SCHOOL OF
ECONOMICS AND
MANAGEMENT

Bachelor/ Master's Programme in Innovation and Global Sustainable Development

The impact of democratic transitions on innovation.

An empirical panel analysis of 168 countries from 1960-2019.

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Abstract

This thesis empirically examines the impact of democratic transitions on innovation using a difference-in-differences method on a panel of 168 countries from 1960 to 2019. Patents, R&D expenditure, and scientific articles are employed as proxies for innovation. The results indicate that democratisations have a positive effect on patents. This association is significant for permanent democratisations and robust to various robustness checks. There is however no association reliably measurable for R&D expenditures and scientific articles on a global level. Furthermore, the findings suggest that the effect of transitions is more pronounced when a democratisation is sustained or permanent and that the impact on innovation varies among world regions. Europe, sub-Saharan Africa, and Latin America and the Caribbean broadly resemble the global pattern, whereas democratisations in MENA and East- and South-East Asia exhibit a different one. Lastly, it is found that the higher the achieved level of democracy after democratisation, the greater the countries' patent counts and R&D expenditures. Supportive international efforts should be increased to ensure that democratic transitions are sustained and that a higher level of democracy is reached.

Keywords: innovation | democratic transitions | political regimes | institutions | development

Programme Code EKHS34
First Year Independent Research (15 credits ECTS)
27 May 2022
Supervisor: Sara Torregrosa Hetland
Examiner: Olof Ejermo
Word Count: 17,027

Acknowledgements

The present research thesis benefitted substantially from comments and suggestions by various people. First and foremost, I would like to thank my supervisor Sara Torregrosa Hetland for her supportive advice and the very valuable feedback along the way. Similarly, I would like to pay tribute to Isabel and David for their helpful comments. I owe further credits to Riccarda for her methodological advice and to Lotta for her very helpful natural science perspectives on this interdisciplinary work in the social sciences. Interdisciplinary and social sciences are also the keywords to thank all the great professors and teachers from diverse fields and different universities (WU Vienna, University of Vienna, Nanyang Technological University, Lund University) I had the opportunity to learn from with regards to the examined topic(s) of this thesis. On this occasion I would also like to thank my parents for their excellent support throughout the studies. Lastly, thanks to my study colleagues (and friends), e.g. Philip, Arnaldo, Elliot, and Anouk, with whom writing this thesis was fun at times too.

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Abbreviations

FDI	Foreign Direct Investment
GDP	Gross Domestic Product
IP	Intellectual Property
MENA	Middle East and North Africa
NIE	New Institutional Economics
NIS	National Innovation System
R&D	Research and Development
RoW	Regimes of the World
V-Dem	Varieties of Democracy
WDI	World Development Indicators

1 Introduction

Humanity is currently facing a number of grand challenges, most prominently climate change but also biodiversity loss, global and national inequality, poverty, or the allocation of food and water. In general, research as well as policymakers attribute innovations an important role regarding sustainable development and in finding solutions for these grand challenges (Chaminade, 2020). Innovations are at least partially able to foster necessary changes and improve the livelihood of the population. According to Schumpeter (1947), organizations, firms, and entrepreneurs respond to changes and external pressures by adaptation or by creatively coming up with new ideas, i.e. by inventing and innovating. Following Bozeman and Link (1983, 4) an "invention is the creation of something new" and "[…] becomes an innovation when it is put in use". Innovations can thus be seen as new creations or improvements of products, processes, or knowledge. It should be considered though that innovations not necessarily lead to more social or ecological sustainability. They have to be the right ones and need to be pointed in a particular direction (Chaminade, 2020; Fagerberg, 2018; Vollenbroek, 2002). Innovations have however a crucial role regarding economic development and growth. Romer (1986), for example, regards the endogenous accumulation of knowledge in his growth model as the primary driver of long-run growth as more knowledge triggers innovations, initiating ultimately a rise in productivity. Similarly, for Kuznets (1973) innovation is the permissive source of growth but needs to be accompanied by institutional and ideological adjustments. Historically, general purpose technologies and industries affected by associated spillover effects often contributed extensively to economic growth for a particular period of time (Dosi & Nelson, 2010). Summarizing this short discussion, innovations often, though not necessarily, lead to economic development and can contribute to finding solutions for humanity's grand challenges.

Institutions, political conditions, and governmental policies have considerable effects on innovations. Institutions refer to constraints structuring human interactions and consisting of informal (e.g. taboos and traditions) and formal (e.g. laws and constitutions) rules (North, 1991). Institutionalists usually consider two different sets of institutions: economic and political institutions. While economic institutions, such as property rights or business customs, etc., are only indirectly affected by the political regime of a country, the type and character of the political regime of a particular country or region forms an important part of political institutions (Williamson, 2000). Another example is the concept of national innovation systems (NIS), which attributes a major role to institutions (Freeman, 2004; Lundvall, 1992; Lundvall et al., 2009).

Building on this, the role of political institutions for innovations should not be underestimated. But which regime type provides the better conditions to nurture innovations? This question is part of one of the most fundamental and heavily disputed issues of human coexistence surrounding the notions of democracy, autocracy, and the ideal type of government. Already Plato and Aristotle denounced democracy as disadvantageous for the common good. For

Aristotle democracy was together with tyranny and oligarchy a perverted form of the good regime types of royalty, aristocracy and constitutional government (Aristotle, Jowett & Davis, 2000). However, this view remained far from uncontested over the centuries. For example, the philosopher Karl Popper defended the qualities of liberal democracies as demarcating from illiberal autocratic regimes (Popper, 2020). Moreover, a large stream of academic literature in the new institutional economics (NIE) points to the pivotal role of a democratic political system and its particular properties for the success of a country (e.g., Acemoglu, Johnson & Robinson, 2004; Bardhan, 2005; North, Wallis & Weingast, 2006; Shirley, 2005), usually measured in economic growth and the gross domestic product (GDP) per capita.

After a wave of democratisations in the decades following WW2, many countries have experienced a shift towards authoritarian regime types in the years preceding 2022 (Alizada et al., 2021; The Economist, 2021). The average level of democracy for global citizens decreased to a comparable degree than right before the end of the Cold War in 1989 (Boese et al., 2022). In the interim, while many countries were still recovering from the 2008 financial crisis, the Covid-19 pandemic has been challenging societies and economies on a large scale since 2020. This raises inevitably a number of important questions. For instance, one starts to wonder which type of political regimes would be better equipped to address and find solutions for the grand challenges and the deep social, ecological, and economic crises.

1.1 Research Problem

A potential association between the nature of political regimes and innovation has been discussed by many scholars on a theoretical level (e.g., Acemoglu et al., 2019; Lundvall & Borrás, 2005; Nelson, 1993; Ober, 2008; Popper, 2005, 2020). However, on an empirical level the number of analyses examining this relationship is surprisingly small and provides opposing evidence. While Gao et al. (2017) could not establish an association between democratisations and innovation, others demonstrated that there could indeed be a positive influence of democratic transitions on innovation (Nazarov & Obydenkova, 2020; Wang et al., 2021). Additionally, previous research on this association has not sufficiently paid close attention to potential spatial disparities and other historical factors that may influence the effect.

It is important to know whether democratisations lead to an increased number of innovations or whether more authoritarian regimes have an advantage regarding this aspect for at least three main reasons. First, to deduce for policymakers and international organizations how economic and social development might be better reachable for developing countries. There is an ongoing debate in development economics whether financial and other support by international development organisations or foreign countries should be tied to improvements in the democratic institutional structure of the benefitting countries. Second, in light of the grand challenges such as climate change it is essential to understand which institutional setting should theoretically allow countries to better react by innovating more. Third, to contribute with a novel approach to the academic debate, which generally assumes a positive relationship between democratisation and innovation but lacks in providing sufficient empirical evidence as briefly illustrated above.

1.2 Aim and Scope

Which lectures is history providing for us? The research objective of this thesis is fourfold. First, to empirically analyse the impact of democratisations on innovation. Second, to investigate whether this potential association between democratic transitions and innovation is homogeneous worldwide or whether there exist spatial disparities. Third, to gain an understanding about potential differences of the effect on innovation along simple democratic transitions and transitions that are sustained for a longer period. Fourth, to examine whether different innovation indicators are affected by democratisation to a differing degree.

1.2.1 Research Questions

The main research question of this thesis is the following:

What is the impact of democratisations on innovation?

From this question and the research objectives a number of sub-questions is derived: Are there differences of the influence among the different indicators of innovation? Is there a different impact of democratisations regarding the underlying measure of democratic transitions? Are other economic and social factors significantly influencing the outcome? And, lastly, are the findings geographically equally distributed or do spatial disparities exist?

1.2.2 Data and Methods

In order to assess the impact of democratisation on innovation, I conducted regression analyses on a panel of 168 countries from 1960 to 2019. It is to note that the number of countries and the analysed period varied however for different models according to data availability. Indicators for innovation included the R&D to GDP/population ratio, patent applications per capita and the number of scientific publications per head. Looking at three different indicators instead of focussing on one, I was thus able to catch a more encompassing picture of innovation than previous studies on the democracy-innovation association, which overarchingly examined patents. The data for political regimes was derived from the Varieties of Democracy (V-Dem) database (Coppedge et al., 2022). Using V-Dem's Regimes of the World classification (Coppedge et al., 2022c; Lührmann, Tannenberg & Lindberg, 2018), I constructed three different binary measures of democratisation: democratisation (transition from an autocracy to a democracy), sustained democratisation (not reversed for at least 5 years), and successful democratisation (sustained democratisation that was not reversed until 2019).

Concerning the econometrical strategy, I applied the difference-in-differences method to investigate a potential association between democratic transitions and innovation. Democratising countries were included in the model as the treatment group and the control group consisted of non-democratising countries. The model controls for country as well as year fixed effects and a set of control variables was included. In addition to estimations on a global

level, I examined a potentially varying effect on a regional level and considered important historical developments such as the abolishment of communism or the dissolution of the colonial empires. Robustness checks and a sensitivity analysis demonstrated the appropriateness of the used models and specifications and provided further insights into the association between democratic transitions and innovation.

The results of the conducted difference-in-differences estimations suggest a number of important findings and contributions. First, all three measures of democratisation seem to have a positive effect on patent counts and this association is significant for successful democratisations. Second, democratic transitions do not appear to have a measurable impact on scientific articles and R&D expenditures. Third, world regions matter; specifically, there exists a difference between Europe, sub-Saharan Africa, and Latin America and the Caribbean on the one hand, and MENA and East- and South-East Asia on the other. While the former group of countries resembles broadly the global pattern, the latter shows a sometimes-negative effect of democratic transitions on patents (whereas transitions have a significantly positive impact on scientific articles in MENA and a significantly positive impact on R&D in East- and South-East Asia). Fourth, the impact of democratic transitions on innovation is generally more pronounced for successful democratisations. And, using a higher benchmark for democratisations, the results suggest that countries that were an autocracy in 1960 but subsequently underwent successful democratic transition to a liberal democracy patent considerably more and have significantly higher R&D expenditures than in the absence of such a treatment.

1.3 Outline of the Thesis

The outline of this thesis is as follows. In the theory section I will first provide an overview and discuss the three streams of research that form the main pillars of this examination: economics of innovation, (new) institutional economics, and political science with regards to theory on political regimes and democratic transitions. This will be followed by an extensive review of previous literature, including an overview of how democracy as a political regime type could exhibit an influence on innovation, a discussion of the empirical studies on democratisation and innovation as well as on the somewhat related association between democratic transitions and economic growth. The data section introduces and reviews the data collection process and the used sources for the analysed variables and provides summary statistics. The fourth section explains the detailed methodological approach and presents and discusses the econometrical strategy. This will finally be followed by the empirical results for all estimations globally, on a regional level, considering historical developments, as well as for the robustness checks and the sensitivity analysis. The findings are then extensively discussed in relation to previous literature and the theoretical pillars of this thesis. Towards the end of the discussion, I elaborate on the most important limitations of the used approach and point out avenues for future research. The thesis concludes with a concise summary of the examination and a brief discussion of some policy implications.

2 Theory

In the following theory section, I will in the first part provide an overview about crucial theoretical concepts for the examined topic, including the vast and productive arrays of institutional economics' literature and economics of innovation. I will additionally briefly discuss some important pillars of political science with regards to political regimes and democratisations. In the second part I will summarize and extensively discuss previous research on democracy as well as democratic transitions and innovation as well as on the somewhat related association between democratisation and economic growth.

2.1 Theoretical Approach

The theoretical approach and the general underlying theoretical pillars of the examination build mainly on two important streams of research in economics, institutional economics and innovation economics, as well as on some concepts derived from political science scholars regarding political regimes, democracies, and autocracies. In the following some major scientific insights of these three different areas will be discussed in relation to the assumed relationship between democracy and innovation.

2.1.1 Economics of Innovation

Contrary to assumption of neoclassical economics, the scientific stream of economics of innovation emphasizes the endogeneity of innovative processes. Innovation can from this perspective be considered as "a complex, path-dependent process characterized by the interdependence and interaction of a variety of heterogeneous agents, able to learn and react creatively with subjective and procedural rationality" (Antonelli, 2009, 611). A key aspect for a particular innovation to gain significance is that it spreads and is adopted by a considerable number of individuals, firms, or organizations. Diffusion, however, is a rather time-consuming process, often following asymmetric S-shaped patterns, and many innovations fail regarding this aspect and vanish (Dosi & Nelson, 2010; Hall, 2006). Moreover, improvements in the innovation over time are often economically more significant than the availability of the product or idea in its initial form (Kline & Rosenberg, 1986). Additional general insights include that there are considerable differences in innovation across different sectors of the economy (Malerba, 2006) and on a spatial level not least because innovative activities tend to cluster (Asheim & Gertler, 2006).

