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Financial Development and Sustainable Competitiveness in Arctic Region: A Dynamic Panel Data Analysis

Rozwój finansowy i zrównoważona konkurencyjność w regionie Arktyki: analiza dynamiczna danych panelowych

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Abstract
The present study investigates the effect of financial development on sustainable competitiveness and its components (natural capital, resource intensity, and social cohesion) in the Arctic region. We employed bank-based, stock-market based, and composite indexes to measure financial development. To deal with endogeneity bias, system GMM is utilized. The results show a positive and significant effect of financial development on sustainable competitiveness. The estimates also assert that financial development encourages resource efficiency and social cohesion in the region. In contrast, we found the negative effect of financial development on natural capital. This suggests that overexploitation of natural resources may provide short-term benefits to the local and regional communities but it may threaten the long-term sustainability of the Arctic. Thus, the financial sector should be guided to support financing and investing activities in alternative eco-friendly technologies and ventures for reducing excessive natural resource utilization.

Keywords: sustainable competitiveness, financial development, social cohesion, resource intensity, natural capital

Streszczenie
W niniejszej pracy zbadano wpływ rozwoju finansowego na zrównoważoną konkurencyjność i jej komponenty (kapitał naturalny, zasobochłonność i spójność społeczną) w regionie Arktyki. Do pomiaru rozwoju finansowego stosujemy indeksy bankowe, giełdowe i złożone. Aby poradzić sobie z błędem endogenności, wykorzystywany jest system GMM. Wyniki pokazują pozytywny i znaczący wpływ rozwoju finansowego na zrównoważoną konkurencyjność. Szacunki potwierdzają również, że rozwój finansowy sprzyja efektywnemu gospodarowaniu zasobami i spójności społecznej w regionie. Z drugiej strony dostrzegamy negatywny wpływ rozwoju finansowego na kapitał naturalny. Sugeruje to, że nadmierna eksploatacja zasobów naturalnych może przynieść krótkoterminowe korzyści społecznościom lokalnym i regionalnym, ale może zagrozić długoterminowej stabilności Arktyki. Sektor finansowy powinien zatem kierować się wspieraniem finansowania i inwestowania w alternatywne technologie

przyjazne dla środowiska oraz przedsięwzięcia mające na celu ograniczenie nadmiernego wykorzystania zasobów naturalnych.

Słowa kluczowe: zrównoważona konkurencyjność, rozwój finansowy, zasobochłonność, spójność społeczna, kapitał naturalny

1. Introduction

Economic activities and development are essential for the prosperity of human civilization. Besides, the demand for fresh air, raw material, energy, and food by humans from Mother Nature has emerged. These dramatic changes in demand deteriorated the ecosystem by depleting natural resources, loss of biodiversity, land degradations, and increased waste and pollution emissions (Lan, Malik, Lenzen, McBain, & Kanemoto, 2016). Currently, the earth is in an Anthropocene phase where human greed is deliberately deteriorating nature and creating threats for their current and future generations (Gough, 2017). Consequently, global economies are finding adequate ways to be commercially competitive without compromising environmental quality and social welfare to avoid further socio-ecological crises (Thore & Tarverdyan, 2016). The notion of sustainable development harmonized the institutional development, technological orientation, financial investment, and exploitation of resources to meet both present and eventual needs of human survival (Thore & Tarverdyan, 2016).

The universalization of capital markets through globalization exhibits both scale and wealth effects of the economy (Dauvergne, 2010). Researchers have also observed that environmentally cleaner countries usually have efficient and more developed financial markets (Al Mamun, Sohag, Shahbaz, & Hammoudeh, 2018; Dasgupta, Laplante, & Mamingi, 2001). Increased level of accessibility to wealth by financial development advances living standards, attract energy-efficient green technologies and mitigate environmental degradation(Du, Wei, & Cai, 2012; Hsueh, Hu, & Tu, 2013; Zafar, Saud, & Hou, 2019; Zaidi, Zafar, Shahbaz, & Hou, 2019). Strong financial systems have more lenient and low cost credit policies for eco-friendly projects (Dasgupta et al., 2001; Tamazian & Rao, 2010). On the other hand, the critics of the finance-environment nexus found adverse consequences of financial development on the environment. More access to finance and credit increases industrial activities that may lead to environmental degradation and more carbon emissions (Sadorsky, 2010; Shahbaz, Mallick, Mahalik, & Loganathan, 2015).

This study focuses on the Arctic region to further explore the relationship between financial development and sustainable competitiveness. The fluctuation in temperature of the Arctic region is more significant compared to other regions on the earth. A World Bank report predicts around a 4°C to 8°C increase in the Arctic Ocean along with a complete meltdown of ice packs by the year 2025 (Schellnhuber et al., 2012). Ocean acidification has increased by 30% in the past few years due to the increase in CO_2 emissions (Qi et al., 2017). Natural resources remained largely untapped despite their abundance in the region. Along with the risks of major disasters, the cost of oil exploration, gas drilling, and mining is very high. Despite global warming and ecological emergency in the Arctic region, melting ice is in favor of economic outlooks with respect to tourism, trade and exploitation of natural resources. Thus, investigating the role of financial development in the region to facilitate natural capital, social capital, resource intensity and overall long-term sustainable competitiveness is important for prospective policy implications.

