100 (df = 135)	0.101 (df = 135)	0.101 (df = 135)
F Statistic	26.828*** (df = 1; 222)	16.807*** (df = 1; 222)	13.537*** (df = 1; 222)	23.158*** (df = 1; 85)	9.509** (df = 1; 85)	10.466** (df = 1; 85)	0.953 (df = 1; 135)	0.476 (df = 1; 135)	0.019 (df = 1; 135)

Note: (1-3) V4; (4-6) CZ and SK; (7-9) HU and PL; * p<0.05; ** p<0.01; *** p<0.001

Appendix 3.4: Governance quality and innovation (low-income by country)

The effect of government quality on innovation (by country, poorest regions)

	Dependent variable:											
	tsi											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
row_5	-0.042			0.225*			0.229			-0.006		
	(0.058)			(0.095)			(0.137)			(0.057)		
goveff_5		-0.096			0.062			0.212			0.038	
		(0.062)			(0.114)			(0.162)			(0.060)	
regqual_5			-0.068			0.231			0.255*			0.048
			(0.053)			(0.136)			(0.127)			(0.042)
Constant	0.093*	0.132**	0.131*	-0.079	0.031	-0.142	0.007	0.019	-0.070	0.032	0.001	-0.018
	(0.047)	(0.048)	(0.056)	(0.063)	(0.069)	(0.124)	(0.122)	(0.146)	(0.140)	(0.029)	(0.046)	(0.042)
Observations	62	62	62	75	75	75	62	62	62	25	25	25
R^2	0.009	0.038	0.027	0.072	0.004	0.038	0.044	0.028	0.063	0.0004	0.017	0.054
Adjusted R^2	-0.008	0.022	0.011	0.059	-0.010	0.025	0.029	0.012	0.047	-0.043	-0.026	0.013
Residual Std. Error	0.081 (df = 60)	0.080 (df = 60)	0.080 (df = 60)	0.111 (df = 73)	0.115 (df = 73)	0.113 (df = 73)	0.179 (df = 60)	0.180 (df = 60)	0.177 (df = 60)	0.032 (df = 23)	0.032 (df = 23)	0.031 (df = 23)
F Statistic	0.524 (df = 1; 60)	2.365 (df = 1; 60)	1.667 (df = 1; 60)	5.645* (df = 1; 73)	0.295 (df = 1; 73)	2.889 (df = 1; 73)	2.790 (df = 1; 60)	1.716 (df = 1; 60)	4.041* (df = 1; 60)	0.010 (df = 1; 23)	0.397 (df = 1; 23)	1.320 (df = 1; 23)

Note: (1-3) HU; (4-6) PL; (7-9) CZ; (10-12) SK; * p<0.05; ** p<0.01; *** p<0.001

Appendix 3.5: Governance quality and R&I expenditure (by group)

The effect of government quality on R&I expenditure

	Dependent variable:								
	gerd								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
row	256.471***			336.962***			-31.939		
	(39.197)			(81.770)			(33.882)		
goveff		366.307***			558.211**			52.293	
		(43.415)			(194.597)			(39.152)	
regqual			223.332***			137.945			-38.165
			(49.877)			(142.691)			(38.349)
Constant	-34.689	-116.599***	-69.830	-12.864	-244.419	108.622	111.431***	57.849*	125.250***
	(28.757)	(32.103)	(48.812)	(68.519)	(175.966)	(154.755)	(22.919)	(25.174)	(35.360)
Observations	579	579	579	191	191	191	388	388	388
R^2	0.069	0.110	0.034	0.082	0.042	0.005	0.002	0.005	0.003
Adjusted R^2	0.067	0.108	0.032	0.078	0.037	-0.0003	-0.0003	0.002	-0.00002
Residual Std. Error	200.472 (df = 577)	196.035 (df = 577)	204.258 (df = 577)	280.409 (df = 189)	286.564 (df = 189)	292.014 (df = 189)	115.650 (df = 386)	115.516 (df = 386)	115.635 (df = 386)
F Statistic	42.813*** (df = 1; 577)	71.189*** (df = 1; 577)	20.049*** (df = 1; 577)	16.982*** (df = 1; 189)	8.229** (df = 1; 189)	0.935 (df = 1; 189)	0.889 (df = 1; 386)	1.784 (df = 1; 386)	0.990 (df = 1; 386)

Note: (1-3) V4; (4-6) CZ and SK; (7-9) HU and PL; * p<0.05; ** p<0.01; *** p<0.001

Appendix 3.6: Governance quality and R&I expenditure (by country)

The effect of government quality on R&I expenditure (by country)

	Dependent variable:											
	gerd											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
row	-181.407***			64.199			782.760**			345.181		
	(51.455)			(47.296)			(263.564)			(304.902)		
goveff		-223.536***			263.638***			407.253			199.970	
		(58.366)			(53.157)			(438.189)			(284.620)	
regqual			-200.445***			246.263***			-138.277			-198.529
			(44.664)			(66.779)			(294.942)			(179.666)
Constant	227.286***	249.736***	288.631***	49.999	-67.036*	-127.500*	-459.396	-83.376	463.447	1.037	15.679	367.382*
	(39.547)	(42.260)	(44.791)	(30.093)	(32.316)	(59.303)	(259.067)	(419.372)	(338.268)	(157.193)	(230.392)	(174.775)
Observations	110	110	110	278	278	278	119	119	119	72	72	72
R^2	0.103	0.120	0.157	0.007	0.082	0.047	0.070	0.007	0.002	0.018	0.007	0.017
Adjusted R^2	0.095	0.111	0.149	0.003	0.079	0.044	0.062	-0.001	-0.007	0.004	-0.007	0.003
Residual Std. Error	107.451 (df = 108)	106.466 (df = 108)	104.168 (df = 108)	116.694 (df = 276)	112.190 (df = 276)	114.300 (df = 276)	307.257 (df = 117)	317.459 (df = 117)	318.330 (df = 117)	223.843 (df = 70)	225.091 (df = 70)	223.939 (df = 70)
F Statistic	12.430*** (df = 1; 108)	14.668*** (df = 1; 108)	20.141*** (df = 1; 108)	1.843 (df = 1; 276)	24.598*** (df = 1; 276)	13.599*** (df = 1; 276)	8.820** (df = 1; 117)	0.864 (df = 1; 117)	0.220 (df = 1; 117)	1.282 (df = 1; 70)	0.494 (df = 1; 70)	1.221 (df = 1; 70)

Note: (1-3) HU; (4-6) PL; (7-9) CZ; (10-12) SK; * p<0.05; ** p<0.01; *** p<0.001

Appendix 3.7: Governance quality and R&I expenditure (low-income by group)

The effect of government quality on R&I expenditure (poorest regions)

	Dependent variable:								
	gerd								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
row	461.914***			715.583***			6.819		
	(54.937)			(124.210)			(28.042)		
goveff		486.381***			1,171.123***			33.434	
		(63.127)			(312.189)			(32.302)	
regqual			386.832***			539.637*			12.418
			(72.008)			(233.690)			(31.260)
Constant	-190.523***	-211.708***	-237.112***	-301.492**	-775.481**	-301.219	64.401***	47.831*	57.532*
	(40.783)	(46.908)	(70.893)	(105.669)	(283.682)	(254.670)	(19.191)	(20.960)	(29.067)
Observations	321	321	321	104	104	104	217	217	217
R^2	0.181	0.157	0.083	0.246	0.121	0.050	0.0003	0.005	0.001
Adjusted R^2	0.179	0.154	0.080	0.238	0.113	0.040	-0.004	0.0003	-0.004
Residual Std. Error	210.760 (df = 319)	213.892 (df = 319)	223.074 (df = 319)	309.800 (df = 102)	334.340 (df = 102)	347.686 (df = 102)	73.302 (df = 215)	73.130 (df = 215)	73.286 (df = 215)
F Statistic	70.695*** (df = 1; 319)	59.364*** (df = 1; 319)	28.859*** (df = 1; 319)	33.190*** (df = 1; 102)	14.072*** (df = 1; 102)	5.332* (df = 1; 102)	0.059 (df = 1; 215)	1.071 (df = 1; 215)	0.158 (df = 1; 215)

Note: (1-3) V4; (4-6) CZ and SK; (7-9) HU and PL; * p<0.05; ** p<0.01; *** p<0.001

Appendix 3.8: Governance quality and R&I expenditure (low-income by country)

The effect of government quality on R&I expenditure (by country, poorest regions)

	Dependent variable:											
	gerd											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
row	-86.816***			85.290			951.517*			48.818		
	(17.337)			(47.904)			(432.408)			(68.472)		
goveff		-103.523***			161.065**			516.722			-1.554	
		(19.620)			(55.053)			(718.061)			(64.036)	
regqual			-72.716***			194.824**			-173.914			-151.663***
			(16.209)			(67.719)			(483.413)			(31.215)
Constant	136.000***	144.375***	142.831***	14.984	-27.699	-104.101	-532.138	-95.738	596.319	37.594	63.655	208.248***
	(13.387)	(14.274)	(16.349)	(30.481)	(33.366)	(60.144)	(425.031)	(687.225)	(554.425)	(35.301)	(51.835)	(30.365)
Observations	72	72	72	145	145	145	68	68	68	36	36	36
R^2	0.264	0.285	0.223	0.022	0.056	0.055	0.068	0.008	0.002	0.015	0.00002	0.410
Adjusted R^2	0.253	0.274	0.212	0.015	0.050	0.048	0.054	-0.007	-0.013	-0.014	-0.029	0.392
Residual Std. Error	29.283 (df = 70)	28.866 (df = 70)	30.076 (df = 70)	85.697 (df = 143)	84.159 (df = 143)	84.238 (df = 143)	381.058 (df = 66)	393.249 (df = 66)	394.403 (df = 66)	35.545 (df = 34)	35.810 (df = 34)	27.511 (df = 34)
F Statistic	25.074*** (df = 1; 70)	27.841*** (df = 1; 70)	20.126*** (df = 1; 70)	3.170 (df = 1; 143)	8.559** (df = 1; 143)	8.277** (df = 1; 143)	4.842* (df = 1; 66)	0.518 (df = 1; 66)	0.129 (df = 1; 66)	0.508 (df = 1; 34)	0.001 (df = 1; 34)	23.607*** (df = 1; 34)

Note: (1-3) HU; (4-6) PL; (7-9) CZ; (10-12) SK; * p<0.05; ** p<0.01; *** p<0.001

Appendix 3.9: Governance quality and tax incentive (by group)

The effect of government quality on R&I tax incentive

	Dependent variable:								
	tax								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
row	0.072***			0.076***			0.111***		
	(0.010)			(0.003)			(0.018)		
regqual		0.072***			0.049***			0.152***	
		(0.012)			(0.009)			(0.020)	
goveff			0.032**			0.113***			0.131***
			(0.012)			(0.011)			(0.022)
Constant	-0.019**	-0.038**	0.009	-0.039***	-0.031**	-0.080***	-0.036**	-0.101***	-0.043**
	(0.007)	(0.012)	(0.008)	(0.003)	(0.010)	(0.010)	(0.012)	(0.018)	(0.014)
Observations	612	612	612	198	198	198	414	414	414
R^2	0.078	0.052	0.012	0.747	0.124	0.359	0.086	0.127	0.076
Adjusted R^2	0.076	0.051	0.011	0.745	0.120	0.356	0.084	0.125	0.074
Residual Std. Error	0.051 (df = 610)	0.052 (df = 610)	0.053 (df = 610)	0.011 (df = 196)	0.020 (df = 196)	0.017 (df = 196)	0.059 (df = 412)	0.058 (df = 412)	0.060 (df = 412)
F Statistic	51.441*** (df = 1; 610)	33.789*** (df = 1; 610)	7.712** (df = 1; 610)	577.938*** (df = 1; 196)	27.850*** (df = 1; 196)	109.983*** (df = 1; 196)	38.953*** (df = 1; 412)	59.918*** (df = 1; 412)	33.888*** (df = 1; 412)

Note: (1-3) V4; (4-6) CZ and SK; (7-9) HU and PL; * p<0.05; ** p<0.01; *** p<0.001

Appendix 3.10: Governance quality and tax incentive (by country)

The effect of government quality on R&I tax incentive (by country)

	Dependent variable:											
	tax											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
row	0.104***			-0.006***			0.135***			0.012		
	(0.015)			(0.001)			(0.006)			(0.008)		
regqual		0.129***			0.002			0.019			-0.014**	
		(0.011)			(0.002)			(0.013)			(0.004)	
goveff			0.162***			0.006***			0.103***			-0.012
			(0.024)			(0.002)			(0.016)			(0.007)
Constant	0.063***	0.014	0.032*	0.005***	-0.001	-0.002*	-0.097***	0.011	-0.065***	-0.004	0.015***	0.012
	(0.011)	(0.011)	(0.016)	(0.001)	(0.002)	(0.001)	(0.006)	(0.015)	(0.015)	(0.004)	(0.004)	(0.006)
Observations	105	105	105	309	309	309	126	126	126	72	72	72
R^2	0.310	0.579	0.299	0.058	0.005	0.049	0.784	0.015	0.247	0.029	0.118	0.035
Adjusted R^2	0.303	0.575	0.292	0.055	0.002	0.046	0.782	0.007	0.241	0.015	0.106	0.021
Residual Std. Error	0.031 (df = 103)	0.024 (df = 103)	0.031 (df = 103)	0.003 (df = 307)	0.004 (df = 307)	0.003 (df = 307)	0.009 (df = 124)	0.020 (df = 124)	0.017 (df = 124)	0.006 (df = 70)	0.006 (df = 70)	0.006 (df = 70)
F Statistic	46.214*** (df = 1; 103)	141.850*** (df = 1; 103)	43.929*** (df = 1; 103)	19.053*** (df = 1; 307)	1.603 (df = 1; 307)	15.766*** (df = 1; 307)	450.028*** (df = 1; 124)	1.891 (df = 1; 124)	40.621*** (df = 1; 124)	2.085 (df = 1; 70)	9.405** (df = 1; 70)	2.545 (df = 1; 70)

Note: (1-3) HU; (4-6) PL; (7-9) CZ; (10-12) SK; * p<0.05; ** p<0.01; *** p<0.001

Appendix 3.11: Governance quality and tax incentive (low-income by group)

The effect of government quality on R&I tax incentive (poorest regions)