Drivers and influencing factors of innovations in general have been studied extensively by innovation economics scholars. Demand, appropriability and technological opportunity

conditions can explain differences in innovative activities on the firm level quite well (Cohen, 2010). According to Taalbi (2017) an economic boom or new markets constitute positive driving forces on the macro level, whereas economic crises and regulations are considered to be negative ones. While for regulations the impact of political regimes on innovations is a rather obvious one, the effects on other levels are less direct and manyfold. A crucial aspect of regulations constitutes intellectual property (IP) legislature, with patent laws having f. ex. a significant effect on the direction and diversity of innovations (Moser, 2005), whereas it is more controversial whether they really increase the number of inventions (Granstrand, 2006; Moser, 2013). An example is that strong patent laws can make it more difficult for subsequent potential innovators to develop a patented technology further (Scotchmer, 1991). Patent laws have a long history, but they became only from the 19th century in Western countries onwards and worldwide from the late 20th century onwards a central feature of debates (Granstrand, 2006). There is no general consensus on the evaluation of patents as a positive driving force for innovative activities as they and the international patent system in general might hold developing countries back (Granstrand, 2006). Other forms of regulations pose important influencing factors and drivers for innovations too. For instance, higher environmental standards or legally specified dimensions have historically led to a variety of novel innovations (Rosenberg, 1969).

Academic research on the economics of innovation additionally provides insights why state agency is needed for the innovation process, even in near-perfect market economies. Crucial aspects are to correct for market failures in liberal market economies and to generally provide incentives and the infrastructure for innovative activities. For example, due to a potential lack of rewards for innovations on the market, the patent system can provide the incentives for firms, organizations, or individuals to invest in innovative endeavours (Jones, 2002). Apart from patents, the development of the internet and of nanotechnology can be seen as two innovations where the US government corrected for market failures by decisively funding R&D activities to a considerable extent (Link & Siegel, 2007). The latter example further demonstrates that state agency has the power to push innovations in a promising area, which might otherwise be left untapped due to high initial costs and missing incentives. Furthermore, governments act as entrepreneurs by providing the technological infrastructure environment for innovations, referring to f. ex. methods and data for R&D activities or by providing research parks and research centres at universities (Link & Siegel, 2007).

However, policymakers also address and influence innovative activities explicitly via innovation policies. The objectives and design of innovation policies are the outcome of a complex political process, involving a variety of different stakeholders and decision-makers (Borrás & Edquist, 2013). Edler and Fagerberg (2017) distinguish between three main types: mission-oriented, invention-oriented, and system-oriented innovation policies. Mission-oriented innovation policies aim in bringing about innovative solutions for concrete problems and take a holistic standpoint, also including diffusion related aspects; invention-oriented policies focus only on R&D and the invention process while not being concerned with the later diffusion of the innovation; and finally system-oriented approaches aim in creating and improving an innovative system such as a NIS (Edler & Fagerberg, 2017). While the immediate effects of a specific innovation policy are measurable and are usually in line with expectations, it is much more difficult to assess further spillover effects (Edler, 2016).

And, as already mentioned briefly in the introduction, the academic theory on NIS attributes a major role to political institutions (Freeman, 2004; Lundvall, 1992; Lundvall et al., 2009). The NIS is defined by Lundvall et al. (2009, 6) as a complex system consisting of associations "within and between organizations, institutions and socio-economic structures which determine the rate and direction of innovation and competence-building emanating from processes of science-based and experience-based learning". This definition implies that the political regime of a country with its actors, norms, rules, and traditions can have a significant effect on the other parts and processes of the innovation system. It can be f. ex. argued that the Nordic countries, notwithstanding their small size, are among the world's innovation leaders due to their high level of trust stemming from their democratic systems, egalitarian approaches, social policy, and rule of law (Lundvall et al., 2009).

Additionally, a country's social policies indirectly affect conditions for innovations even further. Education and healthcare might be great examples as their scope, quality, and inclusiveness tends to vary extensively between countries, also with regards to hierarchical structures and socioeconomic status within states. There is, for example, a positive relationship between human capital and innovation (Dakhli & De Clercq, 2004; Galor & Moav, 2002; Glaeser et al., 2004; Toivanen & Väänänen, 2016) as well as between social freedom and innovation (Lehmann & Seitz, 2017).

2.1.2 Institutional Economics

Institutional economics offers insights into various aspects of the relationship between institutions and the economy, culture, and society over time and space. NIE considers the bounded rationality of human actors with a capacity for conscious foresight and highlights that contracts are incomplete (Williamson, 2000). At the same time, as there is a lack of clear definitions what institutions are, different people have a different conception of institutions in mind when they write about them or measure them (see f. ex. Woodruff, 2006). Here we shall use a broad conception of institutions, not restricted to economic institutions such as property rights or the enforcement of business contracts, but rather include political institutions as well and understand democracy and the political regime of a country as an institution. As it will be briefly discussed in the following, the stream of research on institutions is particularly helpful in theoretically justifying why democracy and democratisation processes matter for the development of economic processes such as innovations, growth, or inequality.

Many scholars of NIE examined which institutional factors can explain differences among countries regionally and worldwide. While some of the results and theories vary, a common feature is that for sustained economic development institutions fostering exchange are needed (e.g. contracts, commercial norms, business values, etc.) as well as institutions influencing the state to protect property rights and individuals (e.g. constitutions, electoral rules, etc.) (Shirley, 2005). Furthermore, state antiquity, i.e. the tradition of a reasonably strong central state, is a powerful explanatory variable for the wealth of different nations (Bardhan, 2005; Diamond, 2012). A somewhat general consensus of NIE is that most people worldwide live in countries with weak institutions (e.g., North, Wallis & Weingast, 2006; Shirley, 2005).

In their seminal work, Acemoglu, Johnson & Robinson (2004) demonstrate theoretically that the economic growth-evoking institutions, most prominently property rights and a relatively equal access to economic resources, only come into place and are properly enforced in case the right political institutions have been installed beforehand. These good political institutions include checks and balances of political power of a political entity as well as a broad access to this political power for a considerably large group of people with investment opportunities (Acemoglu, Johnson & Robinson, 2004). Evidently, and as outlined in the next section, there exists a clear association between these two main good political institutions and a democratic regime type. It is however less apparent why autocratic regime types would not also be able to sufficiently empower a large group with investment opportunities. Additionally, as Bardhan (2005) points out, human development is associated with democratic institutions and property rights, but there is not necessarily a strong connection between democracy and the protection of property. While their theory has been further criticized for ignoring the influence of cultural factors (McCloskey, 2015), geographical and climatic conditions (Sachs, 2003, 2012) as well as state antiquity (Diamond, 2012), it offers great explanations in which way the inclusiveness or closedness of a political system affects economic structures and outcomes. For example, various commitment problems and the fear for a potential loss of political power in the future often prevent power holders from opening up institutions, even though everyone, including themselves, would be better off economically when doing so (Acemoglu, Johnson & Robinson, 2004).

Similarly North, Wallis & Weingast (2006) argue that sustained economic and political development is only possible if a country develops an open access social order, i.e. if the political and economic system is characterized by competition. The open access order differs from the limited access order, which would be the predominant system in most countries worldwide, by open access to organizations as the order's defining feature (North, Wallis & Weingast, 2006). Ogilvie (2007) points out that the negative implications of a restricted access to institutions (or organisations in this case) include f. ex. that it provides strong incentives for non-elite actors to engage in the informal sector.

Further important insights of institutional economics for the subject of this thesis include theories about change. The institutional framework is usually rather stable in the absence of drastic events such as a revolution (Shirley, 2005). Formal rules such as constitutions and other defining features of political regimes are products of evolutionary processes and only rare windows of opportunities exist when the system can be altered (Williamson, 2000). Hence, we can deduce that the political regime of a country is a stable entity, which is only slowly changing over time, and which is subject to long-run historical processes. I will partially come back to this important issue for the discussion of endogeneity of democratic transitions in the method section.

2.1.3 Political Science Perspectives

As the prerogative of interpretation of democracy has always been a matter of dispute among scholars and governments alike, it is highly necessary to clearly define what the term comprises, and what is not included in concept. The need for such considerations is amplified by the many different types of political regimes regularly claiming to be a democracy. For instance, political

representatives of Russia and China recently characterized their countries as democracies (see f. ex. Elving, 2022), whereas they are considered by V-Dem as autocracies (Boese et al., 2022). There are many different possibilities to approach the notion. While the term politics usually refers to the processes of political decision making and policy to their content, polity describes the specific structures in which these decisions are made. The regime type is determined by a country's politics, policy as well as by its polity. A regime type is a certain characteristics of patterns with regards to the access to public offices, the personal characteristics of actors involved and their used strategies as well as regarding the rules followed in the political decision-making processes (Schmitter & Karl, 1991). Following the definition by Schmitter & Karl (1991, 76), a modern democracy is "a system of governance in which rulers are held accountable for their actions in the public realm by citizens, acting indirectly through the competition and cooperation of their elected representatives." This definition includes more aspects than the often cited one by Schumpeter (1994, 269) that democracy is the "institutional arrangement for arriving at political decisions in which individuals acquire the power to decide by means of a competitive struggle for the people's vote." From both definitions it can be deduced that competition in the form of elections as well as the political power granted to the winners of elections are the defining features of a democratic system. These two characteristics alone are however not sufficient.

Dahl (1983, 10-11) states seven conditions that need to be fulfilled to call a political regime a modern democracy, which is termed by him a polyarchy:

> *"1. Control over government decisions about policy is constitutionally vested in elected officials. 2. Elected officials are chosen in frequent and fairly conducted elections in which coercion is comparatively uncommon. 3. Practically all adults have the right to vote in the election of officials" and 4. "to run for elective offices in the government, though age limits may be higher for holding office than for the suffrage. 5. Citizens have a right to express themselves without the danger of severe punishment on political matters broadly defined [...]. 6. Citizens have a right to seek out alternative sources of information", which "exist and are protected by law. 7. […] citizens also have the right to form relatively independent associations or organizations […]."*

These seven conditions are roughly captured by V-Dem's democracy indices and especially by the electoral democracy index as discussed below in the data section (Coppedge et al., 2022b). Evidently there are differences between democratic or polyarchic countries regarding the degree to which these conditions are satisfied. It is thus important to keep in mind that there exist many different sets of democracy, for example due to differences in socioeconomic conditions as well as variations in state structures and policy practices (Schmitter & Karl, 1991). Furthermore, there may be considerable gaps between a country's de jure and de facto political regime, which is usually taken into account by democracy indices such as V-Dem. For instance, the Russian constitution and legal institutions may resemble those of countries with a democratic regime, whereas the de facto political processes, election procedures, the difficulties for opposition parties and media, etc. lead to the classification of Russia's political regime as an autocratic one by V-Dem (Boese et al., 2022).

Political science further offers insights into factors needed that a democratic transition is consolidated and not being reversed or resulting in a prolonged unstable situation. According to Przeworski (2006) democracy works when there are conflicts about interests and values, elections provide the authorization to rule and designate winners and loser, and when a system

of constitutive and non-constitutive rules is enforcing the democratic system. Furthermore, in countries with higher per capita income it is more likely that democracy endures and is stable (Przeworski, 2006). However, as Schmitter & Karl (1991) point out, the transition period from an autocratic regime to a democratic one is rather often characterized by political and economic instability, and improvements in economic and socioeconomic conditions may thus not be expectable in the short term.

2.2 Previous Research

Academic research has already paid close attention to an assumed relationship between larger institutional developments, such as democratisations, and social as well as economic indicators. This allows for deducing some generalizations and hypotheses as shown in the following section. However, the empirical literature remains largely ambiguous with differing results. Additionally, the number of quantitative studies specifically examining the effect of democratisations on innovation indicators is limited compared to studies on economic growth.

2.2.1 Democracy and innovation

The philosopher Karl Popper claimed that a liberal democracy would favour innovations as democratic countries would have a better developmental policy and encourage individual freedom and property protection more (Gao et al., 2017; Popper, 2005, 2020). A number of qualitative historical studies argued, similarly, that there exists a positive connection between the liberal policies of democracies and the production of innovations and knowledge (Lundvall & Borrás, 2005; Nelson, 1993; Ober, 2008). Additionally, democracy and political pluralism are regarded as a supporting and encouraging factor for innovations and innovation systems as political pluralism and democratic debate stimulate creativity and the production of knowledge (Campbell et al., 2015; Carayannis & Campbell, 2014). Furthermore, Campbell (2018) outlined a positive connection of the quality of democracy with knowledge economies and knowledge innovations.

On a more detailed level, there are various reasons for the possible positive impact of democracy on innovations. Democracies put, for example, considerable emphasis on learning processes due to encouraging a free and open debate with trial and error as an important mechanism (Halperin, Siegle & Weinstein, 2009). Additionally, polyarchic organizations such as democracies are more likely to accept new projects and ideas than more hierarchical organizations (Sah & Stiglitz, 1984). Another supportive argument is that the emphasis on societal diversity, which is an important part of a functioning democracy, would lead to better collective choices (Page, 2008). A democracy's commitment to emphasize the inclusion of all citizens should theoretically provide a larger pool of talented people in the population with the opportunity to innovate. And the probability of democratising countries to undertake market reforms and facilitate the entry of new firms on the market is higher than for non-democratic ones (Islam, 2018). This argument is however an ambiguous one as democracy shall not be equated with capitalism, though some cases in the theory section demonstrate exactly this

common misconception. History provides us with plenty of examples of democracies that were capitalist economies but also more than a few exceptions of democracies that clearly emphasized a non-capitalist system (e.g. India in the first decades after independence) as well as of capitalist systems in autocratic countries (e.g. contemporary China and Singapore). Rode & Gwartney (2012) found, nevertheless, empirical evidence that democratisations are associated with a subsequent rise in economic liberalization. Furthermore, democracies themselves tend to exhibit system-inherently a strong commitment to innovation in order to keep their promises to citizens and to secure the survival of the system (Helms, 2016; Saward, 2003). Contrary to authoritarian regimes democracies "have the capacity to modify their rules and institutions consensually in response to changing circumstances" (Schmitter & Karl, 1991, 87).

An argument in favour of the effectiveness of authoritarian governments may be that democracy would often reduce political stability and as dictatorships respond less to demands for immediate consumption, which presumably triggers a reduction in investments (Huntington, 2006). As discussed in the theory section, this reduction in political stability can be observed in early phases of democratisations but does not necessarily hold for later years in case of a successful transition to democracy. Additionally, one would initially expect democratic countries to be net-receivers of global migration flows. The study of Breunig, Cao & Luedtke (2012) however demonstrates that their tendency for restricting immigration whilst allowing emigration leads to a situation in which autocratic countries (that tend to prevent their citizens to leave the country) receive more (potentially skilled) immigrants than democratic ones.