The contribution of the present study to the existing literature is fourfold. Firstly, this study examines the association between financial development and sustainable competitiveness in the Arctic region. Owing to the major climatic changes and environmental degradation issues in the region, this study will help regulatory bodies to design an optimal policy to expedite economic growth with depleting natural and social capital. Secondly, we have investigated several individual and aggregate indexes of financial development on sustainable competitiveness to evaluate the scale and efficiency effects of financial development. Thirdly, besides composite measures, we also investigated the effect of financial development on the dimensions of sustainable competitiveness including social capital, natural capital, and resource intensity to evaluate a more holistic view. Fourthly, considering the limitations of data availability, we used several advanced statistical tools to deal with omitted variables bias and endogeneity issues.

The rest of the paper is organized as follows. Section 2 discusses the notion of sustainable competitiveness along with its relationship with financial development. Section 3 is related to data sources, measurement of the variables, and the empirical model of the study. Section 4 discusses the estimation results and discussion. We concluded the study in the final section along with policy implications and future recommendations.

2. Literature Review

The concept of sustainable development in economics emerged after the expeditious degradation of natural, social, and human capital despite economic growth. Currently, researchers and policymakers

have incorporated United Nation's seventeen sustainable development goals (SDGs) in their agenda-setting to achieve global sustainability by fostering innovation, reducing poverty, protecting the planet, providing quality education, ensuring peace and prosperity, promoting inclusive industrialization, building resilient infrastructure (Thore & Tarverdyan, 2016). Previously, sustainable growth was linked to innovation, the labor force, and natural resources. Later, classical economic theorists introduced capital to the construct as all other production functions remain futile without capital accumulation (Paun, Musetescu, Topan, & Danuletiu, 2019). Thus, sustaining natural capital, social capital, and human capital along with economic growth is important to achieve sustainable competitiveness.

Previous studies argued that financial sector development is conducive to sustainable economic development especially in the long-run (Durusu-Ciftci, Ispir, & Yetkiner, 2017; Paun et al., 2019). However, it is still an underexplored phenomenon that how financial development impedes (facilitates) natural capital, social capital, resource intensity, or overall sustainable competitiveness, especially in the Arctic region. A wide strand of studies mainly focused on two components of sustainable competitiveness, i.e., environmental quality and economic growth. It is argued that economic and financial development is a protracted process that may promise a good standard of comfort but also degrade environmental quality (Zhang, 2011).

Initially, the debate between environmental quality and financial development was established after Grossman and Krueger (1995) proposed the Environmental Kuznets curve (EKC). According to the EKC hypothesis, economic development may deteriorate environmental quality but economies thrive to take steps to control environmental degradation once they reach a GDP's threshold level. This hypothesis is tested by various researchers at the country and region level (Apergis & Ozturk, 2015; Carson, 2010; Jebli, Youssef, & Ozturk, 2016). Nonetheless, omitting financial development from the environmental degradation function may lead to spurious estimates (Tamazian, Chousa, & Vadlamannati, 2009).

Financial development may influence the environmental quality or air pollution through wealth effect (efficient stock markets), business effect (elevating investment activities), and scale effect (domestic output expansion). Developed financial markets may allocate funds efficiently, reduce finance costs, facilitate the acquisition of energy-efficient technologies to mitigate environmental pollution (Tamazian et al., 2009). On the other hand, Tamazian and Rao (2010) argued that financial development may reduce environmental degradation in the presence of strong institutions only in transactional economics. Similar results were purported by Ntow-Gyamfi, Bokpin, Aboagye, and Ackah (2020) in the African region. Lee, Chen, and Cho (2015) investigated this relationship in OECD countries using Fully Modified Least Square (FMOLS). Using domestic credit to the private sector as a measurement of financial development, they found its negative effect on environmental degradation. Besides the advocates of financial development, researchers have also revealed its adverse effects on the eco-system (Al-Mulali, Ozturk, & Lean, 2015; Sadorsky, 2010; Shahbaz, Shahzad, Ahmad, & Alam, 2016; Zhang, 2011).

Shahbaz et al. (2016) investigated the effect of financial development on environmental degradation in Pakistan using quarterly data. They argued that bank-based financial development impedes environmental quality by increasing energy demand. Developing countries generally meet the energy demands using all available resources including non-renewable energy. Based on the Keynesian theory of consumption, Zhang (2011) posited that the development of financial intermediation boosts the consumption of household items that exuberate air pollution emissions. Using the panel data of European countries, Al-Mulali et al. (2015) also find a positive effect of financial development on CO_2 emissions. Nonetheless, natural capital is not only related to sustaining air quality, it is a wider concept that delineates the country's capability to self-sustain through mineral resources, energy, food production, biodiversity, climate, water and land.