	Dependent variable:								
	tax								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
row	0.070***			0.078***			0.117***		
	(0.014)			(0.004)			(0.025)		
regqual		0.071***			0.050***			0.158***	
		(0.017)			(0.013)			(0.028)	
goveff			0.029			0.116***			0.140***
			(0.016)			(0.015)			(0.032)
Constant	-0.016	-0.035*	0.013	-0.041***	-0.031*	-0.081***	-0.037*	-0.103***	-0.046*
	(0.010)	(0.017)	(0.012)	(0.004)	(0.014)	(0.013)	(0.017)	(0.025)	(0.020)
Observations	322	322	322	108	108	108	214	214	214
R^2	0.073	0.050	0.010	0.752	0.127	0.367	0.092	0.134	0.082
Adjusted R^2	0.070	0.047	0.006	0.749	0.118	0.361	0.088	0.130	0.078
Residual Std. Error	0.052 (df = 320)	0.053 (df = 320)	0.054 (df = 320)	0.011 (df = 106)	0.020 (df = 106)	0.017 (df = 106)	0.061 (df = 212)	0.060 (df = 212)	0.062 (df = 212)
F Statistic	25.090*** (df = 1; 320)	16.732*** (df = 1; 320)	3.095 (df = 1; 320)	320.758*** (df = 1; 106)	15.366*** (df = 1; 106)	61.332*** (df = 1; 106)	21.501*** (df = 1; 212)	32.702*** (df = 1; 212)	19.056*** (df = 1; 212)

Note: (1-3) V4; (4-6) CZ and SK; (7-9) HU and PL; * p<0.05; ** p<0.01; *** p<0.001

Appendix 3.12: Governance quality and tax incentive (low-income by country)

The effect of government quality on R&I tax incentive (poorest regions, by country)

	Dependent variable:											
	tax											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
row	0.104***			-0.006**			0.135***			0.010		
	(0.020)			(0.002)			(0.008)			(0.010)		
regqual		0.129***			0.003			0.019			-0.011	
		(0.014)			(0.003)			(0.018)			(0.006)	
goveff			0.162***			0.006**			0.103***			-0.009
			(0.032)			(0.002)			(0.022)			(0.009)
Constant	0.063***	0.014	0.032	0.005***	-0.001	-0.002	-0.097***	0.011	-0.065**	-0.003	0.012*	0.009
	(0.015)	(0.014)	(0.021)	(0.001)	(0.002)	(0.001)	(0.008)	(0.020)	(0.020)	(0.005)	(0.005)	(0.007)
Observations	60	60	60	154	154	154	72	72	72	36	36	36
R^2	0.310	0.579	0.299	0.055	0.007	0.052	0.784	0.015	0.247	0.028	0.106	0.031
Adjusted R^2	0.298	0.572	0.287	0.048	0.0002	0.046	0.781	0.001	0.236	-0.0003	0.080	0.002
Residual Std. Error	0.031 (df = 58)	0.024 (df = 58)	0.031 (df = 58)	0.004 (df = 152)	0.004 (df = 152)	0.004 (df = 152)	0.009 (df = 70)	0.020 (df = 70)	0.017 (df = 70)	0.005 (df = 34)	0.005 (df = 34)	0.005 (df = 34)
F Statistic	26.023*** (df = 1; 58)	79.877*** (df = 1; 58)	24.737*** (df = 1; 58)	8.798** (df = 1; 152)	1.026 (df = 1; 152)	8.294** (df = 1; 152)	254.048*** (df = 1; 70)	1.068 (df = 1; 70)	22.931*** (df = 1; 70)	0.991 (df = 1; 34)	4.040 (df = 1; 34)	1.070 (df = 1; 34)
Note:												(1-3) HU; (4-6) PL; (7-9) CZ; (10-12) SK; * p<0.05; ** p<0.01; *** p<0.001

Appendix 4.1: R&I expenditure and innovation

The effect of GERD on innovation (5-year lag)

	Dependent variable:						
	tsi						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
gerd_5	0.0002***	0.0002***	0.0001**	0.0002*	0.0001	0.0001**	0.0003***
	(0.00003)	(0.00004)	(0.00004)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Constant	0.061***	0.094***	0.050***	0.045***	0.053***	0.133***	0.036*
	(0.007)	(0.014)	(0.007)	(0.011)	(0.009)	(0.020)	(0.016)
Observations	418	166	252	104	148	107	59
R^2	0.126	0.119	0.027	0.054	0.015	0.065	0.249
Adjusted R^2	0.124	0.114	0.023	0.045	0.008	0.056	0.235
Residual Std. Error	0.116 (df = 416)	0.142 (df = 164)	0.090 (df = 250)	0.087 (df = 102)	0.093 (df = 146)	0.157 (df = 105)	0.094 (df = 57)
F Statistic	60.020*** (df = 1; 416)	22.216*** (df = 1; 164)	6.898** (df = 1; 250)	5.832* (df = 1; 102)	2.241 (df = 1; 146)	7.325** (df = 1; 105)	18.852*** (df = 1; 57)
Note:							(1) V4; (2) CZ and SK; (3) HU and PL; (4) HU; (5) PL; (6) CZ; (7) SK; * p<0.05; ** p<0.01; *** p<0.001

Appendix 4.2: R&I expenditure and innovation (low-income)

The effect of GERD on innovation (poorest regions, 5-year lag)

	Dependent variable:						
	tsi						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
gerd_5	0.0003***	0.0002***	0.0001**	0.0002**	0.001***	0.0001*	-0.0003
	(0.00003)	(0.00004)	(0.00004)	(0.0001)	(0.0001)	(0.0001)	(0.0002)
Constant	0.058***	0.094***	0.050***	0.040***	0.019	0.164***	0.041**
	(0.010)	(0.014)	(0.007)	(0.011)	(0.015)	(0.031)	(0.011)
Observations	230	166	252	68	73	62	27
R^2	0.203	0.119	0.027	0.099	0.248	0.067	0.075
Adjusted R^2	0.200	0.114	0.023	0.085	0.237	0.051	0.038
Residual Std. Error	0.125 (df = 228)	0.142 (df = 164)	0.090 (df = 250)	0.074 (df = 66)	0.100 (df = 71)	0.176 (df = 60)	0.031 (df = 25)
F Statistic	58.151*** (df = 1; 228)	22.216*** (df = 1; 164)	6.898** (df = 1; 250)	7.261** (df = 1; 66)	23.425*** (df = 1; 71)	4.298* (df = 1; 60)	2.015 (df = 1; 25)
Note:	(1) V4; (2) CZ and SK; (3) HU and PL; (4) HU; (5) PL; (6) CZ; (7) SK; * p<0.05; ** p<0.01; *** p<0.001						

Appendix 4.3: Tax incentive and innovation

The effect of R&I tax incentive on innovation (5-year lag)

	Dependent variable:						
	tsi						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
tax_5	-0.103	1.944***	-0.082	0.095	-0.971	1.338	-6.431
	(0.135)	(0.558)	(0.141)	(0.264)	(0.840)	(0.731)	(4.916)
Constant	0.106***	0.105***	0.082***	0.059	0.084***	0.131***	0.087***
	(0.009)	(0.014)	(0.011)	(0.037)	(0.013)	(0.023)	(0.015)
Observations	408	172	236	76	160	115	57
R^2	0.001	0.067	0.001	0.002	0.008	0.029	0.030
Adjusted R^2	-0.001	0.061	-0.003	-0.012	0.002	0.020	0.013
Residual Std. Error	0.150 (df = 406)	0.144 (df = 170)	0.146 (df = 234)	0.100 (df = 74)	0.163 (df = 158)	0.157 (df = 113)	0.107 (df = 55)
F Statistic	0.575 (df = 1; 406)	12.117*** (df = 1; 170)	0.342 (df = 1; 234)	0.131 (df = 1; 74)	1.335 (df = 1; 158)	3.355 (df = 1; 113)	1.711 (df = 1; 55)
Note:	(1) V4; (2) CZ and SK; (3) HU and PL; (4) HU; (5) PL; (6) CZ; (7) SK; * p<0.05; ** p<0.01; *** p<0.001						

Appendix 4.4: Tax incentive and innovation (low-income)

The effect of R&I tax incentive on innovation (poorest regions, 5-year lag)

	Dependent variable:						
	tsi						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
tax_5	-0.069	2.514**	0.025	0.197	-3.925	0.872	-1.550
	(0.164)	(0.819)	(0.128)	(0.290)	(3.400)	(1.046)	(1.523)
Constant	0.105***	0.109***	0.063***	0.038	0.068***	0.182***	0.032***
	(0.012)	(0.023)	(0.011)	(0.041)	(0.013)	(0.035)	(0.007)
Observations	219	90	129	50	79	65	25
R^2	0.001	0.097	0.0003	0.010	0.017	0.011	0.043
Adjusted R^2	-0.004	0.086	-0.008	-0.011	0.004	-0.005	0.001
Residual Std. Error	0.142 (df = 217)	0.164 (df = 88)	0.103 (df = 127)	0.086 (df = 48)	0.113 (df = 77)	0.178 (df = 63)	0.031 (df = 23)
F Statistic	0.175 (df = 1; 217)	9.410** (df = 1; 88)	0.038 (df = 1; 127)	0.463 (df = 1; 48)	1.332 (df = 1; 77)	0.695 (df = 1; 63)	1.036 (df = 1; 23)
Note:	(1) V4; (2) CZ and SK; (3) HU and PL; (4) HU; (5) PL; (6) CZ; (7) SK; * p<0.05; ** p<0.01; *** p<0.001						

Annexes[9]

Annex A: Descriptive statistics of innovation capacity and expenditure (NUTS-2)

NUTS-2[10]	Avg. R&I 2000-18	R&I 2000	R&I 2018	Difference	% change	GERD 2000	GERD 2018	Difference	% change
CZ03	0.133	0.076	0.108	0.032	42.093	100.100	310.000	209.900	309.690
CZ04	0.037	0.003	0.018	0.015	498.843	104.000	56.500	-47.500	-45.673
CZ05	0.214	0.081	0.117	0.036	45.040	107.900	291.800	183.900	270.436
CZ06	0.580	0.430	0.578	0.147	34.194	129.800	517.900	388.100	398.999
CZ07	0.233	0.096	0.210	0.114	118.514	72.900	306.500	233.600	420.439
CZ08	0.097	0.036	0.083	0.047	131.314	88.000	225.200	137.200	255.909
mean	0.215	0.120	0.186	0.065	145.000	100.450	284.650	184.200	268.300
SK02	0.069	0.017	0.056	0.039	222.969	69.000	139.500	70.500	102.174
SK03	0.059	0.031	0.075	0.044	143.956	77.400	106.500	29.100	37.597
SK04	0.030	0.014	0.018	0.004	30.820	85.900	76.200	-9.700	-11.292
mean	0.053	0.021	0.050	0.029	132.582	77.430	107.400	29.970	42.826
HU21	0.099	0.043	0.097	0.054	124.598	29.300	22.540	-6.760	-23.072
HU22	0.072	0.352	0.029	-0.323	-91.790	30.400	140.100	109.700	460.855
HU23	0.031	0.060	0.026	-0.034	-56.624	29.300	82.500	53.200	281.570
HU31	0.020	0.011	0.011	-0.001	-4.828	11.700	77.100	65.400	658.974
HU32	0.011	0.002	0.006	0.005	279.237	39.800	112.700	72.900	283.166
HU33	0.025	0.029	0.013	-0.016	-53.569	48.700	133.100	84.400	273.306
mean	0.043	0.083	0.030	-0.052	32.837	31.533	94.673	63.140	322.467
PL21	0.025	0.022	0.120	0.098	450.000	70.600	339.800	269.200	381.303
PL22	0.023	0.010	0.001	-0.009	-94.027	42.200	147.000	104.800	248.341
PL41	0.015	0.003	0.000	-0.002	-93.529	52.400	158.400	106.000	202.290
PL42	0.024	0.013	0.013	0.000	-0.776	21.200	90.500	69.300	326.887
PL43	0.047	0.024	0.033	0.009	36.375	19.500	78.400	58.900	302.051
PL51	0.023	0.003	0.003	0.001	32.863	55.600	236.300	180.700	325.000
PL52	0.039	0.039	0.084	0.045	114.286	20.400	102.200	81.800	400.980
PL61	0.011	0.003	0.010	0.007	207.536	31.300	104.100	72.800	232.588
PL62	0.008	0.003	0.000	-0.003	-84.784	20.700	76.100	55.400	267.633
PL63	0.010	0.016	0.016	0.000	0.000	49.000	269.400	220.400	449.796
PL71	0.014	0.067	0.007	-0.060	-89.711	57.200	172.200	115.000	201.049
PL72	0.039	0.031	0.031	0.000	0.000	8.500	80.600	72.100	848.235
PL81	0.077	0.103	0.032	-0.071	-69.314	34.700	135.500	100.800	290.490
PL82	0.055	0.063	0.009	-0.053	-85.256	51.600	155.400	103.800	201.163
PL84	0.016	0.019	0.007	-0.012	-63.366	15.500	102.000	86.500	558.065
PL92	0.057	0.194	0.005	-0.189	-97.627	219.400	478.400	259.000	118.049
mean	0.030	0.038	0.023	-0.015	10.167	48.113	170.394	115.088	314.937

[9] Tables included in the annexes were constructed from Eurostat data (Eurostat 2020b).
[10] Italics mark low-income regions.