While there is, besides these small number of counterarguments, plenty of reason to assume that democracy promotes innovations and the production of knowledge and ideas, the hypothesis, however, has not been verified yet by a sufficient number of empirical studies and became only in recent years a matter of investigation. Using a difference-in-difference method, Gao et al. (2017) found that democracy would not have a direct positive effect on innovation by utilizing patent counts, patent citations, and patent originality as indicators. They examined 156 countries during the period between 1964 and 2010. Quite on the contrary, applying GMM estimations, the analysis of Wang et al. (2021) of a shorter period, 1980-2017, with patent and trademark applications as innovation indicators demonstrated that there could be indeed a positive influence of democracy on innovation performance. While these two studies relied on different methodologies and innovation indicators, the variance in the outcomes could partly stem from time-specific factors as well. Only a rather small number of countries democratised before 1980 and only eight were sustained until 2019 according to my measure of democratisation (see appendix A).

The estimations of Nazarov and Obydenkova (2020) regarding the influence of post-communist democratisations on firm innovations in 29 economies demonstrated a direct impact of it and showed that there might be an inverted U-shaped curve, i.e. those countries with an intermediate level of democracy have more firm innovation compared to countries with a low or high degree of democracy. They have however difficulties to explain this phenomenon and their results suggest contrastingly for R&D spending a U-shaped curve with countries at an intermediate democracy level scoring lowest (Nazarov & Obydenkova, 2020). Another recent study, looking at panel data of 37 countries in sub-Saharan Africa and thus similarly at a spatially delimited area, could not provide evidence for a positive association between democracy and innovation

in that region (Bekana, 2021). A common trait of these studies is that innovation is understood as technological innovation, measured with patent counts and citations as well as R&D expenditures. An exception are the findings of Yang & Liu's (2021) cross-country comparisons of 92 states that a democratic regime type is significantly positively correlated with academic innovation, i.e. with the quantity and quality of scholarly output. A remarkable study furthermore empirically demonstrated that European cities with institutions that protected economic and political freedom as well as with more local autonomy were historically from the 11th to the 19th century significantly more successful in attracting and producing creative talents (Serafinelli & Tabellini, 2022).

Focussing on a related aspect of political regimes, political decentralization vs. political centralization, Taylor (2007) finds no evidence for an association between it and technological innovation. Considering the used control variables, his analysis showed that military spending could be positively associated with innovation. Additionally, he found no significant correlation of democracy as a control variable on technological innovations (Taylor, 2007). The analysis of Rodriguez-Pose and Di Cataldo (2015) however provided again evidence for a strong association between governmental quality (corruption, rule of law, law effectiveness, and government accountability) and the number of patents in regions of the European Union. While governmental quality is undeniably not to be equated with a democracy index, their examined quality components (especially corruption and governmental accountability) are nevertheless also present in the V-Dem methodology. In a similar vein, Tebaldi & Elmslie (2013) showed that institutional quality, measured with the rule of law, risk of expropriation, and using an average institutional index, is significantly positively correlated with the countries' patent counts in their cross-country regression analysis.

2.2.2 Democracy and economic growth

Innovations could be an important channel through which democratisation processes and democracies in general exhibit their influence on economic growth (Acemoglu et al., 2019; Ghardallou & Sridi, 2020; Silve & Plekhanov, 2015). Thus, it is fruitful to examine the vast literature on the association of political regimes and economic growth as well.

Most early studies found no effect of democracy on growth, whereas a number of more recent empirical investigations observed a positive impact of democratisations on economic growth. For Tavares and Wacziarg (2001) there exists an overall negative impact as democracy would hinder growth by reducing the rate of physical capital accumulation and by increasing government consumption. However, according to the analysis of Acemoglu et al. (2019), democratisations increase GDP per capita by about 20% in the following 25 years across different development levels of the examined countries, and most likely due to greater investments in health, education, and capital. Papaioannou and Siourounis (2008) estimated that democratisations are associated with an average annual growth rate that is around one percentage point higher than for non-democratising countries, with a more expressed increase in the long-term than during the first years of the democratic transition. The results of Rodrik & Wacziarg (2005) demonstrate however that also countries in the first years of their democratisation grow significantly faster than autocratic ones. Similarly, the study of Leblang (1997) showed a significantly positive influence of democracies on growth. Other studies

revealed, for example, that there are differences in the effect along the line of a nation's cognitive abilities (Salahodjaev, 2015) and of state capacity, with a significantly more pronounced positive association of democracy and growth in weak-capacity states (Knutsen, 2013).

2.2.3 Empirical gap

Concluding, previous research on the influence of democratic regimes or democratisation on economic growth allows us to cautiously deduce that the association is a positive one. Innovations might be a crucial channel through which the impact of democratisations manifests itself in the economy (Acemoglu et al., 2019; Ghardallou & Sridi, 2020). However, empirical research on the relationship between democracy and innovation is scarce and provides inconclusive evidence. Connecting the potential intermediary role of innovations with the promising role of new technology, ideas, and knowledge regarding sustainable transformations, social improvements, and cultural achievements in developed and developing countries, it is highly necessary to offset this lack of clarity by conducting further quantitative research. Additionally, the previous studies on the democratisation-innovation association by Gao et al. (2017) and Wang et al. (2021) only examined aggregated panel data for most countries worldwide or were limited to merely analyse one point in time (Yang & Liu, 2021). While Nazarov & Obydenkova (2020) looked at former communist countries in Eastern Europe and Bekana (2021) at sub-Saharan Africa, a panel analysis that takes into account the geographical location of countries on a global scale is missing up to this date. Similarly, by focussing on global trends, previous studies might not have considered the specific situation of countries in an adequate manner. It could however be highly insightful to group countries with similar characteristics, e.g. former colonies that were an autocracy in 1960 or the post-communist countries of Eastern Europe and Central Asia. My analysis thus not only consists of regressions on a global level but rather pays close attention to some geographical, economic, and historical factors too. Extending previous studies, the following study additionally introduces different measures of democratisation and examines the impact of transitions on three different innovation indicators.

3 Data

In the subsequent data section, the three innovation indicators and their sources are extensively discussed, followed by elaborations on V-Dem as the used democracy database. The rest of this section explains the used control variables and their sources, discusses the number of examined countries and observations, and concludes with summary statistics of the main variables as well as graphical figures of the development of the independent and dependent variables over the analysed period.

3.1 Innovation Indicators

It is arguably difficult to come up with satisfying innovation indicators and associated data. For example, R&D figures only indicate the investment intensity in innovations but do not provide information regarding the actual outcome, whereas patent counts suggest a figure of actual inventions but lack regarding illustrating the significance and diffusion processes of the innovation (Smith, 2006). Another shortcoming of R&D and patents as the sole measures of innovation is that especially the latter is biased towards technological innovations. Additionally, patent counts might not catch innovations in countries without or with only weak property laws as well as in industries that emphasize other types of protecting innovations (Moser, 2013).

Hence, I take a dichotomous approach to the previous studies on the examined association on a global level by Gao et al. (2017) and Wang et al. (2021) and argue that R&D in the interplay with patent activity and the number of scientific publications might be better equipped to depict the impact of democratisation on innovations and the creation of knowledge and ideas than just focusing on patents. The inclusion of scientific articles in addition to the other two indicators is based on three main rationales. First, an academic publication is a contribution to the scientific literature, it is in a way a knowledge innovation just as patents are a technological innovation. Second, scientific articles cover a much wider area of the human society in comparison to patents and thus also include innovative advancements in f. ex. the humanities. Third, even if one would be hesitating to regard scientific advancements as innovation, their quantity in relation to a country's population still indicates the state's scientific capacity to innovate technologies. Some previous studies thus utilized scientific articles as an innovation indicator (e.g., Taylor, 2007; Yang & Liu, 2021). There exists, additionally, a robust positive association between education and innovation (Dakhli and De Clercq, 2004; Galor & Moav, 2002; Glaeser et al., 2004; Toivanen & Väänänen, 2016). In a similar vein, it can be argued that for modern development (and thus also for innovation performance) a societal emphasis on learning and modern scientific research is needed (Lin, 1995). The three used innovation indicators have in common that they are quantitative measures, not considering the quality or significancy of patents, scientific publications, and R&D investments.

Different sources were used to compile the three innovation indicators. First, patent data stems from the World Intellectual Property Organization (WIPO, 2022a). The dataset from 1980 onwards was taken from the World Bank's World Development Indicators (WDI) (World Bank, 2022), whereas data for earlier years was downloaded directly from WIPO's homepage under historical datasets - patent statistics (WIPOb, 2022). The patent indicator contains, both, applications by residents and non-residents. Second, for R&D data before 1996 the 1999 UNESCO Statistical Yearbook was used (UNESCO, 1999), for years afterwards the UNESCO's institute for statistics database (UNESCO, 2021). Third, data regarding the number of scientific publications per country and year was gathered by my own using Scopus (2022). The abstract and citation database contains more than 74 million articles for the period between 1960 to 2019, though not all articles are matched with a country: e.g., there were 656,889 document results for 1980 and there was no country affiliation available for 253,370 documents. The search results include scientific articles, conference papers, book chapters, etc. The search term PUBYEAR IS YEAR(year) was used and the results provided subsequently information about the affiliated countries of all authors for that particular year. Given an article was co-authored by a scholar from a US university and one from a French research institute, Scopus counts the country for both. If the article was published by two researchers from two different universities in the same country, the country of affiliation is only counted once. The double-counting is not an issue for the purpose of the analysis, it simply follows the understanding that scientific inputs from both countries were needed in order to create the scientific advancement.

As the availability of data for the three innovation indicators is differing, the length of the studied period varies between 39 to 60 years. Table 1 provides a brief overview of the examined years for each of the three indicators:

Table 1 Number of years examined for the three innovation indicators.

Number of years examined for the three innovation indicators	
Innovation indicator	**Years (t) examined in the estimations (start and end year in brackets)**
Patents	60 (1960-2019)
R&D	39 (1980-2018)
Academic Publications	60 (1960-2019)

Lastly, the number of patents and scientific publications are included in the analysis in relation to a country's total population for each year. Population data stems from the WDI (World Bank, 2022).

3.2 Democracy Data

For data on institutional developments, democratisation processes and the general distinction between democracies and non-democracies, I utilized the Varieties of Democracy (V-Dem) database in its 12th version for the analysis (Coppedge et al., 2022a). The dataset contains five democracy indices with 87 subcomponents and 470 democracy indicators in total, which

measure democratisation from 1789-2021 for all countries worldwide on an annual basis. Thus, V-Dem data is also available for years when a country was f. ex. a colony. The data is derived from survey interviews with more than 3,700 country-experts from the field and is freely accessible online. V-Dem is generally considered the most developed and encompassing dataset for democracy measurement (Boese, 2019). The indices in combination with the detailed indicators allow for a reasonable and consistent definition of democracy and other regime types as well as to identify and measure democratisation processes via the creation of proxy-variables.

V-Dem differentiates between seven core principles of democracy, of which five are expressed in the V-Dem's democracy indices with values ranging from low to high (0-1):

- electoral democracy index, forming a fundamental principle as periodic and free elections are undeniably needed to define a political regime as a democracy;
- liberal democracy index, capturing to which degree individual and minority rights are protected through civil liberties, rule of law, and effective checks and balances;
- participatory democracy index, embodying the possibilities for citizens to participate in the political processes, be it via elections or other direct and indirect forms and mechanisms;
- deliberative democracy index, measuring the degree to which political decision-making processes are part of a respectful dialogue and informed by objective perspectives;
- egalitarian democracy index, capturing the egalitarian possibilities of citizens due to material and immaterial equality to be *de jure* and *de facto* able to participate in the democratic processes (Coppedge et al., 2022b).

The majoritarian principle, which emphasizes that policies should follow the will of the majority of the people, and the consensual principle, which highlights that minority opinions should also be represented, are considered to be not measurable in a comprehensive and precise index (Coppedge et al., 2022b). The value for each of the five democracy indices is derived by aggregation from the lower and more detailed levels of the V-Dem subcomponents and democracy indicators (Coppedge et al., 2022b). However, I overarchingly draw for the analysis on the Regimes of the World (RoW) measures, which are the result of a certain aggregation of V-Dem indices, subcomponents and indicators (Coppedge et al., 2022c; Lührmann, Tannenberg & Lindberg, 2018). RoW aims to capture different types of political regimes according to the competitiveness of political power access and liberal democracy principles. It comes in its standard form with four distinct regime types (closed autocracy, electoral autocracy, electoral democracy, and liberal democracy) and in its enhanced form to capture ambiguous cases with ten different regime types. The four types in the standard form are in short defined as follows in table 2 (Coppedge et al., 2022c; Lührmann, Tannenberg & Lindberg, 2018):

Table 2 RoW: The Four Regime Types according to V-Dem (Coppedge et al., 2022c; Lührmann, Tannenberg & Lindberg, 2018).

RoW: The Four Regime Types		
Number	**Type**	**Short Definition**
0	Closed autocracy	No multiparty elections.
1	Electoral autocracy	Multiparty elections are only de-jure as they are not free and fair.
2	Electoral democracy	De-facto multiparty elections but some of the liberal democracy principles are constrained.
3	Liberal democracy	De-facto multiparty elections and fulfilment of the liberal democracy principles.

3.3 Control Variables

In addition to the political regime of a country as the independent variable a set of control variables is used in order to control for other factors that could potentially influence the development of the number of innovations in the examined countries. These control variables stem from the WDI database (World Bank, 2022) and include: GDP per capita; the urbanization rate; education, i.e. the percentage of children in primary school age that are enrolled in primary or secondary school; trade (sum of exports and imports of goods and services) in % of GDP; military expenditure in % of GDP to control for the findings of Taylor (2007) as discussed in the analysis of previous literature; infant mortality rate per 1,000 live births; and the total population of a country. The used control variables follow predominantly comparable examinations of the influence of democratisations on economic outcomes as discussed in the literature section. In addition, I utilized the continent of a country, its region (15 different categories, but only selected ones with sufficient observations were analysed), and recent colonial legacy (defined as becoming independent from 1945 onwards) for detailed analyses. The focus on recent colonial legacy as demarcating from colonial legacy in general stems from the discussion of state antiquity of the NIE literature. There is reason to assume that the impact of democratisation on innovation could differ between f. ex. sub-Saharan African countries that only gained their independence 20 years before their democratic transition and South American countries that had already been independent for 150 years.