Although studies have shown mixed evidence on the effect of natural capital abundance on financial development (Khan, Hussain, Shahbaz, Yang, & Jiao, 2020; Zaidi, Wei, et al., 2019), we highlighted and explored the role of financial development on replenishing or depleting natural resources of Arctic region. Likewise, studies have investigated the impact of social capital in developing financial markets. Social capital is the sum of the well-being and social stability of the entire population. It engenders consensus and social cohesion which in turn protect human capital, over exploration of natural resources, and promote a stable macroeconomic environment. Societies with high social capital are generally less likely to use informal credit, have higher access to institutional credit, invest their savings in stocks, and use checks for financial transactions that facilitate financial development (Elkhuizen, Hermes, Jacobs, & Meesters, 2018; Guiso, Sapienza, & Zingales, 2004). Even though there is a scarcity of literature related to the effect of financial development on a composite index of social capital, studies favor financial development in facilitating the health system (Chireshe & Ocran, 2020), income equality (Gharleghi & Jahanshahi, 2020), voter turnout at referenda and blood donations (Guiso et al., 2004).

Financial development is also capable of stimulating the financial and resource efficiency of a country. It allows FDI flows, reduces information asymmetry between borrowers and lenders, reduces the cost of

loans, and promotes banking activities that eventually affect fixed investment and energy demands (Mukhtarov, Humbatova, Seyfullayev, & Kalbiyev, 2020). Using the provincial panel data, spatial measurement, and generalized least squares methods, Xu and Tan (2020) found a positive effect of financial development on natural resource utilization efficiency by upgrading industrial infrastructure. A higher level of financial development efficiently allocates resources and improves the flow of capital toward industry, making them more competitive and productive. Furthermore, companies transform themselves to cleaner production for avoiding higher environmental governance costs (Zameer, Wang, & Yasmeen, 2020). Thus, based on the aforementioned debate, we posit that financial development plays a vital role in improving sustainable competitiveness and its components.

3. Research Methodology

3.1. Sample and Measurement of Variables

To estimate the dynamic and causal relationship between financial development and sustainable competitiveness, the panel data of 8 countries within the Arctic circle (Iceland, Denmark, Canada, United States, Russia, Finland, Sweden, and Norway) are selected over the period 2012 to 2019. Sustainable competitiveness is the dependent variable of this study. Previously, studies have measured the competitiveness of a country through its GDP or other individual proxies but they do not systematically express a national balance sheet. GDP only measures the monetary value of a country but ignores the environmental and social interconnections that lead to sustainable development. To measure the long-term financial and non-financial sustainability of the country, we adapt the sustainable competitiveness index[1] developed by SolAbility. There are five pillars of sustainable competitiveness including natural resources (agriculture, biodiversity, water, resources, and pollution), resource intensity (energy, water, and raw material), government efficiency (government cohesion, infrastructure, business environment, corruption, and financial stability), intellectual capital (education, R&D and new business) and social cohesion (health, equity, crime, satisfaction, and freedom). Nonetheless, to investigate the effect of financial development on sub-indexes of sustainable competitiveness, we have considered three pillars, i.e. natural capital, resource intensity, and social cohesion due to their consistency in all reports[2].

There are several measures available in prior literature to assess financial development. Relying on the commonly used bank-based and market-based measures of financial development, we used bank concentration, domestic credit to the private sector (DCPS), S&P Global Equity Indices, stock market returns, and financial market development index. The data of bank concentration is collected from the Financial Structure Dataset which is measured through the ratio of total assets of the three largest banks to total banking industry assets in each country. On the other hand, the data of domestic credit to the private sector (% of GDP), S&P Global Equity Indices (annual % change), and stock market return (%, Year-On-Year) are accessed through World Bank Database. We extracted the data of the composite financial market index from the global competitiveness index (GCI). Financial market development is the eighth pillar of GCI and its index is developed based on efficiency, trustworthiness, and confidence in the financial services of the country.

To minimize the omitted variable bias, we consider several control variables including military expenditures, tax revenue, trade openness, and inflation. A higher level of military expenditures may impede economic growth (d'Agostino, Dunne, & Pieroni, 2019), elevate income inequality (Raza, Shahbaz, & Paramati, 2017), and may increase pollutant emissions (Gokmenoglu, Taspinar, & Rahman, 2021). Similarly, it is believed that tax avoidance is a barrier to sustainable development (Bird & Davis-Nozemack, 2018) while an increased level of tax revenue boosts economic growth (Takumah & Iyke, 2017). Inflation is incorporated in the model due to its noticeable role in affecting the finance-growth nexus. Financial development may adversely influence sustainable development if inflation is higher than a certain threshold level (Bandura, 2020). Last but not the least, trade openness is employed as a control variable because it promotes the usage of eco-friendly technologies (Yahya & Rafiq, 2019) and facilities economic growth (Huchet-Bourdon, Le Mouël, & Vijil, 2018).