Annex B: Descriptive statistics of regional economy

NUTS-2	avg. GVA growth	PPS 2000	PPS 2019	Difference	% change
CZ03	2.205	12,600	24,400	11,800	93.651
CZ04	1.210	11,300	20,100	8,800	77.876
CZ05	2.820	12,100	23,600	11,500	95.041
CZ06	2.895	11,800	26,000	14,200	120.339
CZ07	2.915	10,800	23,400	12,600	116.667
CZ08	0.566	10,400	23,100	12,700	122.115
mean	2.102	11,500	19,3667.	9,967	106.028
SK02	3.616	8,700	20,100	11,400	131.034
SK03	3.853	7,700	17,900	10,200	132.468
SK04	4.310	7,100	15,400	8,300	116.901
mean	3.926	7833.33	17800.00	9,967	127.234
HU21	2.789	9,500	21,000	11,500	121.053
HU22	2.963	8,100	18,200	10,100	124.691
HU23	1.695	7,300	15,700	8,400	115.068
HU31	2.016	6,200	15,200	9,000	145.161
HU32	2.552	6,500	14,800	8,300	127.692
HU33	2.157	7,200	16,600	9,400	130.556
mean	2.362	7,466.67	16,916.67	9,450	126.563
PL21	4.960	7900	20,800	12,900	163.291
PL22	4.013	9400	23,200	13,800	146.809
PL41	4.213	9500	24,600	15,100	158.947
PL42	3.279	8800	18,800	10,000	113.636
PL43	3.793	7900	18,400	10,500	132.911
PL51	3.860	9100	24,800	15,700	172.527
PL52	2.456	7400	17,900	10,500	141.892
PL61	3.456	7900	18,100	10,200	129.114
PL62	2.853	6900	15,500	8,600	124.638
PL63	4.473	8800	22,100	13,300	151.136
PL71	3.753	7900	21,400	13,500	170.886
PL72	2.967	6900	16,200	9,300	134.783
PL81	3.087	6300	15,500	9,200	146.032
PL82	4.060	6400	15,900	9,500	148.438
PL84	2.947	6500	16,400	9,900	152.308
PL92	4.330	7,000	19,600	12,600	180.000
mean	3.441	7,787.50	19,325	11,538	148.154

Annex C: Descriptive statistics of human capital (2000-2018, NUTS-2, %)

High-tech employment (total)	**Hungary**	**Poland**	**Czechia**	**Slovakia**
min.	1.700	0.900	1.700	2.100
1st qu.	3.375	1.600	3.500	3.275
median	4.500	2.100	4.200	3.850
mean	4.818	2.559	4.501	4.571
3rd qu.	6.000	3.000	4.800	4.900
max.	12.900	9.700	10.400	10.800
High-tech employment (females)				
min.	1.400	1.100	1.500	1.300
1st qu.	3.100	1.700	3.300	3.000
median	4.600	2.200	4.000	4.050
mean	4.667	2.632	4.120	4.137
3rd qu.	5.925	3.200	5.000	5.100
max.	9.800	7.700	7.900	8.500
R&D employment (total)				
min.	0.400	0.117	0.190	0.450
1st qu.	0.560	0.439	0.775	0.527
median	0.736	0.599	1.053	0.648
mean	0.809	0.714	1.473	1.358
3rd qu.	0.879	0.864	1.428	1.442
max.	5.123	5.346	5.496	4.612
R&D employment (females)				
min.	0.333	0.070	0.162	0.394
1st qu.	0.453	0.433	0.553	0.466
median	0.647	0.583	0.673	0.613
mean	0.756	0.668	1.080	1.309
3rd qu.	0.929	0.809	0.951	1.349
max.	3.410	4.087	4.372	4.220
R&D government employment (total)				
min.	0.004	0.000	0.007	0.018
1st qu.	0.053	0.028	0.028	0.053
median	0.067	0.063	0.078	0.068
mean	0.092	0.108	0.288	0.308
3rd qu.	0.104	0.099	0.225	0.302
max.	1.052	0.809	1.735	1.310
R&D government employment (female)				
min.	0.001	0.000	0.009	0.024
1st qu.	0.053	0.028	0.027	0.068
median	0.072	0.059	0.087	0.081
mean	0.099	0.105	0.306	0.347
3rd qu.	0.130	0.105	0.236	0.343
max.	0.771	0.778	1.836	1.502
R&D business employment (total)				
min.	0.032	0.008	0.118	0.065
1st qu.	0.121	0.062	0.386	0.106

median	0.188	0.103	0.656	0.192
mean	0.238	0.172	0.681	0.236
3rd qu.	0.265	0.213	0.852	0.278
max.	2.424	2.585	2.019	0.887
R&D business employment (female)				
min.	0.023	0.002	0.088	0.032
1st qu.	0.080	0.029	0.180	0.051
median	0.111	0.059	0.291	0.093
mean	0.131	0.103	0.308	0.133
3rd qu.	0.144	0.118	0.359	0.150
max.	1.230	1.695	0.853	0.468
R&D higher education employment (total)				
min.	0.147	0.049	0.088	0.190
1st qu.	0.310	0.368	0.180	0.329
median	0.427	0.485	0.291	0.469
mean	0.478	0.498	0.308	0.810
3rd qu.	0.632	0.590	0.359	0.805
max.	1.647	2.037	0.853	2.839
R&D higher education employment (female)				
min.	0.152	0.035	0.000	0.180
1st qu.	0.285	0.363	0.160	0.329
median	0.461	0.487	0.358	0.469
mean	0.527	0.508	0.499	0.826
3rd qu.	0.738	0.589	0.557	0.816
max.	1.442	2.088	1.795	2.784

Annex D: Descriptive statistics of education (2000-2018 NUTS-2, %)

0-2, age 20-24 (total)[11]	**Hungary**	**Poland**	**Czechia**	**Slovakia**
min.	3.000	4.200	3.600	3.600
1st qu.	13.600	8.100	6.800	5.800
median	16.450	9.600	8.450	8.000
mean	16.150	10.220	9.342	8.035
3rd qu.	18.900	12.120	10.825	9.500
max.	26.000	19.200	22.600	16.400
0-2, age 20-24 (females)				
min.	7.200	3.900	2.600	3.100
1st qu.	12.900	6.425	6.450	5.200
median	15.200	8.000	7.700	7.750
mean	15.620	8.587	9.043	7.937
3rd qu.	18.270	10.100	10.600	10.050
max.	28.000	17.100	28.700	16.700
0-2, age 25-64 (total)				
min.	6.700	3.000	2.300	3.500
1st qu.	17.020	9.400	6.075	7.600
median	21.550	12.400	8.300	9.250
mean	21.730	13.090	8.917	9.788
3rd qu.	26.230	16.650	11.625	11.625
max.	37.100	28.400	21.900	17.600
0-2, age 25-64 (females)				
min.	7.000	2.500	1.900	3.200
1st qu.	19.700	9.100	7.775	9.150
median	25.100	12.800	11.150	11.200
mean	24.880	13.550	11.761	11.930
3rd qu.	30.930	17.800	15.225	14.820
max.	42.200	28.700	25.800	23.600
3-4, age 20-24 (total)				
min.	74.000	80.800	77.400	83.600
1st qu.	81.100	88.000	89.170	90.720
median	83.550	90.600	91.550	92.050
mean	83.850	89.880	90.660	91.990
3rd qu.	86.400	92.000	93.200	94.200
max.	97.000	97.800	96.400	96.400
3-4, age 20-24 (females)				
min.	72.000	80.800	71.300	83.300
1st qu.	81.900	90.800	89.400	90.450
median	85.050	93.000	92.300	92.600
mean	84.980	92.440	91.000	92.270
3rd qu.	87.470	94.700	93.600	94.830
max.	98.100	98.500	98.700	96.900
3-4, age 25-64 (total)				

[11] Education levels: 0-2 (less than primary, primary and lower secondary); 3-4 (upper secondary and post-secondary); 5-8 (tertiary education).

min.	62.900	71.600	78.100	82.400
1st qu.	73.780	83.350	88.380	88.380
median	78.450	87.600	91.700	90.750
mean	78.270	86.910	91.080	90.210
3rd qu.	82.970	90.600	93.920	92.400
max.	93.300	97.000	97.700	96.500
3-4, age 25-64 (females)				
min.	40.700	33.800	50.100	45.500
1st qu.	53.000	59.000	69.500	63.380
median	54.800	62.100	71.750	69.000
mean	54.720	61.550	71.000	66.600
3rd qu.	57.000	65.200	74.200	71.830
max.	62.800	70.600	78.400	75.300
5-8, age 20-24 (total)				
min.	3.800	2.300	1.000	2.800
1st qu.	6.000	7.925	4.100	5.625
median	6.900	11.050	6.750	11.300
mean	7.219	10.812	7.401	10.374
3rd qu.	8.150	13.300	10.400	14.875
max.	14.900	27.700	17.700	21.700
5-8, age 20-24 (females)				
min.	5.500	3.900	1.800	3.300
1st qu.	8.500	11.400	5.300	6.975
median	10.100	16.450	9.100	15.550
mean	10.120	15.680	9.619	13.540
3rd qu.	11.300	19.300	14.000	19.025
max.	19.200	32.900	19.800	26.600
5-8, age 25-64 (total)				
min.	10.300	7.900	6.500	7.800
1st qu.	13.400	15.350	11.000	12.400
median	17.000	20.900	15.250	17.700
mean	18.600	21.400	17.380	20.030
3rd qu.	19.000	25.900	20.520	24.320
max.	49.800	57.400	46.400	45.600
5-8, age 25-64 (females)				
min.	10.700	8.000	6.200	7.100
1st qu.	14.620	17.200	9.800	12.500
median	20.100	24.500	15.300	20.200
mean	20.400	24.910	17.250	21.480
3rd qu.	22.400	30.800	22.230	26.680
max.	52.300	63.700	47.200	51.200

Annex E: Descriptive statistics of unemployment (2000-2018 NUTS-2, %)

unemployment, 20-64 (total)	**Hungary**	**Poland**	**Czechia**	**Slovakia**
min.	1.700	1.700	1.300	2.400
1st qu.	4.600	6.500	3.475	6.300
median	6.900	9.700	5.200	11.500
mean	7.213	11.040	5.889	11.810
3rd qu.	9.375	15.400	7.500	16.320
max.	16.300	26.800	14.300	24.200
unemployment, 20-64 (female)				
min.	1.900	1.600	1.500	2.100
1st qu.	4.675	7.100	4.100	6.575
median	6.650	10.400	6.700	12.900
mean	7.189	11.870	7.167	12.347
3rd qu.	9.225	16.250	9.400	16.900
max.	16.100	27.800	17.600	24.500
unemployment, 25-34 (total)				
min.	2.100	1.600	0.900	3.200
1st qu.	5.300	7.600	3.975	6.800
median	7.800	10.700	6.200	12.400
mean	8.229	12.020	6.564	12.510
3rd qu.	10.375	16.400	8.325	17.500
max.	18.600	28.800	16.400	23.500
unemployment, 25-34 (females)				
min.	3.100	2.700	1.200	4.200
1st qu.	7.300	9.500	4.975	10.180
median	8.800	12.700	8.900	15.450
mean	9.622	14.310	9.034	15.190
3rd qu.	11.700	19.200	11.525	19.600
max.	18.900	33.700	23.700	26.400
unemployment, 45-54 (total)				
min.	1.500	1.600	0.900	2.800
1st qu.	3.850	5.800	2.500	5.400
median	5.600	8.000	4.400	9.900
mean	5.999	9.082	4.950	10.110
3rd qu.	8.050	11.700	6.500	13.600
max.	13.800	26.900	13.000	23.900
unemployment, 45-54 (females)				
min.	2.700	2.400	1.100	3.400
1st qu.	4.900	7.550	2.900	7.850
median	6.600	9.400	5.350	11.800
mean	7.005	10.760	5.782	11.240
3rd qu.	8.800	13.750	7.525	14.700
max.	13.000	27.200	15.900	22.200
long-term unemployment (total)				
min.	18.600	12.500	11.000	21.500
1st qu.	38.230	32.300	32.480	48.200

median	43.750	40.900	41.450	62.750
mean	42.830	41.230	40.940	58.600
3rd qu.	47.480	49.600	48.450	68.850
max.	59.300	71.000	64.100	83.200
long-term unemployment (females)				
min.	20.200	21.700	9.400	24.200
1st qu.	37.800	35.730	33.380	49.450
median	44.100	44.200	42.750	62.950
mean	43.160	44.930	41.590	59.100
3rd qu.	48.000	53.980	50.050	68.080
max.	56.700	75.500	67.700	80.100
long-term unemployment, 0-2 (total)				
min.	28.600	31.700	25.100	45.800
1st qu.	40.600	45.580	46.980	72.950
median	48.200	54.350	56.850	78.900
mean	47.520	54.750	55.950	77.030
3rd qu.	53.300	62.700	66.150	82.830
max.	76.500	82.100	78.900	93.700
long-term unemployment, 0-2 (females)				
min.	29.000	34.400	28.500	58.600
1st qu.	46.950	58.100	49.400	73.170
median	52.050	67.450	58.600	79.500
mean	51.900	65.380	58.110	78.600
3rd qu.	57.250	74.280	68.300	84.530
max.	72.200	92.200	85.300	92.200
long-term unemployment, 3-4 (total)				
min.	15.200	11.500	10.600	21.700
1st qu.	38.580	33.650	30.200	48.500
median	43.250	40.800	38.600	60.900
mean	42.640	41.850	37.590	57.270
3rd qu.	47.000	50.100	45.600	67.550
max.	65.500	70.700	58.100	78.800
long-term unemployment, 3-4 (females)				
min.	26.000	21.900	11.400	32.500
1st qu.	41.900	38.520	30.320	52.000
median	45.500	46.700	40.250	61.700
mean	44.870	46.980	39.020	59.540
3rd qu.	47.700	55.550	46.900	67.780
max.	63.500	75.700	64.800	76.600
employment, 15-64 (total)				
min.	48.000	45.000	57.400	51.100
1st qu.	52.670	54.230	64.380	56.380
median	59.600	58.350	67.300	61.800
mean	59.360	58.690	67.830	62.240
3rd qu.	65.330	63.050	71.700	68.830
max.	74.600	78.600	79.600	77.100

Annex F: Thesis Report

Thesis Report

by Michelle Magvasi

Thesis Supervisor 2019/20 – Prof. Andrew Cartwright

Central European University

Thesis Supervisor 2020/21 – Prof. Adam Holesch

Institut Barcelona d'Estudis Internacionals

Table of Contents

Introduction and objective

The general focus of the thesis concerns regional disparities across the European Union (EU). International and intranational inequalities have always existed, however, regarding candidates with incomes below the EU average, enlargement has in many cases aggravated both dimensions (Commission 2015). Broadly speaking, this economic situation is mainly associated with neoliberalism, sweeping through the 1980s up to the early 2000s, during which capital flows and investment have been disproportionately targeting the most developed areas, leaving regions with less favourable socio-economic conditions and/or geographic locations increasingly behind (Szalai 2014).

Also known as the Washington consensus, this economic thinking expected growth to ultimately spill over to lagging regions, hence governments did not counterbalance these dividing forces. Its core logical flaw is rooted in the failure to recognise that development would not occur without adequate levels of absorptive capacity or social capability (Fagerberg et al. 2007). Considering the massively inefficient distribution of goods and services defining Europe's economy, the free market has thus been given green light for decades to turn territorial polarisation into a market failure so acute, that correcting it might be more distant than it was in 1992 when the EU vowed to "pursue actions leading to the strengthening of its economic and social cohesion" (EC Treaty 1992).

The other side of this market failure whose unfolding incidence is disproportionate on the most disadvantaged regions is climate change. The inevitable shift towards a low-carbon economy, accompanied by increasingly extreme weather events will cause major disruptions to economic life, especially in regions so far unable to mitigate shocks (ILO 2016), many of whom are specialised in climate-vulnerable sectors such as agriculture (Stern 2007). Therefore, on the one hand, the *status quo* urgently necessitates a new, mission-oriented industrial policy (IP) to build resilience during the transition period (Ahlström 2019, Rodrik and Aitinger 2019). On the other hand, the *status quo,* or the inability to improve it sheds light to a failure less visible than the market's: a collective governance failure.

There is no commonly agreed definition of IP apart from it being a market intervention – this report defines it in terms of a process deliberately seeking to alter the structural characteristics of an economy (Naudé 2010). The EU's main regional strategy, the Cohesion Policy (CP), therefore, is the territorial dimension of a supranational IP. However, the failure to improve targeted regions' relative competitiveness is not by default attributable to the the EU only. Since

the CP is complementary to the national policies, governments are the principal agents in the development process. Therefore, in case the CP is shown to have no significant impact on lagging regions' progress, yet there are Member States (MSs) where improvement is substantial, a hypothesis can be drawn; if there are successful examples, then the problem lies not primarily on the supranational, but on the national level. In other words, national policies do not fail because the CP fails – instead, the CP fails to achieve its targets because governments' IP frameworks are ill-designed.