3.4 Countries and Observations

The number of countries in the pool was determined, on the one hand, by data availability in the WDI (World Bank, 2022), which f. ex. excludes Taiwan or the German Democratic Republic. On the other hand, a crucial factor was that the respective countries were assessed by V-Dem. The latter concern especially applies to questions regarding for how many years some countries became part of the analysis. For instance, V-Dem coded the democratisation indices and the regime status for Czech Republic and Serbia for the whole period, assuming a continuity

of Czechoslovakia and Yugoslavia, whereas this data was for Slovakia and Slovenia only available from 1993 and 1989 onwards respectively. This is however not an issue as patent and WDI data is for these countries also only available from their independence onwards. At the same time, data for African countries, even when they gained independence only later, was available for the total period, justifying their inclusion from 1960 onwards. Germany, Vietnam, and Yemen were special cases as the size of the countries increased considerably after (re-)unification. Due to the fact that the World Bank (2022) assumes a united country for the whole period in their WDI (even though there existed two different regime types according to V-Dem), these countries were only included from their year of reunification onwards. As an additional criterion, I dropped countries that had less than 500,000 inhabitants in 2019 in order to not have a large number of small countries in the analysis, which might have considerably influenced the results.

3.5 Summary Statistics

The summary statistics in table 3 for the main variables of interest below signifies that after these preliminary considerations the number of countries in the pool totalled 168. It is evident that R&D data is only available for a considerably low number of observations (2,385) as data availability starts from 1980 onwards, whereas data for patents and scientific articles is available for 9,304 observations.

Table 3 Summary Statistics of the Main Variables.
The respective sources can be found in the data description. Dummy 1 indicates that a variable is a dummy variable.

Summary Statistics of the Main Variables						
Variable	**Observations**	**Mean**	**Std. dev.**	**Min**	**Max**	**Dummy**
Country	9,315	82.97	48.47	1	168	0
Year	9,315	1990.68	17.27	1960	2019	0
Regime type	9,313	1.23	1.09	0	3	0
Democracy	9,314	.37	.48			1
Democratisation	9,315	.23	.42			1
Sustained Democratisation	9,315	.22	.42			1
Successful Democratisation	9,315	.17	.37			1
Patents per one mil. population	9,304	146.59	481.77	0	8634.10	0
Scient. Articles per one mil. population	9,304	260.94	657.18	0	5977.16	0
R&D	2,385	.97	.92	0	4.94	0
Colony	9,315	.50	.50			1
Post-communist	9,315	.11	.31			1

Figure 1 illustrates the development of the share of the two bipolar regime types of democracy and autocracy for the countries in the dataset from 1960-2019. Autocracies dominated unequivocally in the first three decades. The share of democratic countries slowly grew until 1990 from 20% to 30%, before the 1990s and early 2000s saw an accelerating growth of democracies worldwide with democracy becoming the dominant regime type around the turn of the millennium. Autocracies in the dataset however overtook democracies again in 2019, signifying the increased pressure on democracy on a global scale in recent years. Furthermore, figure 2 below provides information about the number of democratisations by type for each decade. Please refer to the variable section under methodology for a detailed explanation of the democratisation variables. Lastly, figure 3 groups the 168 countries in the panel according to how many years of the examined period they were a democracy. Almost 57 countries were an autocracy throughout the period, whereas 28 were a democracy for at least 51 years. A big bulk of countries, 47, had a democratic regime type between 11-30 years.

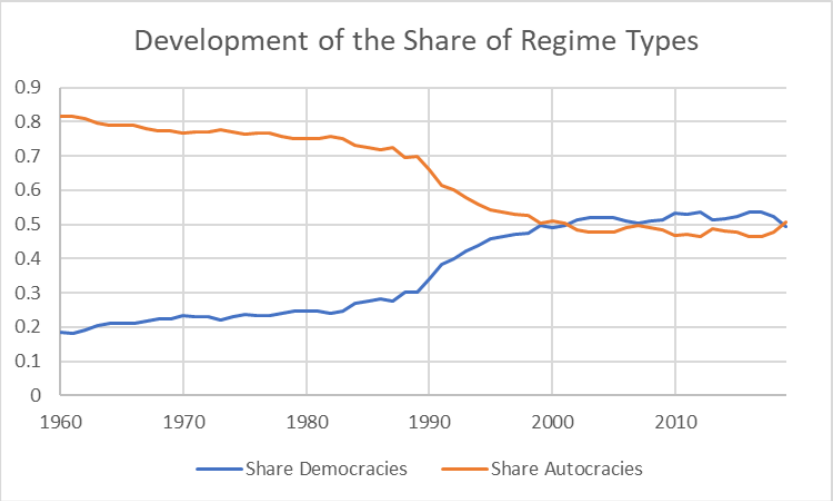

Figure 1 Development of the Share of Regime Types.
The underlying bipolar measure of the regime type is in details explained in the methodology.

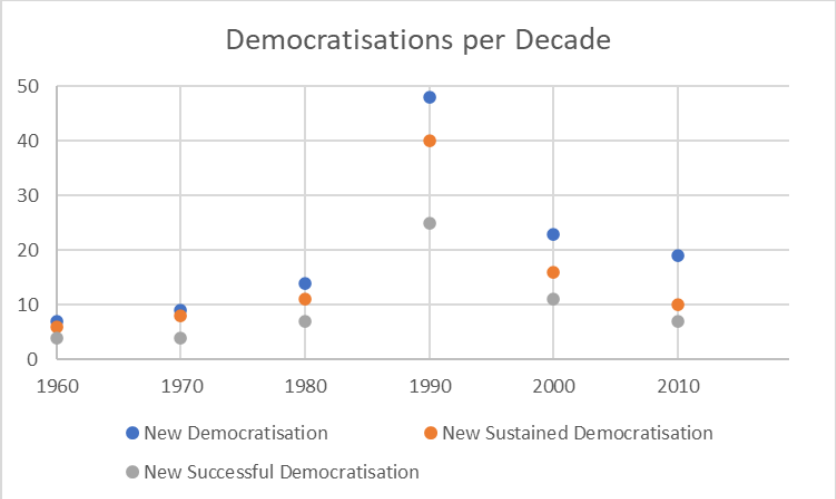

Figure 2 Democratisations per Decade.
The underlying definitions of the three distinct democratisations are in details explained in the methodology.

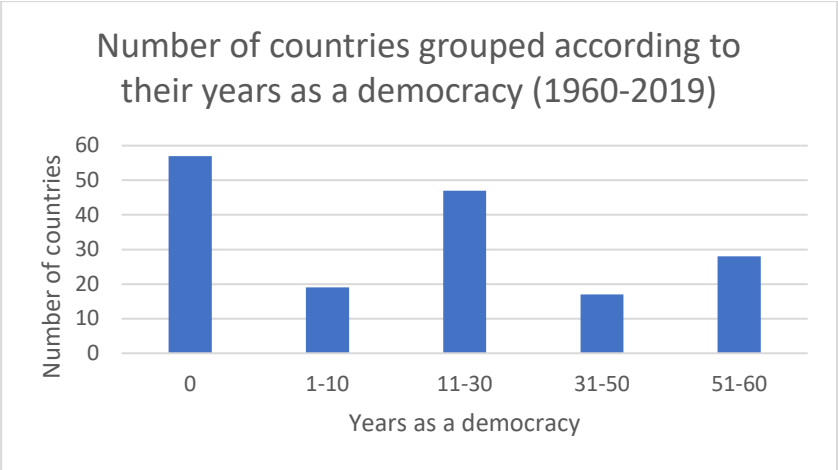

Figure 3 Number of countries grouped according to their years as a democracy (1960-2019). The underlying definition of democracy is in details explained in the methodology.

Lastly, figures 4, 5, and 6 depict the development of the three innovation indicators throughout the course of the examined period. The average number of patents oscillated substantially between roughly 100 to 180 from 1960-2019, though since the new millennium only between 145 to 170. The average number of scientific articles per one million population was constantly increasing throughout the period, and specifically since the start of the new millennium it roughly tripled. The average R&D expenditures were fluctuating considerably until 1996 when the availability of the respective statistics improved. Due to the outlier for R&D in 2019 as a result of many missing observations, the analysis covers 1980-2018.

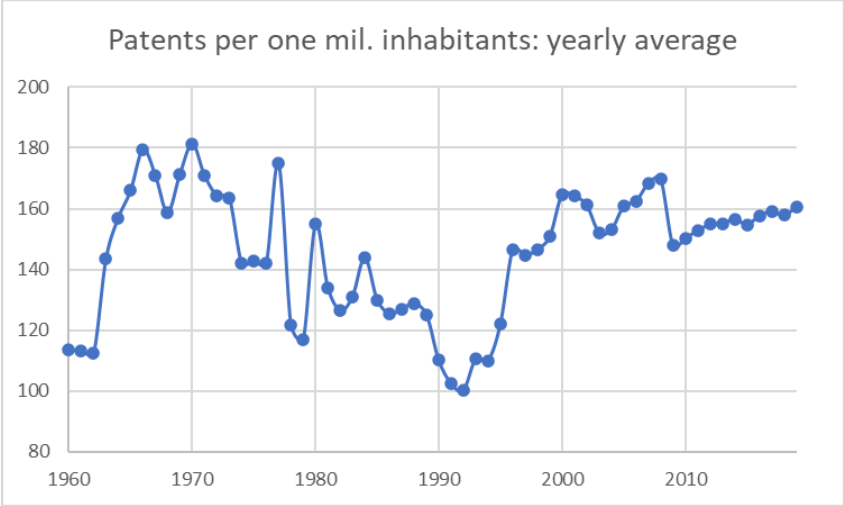

Figure 4 Patents per one mil. inhabitants: yearly average. See text for the sources of the data.

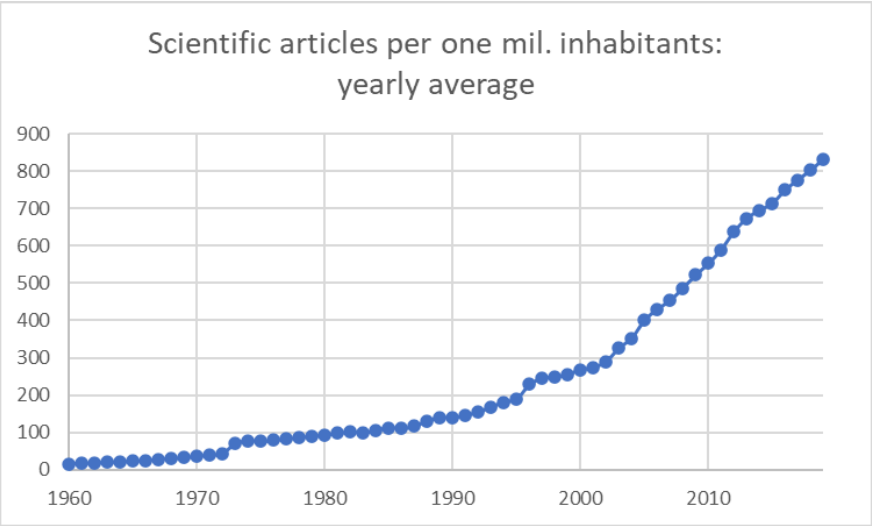

Figure 5 Scientific articles per one mil. inhabitants: yearly average. See text for the sources of the data.

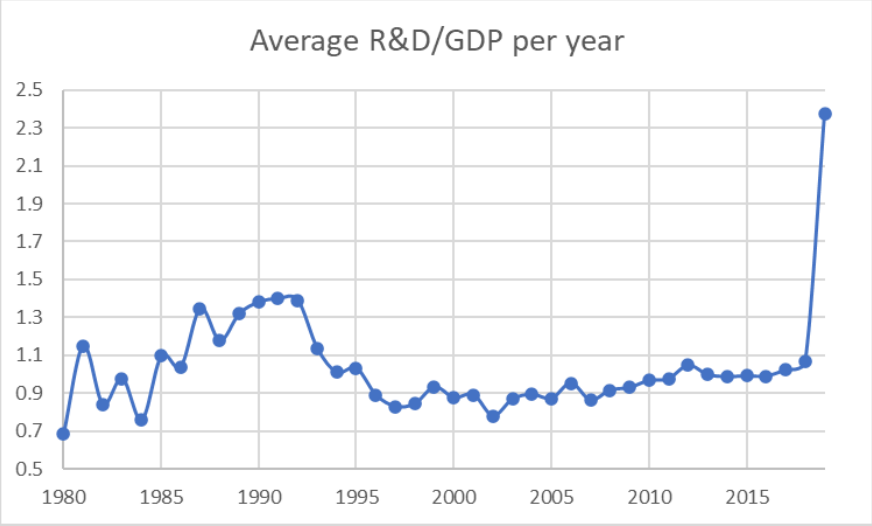

Figure 6 Average R&D/GDP per year. See text for the sources of the data.

4 Methodology

The following methodology section consists of a brief explanation of the general methodological approach, an overview about the main variables, including a detailed explanation how the democratisation dummies were created, and finally of a description and discussion of the econometrical model.

4.1 The Approach

The methodological approach of this thesis was to examine empirically using panel regression analysis the impact of democratisation on innovation. The timeframe of the study depended largely on the availability of innovation data as well as of data for the control variables, and thus differed for different models. Generally, I examined the period from 1960 to 2019 as the most recent year, right before the outbreak of the Covid-19 pandemic. There were two main reasons for 1960 as a starting date. First, data availability would have decreased considerably when going further back in time. Second, the early 1960s mark the years when a significant number of mainly African countries gained independence, which can be regarded as a somewhat natural experiment. The same condition applies to the number of countries in the pool, which varied due to data availability between different models.