3.2. Model Specification

Initially, we assume that financial development positively influences sustainable competitiveness and its pillars. Thus, the baseline static model is specified as below:

$$SC_{it} = \beta_0 + \beta_1 FD_{it} + AX_{it} + \mu_t + \varepsilon_{it} \quad (1)$$

[1]Although several measurements of sustainable competitiveness are available in prior studies, the Global Sustainable Competitiveness index (GSCI) is a comprehensive index based on 116 quantitative indicators. The first annual report of GSCI was developed in year 2012. Although the data over the period 2012 to 2020 is available for sustainable competitiveness and its components, the financial development indicators data is available till 2019. Thus, we restrict the time-series from 2012 to 2019 after considering the data availability of financial development indicators.

[2]Initially, four pillars were developed to measure sustainable competitiveness index, i.e. natural capital, resource intensity, sustainable innovation and social cohesion. However, sustainable innovation was replaced by government efficiency and intellectual capital in later reports.

Table 1. Descriptive Statistics, source: Authors' calculations

	Minimum	Maximum	Mean	S.D.
Sustainable Competitiveness	43.900	62.800	54.000	5.002
Natural Capital	42.900	67.600	57.225	5.452
Resource Intensity	28.400	59.200	35.673	17.415
Social Cohesion	34.400	78.300	56.173	15.421
DCPS	43.914	190.949	107.547	58.090
Bank Concentration	28.794	100.000	72.045	26.534
S&P-GE-Indices	-48.983	48.733	7.209	17.302
SM-Return	-14.200	31.680	9.401	10.469
Financial Market Development	3.192	5.565	4.821	0.750
Military Expenditures	0.000	5.452	1.810	1.414
Tax-Revenue	9.183	37.934	20.714	8.349
Trade Openness	26.514	104.268	70.671	23.241
Inflation	-0.208	15.534	2.228	2.675

SC is the sustainable competitiveness index, FD is the financial development, X_{it} is the vector of control variables namely: tax revenue, inflation, and financial openness, ε_{it} is the error term, i is the individual dimension of the panel, and t is the temporal dimension.

It should be noted that pooled ordinary least squares are generally biased and produce inconsistent estimates of the parameters in the presence of reverse causality. Although the fixed-effect estimator may reduce the issue of omitted variable bias, the two-way causal relationships can be dealt with some instrumental variables methods (Anderson & Hsiao, 1981). Nonetheless, the instrumental variable estimator developed by Anderson and Hsiao (1981) does not account for the differenced structure of the new error terms and does not utilize the moment conditions, thus, yield inefficient estimates for short panels. To deal with the measurement errors, endogeneity, and omitted variable bias, we take into account the system generalized method of moments (GMM) proposed by Arellano and Bover (1995) and Blundell and Bond (1998). This method uses both levels and differenced equations to evaluate valid instruments. Difference estimators generally produce asymptotic imprecision and latent biases in finite samples due to which system GMM is a preferred tool (Blundell & Bond, 1998). The system GMM neither intensity the strength of measurement error nor discard cross-country variation. Accordingly, a revised dynamic model is specified in equation 2:

$$SC_{it} = \beta_0 + \beta_1 SC_{it-1} + \beta_2 FD_{it} + AX_{it} + \mu_t + \varepsilon_{it} \quad (2)$$

In system GMM, additional moment conditions can be introduced by incorporating the lagged differences of the explanatory variables as instruments for the level equations and the level equations to the first-differenced equations. Even though economies with a higher level of financial development may lead to economic growth but there could be certain omitted variables that drive sustainable competitiveness. Additionally, it is also possible that natural capital depletion, resource intensity, and social cohesion boost the demand for financial services and thereby enhance financial development. Thus, valid instrumental variables (correlated with financial development but no relation with error term) may mitigate the reverse causality issue. Furthermore, we use the standard Sargan-Hansen test of over-identifying restriction to test the validity of the instrumental variables and the existence of serial correlation through AR (2) test for second-order serial correlation of the differenced residuals.

4. Empirical Findings and Discussion

The descriptive statistics of the dependent, independent, and control variables are shown in Table 1. The mean value of sustainable competitiveness is 54.00 showing better sustainable performance of the Arctic region compared to other regions with Russia at the lower end and Denmark at the upper end. The overall mean scores of natural capital (M = 57.23) and social cohesion (M = 56.17) are also indicating natural resource abundance and satisfactory connectedness among the societal environment in the region. Nonetheless, the mean score of resource intensity (M = 35.67) is low compared to other SC indicators with the lowest value of Russia and the highest value of Sweden. Despite resource abundance in the Arctic region, the efficiency of resource use is not reasonable. From the perspective of explanatory values, the standard deviation values of bank-based financial development indicators (DCPS and bank concentration) are very high, indicating significant regional differences. The financial development of Russia stands lowest in the region while the most domestic credit to the private sector is provided by the USA and Iceland has the most concentrated banking system. The stock market-based indicates that the region provides around 7% to 9% to the investors. Overall, the financial market of Russia is the least developed while Finland has the most efficient and trustworthy financial market.