The purpose of the report is to provide support for the assumption, thereby providing evidence-based foundation for the forthcoming thesis. First, I conducted a series of t-tests to determine whether the EU has been able to achieve progress towards its aims of (i) reducing the gap between higher- and lower-income (LI) MSs' regions, and (ii) improving LI regions' competitiveness (EC Treaty 2002). Further, I applied a local regression to detect any (iii) relationship between regional funds and competitiveness, as well as a pairwise correlation to approximate the (iv) association between funds and regional growth rate. The rationale behind identifying and analysing successful cases is to accelerate and strategically coordinate sustainable industrialisation in Europe's most vulnerable regions. However, to kick-start the process, first those successful elements must be recognised that others lack.

The null hypothesis, *i.e.* the lack of regional progress is universal across LI countries – which would keep the possibility of holding the EU accountable alone open – is rejected by the results. I found that despite inequalities both within and among MSs growing, moreover despite funds neither being associated with competitiveness, nor with growth, there are three countries, Czechia, Lithuania, and Slovakia, whose improvement is remarkable in all aspects considered. Hence, the question the research will investigate is *why are some lower-income Member States' regions developing while others' are not?* The underlying hypothesis is that their industrial frameworks are better-suited to the rapidly changing economic environment. The objective of the thesis will be both to offer a better insight into why regional development has been more effective in these countries than elsewhere, and what institutional setting could improve strategies' effectiveness. For this purpose, I will adopt a mixed-methods approach, where quantitative assessments of various socio-economic indicators against industrial policy measures within a taxonomy will be complemented by semi-structured stakeholder interviews to capture the essence of public-private-civic partnerships underpinning governance dynamics.

The value of this research is threefold. First, since IP has predominantly been approached from its traditional "market-failure-correcting" role, the core of these failures and the failure to

correct them are generally neglected from the governance perspective. Put differently, socio-economic and environmental outcomes, and the fact that they persist suggest not only economic, but political-economic malfunctions. Second, as it has only been back on the agenda recently (Rodrik and Aiginger 2019, Landesmann and Stöllinger 2020), IP so far received insufficient academic scrutiny in terms of its development potential. Third, as currently there does not exist a consistent classification framework for IP interventions' assessment (Weiss 2020), the thesis by constructing a taxonomy will contribute to filling this methodological gap.

The structure of the report is the following; Section I introduces a theoretical case and an analytical framework for IP. Section II focuses on the CP, including a brief discussion of the econometric studies on the topic, followed by own calculations and preliminary findings. Section III reviews the literature on the governance failures to overcome for delivering new IP. Section IV outlines the research design, and V provides a workplan for the research.

Section I – Theoretical case and analytical framework for industrial policy

IP is traditionally centred at manufacturing, whose association with Gross Domestic Product (GDP) growth is well-established. However, economic theory has long predicted that the higher the level of industrialisation, the lower the share of manufacturing in GDP, given that higher incomes would increasingly shift demand towards the service sector, while at the same time technological progress would phaseout human labour and reduce manufacturing costs. If other sectors have more growth-enhancing potential, what is the theoretical case for IP in post-industrial economies?

The growth fetish in classical economic theory comes from its unquestionable role in boosting wellbeing. However, just as GDP alone cannot capture how the benefits of growth are distributed across society, making it an inadequate indicator for estimating wellbeing, neither can the shrinking size of industry measured in terms of its value-added as a percentage of GDP approximate its true value beyond GDP. The social and environmental value IP traditionally brings to enhance wellbeing is mainly captured by Pigouvian taxes correcting market failures. Theoretically, for example, the price on carbon emissions from productive activity should be as high as to correct the damage caused to society and the environment. Implicit in this line of thinking is that industry is something inherently "bad" and that policy at best can reduce the harm that otherwise would be done.

The new IP thinking moves beyond GDP, market-failure-correcting, as well as manufacturing as its primary definition. I propose to define industry as the productive network of a society

structuring human interaction. In theory, therefore, IP can intervene to restructure the productive network in a way that renders human interaction constituting the economy conducive to inclusive and sustainable development. The role of IP in the green transition era is thus to promote ‘’high-road competitiveness’’ (Aiginger 2014) of innovation, job-creation, human capital, carbon phaseout, and societal goals alike to allow economies enhance overall wellbeing. Incorporating societal goals into IP, apart from correcting negative externalities, is essentially a positive internality as it will have the long-term effect of economic resilience. These objectives, as we have experienced over the decades, will not be met if the market remains the final distributor (Grimm et al. 2013).

While such restructuring is theoretically sound, why has not this future- and welfare-oriented industrial model taken place yet (apart from some Scandinavian countries)? In the European context, this dilemma could probably be best captured by a combination of multi-level governance (MLG) and game theory. This analytical framework should aid understanding the lack of synergy between the CP and national policies, thus illuminate why LI MSs struggle to achieve progress overall.

The emergence of MLG as a concept and the CP are intrinsically linked. It was introduced by Marks (1992) to capture the essence of the ever-more complex EU policymaking process. Following the 1988 reform, the assumption that MSs constitute the core unit of analysis in that EU integration is an outcome of strategic bargaining between governments (Moravcsik 1988) did not fully hold anymore. The CP granted considerable influence to sub-national as well as to non-state actors over decision-making, thereby dispersing power across multiple levels. Although MLG is broadly applied in various contexts and hence there is no commonly agreed definition (Schakel et al. 2015), the central feature uniting different approaches is the dynamic between public, private, and societal actors at the local, regional, national, and supranational levels in policymaking and implementation (Radzyner et al. 2014). Therefore, when considering budget allocation, programme design, or goals that players agree to in a “multi-level-game” framework, neither the number of stakeholders behind the bargaining process, nor their interests can be known that may influence formal decision-making. With a large yet unknown number of players from multiple levels, furthermore without complete or reliable information about pay-offs, individual gains will be higher from defection than from cooperation (North 1993). In the context of IP especially, the likelihood of self-interested over cooperative behaviour, and thus of blocking progress is further exacerbated by path-dependence – *e.g.* favouring investments which previously worked, and the CP’s redistributive nature.

Redistribution can be problematic if the institutional setting rewards what North calls "piracy" (1993). In the CP context, this means that there are no repercussions for non-cooperation (failing to facilitate development, deliberately or not). In fact, non-cooperation is technically rewarded, because the more underdeveloped a region remains, the more funds it is likely to get in the following programming cycle. In other words, the pay-off from redistribution may outweigh that of production. Thus, in this sense, "learning will take the form of learning to be better pirates." (North 1993)

Viewing governance within this framework helps in generating hypotheses on the functioning of political-economic systems. With regards to IP, the MLG perspective can shed light to the quality of vertical and horizontal interactions among stakeholders, reflected in the progress against cohesion targets. The following section will assess regional development in terms of the EU's Regional Competitiveness Index (RCI). Considering development within an MLG framework, the findings shall indicate the health of MLG across the countries considered.

Section II – Regional cohesion

The EU's regional strategy of promoting convergence by boosting competitiveness, employment creation, sustainable and inclusive growth, and better quality of life is embodied by the CP, whose financial instruments make up approximately a third of the EU budget (EC 2020a). Its current form dates back to the 1988 Structural Funds reform following the acceptation of Greece (1981), Spain, and Portugal (1986) (EC 2020e). The CP's two main investment funds are the European Regional Development Fund (ERDF) and the Cohesion Fund[12] (CF) (EC 2020b). It furthermore includes the European Social Fund (ESF), the European Agricultural Fund for Rural Development (EAFDR), and the European Maritime and Fisheries Fund (EMFF), which together constitute the European Structural Investment Funds (ESIF) (EC 2020c), allocated under multi-annual programming periods.

Given its size and ambitions, it comes with no surprise that the CP's impact has attracted vast scholarly attention ever since (Fratesi and Wishdale 2017). The findings, however, are far from homogeneous. Dall'erba and Le Gallo's (2008) cross-section spatial lag model suggests no statistically significant impact during the first two periods of 1989-1993 and 1994-1995, whereas the OLS estimates of Puigcerver-Peñalever's (2007) panel data approach investigating the same timeframe does identify positive effects in the first. Becker et al. (2008) find significant growth effects in both cases, yet Eggert et al.'s cross-section pooled model (2007) or Esposti and Bussoleti's (2008) dynamic panel applying an augmented convergence econometric model show negative effects in some cases. These contradictions hold for later cycles as well, with some indicating towards a gradual improvement over time (Rodríguez-Pose and Novak 2013, Pinho et al. 2015), whereas others observe a decline in effectiveness with the amount of funds injected (Becker et al. 2012).

Apart from differing research designs, Mohl and Hagen (2010) argue that the diversity of findings lies in poor data on structural funds. They highlight that most authors only have access to certain funds and rely on those when making calculations (e.g. Soukiazis and Antunes 2006, Bouvet, 2005, Percoco 2005), whereas others base estimations on commitments rather than actual payments (e.g. Rodriguez-Pose and Fratesi, 2004). However, in 2018 the Commission made regionalised EU payments data available online which it regularly updates (DG Regional Policy 2020). Accompanied by data on regions' competitiveness published periodically by the

[12] MSs whose Gross National Income per capita is below the 90 percent of the EU average are eligible for the CF (EC 2020d).

EU, I was able to draw some preliminary conclusions regarding the relationship between regional funds, competitiveness, and growth, as well as the current state of regional disparities both across Europe and within its MSs to guide me in the forthcoming research.

Rationale

In line with Berkowitz and Pieńkowski (2015), I argue that the econometric analyses that measure the CP's success in terms of GDP are to some extent misguided, given that its goal is not limited to increasing the size of regional economies, but include various dimensions of competitiveness. Therefore, I will mainly focus on the latter aspect, nevertheless will also cover growth. However, unlike the analyses previously mentioned, my objective is not to determine whether the CP had an impact *per se*. Instead, this initial analysis, on the one hand, concentrates on whether the EU has been able to achieve progress towards its aims of (i) reducing the gap between higher and LI MSs' regions, (ii) and improving LI regions' competitiveness. On the other hand, to separate the CP from national policies, I will also estimate funds' association with (iii) competitiveness and (iv) growth. In short, the rationale behind these calculations is to identify successful cases and to approximate their relationship to the CP.

Data and methods

The first and second part of the calculations are based on the EU's RCI. It was first published in 2010, and then every three years in 2013, 2016, and 2019. The RCI, with using over 70 comparable indicators, allows us to assess the quality of a NUTS-2[13] region as an environment to live, work, and conduct business in (EC 2020f). The indicators are grouped into 11 dimensions which form the basis of an overall competitiveness index and are further broken down into three sub-indices of a basic[14], an efficiency[15], and an innovation[16] pillar. The core advantage of the RCI is that by offering disaggregated spatial data on various aspects of competitiveness, we can not only track progress *per se*, but also identify general trends across countries and individual conditions that may hinder development and thus necessitate policy intervention. Another "fortunate" aspect of it is that the first measurements precede the 2008

[13] The Nomenclature of Territorial Units for Statistics (NUTS) is a geocode standard for subdividing countries according to the population size of a territorial unit – the minimum and maximum population threshold under the NUTS-2 level is 800,000 and 3,000,000 (Eurostat 2020a).
[14] Basic: institutions, macroeconomic stability, infrastructure, health, basic education (RCI 2019).
[15] Efficiency: higher education and lifelong learning, labour market efficiency, market size (RCI 2019).
[16] Innovation: technological readiness, business sophistication, innovation (RCI 2019).

financial crisis, therefore the indices also demonstrate how resilient sub-national entities have been (Annoni and Dijkstra 2019).

I used data from the 2010 and 2019 editions, which reflect approximately the 2008 and 2017 circumstances (however, I will refer to them according to the publication date). The indicators are the same, however the 2010 edition covers 270 regions, while the latest tracks 283. This is because "sometimes national interests require changing the regional breakdown of a country" (Eurostat 2020b). As I will be comparing mean scores, the territorial modifications are not expected to significantly alter the results – a robustness check will nonetheless be performed to validate the findings. Croatia is excluded from the analysis, as it was not an EU member in 2010. I divided the EU27 into higher[17] and LI MSs for comparison. The LI group includes 16 MSs – the Cohesion countries[18] plus Italy[19].

The third and fourth parts of the estimations concern the CP's two main funding instruments' relation to regions' competitiveness and growth rate. Regarding competitiveness, funds are measured as funds per capita for a region, thus the sum of the CF and the ERDF a region receives a year is divided by its population size for the same year. Due to missing data either on population size or competitiveness indices, the estimations are based on the 2016 publication, as the largest coverage for both dimensions is available for the year 2014. Nonetheless, I will compare those to the 2019 RCI to uncover any change in the relationship. Croatia is included, but Italy is excluded since it is not a recipient of both funds.

As to growth rate, funds are understood in terms of their size to regional GDP, thus their sum for each region for each year is divided by the corresponding regional GDPs. Growth rate is measured as a region's GDP in a given year divided by the previous year's GDP. The correlation between funds and growth is lagged by a year, hence growth rate corresponds to the previous year's funds. I selected payment data on the CF and ERDF between 2009 and 2018 for 15 LI countries (Croatia and Italy are excluded). Payments are expressed in EUR current prices for each year. The programming cycle in which payments were agreed and the year in which they were made do not necessarily match, as often payments are transferred later.

[17] Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg, Netherlands, Sweden, and the United Kingdom

[18] Cohesion countries are those eligible for the CF: Bulgaria, (Croatia), Cyprus, Czechia, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia and Slovenia. Spain is also included as it is eligible on a transitional basis (EC 2020g).

[19] Italy is considered a LI country as its GDP per capita is below the EU average, albeit not low enough to qualify for the CF (Eurostat 2020c). It nonetheless receives considerable amounts from other CP funds.

For estimations (i) and (ii) I applied Welch's t-test to assess the change in means between the two periods' four indices, first between lower -and higher-income MSs, and then on the former group's countries individually. This type of t-test is designed for samples with unequal variance and/or sample sizes (Ruxton 2006), defined by the following formula:

$$t = \frac{\overline{X_1} + \overline{X_2}}{\sqrt{\frac{{s_1}^2}{N_1} + \frac{{s_2}^2}{N_2}}}$$

$j\epsilon\{1,2\}$, where $\overline{X_j}$, s_j and N_j are the j^{th} sample mean, standard deviation, and size.