Hereby, also democracy developments matter as it is crucial to have a number of stable democracies throughout the examined period in the dataset as well as countries that experienced radical changes in their political structure: i.e., when there was a transformation from autocracy to democracy or vice versa. The period from 1960 to 2019 is indeed not facing difficulties in providing a substantial number of countries which changed their regime type at least once or even more frequently during the examined timeframe. In fact, a total of 105 countries changed their regime type from an autocracy to a democracy at least once for a short period between 1960-2019, 81 countries democratised for at least 5 years in a row, and 58 countries remained after the democratisation a democracy until 2019. Appendix A provides more details regarding countries that were a democracy for the whole period and countries that democratised during the examined period.

4.2 Main Variables

As illustrated in the data section, the independent variables stem from the V-Dem democratisation database. The dependent variables consist of three different innovation

indicators, including a country's population ratio to patent counts and to academic publications as well as R&D expenditures in relation to a country's GDP.

The approach further takes the form of an event study analysis similarly to the methodological approach by Bengtsson et al. (2020). I intended to catch transformations of the political landscape of the particular countries (e.g. developments from an autocratic regime to a democratic one) and include these independent variables finally as dummy variables. For the purpose of this study, a country democratised when it changed according to V-Dem's RoW classification (Coppedge et al., 2022c; Lührmann, Tannenberg & Lindberg, 2018) from a closed or electoral autocracy to an electoral or liberal democracy (*democratisation*).

Another issue to consider from the theory section is that there might be a considerable difference in the effect between democratisations that are only partially successful or are reversed already within the first few years and democratisations that are sustained (Huntington, 2006; Lacroix, Méon & Sekkat, 2021; Papaioannou & Siourounis, 2008; Schmitter & Karl, 1991). For Papaioannou and Siourounis (2008) a democratic transition is sustained if it lasts at least for five years without becoming a closed or electoral autocracy again. Consequently, a dummy variable for sustained democratisations (>=5 years) is created (*sustained democratisation*) as well as a dummy variable, which comprises sustained democratisations that were not reversed again until 2019 (*successful democratisation*). The following figure 7 demonstrates how the three democratisation dummy variables were constructed, whereby zero essentially equals no democratic transition as defined above and one denotes a democratic transition:

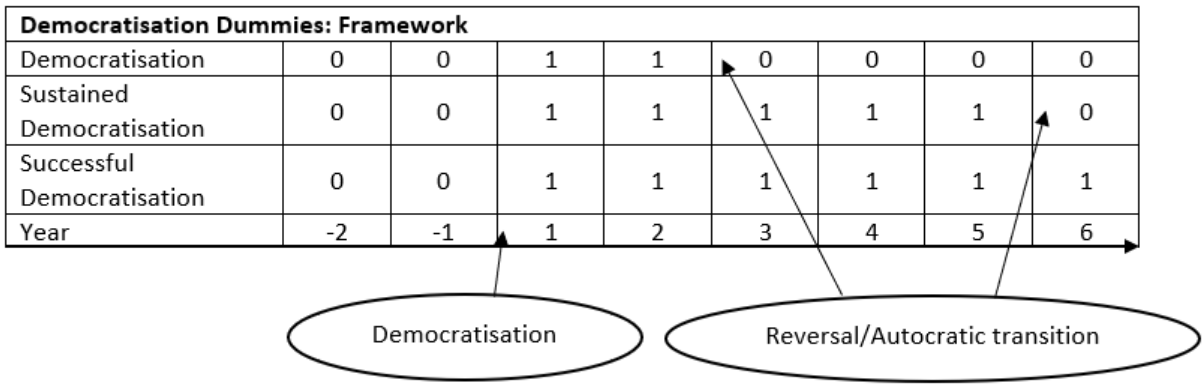

Figure 7 Democratisation Dummies: Framework.
See text for their definition.

The usage of a binary democracy indicator is best suited for the analysis as it allows to apply the difference-in-differences method and to have an unambiguous measure of transitions to democracy. It should, nevertheless, be considered that such a definition ignores that democratisation is not necessarily a clear-cut process and that there exist ambiguous cases between a democracy and an autocracy. The sustained democratisation and the successful democratisation variables are thus essential as it is highly unlikely that a country sustains a democratisation for years being located just above the democracy threshold.

Other variables created using the RoW classification are *autocracy1960*, providing information about which countries were an autocracy in 1960 or were part of a country that was an autocracy

in 1960, *democracy2019*, which denotes democratic countries in 2019, and *democracyperiod*, recording countries that were a democracy during the whole period.

4.3 Method and Model

Regarding the econometric methodology, I applied the difference-in-differences method to investigate the potential association between democratisations and innovation. This method was also employed for comparable investigations by f. ex. Acemoglu et al. (2019) and Papaioannou and Siourounis (2008) to examine the impact of democratisations on economic growth, by Lacroix, Méon & Sekkat (2021) to study the effect of democratic transitions on foreign direct investment (FDI) inflows, and by one of the previous studies on the democracy-innovation relationship (Gao et al. 2017). The difference-in-differences method fits well to the research objectives as it uses a panel of countries and allows to define one group of countries as the treatment group (i.e. democratising countries) and the other group of countries without treatment as the control group (i.e. autocracies or non-democratising countries). In this way the method is f. ex. an ideal approach to estimate the effect of democratisation on innovation in previously autocratic countries in comparison with countries that remained an autocracy. Furthermore, the model takes time-invariant characteristics, such as geography, colonisation, resources, etc., of the examined countries into account as well as unobserved characteristics at an aggregate level.

Following Papaioannou & Siourounis (2008) as well as Lacroix, Méon & Sekkat (2021), the difference-in-differences model is for this analysis specified with the following equation:

$$I_{i,t} = \rho I_{i,t} + \alpha D_{i,t} + \delta X'_{i,t} + \emptyset_t + \eta_i + \varepsilon_{i,t}$$

Hereby $I_{i,t}$ refers to a measure of innovation in Country i and Year t, $D_{i,t}$ is a dummy variable that captures by taking the value one whether a country is democratising, $X'_{i,t}$ denotes a set of control variables, $\emptyset_t$ is a year fixed effect, η_i is a country fixed effect, $\varepsilon_{i,t}$ is the error term, $\rho,$ and α are coefficients, and δ denotes a vector of coefficients. Standard ordinary least squares estimators are used to estimate the regression.

The inclusion of country and year fixed effects allows the coefficient α to capture the within effect of democratisations on the used innovation indicators. Furthermore, I run the model several times using different variables for $I_{i,t}$ (patents, R&D, academic publications) to examine whether the association between democracy as well as democratisations and innovation varies for different innovation indicators.

Similarly and following the example of Lacroix, Méon & Sekkat (2021) and Papaioannou & Siourounis (2008), I estimate the model with three differing definitions of democratisation: democratisation, sustained democratisation (>=5 years), and successful democratisation. These additions allow me to examine whether there exists a potential difference in the effect on innovations between democratisations per se that might be reversed after some years and consolidated transitions from an autocratic to a democratic regime type.

Furthermore, logarithmic values for the dependent variables are applied in the estimations. In order to apply the logarithm for observations with zero patents or scientific articles, these values were beforehand substituted by the value 0.01. The following equation illustrates these changes:

$$lnI_{i,t} = ln\rho I_{i,t} + \alpha D_{i,t} + \delta X'_{i,t} + \emptyset_t + \eta_i + \varepsilon_{i,t}$$

Difference-in-differences models come along with some important obstacles, which can however partially be offset. First, resulting from positive residual autocorrelation the method leads to inconsistent standard errors (Bertrand, Duflo & Mullainathan, 2004). This issue can be solved by applying adjusted standard errors based on White's procedure and by allowing autocorrelation in the error term (Lacroix, Méon & Sekkat, 2021; Papaioannou & Siourounis, 2008). Thus, heteroscedasticity and autocorrelation are clustered on a country-level. Second, due to the considerable length of the study with the examined number of years varying between 39 to 60 years, the probability for a potential Nickell bias is negligible. Third, the method demands that the parallel trend assumption is valid, i.e. trends in outcomes would have been the same without treatment (democratisation). The following figures 8 and 9 depict the time-demeaned growth rate (country innovation growth rate minus the average growth rate of that year for all autocratic countries) of scientific articles and patents per capita (using logarithmic values) in the 10 years before and after a transition to democracy that was never reversed until 2019. The common trend assumption is only roughly met, but as the sample includes a big number of countries and years, it is possible to relax this assumption by introducing country-specific trends η_i.

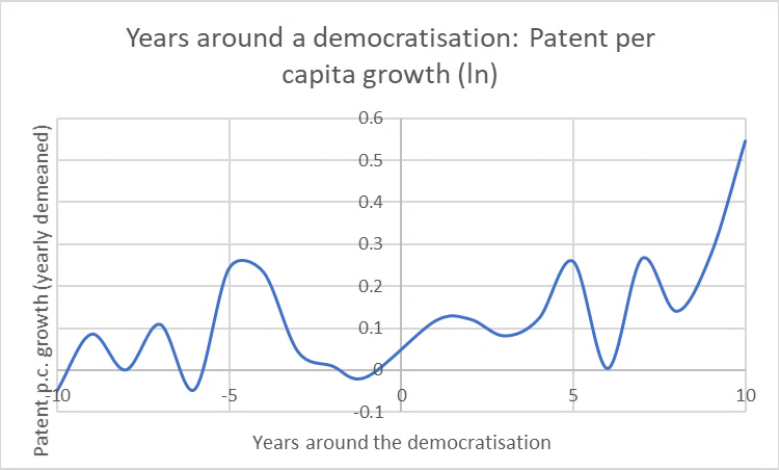

Figure 8 Years around a democratisation: Patents per capita growth (ln).
The figure depicts the time-demeaned growth rate for democratising countries (country innovation growth rate minus the average growth rate of that year for all autocratic countries).

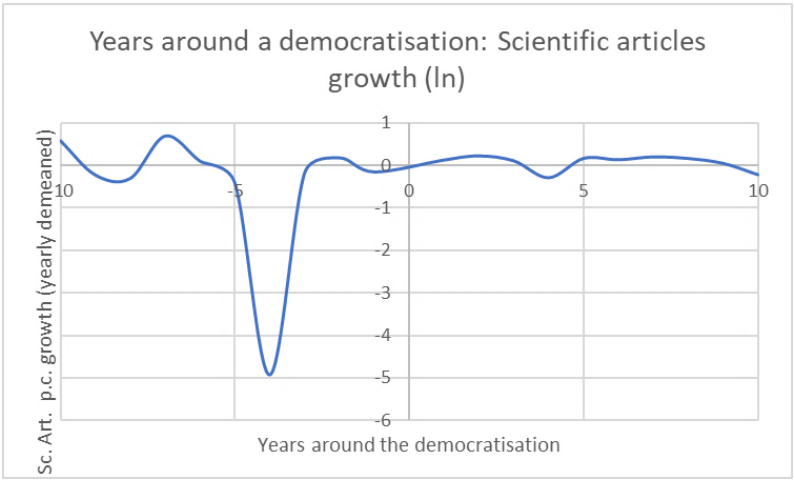

Figure 9 Years around a democratisation: Scientific articles growth (ln).
The figure depicts the time-demeaned growth rate for democratising countries (country innovation growth rate minus the average growth rate of that year for all autocratic countries).

Fourth, the method requires that democratic transitions are exogeneous in order to produce unbiased estimates. This requirement is arguably difficult to meet. Scientific insights point to the unpredictability of democratic transitions (Kuran, 1991) and to random mistakes by autocratic rulers (Treisman, 2020). Nevertheless, there exist also well-grounded arguments in favour of a certain kind of situation that increases the likelihood of a democratic revolution and that is partially determined by economic factors. For example, Acemoglu, Johnson & Robinson (2004) outline rare windows of opportunities for a thorough institutional change due to a condition in which f. ex. economic changes shift the economic and political power equilibria. North, Wallis & Weingast (2006) similarly argue that a number of factors, such as impersonal exchange among elites (i.e. transactions without knowing the other person), perpetual forms of organizations (i.e. organizations that survive beyond the lifetime of its member), and political control of the military, have to collude for the possibility of a sustained democratic (and economic) transition. Olson (1993) already earlier claimed that a democratisation requires either some sort of outside influence, i.e. democracy imposed by the winner of a military conflict on the losing country, or a situation in which a historical accident leaves a balance of power between different people or groups. Democratisations further often follow patterns of waves, both spatially and periodically (Huntington, 1991). Hence, while democratic transitions might not be predictable, they still do not happen completely randomly. An additional aspect regarding exogeneity is reverse causality, but for the examined association there is no real reason to assume that innovation would cause democratisations. Causality is still difficult to establish, considering that the effect of democratisation on innovation could run through a wide variety of intermediary variables or that there could be an omitted variable bias. Rather than downright proof of a causal effect, the results below shall thus be considered as an indication of a likely influence of democracy on innovation.

5 Empirical Analysis

In the following section, I will first provide an overview of the baseline results on a global level, on a regional levels, and for countries grouped according to important historical developments. Additionally, a robustness check and a sensitivity analysis demonstrate the appropriateness of the used models and democratisation measures and provide further insights into the association between democratisation and innovation. Subsequently the findings are summarized, extensively discussed, and evaluated with regards to the theory and previous literature.

5.1 Baseline Results

Table 4 displays the baseline results for the models run on a global level. The results in estimation (1) are estimated without control variables, which are included in the estimations presented in estimation (2) and in all other estimations that follow. The control group existed of all countries that did not democratised according to the respective democratisation measures. The p-values for all estimations can be found summarized in appendix B.

Table 4 Baseline results on a global level.
*The first number of the different models denotes the kind of democratisation (1. democratisation, 2. sustained democratisation, 3. successful democratisation). The second number denotes the logarithmic innovation indicator used in relation to a country's population/GDP (.1 patents, .2 scientific articles, .3 R&D). The value for $D_{i,t}$ denotes the coefficient and below in parentheses the adj. standard error is given. *** p<0.01, ** p<0.05, * p<0.1.*
In estimation (2) the following control variables were included: urbanization rate, school, trade, military, infant mortality, GDP per capita, population (see data' section for their sources and appendix C for their baseline results).