Table 2 reports the correlation matrix of the underlying variables of the study. The results show a positive and significant relationship of financial development (FMD and BC) with sustainable competitiveness while military expenditures and inflation impede sustainable development. Similarly, financial development indicators are positively associated

Table 2. Correlation Matrix, source: Authors' own calculations

	SC	NC	RI	SC	DCPS	BC	S&P	SMR	FMD	MILX	TAXR	TROP
SC	1											
NC	.094	1										
RI	.458**	.013	1									
SOC	.751**	-.084	.209	1								
DCPS	.198	-.427**	.072	.181	1							
BC	.728**	.036	.137	.708**	.156	1						
S&P	.254	-.182	.486**	.136	.251	.035	1					
SMR	.064	-.306*	-.169	.170	.328*	.150	.246	1				
FMD	.379**	.293*	.105	.372**	.232	.284	.163	.009	1			
MILX	-.730**	-.123	-.147	-.735**	.058	-.664**	.109	-.085	-.253	1		
TAXR	.676**	-.133	.166	.619**	.439**	.535**	.086	.237	.063	-.649**	1	
TROP	.693**	-.062	.164	.700**	.080	.706**	.036	.196	-.063	-.717**	.743**	1
INF	-.448**	-.135	-.144	-.414**	-.292*	-.323*	-.122	-.062	-.670**	.530**	-.380**	-.267

Note: SC = Sustainable competitiveness, NC = Natural capital, RI = Resource intensity, SOC = Social cohesion, DCPS = Domestic credit to private sector, BC = Bank concentration, S&P = S&P-GE-indices, SMR = Stock market returns, FMD = Financial market development index, MILX = Military expenditures, TAXR = Tax revenue, TROP = Trade openness, INF = Inflation. **, * indicate significant at 1% and 5% levels, respectively

with social capital and resource efficiency. On the other hand, financial development (DCPS and SMR) may deplete the natural resources of the Arctic region. The results also show that trade openness and tax revenues improve the sustainable performance of the countries especially by cultivating social wellbeing in the society.

Initially, we analyzed the effect of financial development indicators on sustainable competitiveness and its sub-indexes using pooled OLS estimations. The results shown in Table 3 and 4 indicate a positive effect of financial development on sustainable competitiveness and social cohesion. On the other hand, we found a significant and positive effect of only stock market-based proxies on resource intensity while the negative effect of DCPS and SM returns on natural capital. Nonetheless, the pooled OLS estimates are generally criticized for generating *upward biased* estimates (Basu, 2020; Yahya & Rafiq, 2020). In contrast, the fixed-effect estimations produced *downward biased* estimates for our models (see Table 5 and 6) despite their ability to control omitted variable bias. To control omitted variable bias and reverse causality simultaneously, we relied on the estimations of system GMM. Hausman test of endogeneity is utilized to test the endogeneity of variables. The results[3] warranted reverse causality and threatened the reliability of static models (i.e. fixed-effect or pooled OLS estimations). Before applying the system GMM, we also confirmed the stationarity of the variables. The unit root test by Levin, Lin, and Chu (2002) is employed to test if the time series is free of unit root to avoid spurious regression estimates. The LLC test results show that all variables are stationarity at level form except military expenses which is stationary at the first-order difference.

We used lagged values of financial development indicators as possible instruments in the system GMM as we were able to gather exogenous variables to instrument these indicators. For all the underlying models, the null hypothesis for the Sargan test is not rejected proving the validity of instruments used by system GMM (see Table 7 and 8). Correspondingly, the insignificant p-values of AR(2) test statistic also specify the absence of second-order serial correlation which further validates the accuracy of all estimated models. The results of sys-GMM show a significant and positive effect of all financial development indicators on sustainable competitiveness except S&P GE indices. Consistent with prior studies, it is argued that financial development is conducive to the sustainable development of the Arctic region (Busch, Bauer, & Orlitzky, 2016; Durusu-Ciftci et al., 2017; Haider & Adil, 2019; Paun et al., 2019). Financial development has made these countries commercially competitive and simultaneously encourage social welfare and environmental protection (Thore & Tarverdyan, 2016). Possibly, the banks and stock markets in the region are encouraging socially responsible investments (Ganda, 2019).

In contrast, we find evidence that financial development is increasing the consumption of natural resources as bank concentration and stock market returns are negatively associated with natural capital. We partially endorse the previous studies that financial development elevates energy demands (Al-Mulali et al., 2015; Sadorsky, 2010; Shahbaz et al., 2016) which are generally met by natural resources including oil, coal, natural gas, etc. Nonetheless, our results are not asserting the detrimental effect of financial development on environmental quality because our estimates also support the positive effect of financial development on resource efficiency (in line with, Xu & Tan, 2020). Although financial markets and institutions play a prominent role in increasing natural resource consumption, the Arctic region

[3] Except DCPS, SMR and INF, the p-values of all other variables were significant confirming endogeneity issue. The results are not reported for brevity purpose, however, can be provided on demand.