Estimation (iii) is a local regression for scatterplot smoothing. Estimation (iv) is a pairwise correlation, commonly referred to as Pearson's r between the two variables, funds and growth rate. The formula for r is:

$$r_{xy} = \frac{\sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \overline{x})^2}\sqrt{\sum_{i=1}^{n}(y_i - \overline{y})^2}}$$

Where $\{(x_1, y_1), \ldots, (x_n, y_n)\}$ n is the sample size, x_i, y_i are individual sample points, and $\overline{x}, \overline{y} = \frac{1}{n}\sum_{i=1}^{n} x_i, y_i$ are the sample means.

Results

(i) Reducing the gap between higher- and lower-income Member States' regions

The mean difference between lower- and higher-income MSs regions' competitiveness increased from 30.82 points in 2010 to 37.27 in 2019. Whereas higher income countries' competitiveness score increased by 4.73, those on the lower strata lost 1.71 points on average between the two periods. Among the three sub-indices, apart from innovation, where there has been an overall decrease of 1.73, the difference between the North/West and the South/East has also aggravated in the basic and efficiency pillars – by 6.09 and 8.06 points.

year	RCI			Basic			Efficiency			Innovation		
	high	low	*diff.*	high	low	*diff.*	high	low	*diff.*	high	low	*diff.*
2010	68.07	37.24	30.82	66.11	35.88	30.23	72.00	51.80	20.20	64.83	26.96	37.87
2019	72.80	35.50	37.27	71.21	34.90	36.32	76.87	48.62	28.26	68.31	32.16	36.14
diff.	4.73	-1.74	6.45	5.1	-0.98	6.09	4.87	-3.18	8.06	3.48	5.2	-1.73

Source: own calculations

The same trend holds for the change in the 16 countries' sub-indices; while innovation improved by 5.2, basic decreased by 0.98, with efficiency experiencing the starkest average decline of 3.18 points. Overall, in 2019, higher income MSs' regions were over twice as competitive and innovative than their less well-off counterparts. Their mean score for basic was also more than twice as high, with their markets being approximately 1.6 times more efficient. In 2010, the ratio only exceeded 1:2 in innovation – considering the other indicators on average, higher income MSs score was 1.7 times higher in 2010. The results, therefore, clearly point toward a deteriorating trend in regions' competitiveness across LI countries, not only compared to MSs of the North/West throughout the decade, but also in absolute terms compared to the base year.

(ii) Improving lower-income regions' competitiveness

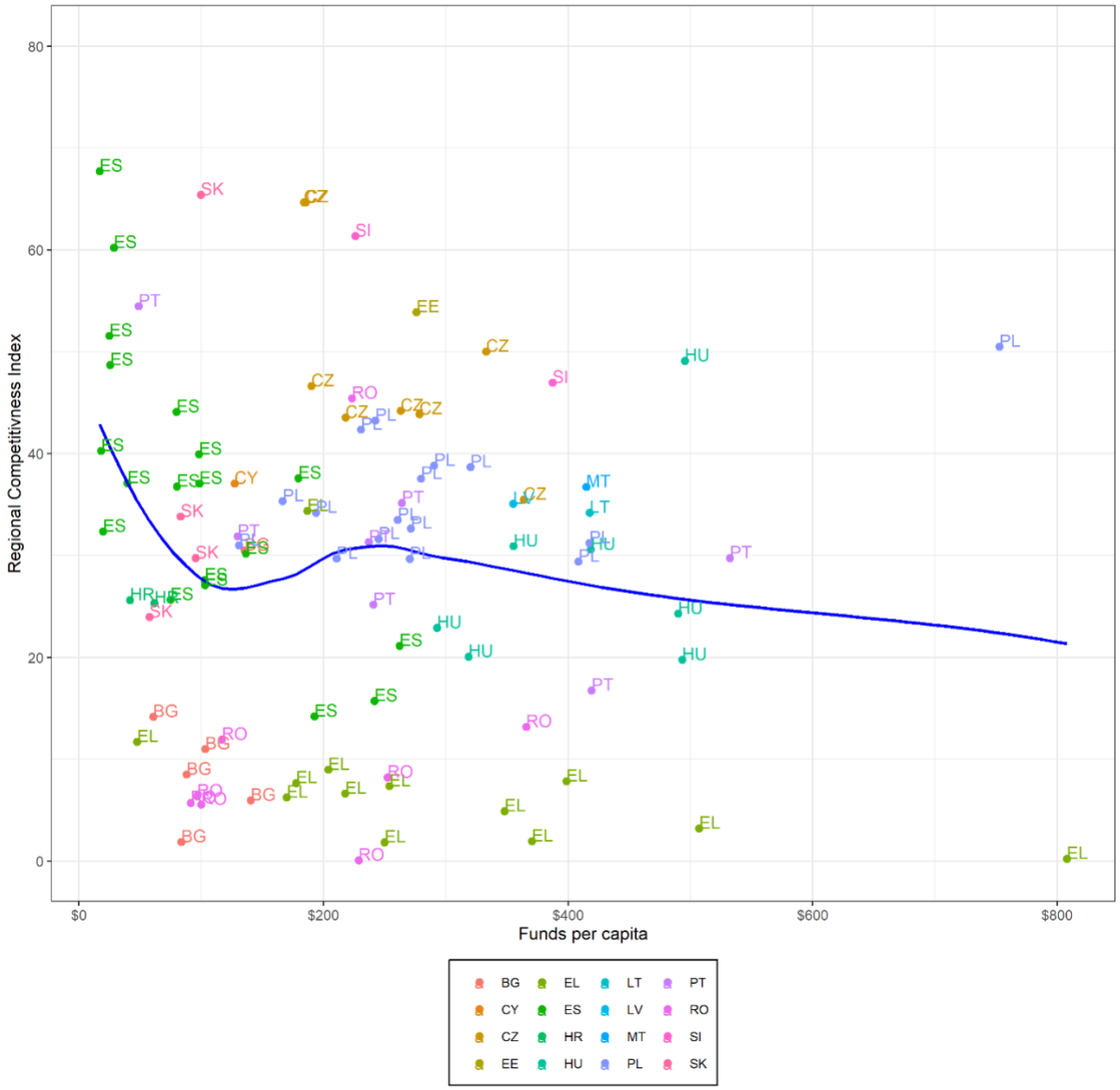
Tracking progress against the four indices on the MS level across the 16 LI countries, I found that only five – Bulgaria, Czechia, Lithuania, Malta, and Slovakia – improved in all aspects, whereas 7 – Greece, Spain, Italy, Cyprus, Poland, Romania, and Slovenia – scored worse compared to 2010 in at least two indicators. The remaining four – Estonia, Latvia, Hungary, and Portugal – worsened in one sub-index each: Hungary scores lower in basic, while the others all performed weaker in the efficiency pillar.

As previously mentioned, there are some differences between the regions within the NUTS-2 category. Regarding LI countries, while there are 116 regions in total in 2010, there are 118 in 2019. Only Czechia, Lithuania, Poland, and Romania are affected by the changes. Czechia has one less NUTS-2 regions in 2019, while the others have one more than they had in 2010. During the first round of individual country assessments, only those regions were kept that are present

in both years. Nonetheless, in order to conclude that the results hold under different circumstances, *i.e.* when all regions are included, I applied the same t-tests on a "full" dataset. Apart from Poland, where instead of a slight decrease in the RCI (-0.85), there is a slight increase (0.89) in the second case, the results are the same for the other three countries, except for minor changes in the values. In both cases, statistically significant improvements were observed for innovation in four countries (Czechia, Greece, Spain, and Portugal), for basic in two (Czechia and Spain), and for efficiency it was only observed in Poland, while none of the countries achieved significant improvement in the RCI. Important to note that there are no p-values for those countries that only have one region in either or both years (Estonia, Cyprus, Latvia, Lithuania, and Malta) – thus the findings on statistical significance concern 12 countries in total. With all countries included, while there is a significant improvement in innovation, their mean performance across the other three indices are worse than in 2010, with efficiency declining the most (Appendix A).

(iii) and (iv) EU funds' association with Cohesion country progress

The regression line shows a clear relationship between income and competitiveness (Appendix B). Not surprising, the higher the GDP per capita the higher the RCI indices – the line is driven down by Greece, where albeit GDP per capita is relatively high, RCI scores are extraordinarily low. However, the graphs show no relationship between RCI indices and funding (for sub-indices see Appendices C, D, and E). There is also no relationship in 2017 – the only difference is that funding per capita was less that year (Appendix F).



Source: own calculations

The correlation between funds and growth is 0.025, which means that with every additional percentage point funds' ratio grow relative to a region's GDP, regions' growth rate increases by 2.5 percent the following year on average. However, when calculating Pearson's r separately, the correlation only has a positive value in a third of the cases – the four least developed MSs (Bulgaria, Cyprus, Malta, and Romania) and Estonia. Across the other 10 countries, the mean value of the correlation coefficients is -0.26, with statistical significance in three cases (Spain, Poland, and Slovakia).

Preliminary conclusions

The results suggest that following the 2008 financial crisis, the CP has neither been effective in (i) reducing disparities across the EU's lower- and higher-income countries, nor in (ii) (iii) contributing to regions' competitiveness and (iv) growth overall. Since the calculations were not designed not to assess the CP's impact, the findings regarding its relationship to development are not exact, as for example they do not consider spillover effects between regions. However, in line with my objective, they do offer a general intuition on how supranational and national bodies work together as well as on which domestic frameworks are most effective. Therefore, the two broad conclusions they point towards are valid; first, the synergy between the national and supranational industrial policies, and thus MLG mechanisms are dysfunctional, and second, Czechia, Lithuania, and Slovakia deserve attention in terms of their domestic strategies.

Section III – Literature review: towards a new industrial policy

As indicated in the theoretical section, new IP must be driven by societal goals. However, this does not only require a radical shift in the mindset underpinning current governance dynamics, but also a strategic approach to overcome governance failures inhibiting the process. This literature review, by considering some of the most pressing dysfunctions and deficiencies in cooperation across multiple levels provides crucial foundation for the research as it will allow me to approach stakeholder interviews in a critical and targeted manner to uncover the nature of partnerships.

The first cluster of problems concerns a behavioural dimension, in which governance failures degenerate "into an orgy of corruption and detrimental rent-seeking" (Hodler 2009). This aspect concerns the potentially differing interests on the supranational and national levels, captured by the principal-agent (P-A) problem. Applying it to the EU context, the literature identifies three prominent phenomena that can affect the optimal delivery of IP: the pork-barrel distribution, the substitution effect, and vested interests.

Blom-Hansen (2005) depicts the problem the following way; ideally, the principal (EU) would hire agents (MSs) committed to delivering the results expected by their employer. However, the first problem is that national governments are given, not chosen by the EU, and the second is that the "contracts" between the two are not legally binding. Therefore, if governments wish to covertly pursue their own goals by either manipulating the contract *ex ante,* or failing to deliver *ex post*, the EU's awareness about and control over their actions are both limited.

Conceptualising these goals from a political-economy perspective, the first incentive that may divert governments' interests away from the EU's resulting in sub-optimal policy outcomes is that of political gains, known as the problem of pork-barrel distribution in the literature (*e.g.* Weingast et al. 1981, Baron 1991). Sharma (2017) defines the phenomenon as instances in which money is channelled "to particular constituencies based on political considerations, at the expense of broader public interests". For example, Bodenstein and Kemmerling's (2012) findings suggest that structural funds' allocation across regions are at times strategically targeted to buying votes. The context is similar in examples where the funds evoke a substitution effect, meaning that governments replace a part of their expenditure (*e.g.* infrastructural investments) by EU funds, using the surplus for their own benefit (Landesmann and Stöllinger 2020). Another considerable factor hindering productive MLG occurs in cases where the government is too embedded in the economic structure, and thus manipulates the CP in a way that supports, or at least does not harm their private interests (Dimulescu and Doroftei 2013).

Blom-Hansen (2005) posits the P-A as an alternative to MLG for analysing the CP. However, given that the P-A problem concerns the mismatch between interests across the organisational hierarchy, it is MLG at its core, drawing attention to dysfunctions in its operation. This dysfunction, therefore, on the one hand, is rooted in the institutional constraints of the EU in terms of its legal authority over national matters. On the other hand, it is often accompanied by weak domestic institutions that do not have the capacity to oversee whether governments' decisions serve the public interest.

This issue of institutional constraints or deficiencies overlaps with the other dimension of governance failures, where sub-optimal policy design and/or inefficient allocation of cohesion funds results not of intention, but of structural deficit. Rodrik (2004) separates these into two categories of information and coordination externalities. In these instances, the obstacle towards industrial diversification and development is not that governance mechanisms are corrupted, but that they are absent or insufficient. Rodrik and Hausmann (2002) argue that the information externality hinders progress because entrepreneurs fear to engage in "self-discovery". What they mean is that without *ex ante* financial instruments that would guarantee entrepreneurs recovery in case their investments in new, non-traditional industries fail, experimentation remains too risky, hence what could be produced home often does not get discovered. On the flip side of the coin is when government would act, however the intervention gets blocked. In this instance, a certain market failure alone is deemed insufficient to justify action in the absence

of information on whether it would be cost-effective and welfare-enhancing enough to ascertain that the investment pays off (Budzinski and Schmidt 2006, Harrison and Rodriguez-Clare 2009). Both sides point toward the same conclusion: the information externality is a problem because without knowledge on what might work will not be found out. This leads to the other facet of failures deriving from inadequate multi-level interactions, the coordination externality.

Unlike the previous governance failure, overcoming the latter does not require subsidies, only strategic coordination between the public and private spheres. The logic is that once entrepreneurs coordinate their activities and make simultaneous investments, they all end up profitable – the problem is that in the absence of such coordination, many investments are not made. This externality creates a paradox in less developed regions, as they evidently need investments the most, however, given the lack of familiarity with coordinating activities (Trippl et al. 2018), they struggle the most with bringing stakeholders together productively (Radosevic 2017). This is especially problematic in cases where some extent of coordinating activities is inevitable to avoid conflict, because consensus will usually be achieved on the lowest common denominator which in turn may lead to sub-optimal socio-economic outcomes (Landesmann and Stöllinger 2020).

Governments, therefore, need to create an environment where dialogue can take place, both for businesses to cooperate, and for governments to be able to elicit knowledge from the private sector about constraints and opportunities (Rodrik 2004). Hence, reducing the coordination externality also has the potential to mitigate the information externality. Active stakeholder involvement from all levels is crucial for delivering a new, better-targeted, and forward-looking IP. This includes civic actors as well. For example, Mair's (2010) insight concerning microfinance illuminates that money alone is insufficient to deliver change, unless supported by non-market instruments, such as training and education. Therefore, civic engagement may be necessary in programme design and/or delivery, given their unique insight into local challenges. Mitigating the skills gap in such way ensures that interventions are targeted, and that they will ultimately lead to increased consumer demand and less welfare spending, establishing a cycle where people, along with the private and public actors will be increasingly better-off.