(1) Baseline results (without control variables)									
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
$D_{i,t}$	.54*	.13	-.16	.53*	.11	-.22*	.65	.04	-.38*
	(.30)	(.14)	(.12)	(.32)	(.15)	(.12)	(.12)	(.20)	(.12)
Observations	9,304	9,304	2,383	9,304	9,304	2,383	9,304	9,304	2,383
Countries	168	168	140	168	168	140	168	168	140
(2) Baseline results with control variables									
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
$D_{i,t}$	.46	.05	-.03	.52	.07	-.09	.78*	-.00	-.10
	(.29)	(.11)	(.12)	(.31)	(.12)	(.12)	(.41)	(.18)	(.18)
Observations	3,217	3,217	1,542	3,217	3,217	1,542	3,217	3,217	1,542
Countries	149	149	125	149	149	125	149	149	125

These first estimates indicate that there is no significant association between the three democratisation measures on the one hand and scientific articles on the other. The coefficients for this innovation indicator are marginally positive and even turn slightly negative for successful democratisation using control variables. The results however show an effect of democratisations on the number of patents, which is significant at the 10% level for three of the six models that used patents as the innovation indicator. The coefficient is constantly positive and is ranging from 0.46 for democratisations with controls to 0.78 for successful democratisations with controls. This suggests that the within-effect of successful democratisations equals on average an increase in patent activity of 0.78 percentage points of a country's population in the long-term. In estimation (2) the coefficients for this association increase as expected and become significant for successful democratic transitions (p-value: 0.060). The results furthermore suggest a significant negative association (10% level) of sustained and successful democratisations with R&D in the absence of control variables. Generally, the estimations indicate a negative impact of democratisations on R&D, though the coefficients are only marginally negative when control variables are included. The findings for R&D should however be seen cautiously as the number of observations, and the examined timeframe was significantly lower than for the other two variables. Lastly, the control variables do not have a significant effect on the tested associations and their respective coefficients. Their inclusion reduces the number of observations for patents and scientific articles from 9,304 to 3,217 and for R&D from 2,383 to 1,542.

In line with comparable studies that examined the impact of democratisation on an economic outcome (e.g. Acemoglu et al., 2019; Lacroix, Méon & Sekkat, 2021; Papaioannou & Siourounis, 2008), I estimated further two models with two different lags of the dependent variables in order to analyse the level of persistence in the innovation indicators. The baseline results of these two estimations (3) and (4) are summarized in appendix D. Compared to a lag of 5 years for the innovation indicators, a lag of 10 years leads to considerably more pronounced coefficients for patents, and generally speaking to more negative coefficients for scientific articles and R&D. This indicates that values of the dependent variables in a given year can partially be explained by past values of the variable.

5.2 Spatial and Historical Analysis

The discussion in the theory and previous literature sections demonstrated that the impact of democratisation on innovation might be subject to spatial disparities and historical factors. Thus, I estimated focussed models for different regions as well as for countries that shared specific historical experiences, i.e. Eastern European and Central Asian countries that abolished communism after the Cold War and former colonies that became independent in the years after WW2.

5.2.1 Regions and Continents

Table 5 presents the results of estimations for selected regions with a sufficiently high number of countries, observations, and democratic transitions. Regarding Europe, there are two considerable differences to the global results. On the one hand, the impact of democratisations and sustained democratisations on patents in Europe is twice as strong as worldwide, and both associations are significant (with p-values of 0.039 and 0.055 respectively). On the other hand, the coefficient for the effect of successful democratic transitions on patents turns negative.

The estimations for Latin America and the Caribbean as well as sub-Saharan Africa reveal that democratic transitions tend to have a positive impact on innovation in these two world regions. Once more the association is most pronounced for patents: in sub-Saharan Africa democratisations are associated with a 0.52 percentage point increase in patent activity (p-value: 0.095) and sustained democratisations with a 0.83% increase (p-value: 0.021) in relation to the population, though the coefficient for successful democratisations is with 0.20 comparatively low. In Latin America and the Caribbean, the pattern resembles more the expected form with a significant association of 1.68 of successful democratisations and patents at a 10% significance level.

For the Middle East and North Africa (MENA) and East- and South-East Asia the estimations deviate considerably from the other regions and from the global level. In the MENA, all three measures of democratisation are significantly negatively associated with patents on a 10% significance level, and the coefficients are pronounced with -1.49 for democratisations and sustained democratisations and -2.76 for successful democratisations. However, in this region all three democratic transitions measures have a significant positive impact on scientific articles. In East- and South-East Asia only successful democratisations are associated with an increase in patent activity. In contrast, democratisations and sustained democratisations in this region have a positive impact on R&D that is significant at a 5% level. For successful democratisations the coefficient remains positive but insignificant.

Table 5 Baseline Results Regions.
*The first number of the different models denotes the kind of democratisation (1. democratisation, 2. sustained democratisation, 3. successful democratisation). The second number denotes the logarithmic innovation indicator used in relation to a country's population/GDP (.1 patents, .2 scientific articles, .3 R&D). The value for $D_{i,t}$ denotes the coefficient and below in parentheses the adj. standard error is given. *** p<0.01, ** p<0.05, * p<0.1.) Model 3.3 in estimation (7), signified with +, could not be estimated due to a lack of observations.*

(5) Europe									
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
$D_{i,t}$	.90**	.07	-.12	1.13*	.09	-.24	-.09	.18	.15
	(.42)	(.09)	(.12)	(.57)	(.11)	(.18)	(.57)	(.18)	(.15)
Observations	984	984	750	984	984	750	984	984	750
Countries	38	38	38	38	38	38	38	38	38
(6) MENA									
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
$D_{i,t}$	-1.49*	.27*	-.05	-1.49*	.27*	-.05	-2.76*	.49*	-.17
	(.85)	(.15)	(.13)	(.85)	(.15)	(.13)	(1.47)	(.27)	(.12)

Observations	498	498	202	498	498	202	498	498	202
Countries	21	21	18	21	21	18	21	21	18
(7) Sub-Saharan Africa									
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
$D_{i,t}$	.52*	.26	.44	.83**	.30	.04	.20	.13	+
	(.30)	(.23)	(.29)	(.35)	(.24)	(.33)	(.44)	(.51)	
Observations	704	704	98	704	704	98	704	704	
Countries	41	41	26	41	41	26	41	41	
(8) Latin America and the Caribbean									
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
$D_{i,t}$	.44	.11	.01	.37	.09	.01	1.68*	-.05	-.15
	(.68)	(.10)	(.30)	(.70)	(.10)	(.30)	(.92)	(.22)	(.37)
Observations	488	488	225	488	488	225	488	488	225
Countries	20	20	19	20	20	19	20	20	19
(9) East- and South-East Asia									
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
$D_{i,t}$	-.68	.10	.37**	-.68	.10	.37**	.55	.06	.23
	(1.01)	(.11)	(.14)	(1.01)	(.11)	(.14)	(1.13)	(.23)	(.18)
Observations	280	280	136	280	280	136	280	280	136
Countries	14	14	13	14	14	13	14	14	13

5.2.2 Post-communist Countries

Table 6 shows the estimations for post-communist countries in Eastern Europe and Central Asia. Like on the global level, the coefficients for the estimations using patents as a dependent variable are throughout positive, but only very pronounced for democratisations and sustained democratisations (for the latter at a 10% significance level). Additionally, for this group of countries all three measures of democratisations are negatively associated with R&D activity, with the relationship being significant for sustained and successful democratisations (p-values: 0.014 and 0.041). It is however to note that these countries are difficult to measure due to a lack of pre-treatment data on the level of the later independent countries. Additionally, the period of their democratic transitions resembles the period of the abolishment of communism and the change to market economies. I thus estimate later a robustness check for global results by excluding these countries.

Table 6 Baseline Results for post-communist countries.
*The first number of the different models denotes the kind of democratisation (1. democratisation, 2. sustained democratisation, 3. successful democratisation). The second number denotes the logarithmic innovation indicator used in relation to a country's population/GDP (.1 patents, .2 scientific articles, .3 R&D). The value for $D_{i,t}$ denotes the coefficient and below in parentheses the adj. standard error is given. *** p<0.01, ** p<0.05, * p<0.1. Post-communist countries are here restricted to Eastern Europe and Central Asia.*

(10) Post-communist countries									
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
$D_{i,t}$	.92 (.59)	.20 (.15)	-.17 (.11)	1.16* (.66)	.30 (.19)	-.34** (.13)	.16 (1.00)	.06 (.22)	-.27** (.13)
Observations	449	449	400	449	449	400	449	449	400
Countries	26	26	26	26	26	26	26	26	26

5.2.3 Recent Colonial Legacy

In the group of countries with a recent colonial legacy the coefficients of the estimated associations are generally low and never significant as signified by estimation (11) in table 7. The impact of all three measures of democratisation on patents is considerably lower for this group of countries than on a global level, whereas the strength of the coefficients for the other two innovation indicators is comparable (3.3 signifies a more negative effect on R&D though).

Table 7 Baseline Results for recent colonial legacy.
*The first number of the different models denotes the kind of democratisation (1. democratisation, 2. sustained democratisation, 3. successful democratisation). The second number denotes the logarithmic innovation indicator used in relation to a country's population/GDP (.1 patents, .2 scientific articles, .3 R&D). The value for $D_{i,t}$ denotes the coefficient and below in parentheses the adj. standard error is given. *** p<0.01, ** p<0.05, * p<0.1. Countries considered as having a recent colonial legacy are those that became independent of the colonial empires in the post-WW2 period.*

(11) Recent colonial legacy									
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
$D_{i,t}$	.18 (.26)	.03 (.19)	.14 (.15)	.31 (.28)	.07 (.20)	-.03 (.14)	.13 (.39)	.03 (.37)	-.28 (.18)
Observations	1,299	1,299	267	1,299	1,299	267	1,299	1,299	267
Countries	68	68	48	68	68	48	68	68	48

5.3 Robustness Checks and Sensitivity Analysis

In the following, I will present and briefly discuss the results of various robustness checks and a sensitivity analysis conducted. First, post-communist countries were excluded as they democratised at the same time as their economic systems underwent rapid transformation. The results of estimation (12) in table 8 compared with those of estimation (2) above suggest that the exclusion of these countries is not having a significant effect on the estimations. The

respective coefficients only change slightly, and their signs remain constant (1.3 is an exception: -0.03 before compared to 0.02 here).

Table 8 Robustness check 1: exclusion of post-communist countries.
*The first number of the different models denotes the kind of democratisation (1. democratisation, 2. sustained democratisation, 3. successful democratisation). The second number denotes the logarithmic innovation indicator used in relation to a country's population/GDP (.1 patents, .2 scientific articles, .3 R&D). The value for $D_{i,t}$ denotes the coefficient and below in parentheses the adj. standard error is given. *** p<0.01, ** p<0.05, * p<0.1. Post-communist countries are here restricted to Eastern Europe and Central Asia.*

(12) Robustness check 1: exclusion of post-communist countries									
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
$D_{i,t}$	.43	.04	.02	.49	.05	-.04	.83*	-.01	-.11
	(.33)	(.12)	(.14)	(.34)	(.13)	(.14)	(.43)	(.19)	(.20)
Observations	2,768	2,768	1,142	2,768	2,768	1,142	2,768	2,768	1,142
Countries	123	123	99	123	123	99	123	123	99

Second, the robustness check in table 9 shows estimates without including countries that were a democracy for the whole period in the control group, i.e. the control group only exists of autocratic countries. Similar to the first robustness check, the coefficients and their signs remain largely analogous to the results of estimation (2). The coefficients for all estimations decrease however marginally and the signs of the coefficients for the non-significant associations of democratisations and sustained democratisations with scientific articles turn negative. Both observations suggest that the impact of democratic transitions on innovation is slightly lower if countries that were a democracy throughout the examined period are excluded from the estimations. The effect is however negligible and only valid for the results on a global level as well as for the estimations of European transitions.

Table 9 Robustness check 2: exclusion of old democracies.
*The first number of the different models denotes the kind of democratisation (1. democratisation, 2. sustained democratisation, 3. successful democratisation). The second number denotes the logarithmic innovation indicator used in relation to a country's population/GDP (.1 patents, .2 scientific articles, .3 R&D). The value for $D_{i,t}$ denotes the coefficient and below in parentheses the adj. standard error is given. *** p<0.01, ** p<0.05, * p<0.1. The countries that were a democracy for the whole period are listed in appendix A.*

(13) Robustness check 2: exclusion of old democracies									
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
$D_{i,t}$	.40	-.04	-.06	.46	-.03	-.13	.73*	-.21	-.20
	(.29)	(.10)	(.09)	(.31)	(.11)	(.10)	(.41)	(.16)	(.12)
Observations	2,553	2,553	1,092	2,553	2,553	1,092	2,553	2,553	1,092
Countries	128	128	104	128	128	104	128	128	104

Third, the control group existed so far of all countries that did not democratise according to one of the three respective measures of democratic transitions. This might lead especially for successful democratisations to a biased effect on innovation as they are f. ex. compared to countries that may have also benefitted of a democratic regime type for a longer period but have subsequently seen a change back to an autocratic regime. The estimations in the following table

10 thus assess the impact of successful democratisations compared to countries that remained an autocracy for the whole period between 1960-2019. Compared to the global baseline results (estimation (2)), these estimations reveal a lower positive coefficient for patents, and a more negative association for scientific articles and R&D. The observed lower effect signifies that the inclusion of non-successful democratisations in the control group led to an upward bias of the impact of successful democratisations.