Table 3. Pooled OLS Estimations (Effect of Financial Development on Sustainable Competitiveness and Natural Capital)

Variables	DV = Sustainable Competitiveness					DV= Natural Capital				
	1	2	3	4	5	1	2	3	4	5
Domestic Credit	0.100 (0.012)					-0.059*** (0.017)				
Bank Concentration		0.087*** (0.023)					0.008 (0.044)			
S&P (GE-Indices)			0.091*** (0.026)					-0.041 (0.049)		
SM-Return				-0.031 (0.047)					-0.136*** (0.075)	
FMD					2.800*** (0.847)					2.286 (1.520)
Military Expenses	-1.873*** (0.810)	-1.553*** (0.673)	-2.592*** (0.739)	-1.594*** (0.776)	-1.091* (0.710)	-0.443 (1.193)	-1.690 (1.271)	-1.276 (1.357)	-1.423 (1.233)	-1.237 (1.275)
Tax Revenue	0.132 (0.150)	0.286*** (0.107)	0.235*** (0.108)	0.213*** (0.121)	0.172* (0.108)	0.277 (0.221)	-0.152 (0.203)	-0.173 (0.198)	-0.130 (0.193)	-0.188 (0.195)
Trade Openness	0.011 (0.062)	-0.0841* (0.057)	-0.049 (0.056)	0.003 (0.061)	0.058 (0.057)	-0.123 (0.092)	-0.0627 (0.109)	-0.0315 (0.103)	-0.038 (0.097)	-0.006 (0.103)
Inflation	-0.063 (0.263)	0.020 (0.224)	0.125 (0.237)	-0.135 (0.253)	0.335 (0.266)	-0.484 (0.388)	-0.098 (0.423)	-0.228 (0.435)	-0.152 (0.402)	0.263 (0.477)
Intercept	52.857*** (3.841)	50.524*** (3.427)	56.382*** (3.571)	52.791 (3.860)	34.005*** (6.697)	68.497*** (5.661)	67.460*** (6.472)	66.163*** (6.561)	66.855*** (6.137)	52.209*** (12.022)
R-Squared	0.613	0.703	0.691	0611	0.688	0.293	0.109	0.123	0.172	0.154

Table 4. Pooled OLS Estimations (Effect of Financial Development on Resource Intensity and Social Cohesion)

Variables	DV= Resource Intensity (Pooled OLS)					DV= Social Cohesion (Pooled OLS)				
	1	2	3	4	5	1	2	3	4	5
Domestic Credit	0.004 (0.066)					0.065** (0.037)				
Bank Concentration		0.017 (0.147)					0.220*** (0.079)			
S&P (GE-Indices)			0.539*** (0.143)					0.162** (0.093)		
SM-Return				0.376* (0.254)					0.088 (0.151)	
FMD					2.382 (5.162)					9.680*** (2.630)
Military Expenses	0.938 (4.444)	1.049 (4.216)	-4.475 (3.923)	1.792 (4.140)	1.511 (4.330)	-6.026 (2.509)	-4.372*** (2.264)	-6.302*** (2.562)	-4.823*** (2.471)	-2.679 (2.206)
Tax Revenue	-0.000 (0.824)	0.046 (0.675)	0.199 (0.574)	0.111 (0.647)	0.001 (0.663)	0.271 (0.465)	0.411 (0.362)	0.260 (0.374)	0.190 (0.386)	0.089 (0.338)
Trade Openness	0.142 (0.342)	0.120 (0.362)	-0.155 (0.298)	0.180 (0.326)	0.187 (0.349)	0.231 (0.193)	-0.058 (0.194)	0.067 (0.195)	0.145 (0.194)	0.358*** (0.178)
Inflation	-0.844 (1.445)	-0.841 (1.405)	0.614 (1.259)	-0.979 (1.351)	-0.478 (1.621)	-0.069 (0.816)	-0.105 (0.755)	-0.030 (0.822)	-0.452 (0.806)	1.117 (0.826)
Intercept	25.331 (21.076)	24.904 (21.466)	45.402*** (18.963)	23.043 (20.593)	9.240 (40.813)	49.453*** (11.901)	44.064*** (11.529)	56.351*** (12.382)	50.871*** (12.295)	-15.306 (20.794)
R-Squared	0.039	0.039	0.282	0.086	0.074	0.609	0.646	0.609	0.584	0.683

is using these resources efficiently to attain sustainable competitiveness. Thus, opposed to prior studies (Asif et al., 2020; Manzano & Gutiérrez, 2019), our study also does not support the *resource curse hypothesis* for the Polar region.

Finally, our results also reveal that financial development promotes social cohesion and social wellbeing. The banking efficiency, stock market efficiency, and the trustworthiness of financial markets in the Arctic region may facilitate their health system (Chireshe & Ocran, 2020), income equality (Gharleghi & Jahanshahi, 2020), and improve the connectedness among groups in society. The region has substantial deposits of precious metals, around 30 percent of undiscovered gas, and 13 percent of the world's oil reserves (Trump, Kadenic, & Linkov, 2018). Despite the rapid exploration of these natural resources by private companies, the human activity in the area is increased which is expediting economic and social development (Becker & Pollard, 2016). From the perspective of control variables, the results show expected signs in all models, however, the significance level differs across the estimated models.