The supranational role in evoking such multiplier effect on a large scale is also vast and thus the EU must also improve its governance. Pellegrin et al.'s study (2019) suggests that EU IP in its current form is too fragmented to realise its goals. The territorial approach represented mainly by the CP, the horizontal (*e.g.* regulatory environment, trade, human capital, innovation)

and thematic-sectoral dimensions (*e.g.* industrial modernisation, value chains, sector-specific support) are to be combine under a mission-oriented framework focusing on market creation, experimentation, and policy learning (Pellegrin et al. 2019).

To conclude, the literature collectively indicates that the key to sustainable industrial development lies in the effective coordination of stakeholders both vertically and horizontally, as well as of policy areas, including innovation, trade, and regional policy, with manufacturing at the centre to change the socio-economic structure that prevents economies from becoming adaptive and resilient (Rodrik and Aiginger 2019). For this to happen, meaning that for public, private, and civic actors to engage such cooperation, an equilibrium must be found between too much government embeddedness and too little for MLG to be productive. Hence, the research will investigate effectively integrated multi-level, multi-stakeholder, and multi-dimensional models, as well as identify elements in successful countries' industrial frameworks that foster diversification and growth, while being sensitive to current and future social, economic, and environmental challenges.

Section IV – Research design

Case selection

The objective of the preliminary calculations was to identify countries whose regional economies' competitiveness is not only above the average, but also demonstrated considerable improvement throughout the last decade. As the assumption driving the research is that

H_1: the most competitive countries' industrial frameworks are better-suited to the socio-economic transformations defining the transition period

than those stagnating or performing worse, they shall constitute the cases investigated for the thesis. Whose scores have been consistently above the mean for all four indices considered and became higher in 2019 than in 2010 are Czechia and Slovakia. However, Lithuania is also selected among the cases despite its performance in the basic index being below the average for the following reasons. First, it is among the five countries that improved in all indices, along with Bulgaria and Malta. Nonetheless, Bulgaria remains way below the average in all aspects, while Malta remains below the average in efficiency, and achieved only a slight, 2.02-point improvement in innovation. Although its innovation score of 38.48 is not much below Lithuania's 40.36, the latter scored 12.36 points higher compared to 2010, in addition to its efficiency being 22.1 points above Malta's. Along with Slovakia, Lithuania is moreover

projected to be among the countries growing at the highest rates throughout the next decade (Harvard 2020). Czechia is predicted to grow at a modest rate, however as it ranks 7th among the most competitive countries worldwide (Harvard 2020), the trio carries strong potential in providing policy insight in terms of industrial strategy. Lastly, they are contextually similar due to the shared Soviet historical background, which not only justifies comparison, but makes trends arising across IP planning more likely.

As the goal is not only to uncover the interventions making these economies more resilient, but also to investigate the frameworks allowing them to be formed and operationalised, the sub-hypothesis is that

H_2: *the most competitive countries' multi-level governance mechanisms are more effective.*

Put differently, I assume the differences in regional outcomes' core to be found within the size of governance failures. When comparing the trio to other LI countries, special focus will be given to Hungary. Due to Hungary's increasingly centralised and antidemocratic governance model, indicated also by its worsening basic index, governance failure shall be significantly greater than in Czechia, Lithuania, and Slovakia. Furthermore, Hungary's contextual characteristics fit well with the three cases, therefore the link developed in terms of MLG dysfunctions and overcoming them will be analytically sound, making conclusions more generalisable. Lastly, all countries whose regional economies are fragile are conducive to authoritarian populism – focusing on the case where this phenomenon is most prominent and examining processes through which a productive industrial governance framework can be constructed is not only crucial for EU-wide economic development, but also for political risk-reduction.

Methodology

As currently there does neither exists a database of IP interventions, nor a consistent classification system where they could be evaluated (Weiss 2020), this thesis shall develop a taxonomy influenced by earlier approaches (*e.g.* Peres and Primi 2009, Naude 2010, Warwick 2013, Weiss 2015, UNIDO IDR 2017) for meaningful assessment and comparison. Weiss (2020) argues that such framework must be feasible, meaning that collecting data under the categories should be straightforward and manageable, and simple so that interventions can be clearly related to the policy domains they target. The socio-economic significance of the information gathered will be quantitatively analysed. However, as policy analysis is insufficient to give insight into the governance mechanisms behind strategies, I will adopt a mixed-methods

approach adding qualitative information based on semi-structured stakeholder interviews. This approach, by allowing me to support the analysis by anecdotal evidence on the institutional processes and the dynamics defining stakeholder interactions shall provide a comprehensive picture of the most promising countries' formal targets, interventions, and informal strategic relations that make up IP environments. I will furthermore analyse data on their economic structures in terms of production and trade (*e.g*. Harvard's Atlas of Economic Complexity) over time to investigate how strategically industrial policies target growth opportunities. Consequently, the findings will be assessed against countries whose regional economies failed to become more, or are less competitive than before.

Section V – Workplan and deadlines

The final section outlines the planned deadlines and deliverables of the research process during the 2020/21 academic year.

October – November

- Begin collecting IP and socio-economic data across Czechia, Lithuania, Slovakia, and Hungary
- Start systematising the interventions for constructing a taxonomy

December – January

- Reach out to relevant stakeholders for interviews
- Submit draft taxonomy for evaluation
- Finalise literature review

February – March

- Finalise methodology section
- Assess data from formal (policies) and informal (interviews) sources on interventions and governance mechanisms in the finalised taxonomy
- Draw hypotheses why these countries perform better than other LI MSs
- Begin quantitative analyses

April – May

- Compare Hungary's industrial approach and socio-economic indicators specifically, and other LI MSs' in general to the three cases
- Draw preliminary conclusions

- Submit literature section, methodology, and results' analyses for review

June – July

- Revise draft in line with supervisors' recommendations
- Submit thesis

Bibliography

Ahlström, H. (2019) "Policy Hotspots for Sustainability: Changes in the EU Regulation of Sustainable Business and Finance." *Sustainability 2019*, 11(499): 1-22. DOI: 10.3390/su11020499

Aiginger, K. (2014) "Industrial Policy for a sustainable growth path." *Welfare Wealth Work for Europe Policy Paper Series*, Policy Paper no 13. Available at: https://www.oecd.org/economy/Industrial-Policy-for-a-sustainable-growth-path.pdf

Annoni, P. and Dijkstra, L. (2019) *The EU Regional Competitiveness Index 2019*. Luxembourg: Publications Office of the European Union. Available at: https://ec.europa.eu/regional_policy/sources/docgener/work/2019_03_rci2019.pdf

Baron, D.P. (1991) "Majoritarian Incentives, Pork Barrel Programs, and Procedural Control." *American Journal of Political Science*, 35(1): 57-90. DOI: 10.2307/2111438

Becker, S.O., Egger, P., von Ehrlich, and M., Fenge, R. (2008) "Going NUTS: the effect of EU structural funds on regional performance." *Journal of Public Economics*, 94(2010): 578–590. DOI: 10.1016/j.jpubeco.2010.06.006

Becker, S.O., Egger, P., and von Ehrlich, M. (2012) "Too Much of a Good Thing? On the growth effects of the EU's regional policy." *European Economic Review*, 56(4): 648-668. DOI: 10.1016/j.euroecorev.2012.03.001

Berkowicz, P. and Pieńkowski, J. (2015) "Econometric assessments of Cohesion Policy growth effects: How to make them more relevant for policy makers?" *Regional Working Papers*, Paper no 2/2015. Available at: https://ec.europa.eu/regional_policy/sources/docgener/work/2015_02_econ_assess.pdf

Blom-Hansen, J. (2007) "Principals, agents, and the implementation of EU cohesion policy." *Journal of European Public Policy*, 12(4): 624-648. DOI: 10.1080/13501760500160136

Bodenstein, T. and Kemmerling, A. (2012) "Ripples in a Rising Tide: Why Some EU Regions Receive More Structural Funds than Others." *European Integration Online Papers*. DOI: 10.1695/2011007

Budzinski, O., and Schmidt, C. (2006) "European Industrial Policy: Economic Foundations, Concepts and Consequences." Working Paper. Marburg: Philipps University of Marburg. DOI: 10.2139/ssrn.920060

Dall'erba, S. and Le Gallo, J. (2008) "Regional convergence and the impact of European structural funds 1989–1999: a spatial econometric analysis." *Papers in Regional Science*, 82(2): 219–244. DOI: 10.1111/j.1435-5957.2008.00184.x

Dimulescu V. and Doroftei, I.M. (2013) "Risks of corruption and the management of EU funds in Romania." *Romanian Journal of Political Science*, 11(1): 101-124. Available at: https://www.researchgate.net/publication/296420568_Risks_of_corruption_and_the_management_of_EU_funds_in_Romania

DG Regional Policy 2020. “Historic EU payments - regionalised and modelled.” European Commission. Accessed 28 August 2020. <https://cohesiondata.ec.europa.eu/Other/Historic-EU-payments-regionalised-and-modelled/tc55-7ysv>

Esposti, R. and Bussoletti, S. (2008) “Impact of Objective 1 funds on regional growth convergence in the European Union: a panel-data approach.” *Regional Studies,* 42(2): 159–173. DOI: 10.1080/00343400601142753

Eurostat 2020a. “NUTS – Nomenclature of Territorial Units for Statistics: Principles and Characteristics.” European Commission. Accessed 28 August 2020. <https://ec.europa.eu/eurostat/web/nuts/principles-and-characteristics>

Eurostat 2020b. “NUTS – Nomenclature of Territorial Units for Statistics: History of NUTS.” European Commission. Accessed 28 August 2020. <https://ec.europa.eu/eurostat/web/nuts/history>

Eurostat 2020c. “Database.” European Commission. Accessed 28 August 2020. <https://ec.europa.eu/eurostat/data/database>

European Commission (2015) *Mind the Gap.* European Research for Combating Inequalities. Luxembourg: Publications Office of the European Union. Available at: https://ec.europa.eu/info/publications/mind-gap_en

European Commission 2020a. “Glossary: Cohesion Policy, European Commission.” Accessed 28 August 2020. <https://ec.europa.eu/regional_policy/en/policy/what/glossary/c/cohesion-policy>

European Commission 2020b. “The EU's main investment policy.” European Commission. Accessed 28 August 2020. <https://ec.europa.eu/regional_policy/index.cfm/en/policy/what/investment-policy/>

European Commission 2020c. “Supporting economic development.” European Commission. Accessed 28 August 2020. <https://ec.europa.eu/info/funding-tenders/funding-opportunities/funding-programmes/overview-funding-programmes/european-structural-and-investment-funds_en>

European Commission 2020d. “Cohesion Fund, European Commission.” Accessed 28 August 2020. <https://ec.europa.eu/regional_policy/en/funding/cohesion-fund/>

European Commission 2020e. “History of the policy.” European Commission. Accessed 28 August 2020. <https://ec.europa.eu/regional_policy/en/policy/what/history/>

European Commission 2020f. “European Regional Competitiveness Index.” European Commission. Accessed 28 August 2020. <https://ec.europa.eu/regional_policy/en/information/maps/regional_competitiveness/#2>

European Commission 2020g. “Structural Funds Regulations 2007-2013.” European Commission. Accessed 28 August 2020. <https://ec.europa.eu/regional_policy/en/information/legislation/regulations/2007-2013/>

Fagerberg, J., Srholec, M., and Knell, M. (2007) “The Competitiveness of Nations: Why Some Countries Prosper while Others Fall Behind.” *World Development*, 35(10): 1595-620. DOI: 10.1016/j.worlddev.2007.01.004

Fratesi, U. and Wishdale, F.G. (2017) “The impact of European Cohesion Policy in different contexts.” *Regional Studies*, 51(6): 817-821. DOI: 10.1080/00343404.2017.1326673

Grimm, R., Baines, S., and Albertson, K. (2013) *Social innovation, an answer to contemporary societal challenges? Locating the concept in theory and practice.* The European Journal of Social Science Resarch, 26(4): 436-455. DOI: 10.1080/13511610.2013.848163

Harrison, A.E. and Rodriguez-Clare, A. (2009) “Trade, Foreign Investment, and Industrial Policy.” *Munich Personal RePEc Archive,* Paper no 15561. Munich: University Library of Munich. Available at: https://www.nber.org/papers/w15261.pdf

Harvard 2020. “Atlas of Economic Complexity.” Harvard University. Accessed 1 September 2020. <https://atlas.cid.harvard.edu/countries/39>

Hausmann, R., and Rodrik, D. (2002) “Economic Development as Self-Discovery.” *NBER Working Paper Series*, Working Paper 8952. Available at: http://www.nber.org/papers/w8952

Hodler, R. (2009) “Industrial Policy in an Imperfect World.” *Journal of Development Economics*, 90: 85-93. DOI:10.1016/j.jdeveco.2009.01.009

International Labour Organistaion (2016) “A just transition to climate-resilient economies and societies: Issues and perspectives for the world of work.” *The Green Initiative*, Technical Paper. Available at: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---gjp/documents/publication/wcms_536552.pdf

Landesmann, M. and Stöllinger, R. (2020) “The European Union’s Industrial Policy: What ae the Main Challenges?” *The Vienna Institute for International Economic Studies*, Policy Notes and Reports no 36. Available at: https://wiiw.ac.at/the-european-union-s-industrial-policy-what-are-the-main-challenges-p-5211.html

Mair, J. (2010) “Social entrepreneurship: taking stock and looking ahead.” In Fayolle, A. and Matlay, H. (Eds.), *Handbook of Research on Social Entrepreneurship*. Cheltenham: Edward Elgar.

Marks, G. (1992) “Structural Policy in the European Community.” In Sbragia, A. (Ed.) *Europolitics. Institutions and policymaking in the new European Community.* Washington DC: Brookings Institute.

Mohl, P. and Hagen, T. (2010) “Do EU structural funds promote regional growth? New evidence from various panel data approaches.” *Regional Science and Urban Economics*, 40(2010): 353–365. DOI: 10.1016/j.regsciurbeco.2010.03.005

Moravcsik, A. (1998) *The choice for Europe: social purpose and state power from Messina to Maastricht.* Ithaca, NY: Cornell University Press.