Table 10 Robustness check 3: successful democratisations vs. autocracies.
*The first number of the different models denotes the kind of democratisation (here 3. successful democratisation). The second number denotes the logarithmic innovation indicator used in relation to a country's population/GDP (.1 patents, .2 scientific articles, .3 R&D). The value for $D_{i,t}$ denotes the coefficient and below in parentheses the adj. standard error is given. *** p<0.01, ** p<0.05, * p<0.1. Only countries that were an autocracy for the whole period are included in this estimation.*

(14) Robustness check 3: successful democratisations vs. autocracies			
	3.1	3.2	3.3
$D_{i,t}$	.46 (.44)	-.21 (.17)	-.18 (.12)
Observations	2,020	2,020	871
Countries	100	100	80

Up to this point, all estimations of the impact of democratisation on innovation were based on the definition of democratic transitions as discussed in the methodology section, i.e. the transition from a closed or electoral autocracy to an electoral or liberal democracy according to V-Dem's RoW index. In order to test whether other measures of democratisation yield different results, I experiment in the following for a sensitivity analysis with other definitions. First, I strengthen the requirements needed to be considered a democracy by only considering the transition to a liberal democracy according to RoW as a democratisation. The associated dummy variables for democratisations, sustained democratisations, and successful democratisations are created analogous to the procedures explained in the methodology section. This step reduces the number of democratisations to 29, with 26 countries undergoing democratic transition, 23 countries sustaining the transition for at least five years, and 15 countries that sustained their transition until 2019. As visible in appendix E a different set of countries saw their political regime changing to a liberal democracy compared to the previous measure.

The results of the estimations (15) in table 11 below differentiate from the previous findings regarding three important aspects. First, the coefficients illustrating the impact of all three respective measures of democratisation on patents increase, which is especially true for successful democratisations. The associations are not significant though, perhaps because the number of countries in the treatment group is significantly lower than before (and because the impact varies more). Second, although the association is not significant, the coefficients for the association with scientific articles are still throughout considerably pronounced. Third, while all three measures of democratic transitions were before associated with a decrease in R&D activity, the stronger measure of democratisation suggests a significantly positive relationship with this innovation indicator at a 10% significance level for democratisations and sustained democratisations and at a 1% level for successful democratisations. The estimations thus

demonstrate an increasingly positive impact of democratic transitions on innovation the more a country becomes democratic, i.e. there is a difference whether a country simply democratises or whether it adopts and incorporates in addition the principles of a liberal democracy.

Table 11 Sensitivity analysis: transition to liberal democracy (1).
*The first number of the different models denotes the kind of democratisation (1. democratisation, 2. sustained democratisation, 3. successful democratisation). The second number denotes the logarithmic innovation indicator used in relation to a country's population/GDP (.1 patents, .2 scientific articles, .3 R&D). The value for $D_{i,t}$ denotes the coefficient and below in parentheses the adj. standard error is given. *** p<0.01, ** p<0.05, * p<0.1.*
Countries in the treatment group of these estimations are listed in appendix E.

(15) Sensitivity analysis: transition to liberal democracy (1)									
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
$D_{i,t}$	.62	.33	.22*	.60	.34	.26*	1.22	.57	.69***
	(.59)	(.23)	(.13)	(.65)	(.25)	(.15)	(.91)	(.35)	(.10)
Observations	3,217	3,217	1,540	3,217	3,217	1,540	3,217	3,217	1,540
Countries	149	149	125	149	149	125	149	149	125

Second, this finding remains true when only looking at countries that started as an autocracy according to the previous measure of democratisation as arguably the inclusion of f. ex. the USA, Italy or Canada in the treatment group might influence the results of the sensitivity analysis (note that the control group changes as well). As visible in table 12, the estimated coefficients and their signs are comparable to the ones in table 11. An exception is that the effect of all three measures of democratisation on scientific articles is not pronounced.

Table 12 Sensitivity analysis: transition to liberal democracy (2).
*The first number of the different models denotes the kind of democratisation (1. democratisation, 2. sustained democratisation, 3. successful democratisation). The second number denotes the logarithmic innovation indicator used in relation to a country's population/GDP (.1 patents, .2 scientific articles, .3 R&D). The value for $D_{i,t}$ denotes the coefficient and below in parentheses the adj. standard error is given. *** p<0.01, ** p<0.05, * p<0.1.*
Countries in the treatment group of these estimations are listed in appendix E. Countries that were a democracy for the whole period are not included (see appendix A).

(16) Sensitivity analysis: transition to liberal democracy (2)									
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
$D_{i,t}$	.67	.08	.16*	.65	.08	.18*	1.62	.06	.52***
	(.62)	(.19)	(.09)	(.70)	(.21)	(.11)	(1.08)	(.35)	(.13)
Observations	2,553	2,553	1,092	2,553	2,553	1,092	2,553	2,553	1,092
Countries	128	128	104	128	128	104	128	128	104

5.4 Discussion

5.4.1 Democratic transitions and innovation

The findings of this study partially support the expected positive relationship between democratic transitions and innovation. All three measures of democratisation are associated with an increased patent activity than in the absence of the treatment (i.e. the transition to a democracy). The effect on this innovation indicator is economically significant, estimation (2) revealed f. ex. an impact ranging from 0.40% for democratisations and 0.46% for sustained democratisations to 0.73% for successful democratisations on a global level, with the latter association being robust at a 10% significance level. The positive effect on patents was also backed up (with two prominent exceptions) by the analysis on a spatial level as well as by the sensitivity analysis using a higher benchmark for democratic transitions. The association was robust to various robustness checks. Thus, the findings for the effect of democratic transitions on patents provide empirical support for the qualitative studies on this association (Lundvall & Borrás, 2005; Nelson, 1993; Ober, 2008; Popper, 2005, 2020). The estimated positive impact of democratic transitions on patent counts is challenging the results of Gao et al. (2017), while backing those of Wang et al. (2021). Gao et al. (2017) also applied the difference-in-differences method and examined a comparable period. However, they used a different democracy database and did not differentiate between different types of democratic transitions. Considering that technological innovations could be an important channel through which democratic transitions exhibit their influence on economic growth (Acemoglu et al., 2019; Ghardallou & Sridi, 2020; Silve & Plekhanov, 2015), the findings support the studies that found a positive impact of democratisations on growth (Acemoglu et al., 2019; Leblang, 1997; Papaioannou & Siourounis, 2008; Rodrik & Wacziarg, 2005).

For the other two examined innovation indicators, scientific articles and R&D expenditures, the results are however ambiguous. On a global level, democratic transitions seem to not be associated with changes in the number of scientific articles and to have a marginally negative effect on R&D expenditures. Regionally, the estimations revealed a significant and positive relationship of democratisations and R&D in East- and South-East Asia as well as a significantly positive association between democratic transitions and scientific articles in the MENA region. Another prominent exception is that the estimations (15) and (16) looking only at the transition to a liberal democracy according to V-Dem's RoW index (see below for a more extensive discussion) revealed a significantly positive effect of democratisations on R&D expenditures. The generally negligible, or even negative, effect on scientific articles and R&D compared to the strong association with patents is raising a number of questions. What could be the reasons for this observation? Which properties of the three innovation indicators could be affected to a varying degree by democratisations?

First, both innovation indicators could be subject to data issues and measurement errors. R&D data is only available for a short period, and even then, not consistently and uniformly. There could be thus a substantial bias deriving from the kind of countries reporting R&D expenditures, and from the limited number of observations in the difference-in-differences estimations. Contrarily, data for scientific articles is similarly to patents available for the full period and for

all countries worldwide. For this indicator, the issue could rather be found in the selection of academic journals by Scopus, which might be biased towards a dominance of journals published in the English language (Mongeon & Paul-Hus, 2016; Savage, 2021). Second, the disparity in outcomes could originate from differences between the three innovation indicators and the way how their different properties are affected by the type of political regime. As discussed in the data section, patent counts might not catch innovations comprehensively in countries with weak property laws (Moser, 2013) and they measure with invention outcomes something characteristically different than R&D expenditures. Furthermore, R&D expenditures were analysed in this thesis in relation to a country's GDP. As democratisations are associated with higher economic growth, and thus a rising GDP, a potential increase in R&D expenditures might as a consequence be hidden from the analysis. Regarding scientific articles, as discussed above Yang & Liu (2021) found a positive correlation between democracy and scientific articles. The results of this thesis suggest that this might have been due to the dominance of developed (democratic) countries in academia (King, 2004). Third, the sensitivity analysis (estimations (15) and (16)) proposes that R&D might only be substantially positively affected by the transition to a liberal democracy.

Furthermore, the findings imply that the three indicators of innovation applied all measure something different and are thus characteristically distinct from each other. It can be concluded that democratic transitions seem to have a measurable positive effect on patent counts and hence technological innovation, whereas their impact on R&D expenditures and scientific articles remains doubtful.

5.4.2 Spatial and historical factors

The analysis of different world regions and groups of countries according to some shared historical characteristics indicated that the effect of democratic transitions on innovation is not uniform globally but rather influenced by spatial disparities. In Latin America and the Caribbean, the effect of, for example, a successful democratisation on patent counts is very pronounced compared to the global level. In sub-Saharan Africa and in Europe democratisations and sustained democratisations are significantly associated with patents, but here the effect of successful democratisations is lower, and even negative in the case of Europe. In the MENA region and in East- and South-East Asia all three measures of democratisations are negatively associated with patents. However, in the former region there exists a significantly positive effect on scientific articles, in the latter on R&D expenditures. Hence, the analysis reveals that the geographic location of a country is a crucial variable, determining the impact of democratisations on innovation to a considerable degree.

Sharing a common history in the form of gaining independence from colonial powers after WW2 has less drastic changes for the effect of democratic transitions on innovation, though the coefficients are generally lower than on a global level. The association of post-communist democratic transitions with innovation similarly broadly resembles the global pattern, but the impact of successful democratisations on patents is lower and there is a significantly negative association with R&D expenditures.

In relation to the discussed literature, the spatial findings demonstrated that democratisations have indeed a (partly significant) positive effect in sub-Saharan Africa, which was recently questioned by another study (Bekana, 2021). Moreover, all three measures of democratisation have in this region a positive association with all three innovation indicators, though the intensity of this relationship is not always high. With regards to post-communist countries, the analysis provides further evidence that democratic transitions in that region led to increased technological innovation (Nazarov & Obydenkova, 2020), measured with patents counts. On a sidenote, although this was not directly controlled for, the results support the conclusions of Nazarov & Obydenkova (2020) that there might be an inverted U-shaped curve for post-communist transitions. This is signified by high (and partly significant) coefficients for democratisations and sustained democratisation with patents for this group of countries, whereas the effect is low for successful democratisations.

What could explain the difference in outcomes of democratisations for the different regions, and especially the effect on patents between Europe, sub-Saharan Africa, Latin America and the Caribbean, and post-communist countries on one side and MENA and East- and South-East Asia on the other? For East- and South-East Asia as well as MENA the reason could be the success of many autocratic regimes in these countries, which is challenging f. ex. institutional economics' theories on the importance of inclusive institutions. Bardhan (2005) argues that these countries demonstrated that it is possible for autocracies to promote the good economic institutions needed for stable long-term economic development. Similarly, Rodrik (2008) shows how the application of second-best institutions (i.e. not the best ones according to NIE) can lead to favourable economic results. For example, that central banks are rarely independent in these countries gives more freedom to the state to introduce currency undervaluation measures, which is supportive for economic growth (Rodrik, 2008). In general, the autocratic countries in these two regions might have been able to introduce these growth-inducive institutions exactly because of their autocratic nature. Leftwich (1995, 401) characterizes such developmental states as "states whose politics have concentrated sufficient power, autonomy and capacity at the centre to shape, purse and encourage the achievement of explicit developmental objectives […]".

Another explanation could be that developing countries are not located at the technological frontier; they might have more incentives to adopt foreign technologies rather than innovating on their own. Indeed, technological development in developing countries stems from a high degree from technology imports via licenses and from the import of capital goods (Vivarelli, 2012). Moreover, technology imports explain the vast majority of productivity growth in most developing countries (Keller, 2004). Barriers to innovation in these countries include education, unstable political and legal systems, financial constraints and infrastructural deficiencies, whereas a higher degree of openness of an economy constitutes a positive driving force (Zanello et al., 2016). Zanello et al. (2016) identify however those countries as successful cases that increased the diffusion of innovation to strengthen local innovative capabilities. Linking this brief discussion with the findings of this thesis suggests two crucial implications: First, a measurable effect of democratic transitions on patent counts in these countries might not necessarily imply subsequently a comparable effect on economic development; and second, the differences in outcomes across world regions might be explained partially by the patterns of knowledge and technology imports in these regions.

5.4.3 Different measures of democratisation

As discussed in the literature section, there was reason to assume that the positive effect of democratic transitions on innovation is more pronounced for sustained and successful democratisations than for democratisations that may already be reversed after one or two years (Huntington, 2006; Lacroix, Méon & Sekkat, 2021; Papaioannou & Siourounis, 2008; Schmitter & Karl, 1991). The existence of such a pattern is supported by the findings of this thesis as demonstrated f. ex. by the growing coefficient for patents in estimation (2). Furthermore, the inclusion of non-successful democratisations is not having the expected negative bias for the impact of successful democratisation as revealed by estimation (14). This provides some evidence that just the simple fact of democratising is indeed not necessarily associated with many improvements in the socioeconomic conditions of a country (at least not regarding innovation) (Schmitter & Karl, 1991). It further highlights that it is crucially important to differentiate between democratisations per se and successful democratisations. This reasonable conclusion is further supported by the findings of the sensitivity analysis. Countries that were an autocracy in 1960 but subsequently underwent successful democratic transition to a liberal democracy (estimation (16)) patent considerably more and have significantly more R&D expenditures than in the absence of such a treatment.

5.4.4 Limitations

While the findings were with some reservations rather robust, no matter on a global or regional level or when being subject to robustness checks, they still come along with a set of limitations. First, the applied difference-in-differences estimators assume a consistent impact over time. It could however be that f. ex. the first years are associated with a lower effect, whereas the long-term impact is more pronounced. Furthermore, it is difficult to reliably establish causality for the examined association as discussed in the elaborations on the model. And the estimations with lagged dependent variables indicated that the values of the innovation indicators can be explained to some degree by persistence effects. Thus, the findings should be interpreted with caution with regards to these econometrical issues. Second, the underlying dataset has some drawbacks, such as many missing observations for R&D and for some of the control variables. Furthermore, the lack of data especially for developing countries could have biased the results. Third, patents and scientific articles were scrutinized in relation to their quantity, whereas a mix of quantitative and qualitative measures might lead to different findings. Fourth, the political regime of a country was measured with a binary democracy indicator (and for the sensitivity analysis by using a different benchmark), which does not leave space for a grey zone in between democracy and autocracy.