5. Conclusion and Implications

This paper investigated the effect of bank-based and stock market-based indicators of financial development on the sustainable competitiveness of the Arctic region using the system GMM estimator. Furthermore, the effect of financial development is examined with the components of sustainable competitiveness including natural capital, social cohesion, and resource intensity. After controlling for military expenses, tax revenues, inflation, and trade openness, the results show a significant and positive effect of financial development on sustainable competitiveness. It is also posited that financial develop-

Table 5. Fixed Effect Estimations (Effect of Financial Development on Sustainable Competitiveness and Natural Capital)

Variables	DV = Sustainable Competitiveness (Fixed Effect)					DV= Natural Capital (Fixed Effect)				
	1	2	3	4	5	1	2	3	4	5
Domestic Credit	0.046 (0.081)					0.110 (0.130)				
Bank Concentration		0.015 (0.061)					-0.412 (0.097)			
S&P (GE-Indices)			0.084*** (0.023)					-0.056 (0.428)		
SM-Return				-0.420 (0.043)					-0.083 (0.068)	
FMD					-1.530 (3.137)					3.312 (4.993)
Military Expenses	0.824 (1.665)	0.802 (1.712)	-1.468 (1.543)	1.070 (1.681)	0.635 (1.656)	4.322* (2.669)	3.995* (2.728)	5.751*** (2.807)	5.032** (2.663)	4.418* (2.636)
Tax Revenue	-0.069 (0.222)	-0.030 (0.398)	-0.137 (0.179)	-0.112 (0.206)	-0.131 (0.212)	0.334 (0.356)	-0.206 (0.634)	0.038 (0.326)	0.023 (0.327)	0.061 (0.337)
Trade Openness	0.227 (0.204)	-0.206 (0.200)	-0.263 (0.264)	-0.189 (0.197)	-0.248 (0.221)	-0.650** (0.327)	-0.629** (0.320)	-0.601** (0.313)	-0.621** (0.313)	-0.541* (0.352)
Inflation	0.191 (0.320)	0.254 (0.307)	0.381 (0.264)	0.240 (0.302)	0.270 (0.308)	-0.080 (0.513)	-0.838 (0.489)	-0.156 (0.481)	-0.082 (0.478)	-0.116 (0.491)
Country Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	64.615 (18.390)	66.108*** (20.093)	76.688 (14.708)	67.660*** (16.796)	79.897*** (28.434)	93.589*** (29.483)	101.918*** (32.012)	89.290*** (26.752)	92.480*** (26.612)	70.524* (45.249)
R-Squared	0.411	0.532	0.376	0.555	0.611	0.020	0.023	0.015	0.027	0.031

Table 6. Fixed Affect Estimations (Effect of Financial Development on Resource Intensity and Social Cohesion)

Variables	DV= Resource Intensity (Fixed Effect)					DV= Social Cohesion (Fixed Effect)				
	1	2	3	4	5	1	2	3	4	5
Domestic Credit	0.071 (0.568)					0.182 (0.257)				
Bank Concentration		-0.315 (0.421)					0.069 (0.192)			
S&P (GE-Indices)			0.593*** (0.162)					0.062 (0.086)		
SM-Return				0.448* (0.296)					-0.029 (0.139	
FMD					-7.974 (21.828)					4.081 (9.937)
Military Expenses	4.888 (11.619)	2.442 (11.811)	-10.580 (10.659)	8.691 (11.466)	4.379 (11.524)	-7.818* (5.255)	-7.807* (5.412)	5.702 (5.661)	7.579 (5.386)	7.472 (5.246)
Tax Revenue	-0.668 (1.551)	-2.486 (2.748)	-0.905 (1.240)	-0.726 (1.410)	-0.829 (1.475)	0.218 (0.701)	0.429 (1.259)	0.027 (0.658)	0.046 (0.662)	0.093 (0.671)
Trade Openness	-1.110 (1.426)	-0.959 (1.385)	-1.510 (1.188)	-0.947 (1.348)	-1.315 (1.541)	0.490 (0.645)	0.570 (0.635)	0.548 (0.631)	0.603 (0.633)	0.720 (0.701)
Inflation	0.097 (2.234)	0.521 (2.117)	1.127 (1.829)	0.099 (2.061)	0.302 (2.147)	0.225 (1.010)	0.474 (0.970)	0.545 (0.971)	0.440 (0.968)	0.384 (0.977)
Country Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	111.231 (128.321)	173.188 (138.597)	173.576** (101.585)	105.939 (114.550)	175.674 (197.819)	-17.282 (58.044)	-13.245 (6.514)	4.860 (53.950)	-1.823 (53.816)	-30.774 (90.056)
R-Squared	0.026	0.030	0.011	0.020	0.033	0.031	0.143	0.102	0.035	0.265

ment is depleting the natural capital but stimulating the social cohesion and resource efficiency of the Arctic region.