Naudé, W. (2010) "Industrial Policy: Old and new issues." *UNU-WIDER,* Working Paper no 2010/106. Helsinki: United Nations University World Institute for Development Economics Research. Available at: http://t.rrojasdatabank.info/wp2010-106.pdf

North, D.C. (1993) "The new institutional economics and development." Working Paper no 9309002, St. Louis: Washington University. Available at: http://www2.econ.iastate.edu/tesfatsi/NewInstE.North.pdf

Pellegrin, J., Colnot, L., Prota, F., Ardizzoni, F., Delponte, L., Capriati, M., Olechnicka, A., and Smith, C. (2019) *How to tackle challenges in a future-oriented EU industrial strategy?* Study for the Committee on Industry, Research and Energy, Policy Department for Economic, Scientific and Quality of Life Policies. Luxembourg: European Parliament. Available at: http://www.europarl.europa.eu/supporting-analyses

Peres, W. and Primi, A. (2009) "Theory and Practice of Industrial Policy: Evidence from Latin American Experience." *CEPAL Desarrollo Productivo Serie,* no 187. Available at: https://www.cepal.org/en/publications/4582-theory-and-practice-industrial-policy-evidence-latin-american-experience

Pinho, C., Varum, C., and Antunes, M. (2015) "Structural Funds and European regional growth: Comparison of effects among different programming periods." *European Planning Studies*, 23(7): 1302-1326. DOI: 10.1080/09654313.2014.928674

Puigcerver-Peñalver, M. (2007) "The impact of structural funds policy on European regions' growth. A theoretical and empirical approach." *The European Journal of Comparative Economics,* 4(2): 179–208.

Radosevic, S. (2017) "Assessing EU smart specialisation policy in a comparative perspective." In Radosevic, S., Curaj, A., Gheorghiu, R., Andrescu, L., and Wade, I. (Eds.) *Advances in the Theory and Practice of Smart Specialisation.* London: Academic Press.

Radzyner, A., Tödtling-Schönhofer, H., Frangenheim, A., Mendez, C., Bachtler, J., Charles, D., and Granqvist, K. (2014) *An Assessment of Multilevel Governance in Cohesion Policy 2007-2013. Study for the Directorate-General for Internal Policies.* Brussels: European Parliament. Available at: https://www.europarl.europa.eu/RegData/etudes/etudes/join/2014/514004/IPOL-REGI_ET(2014)514004_EN.pdf

Regional Competitiveness Index 2010. European Commission. Accessed 4 September 2020. <https://ec.europa.eu/regional_policy/en/information/publications/working-papers/2011/a-new-regional-competitiveness-index-theory-methods-and-findings>

Regional Competitiveness Index 2013. European Commission. Accessed 4 September 2020. <https://ec.europa.eu/regional_policy/en/information/publications/studies/2013/eu-regional-competitiveness-index-rci-2013>

Regional Competitiveness Index 2016. European Commission. Accessed 4 September 2020. <https://ec.europa.eu/regional_policy/en/information/maps/regional_competitiveness/2016/>

Regional Competitiveness Index 2019. European Commission. Accessed 4 September 2020. <https://ec.europa.eu/regional_policy/en/information/maps/regional_competitiveness/>

Rodríguez-Pose, A. and Fratesi, U. (2004) "Between development and social policies: The impact of European Structural Funds in Objective 1 regions." *Regional Studies*, 38(1): 97–113. DOI: 10.1080/0034340031000163222 6

Rodríguez-Pose, A. and Novak, K. (2013). "Learning processes and economic returns in European Cohesion Policy." *Investigaciones Regionales*, 25:7–26. Available at: https://old.aecr.org/images//ImatgesArticles/2013/5/1_Rodriguez.pdf

Rodrik, D. (2004) "Industrial Policy for the Twenty-First Century." *CEPR*, Discussion Paper no 4767. DOI: 10.2139/ssrn.617544

Rodrik, D. and Aiginger, K. (2019) "Rebirth of Industrial Policy and an Agenda for the Twenty-First Century." *Journal of Industry, Competition and Trade,* 20:189–207. DOI: 10.1007/s10842-019-00322-3

Ruxton, G. D. (2006) "The unequal variance t-test is an underused alternative to Student's t-test and the Mann–Whitney U test." *Behavioral Ecology*, 17(4): 688–690. DOI: 10.1093/beheco/ark016

Schakel, A.H., Hooghe, L., and Marks, G. (2015) "Multilevel governance and the state." In Leibfried, S., Huber, E., Lange, M., Levy, J.D., and Stephens, J.D. (Eds.) *The Oxford Handbook of Transformations of the State.* Oxford: Oxford University Press.

Sharma, C.K. (2017) "A situational theory of pork-barrel politics: The shifting logic of discretionary allocations in India." *India Review*, 16(1): 14-41. DOI: 10.1080/14736489.2017.1279922.

Stern, N. R (2007) *The Economics of Climate Change: The Stern Review*. Cambridge: Cambridge University Press.

Szalai, J. (2014) "Roma Marginalization and Exclusion in a Comparative Perspective." In Szalai, J. and Zentai, V. (Eds.) *Faces and Causes of Roma Marginalization in Local Contexts: Hungary, Romania, Serbia.* Budapest: Center for Policy Studies, Central European University.

Percoco, M. (2005) "The impact of structural funds on the Italian Mezzogiorno, 1994–1999." *Région et Développement*, 21: 141–152. Available at: https://pdfs.semanticscholar.org/4b83/2cc663e7884366a8bb6aa556b08342dcf5eb.pdf

Soukiazis, E. and Antunes, M. (2006) "Two speed regional convergence in Portugal and the importance of structural funds on growth." *Ekonomia*, 9(2): 222–241.

Treaty establishing the European Community (Maastricht consolidated version) [1992] Official Journal C 224, 30/08/1992 P. 0049

Treaty establishing the European Community (Nice consolidated version) [2002] Official Journal C 325, 24/12/2002 P. 0033 – 0184

Trippl, M., Grillitsch, M., and Isaksen, A. (2018) "Exogenous sources of regional industrial change: Attraction and absorption of non-local knowledge for new path development." *Progress in Human Geography*, 42(5): 687–705. DOI: 10.1177/0309132517700982

United Nations Industrial Development Organization, 2017. *Industrial Development Report 2018. Demand for Manufacturing: Driving Inclusive and Sustainable Industrial Development. Overview*. Vienna: United Nations Headquarters. Available at: https://www.unido.org/sites/default/files/files/2017-11/IDR2018_OVERVIEW_ENGLISH.pdf

Weingast, B.R., Shepsle, K.A., and Johnsen, C. (1981) "The Political Economy of Benefits and Costs: A Neoclassical Approach to Distributive Politics." *Journal of Political Economy*, 89(4): 642-664. DOI: 10.1086/260997

Weiss, J. (2015) "Taxonomy of Industrial Policy." *UNIDO Working Paper Series*, no 8/2015. Vienna: United Nations Headquarters. Available at: https://www.unido.org/api/opentext/documents/download/9925558/unido-file-9925558

Weiss, J. (2020) "Taxonomy of Industrial Policy." (forthcoming).

APPENDICES

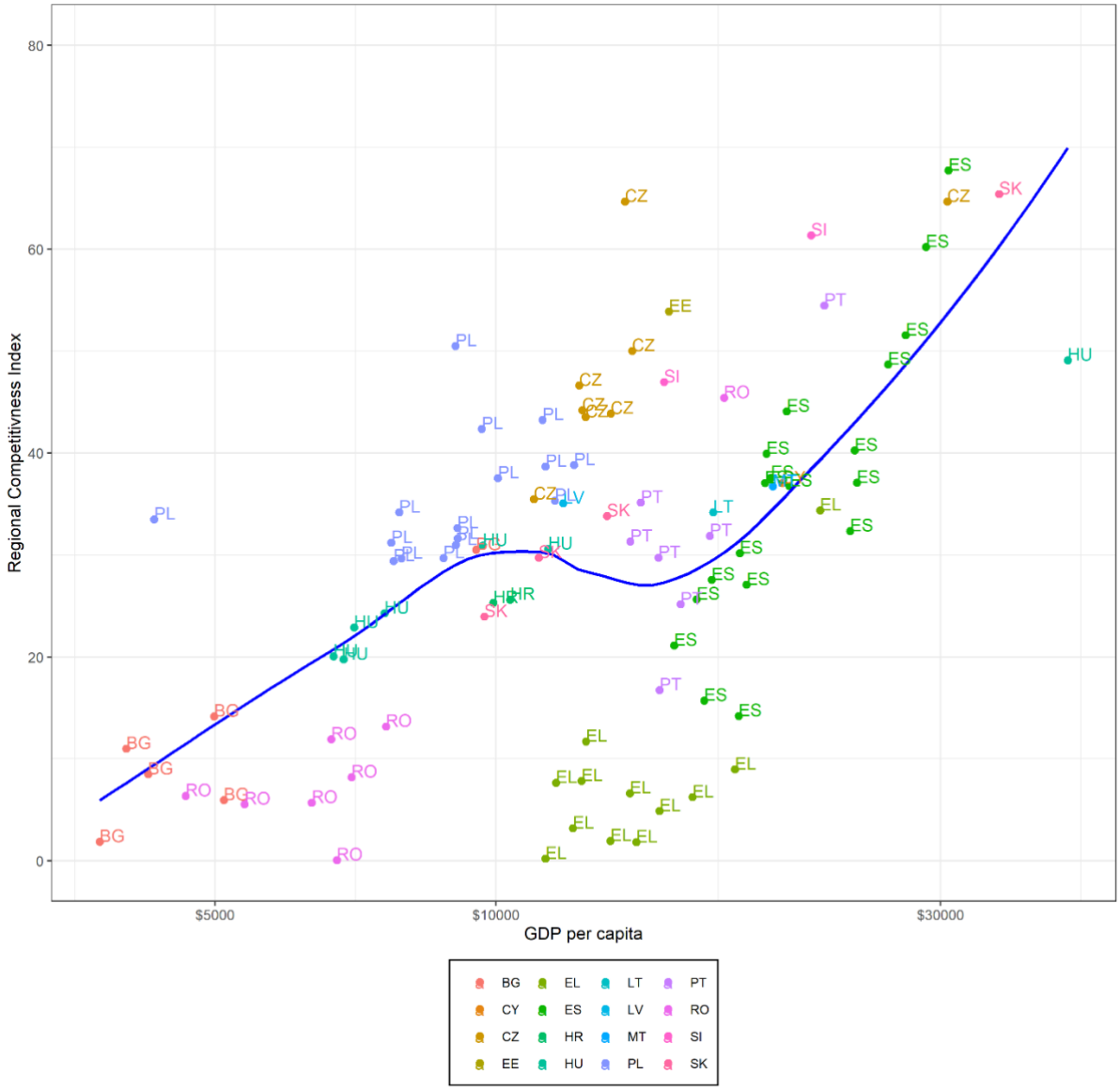
Appendix A – Regional Competitivenss scores 2010/19: lower-income Member States

code	year	RCI	Basic	Efficiency	Innovation	code	year	RCI	Basic	Efficiency	Innovation
BG	2010	19.69	14.33	42.67	7.50	LT	2010	40.37	23.83	64.15	28.04
	2019	21.01	20.10	45.44	11.64		2019	44.72	32.90	66.12	40.36
	diff.	1.32	5.77	2.78	4.14		*diff.*	4.35	8.90	2.12	12.36
	p	0.42	0.07	0.38	0.33		*p*				
CZ	2010	51.02	48.86	62.00	33.14	HU	2010	34.58	26.86	53.00	24.71
	2019	57.57	54.50	67.91	49.72		2019	35.68	23.38	55.65	30.66
	diff.	6.55	5.64	5.91	16.57		*diff.*	1.09	-3.48	2.65	5.95
	p	0.14	0.02*	0.14	0.03*		*p*	0.43	0.89	0.32	0.20
ET	2010	52.36	52.58	60.41	43.82	MT	2010	32.48	36.05	42.24	36.92
	2019	53.87	62.62	57.14	61.02		2019	45.94	64.07	44.02	38.48
	diff.	-1.51	9.62	-2.86	17.02		*diff.*	13.46	28.07	2.02	1.48
	p						*p*				
EL	2010	20.99	24.15	37.77	12.77	PL	2010	39.56	37.44	53.75	26.69
	2019	12.05	13.15	26.65	20.71		2019	38.72	28.23	59.80	26.87
	diff.	-8.95	11.00	-11.12	7.94		*diff.*	-0.85	-9.21	6.05	0.19
	p	0.97	1.00	0.99	0.03*		*p*	0.64	1.00	0.01*	0.48
ES	2010	42.16	48.42	51.89	33.32	PT	2010	32.96	37.57	45.86	19.43
	2019	38.32	53.65	41.14	41.56		2019	33.71	46.42	39.31	36.38
	diff.	-3.85	5.23	-10.76	8.25		*diff.*	0.76	8.85	-6.55	16.95
	p	0.77	0.01*	0.96	0.02*		*p*	0.47	0.08	0.76	0.02*
IT	2010	44.69	43.48	55.95	36.57	RO	2010	20.07	4.38	48.63	12.50
	2019	39.96	40.68	50.07	38.91		2019	18.51	4.58	43.70	10.79
	diff.	-4.72	-2.79	5.88	2.34		*diff.*	-1.56	0.20	-4.93	-1.71
	p	0.90	0.96	0.91	0.23		*p*	0.59	0.47	0.76	0.60
CY	2010	48.34	41.00	65.00	31.00	SI	2010	62.46	55.00	74.00	45.50
	2019	48.93	49.48	56.96	7.16		2019	61.32	58.65	69.18	49.61
	diff.	-0.59	8.48	-8.04	-23.84		*diff.*	-1.15	3.65	-4.82	4.11
	p						*p*	0.55	0.19	0.72	0.35
LV	2010	34.97	22.70	56.43	30.63	SK	2010	45.59	41.00	57.00	38.50
	2019	38.69	39.46	49.25	97.21		2019	48.64	43.15	62.11	40.78
	diff.	3.72	16.46	-6.75	66.21		*diff.*	3.05	2.15	5.11	2.28
	p						*p*	0.41	0.35	0.35	0.43