5.4.5 Future research

The results of this analysis regarding the recorded impact of democratic transitions on patents, the absence of a measurable association with the other two innovation indicators, the spatial disparities, and the differences along measures of democratisation could be a point of departure for future research. There exist plenty different forms of democracies and an analysis

differentiating between the most important ones could yield interesting results. Similarly, future research could examine some of the properties that democratising countries that are successful innovators have in common. Such an analysis could ultimately result in some stylized policy implications for countries on the brink of a democratic transition. In a similar vein, case studies examining closely how democratic transitions affect the innovation system (and especially patents) could help in establishing a more robust causal relationship. Regarding scientific articles and R&D, more empirical research is needed about the impact of political regime types and democratisations as the ambiguous results of this thesis do not allow well-grounded deductions. Considering the importance of technology imports for developing countries (Keller, 2004), a study measuring the impact of democratisation on the diffusion of innovation would be highly relevant. And with regards to the recorded spatial differences, future research could examine on a more detailed level the reasons for the diverging impact of democratic transitions on patents between MENA as well as East- and South-East Asia and the rest of the world.

6 Conclusion

The debate surrounding which type of political regimes leads to the best economic and social outcomes has been around for millennia. Regarding the association of democracy and democratisation with innovation empirical research has however been scarce up to this date and found conflicting results. The main objective of the present analysis was thus to examine the effect of democratic transitions on innovation by applying difference-in-differences estimations on a panel of 168 countries for the period from 1960-2019.

The results suggest that democratic transitions have a positive effect on innovation, measured with patent counts. Democratisations seem to affect national innovation systems in a way that is more favourable to technological innovations. This finding is broadly in line with key assumptions of NIE regarding economic benefits of a democratic regime type (e.g., Acemoglu, Johnson & Robinson, 2004; Bardhan, 2005; North, Wallis & Weingast, 2006; Shirley, 2005). Concerning the other two examined innovation indicators, scientific articles and R&D expenditures, the estimations revealed however no measurable association. Besides potential data and measurement issues, this could signal that only technological innovations are significantly affected by democratisations. The spatial analysis indicated that the effect of democratisations on innovation might vary between some world regions (and especially between MENA as well as East-and South-East Asia and the other regions) rather than being homogenous globally. Although there was reason to assume that spatial disparities might shape the impact due to f. ex. the importance of state antiquity (Bardhan, 2005; Diamond, 2012), the divergence might be instead caused by the success of many autocratic countries in MENA and East- and South-East Asia. Furthermore, the findings offer support from an innovation perspective for the hypothesis that the positive effect of democratic transitions is more pronounced for sustained and successful democratisations than for democratisations that may already be reversed after few years (Huntington, 2006; Lacroix, Méon & Sekkat, 2021; Papaioannou & Siourounis, 2008; Schmitter & Karl, 1991). Moreover, the real benefits of democratisations might even only appear in a subsequent evolution towards a liberal democracy.

These insights suggest some important policy implications. In face of the grand challenges and to spur global economic development it is recommended to promote democratisations in autocratic countries in order to increase patenting activities in the respective economies (besides of various other potential positive effects of democracy not measured in this analysis). It should however be ensured that the transitions are successful and long-lasting, implying that supportive international efforts should be increased for democratising countries in light of the global pressures on democracy (Alizada et al., 2021; The Economist, 2021). Moreover, it would be desirable that democratisations do not end with the plain transition from autocracy to democracy but rather ultimately result in a liberal democracy.

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Appendix A

Countries that were democracies from 1960-2019	
Australia	Italy
Austria	Japan
Belgium	Luxembourg
Canada	Netherlands
Costa Rica	New Zealand
Denmark	Norway
Finland	Sweden
France	Switzerland
Germany*	United Kingdom
Ireland	United States
Israel	

Table 13 Democratic countries from 1960-2019.
*Germany is a special case (marked with *) as one part of the later reunited Germany (the German Democratic Republic) was an autocracy.*

Democratising countries			
Country	**Year(s) of democratisation**	**Sustained democratisation (>=5 years)**	**Successful democratisation (>=5 years + never reversed)**
Albania	2005	1	0
Argentina	1964	0	0
	1974	0	0
	1984	1	1
Armenia	1990	1	0
Bangladesh	1992	1	0
Belarus	1991	1	0
Benin	1992	1	0
Bhutan	2009	1	1
Bolivia	1986	1	0
Bosnia and Herzegovina	1997	1	1
Botswana	1967	1	1
Brazil	1987	1	1
Bulgaria	1991	1	1
Burkina Faso	1999	1	0
	2016	0	0
Cabo Verde	1991	1	1
Chile	1990	1	1
Colombia	1991	1	1
Cote d'Ivoire	2016	0	0

Croatia	2000	1	1
Cyprus	1975	1	1
Czech Republic	1990	1	1
Dominican Republic	1983	0	0
	1996	1	1
Ecuador	1980	1	1
El Salvador	1999	1	1
Estonia	1990	0	0
	1993	1	1
Fiji	1970	1	0
	1993	1	0
	2002	0	0
Gambia, The	2018	0	0
Georgia	2004	1	1
Ghana	1980	0	0
	1996	1	1
Greece	1975	1	1
Guatemala	2000	1	1
Guinea-Bissau	2015	1	1
Guyana	1998	1	1
Honduras	1991	1	0
Hungary	1990	1	0
India	1977	1	0
Indonesia	1999	1	1
Jamaica	1984	1	1
Kenya	2014	0	0
Korea, Rep.	1988	1	1
Latvia	1990	1	1
Lebanon	2010	1	0
Lesotho	2002	1	1
Liberia	2006	1	1
Libya	2013	0	0
Lithuania	1990	1	1
Madagascar	1994	1	0
	2008	0	0
Malawi	1995	1	0
	2009	1	1
Maldives	2009	0	0
	2019	0	0
Mali	1993	1	0
	2014	1	0
Malta	1963	1	1
Mauritius	1968	1	1
Mexico	1996	1	1

Moldova	1992	1	0
	2010	1	1
Mongolia	1991	1	1
Montenegro	2005	0	0
	2010	0	0
Namibia	1990	0	0
	1995	1	1
Nepal	2009	0	0
	2014	1	1
Nicaragua	1990	1	0
Niger	1993	0	0
	2000	1	0
	2011	1	1
Nigeria	2012	1	1
North Macedonia	1999	0	0
	2002	1	0
	2017	0	0
Panama	1991	1	1
Papua New Guinea	1972	1	0
Paraguay	1993	1	1
Peru	1981	1	0
	2001	1	1
Philippines	1988	1	0
	2010	1	0
Poland	1990	1	1
Portugal	1976	1	1
Romania	1991	1	1
Russian Federation	1992	0	0
Senegal	1984	1	1
Serbia	2001	1	0
Sierra Leone	2003	1	1
Slovak Republic	1994	1	1
Slovenia	1990	1	1
Solomon Islands	1979	1	0
	2002	0	0
	2007	1	1
South Africa	1995	1	1
Spain	1978	1	1
Sri Lanka	1995	1	0
	2015	1	1
Suriname	1988	0	0
	1992	1	1
Tanzania	1996	0	0
Thailand	1998	1	0
	2012	0	0

Timor-Leste	2002	1	1
Trinidad and Tobago	1962	1	1
Tunisia	2012	1	1
Turkey	1966	1	0
	1988	1	0
Ukraine	1994	0	0
	2006	0	0
Uruguay	1985	1	1
Venezuela	1963	1	0
Zambia	1994	0	0
	2000	1	0

Table 14 Democratising countries.
A democratisation is defined as the transition from a closed or electoral autocracy to an electoral or liberal democracy according to V-Dem's RoW index. A sustained democratisation is a democratisation that lasts at least 5 years, and a successful democratisation is a sustained democratisation that lasts until 2019.

Appendix B

P-values of the different difference-in-differences estimations									
Estimation	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1	0.079	0.372	0.190	0.096	0.442	0.083	0.116	0.851	0.062
2	0.124	0.627	0.828	0.101	0.530	0.481	0.060	0.982	0.567
3	0.202	0.830	0.466	0.199	0.920	0.227	0.092	0.435	0.419
4	0.106	0.883	0.345	0.086	0.783	0.522	0.001	0.168	0.185
5	0.039	0.423	0.326	0.055	0.441	0.195	0.871	0.332	0.302
6	0.096	0.074	0.709	0.096	0.074	0.709	0.076	0.090	0.181
7	0.095	0.262	0.139	0.021	0.215	0.139	0.649	0.797	
8	0.527	0.275	0.968	0.607	0.363	0.968	0.084	0.820	0.690
9	0.514	0.388	0.023	0.514	0.388	0.023	0.634	0.800	0.236
10	0.130	0.177	0.139	0.094	0.129	0.014	0.876	0.780	0.041
11	0.485	0.856	0.336	0.267	0.727	0.845	0.737	0.934	0.127
12	0.190	0.762	0.918	0.149	0.676	0.781	0.057	0.960	0.585
13	0.165	0.684	0.517	0.134	0.808	0.187	0.075	0.205	0.103
14							0.298	0.217	0.138
15	0.297	0.153	0.078	0.359	0.174	0.090	0.181	0.106	0.000
16	0.284	0.682	0.072	0.353	0.720	0.083	0.137	0.877	0.000

Table 15 P-values of the different difference-in-differences estimations.

Appendix C

(2) Baseline results (including results for control variables)									
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
$D_{i,t}$	.46	.05	-.03	.52	.07	-.09	.78*	-.00	-.10
	(.29)	(.11)	(.12)	(.31)	(.12)	(.12)	(.41)	(.18)	(.18)
urban	.09***	.05***	.02	.09***	.05***	.02	.09***	.05***	.02
	(.03)	(.02)	(.01)	(.03)	(.02)	(.01)	(.03)	(.02)	(.01)
school	.02*	-.00	-.01	.02*	-.00	-.01	.02	-.00	-.01
	(.01)	(.00)	(.01)	(.01)	(.01)	(.01)	(.01)	(.00)	(.01)
trade	-.01	.00	.00	-.01	.00	.00	-.01	.00	.00
	(.01)	(.00)	(.00)	(.01)	(.00)	(.00)	(.01)	(.00)	(.00)
military	-.04	-.06	.03	-.04	-.06	.03	-.04	-.06	.03
	(.05)	(.04)	(.05)	(.05)	(.04)	(.05)	(.05)	(.04)	(.05)
infant mortality	-.01	-.01**	.02***	-.01	-.01**	.02***	-.01	-.01**	.02***
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
GDP per cap.	-.00	.00*	-.00	-.00	.00*	-.00	-.00	.00*	-.00
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
population	.00	-.00**	-.00	.00*	-.00*	-.00	.00*	-.00**	-.00
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
Observations	3,217	3,217	1,542	3,217	3,217	1,542	3,217	3,217	1,542
Countries	149	149	125	149	149	125	149	149	125

Table 16 Baseline results (including results for control variables).
The following control variables were included: urban, school, trade, military, infant mortality, GDP per capita, population (see data' section for their sources).
*The first number of the different models denotes the kind of democratisation (1. democratisation, 2. sustained democratisation, 3. successful democratisation). The second number denotes the logarithmic innovation indicator used in relation to a country's population (.1 patents, .2 scientific articles, .3 R&D). The value for $D_{i,t}$ denotes the coefficient and below in parentheses the adj. standard error is given. *** p<0.01, ** p<0.05, * p<0.1.*

Appendix D

(3) Baseline results: lag 5									
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
$D_{i,t}$	.47 (.36)	-.03 (.13)	-.10 (.14)	.50 (.38)	-.01 (.14)	-.18 (.15)	.91* (.54)	-.17 (.22)	-.19 (.23)
Observations	3,208	3,208	1,348	3,208	3,208	1,348	3,208	3,208	1,348
Countries	148	148	114	148	148	114	148	148	114
(4) Baseline results: lag 10									
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
$D_{i,t}$	.72 (.44)	-.02 (.14)	-.14 (.15)	.80* (.46)	-.04 (.15)	-.11 (.17)	1.80*** (.55)	-.32 (.23)	-.43 (.31)
Observations	3,171	3,171	1,074	3,171	3,171	1,074	3,171	3,171	1,074
Countries	148	148	112	148	148	112	148	148	112

Table 17 Baseline results for lagged dependent variables.
*The first number of the different models denotes the kind of democratisation (1. democratisation, 2. sustained democratisation, 3. successful democratisation). The second number denotes the logarithmic innovation indicator used in relation to a country's population (.1 patents, .2 scientific articles, .3 R&D). The value for $D_{i,t}$ denotes the coefficient and below in parentheses the adj. standard error is given. *** p<0.01, ** p<0.05, * p<0.1.*

Appendix E

Democratising countries (higher benchmark)			
Country	**Year(s) of democratisation**	**Sustained democratisation (>=5 years)**	**Successful democratisation (>=5 years + never reversed)**
Benin	2013	0	0
Botswana	1999	1	1
Canada	1976	1	1
Chile	1996	1	0
Costa Rica	1989	1	1
Cyprus	2004	1	1
Czech Republic	1990	1	1
Estonia	1996	1	1
Ghana	2003 2017	1 0	0 0
Greece	1976	1	0
Hungary	1991	1	0
Israel	1966	1	1
Italy	1970	1	1
Korea, Rep.	1993	1	1
Latvia	2009 2014 2017	0 0 0	0 0 0
Lithuania	1993	1	0
Mauritius	1976	1	0
Poland	1990	1	0
Portugal	1977	1	1
Slovak Republic	2010	0	0
Slovenia	1991	1	1
South Africa	1996	1	0
Spain	1983	1	1
Trinidad and Tobago	2005	1	1
United States	1969	1	1
Uruguay	1986	1	1

Table 18 Democratising countries (higher benchmark)
A democratisation is defined here as the transition from a closed or electoral autocracy or an electoral democracy to a liberal democracy according to V-Dem's RoW index. A sustained democratisation is a democratisation that lasts at least 5 years, and a successful democratisation is a sustained democratisation that lasts until 2019.