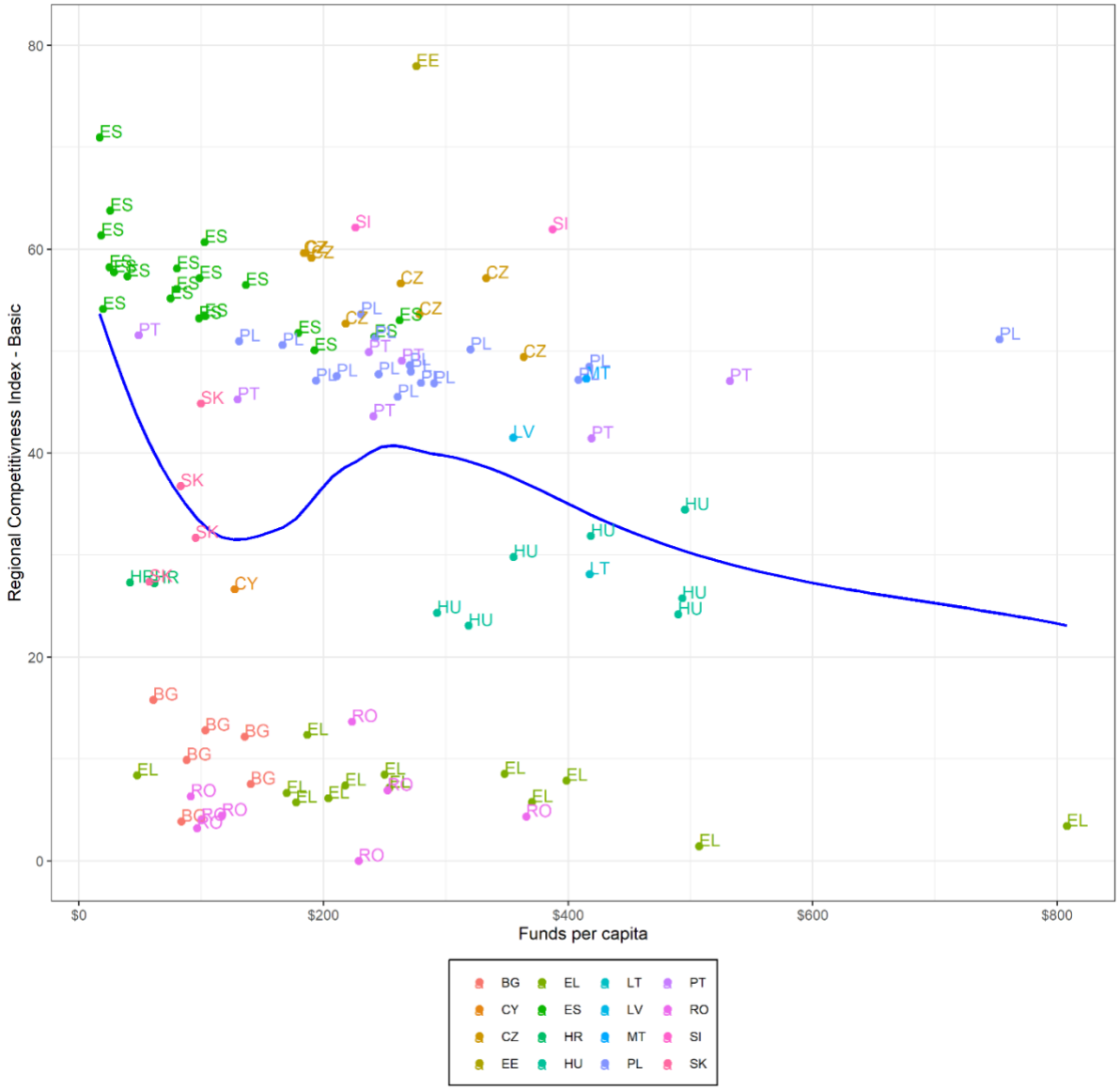
There is no *p* -value for 1 observation countries (ET, CY, LV, LT, and MT).
Significance at the 95% level indicated by *

Source: own calculations

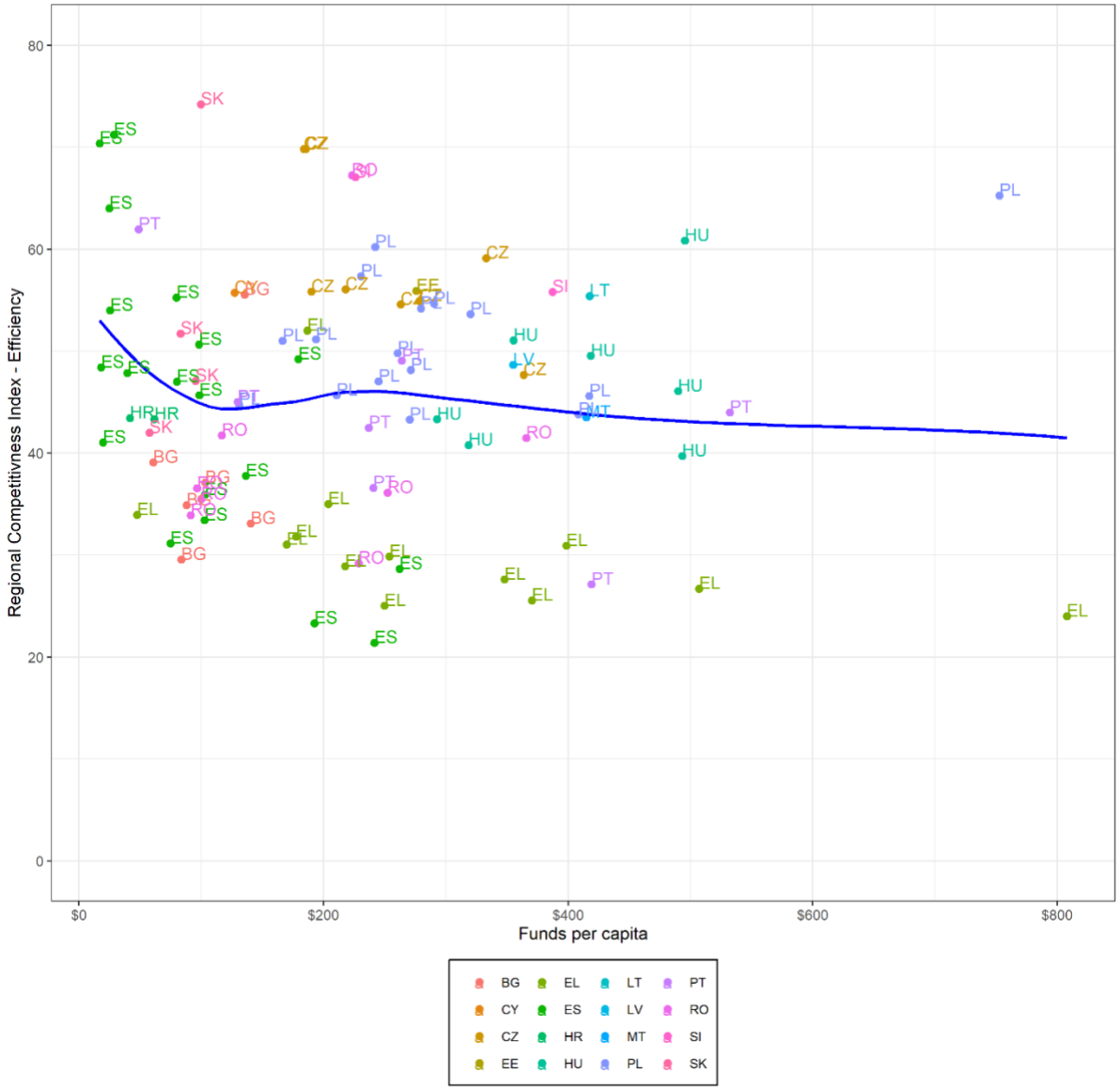
Appendix B – Regional Competitiveness Index and GDP per capita



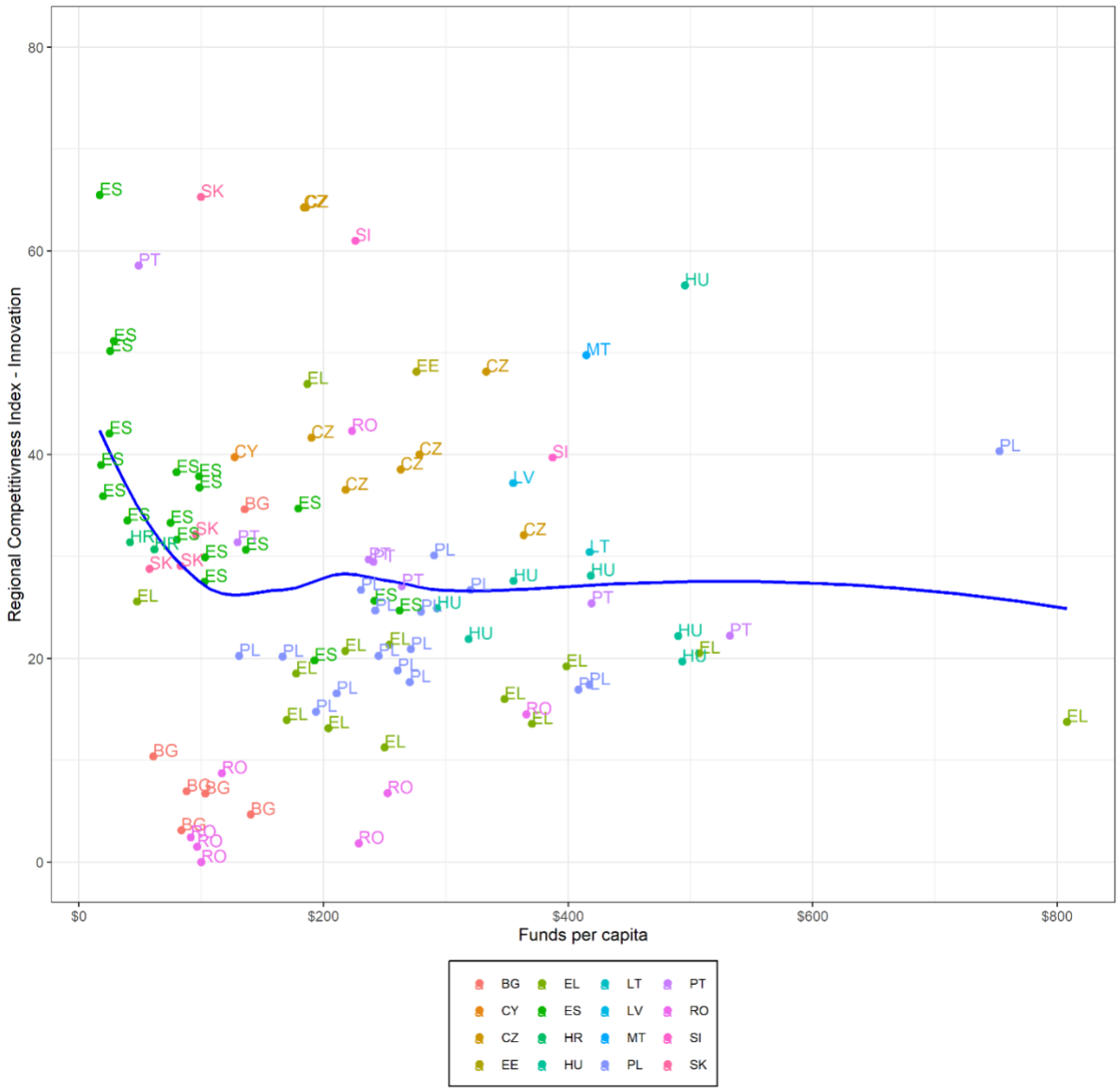
Appendix C – Regional Competitiveness Index: Basic and funds per capita



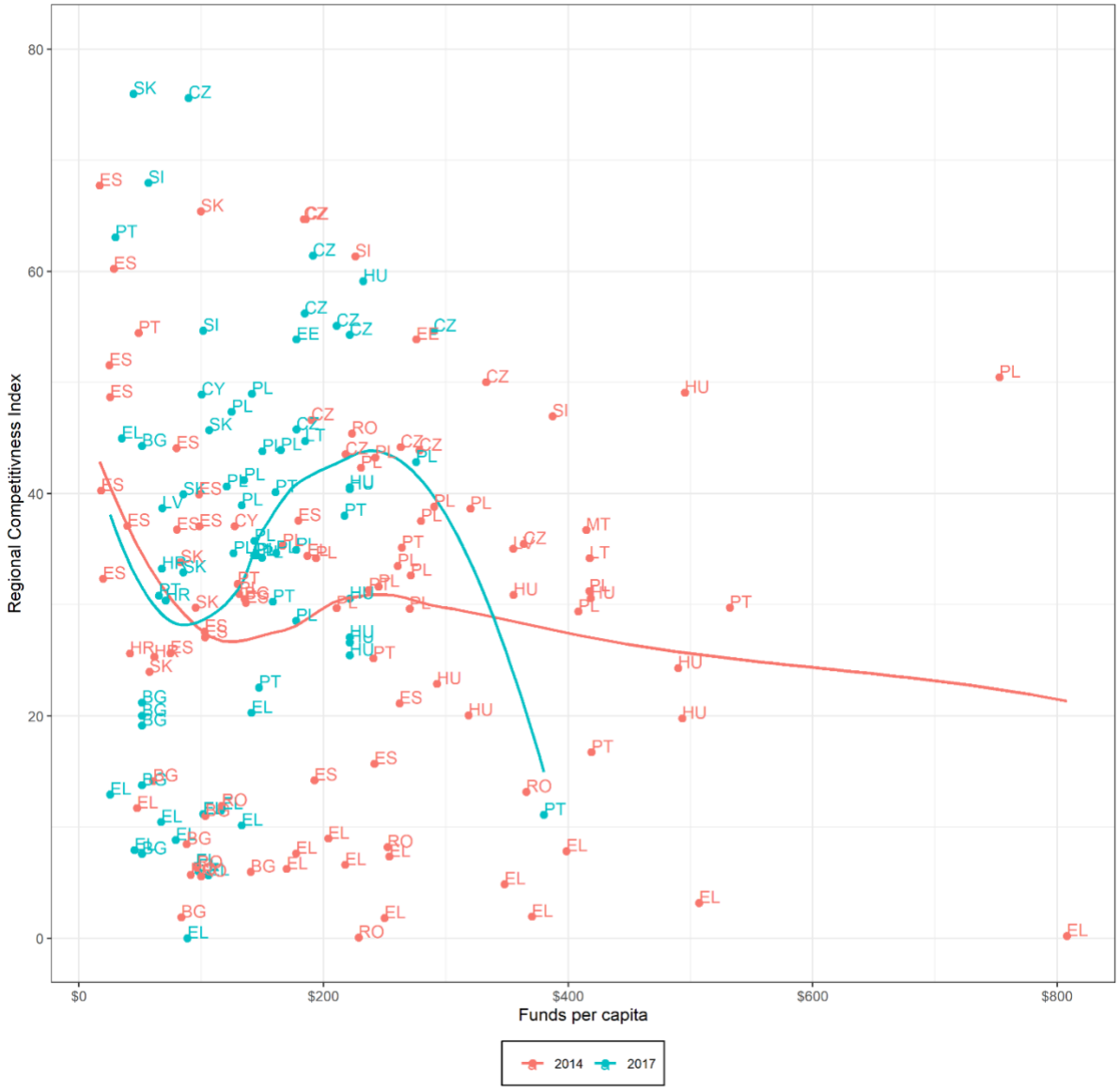
Appendix D – Regional Competitiveness Index: Efficiency and funds per capita



Appendix D – Regional Competitiveness Index: Innovation and funds per capita



Appendix E – Regional Competitiveness Index 2016/19



Appendix G – Declaration of Authorship

I, the undersigned ....Michelle Magvasi..... hereby declare that I am the sole author of this thesis report. To the best of my knowledge this thesis contains no material previously published by any other person except where due acknowledgement has been made. This thesis report contains no material which has been accepted as part of the requirements of any other academic degree or non-degree program, in English or in any other language. This is a true copy of the thesis report, including final revisions.

Date: 07/09/2020

Name (printed letters): MICHELLE MAGVASI

Signature: ...MagSi.....