Banks and financial markets are playing a complementary role in promoting sustainable economic growth in the region by improving the use of financial functions and the rate of return on investment. Especially in the short-run, efficient capital accumulation from financial development is offsetting the negative impact of overexploitation of natural resources. Since our study estimated short-run (dynamic) relationships, we are not able to assert if the positive link between financial development and sustainable competitiveness can be retained in the long-run. Various ecologists and environmental councils have raised concerns over the sustainable development of Polar Regions that current industrial and economic activities are yielding only short-term benefits. In the long-run, over-exploitation of natural resources may pose serious threats to the social, environmental, and economic development of the regional and local communities (Mikkelsen & Langhelle, 2008; Trump et al., 2018).

Energy consumption is conducive to economic growth and natural resources facilitate this link. However, long-term sustainability should not be compromised through overexploitation of natural resources. Currently, diesel is the major source of elec-

Table 7. System GMM Estimations (Effect of Financial Development on Sustainable Competitiveness and Natural Capital)

Variables	DV = Sustainable Competitiveness (SGMM)					DV= Natural Capital (SGMM)				
	1	2	3	4	5	1	2	3	4	5
Lagged DV	0.720*** (0.111)	0.958*** (0.073)	-0.624 (0.507)	0.342*** (0.121)	0.583*** (0.127)	0.816*** (0.159)	0.783*** (0.094)	0.707*** (0.140)	0.656*** (0.134)	0.901*** (0.162)
Domestic Credit	0.042*** (0.017)					0.024 (0.051)				
Bank Concentration		0.375*** (0.062)					-0.200** (0.090)			
S&P (GE-Indices)			0.097 (0.018)					0.251 (0.058)		
SM-Return				0.118*** (0.047)					-0.037* (0.071)	
FMD					0.088** (0.056)					0.084 (0.063)
Military Expenses	-1.992 (0.549)	-1.833 (0.691)	-2.095 (0.526)	-1.937 (0.682)	-2.127 (0.703)	-0.933 (0.587)	-1.082 (0.489)	-1.122 (0.705)	-1.243 (0.622)	-0.916 (0.870)
Tax Revenue	1.816 (0.438)	4.216 (0.633)	0.293** (0.140)	1.166 (0.508)	1.317 (0.269)	-0.240 (0.173)	1.400 (1.083)	0.107 (0.771)	0.122 (0.516)	0.557 (0.714)
Trade Openness	0.452* (0.110)	1.826** (0.247)	1.049*** (0.325)	0.021 (0.099)	0.273** (0.065)	0.179 (0.134)	-0.467 (0.379)	0.200 (0.280)	0.323 (0.209)	-0.094 (0.187)
Inflation	-6.142** (1.053)	-8.654* (1.842)	-3.490 (0.803)	-3.761** (0.668)	-6.715* (1.212)	-0.960 (1.934)	-1.785** (0.935)	-0.668 (0.433)	-2.606 (2.267)	-0.958 (1.841)
Country and Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	7.094* (0.955)	8.193 (0.893)	7.714** (0.960)	8.068* (0.912)	9.127** (0.701)	3.773 (0.834)	3.821 (0.662)	3.612 (0.625)	4.392 (0.705)	3.618 (0.830)
AR(2)	0.663	0.724	0.233	0.652	0.612	0.238	0.814	0.446	0.620	0.265
Sargan test	0.273	0.533	0.293	0.427	0.773	0.994	0.849	0.891	0.943	0.996

Table 8. System GMM Estimations (Effect of Financial Development on Resource Intensity and Social Cohesion)

Variables	DV= Resource Intensity (SGMM)					DV= Social Cohesion (SGMM)				
	1	2	3	4	5	1	2	3	4	5
Lagged DV	0.024 (0.055)	0.113 (0.083)	-0.132** (0.058)	-0.267*** (0.070)	-0.005 (0.079)	0.171 (0.151)	0.240 (0.251)	0.140 (0.227)	0.208 (0.227)	0.406*** (0.131)
Domestic Credit	-0.034 (0.092)					0.081*** (0.021)				
Bank Concentration		0.130*** (0.044)					0.322*** (0.068)			
S&P (GE-Indices)			0.601*** (0.090)					0.080*** (0.032)		
SM-Return				1.070*** (0.112)					0.061 (0.082)	
FMD					0.833 (0.096)					2.481*** (0.953)
Military Expenses	-3.311*** (6.752)	-2.181 (3.118)	-1.386*** (2.833)	-2.346*** (5.501)	-3.133*** (5.486)	-1.362 (1.093)	-1.339 (1.132)	-1.002 (0.094)	-1.212 (1.117)	-2.308 (0.998)
Tax Revenue	13.552*** (1.315)	0.427* (0.241)	9.016*** (1.216)	9.576*** (1.066)	13.667*** (1.177)	0.334 (0.522)	1.436*** (0.451)	0.137 (0.352)	0.443 (0.329)	-0.932 (0.756)
Trade Openness	4.975 (0.426)	0.242 (0.094)	3.232 (0.405)	3.187 (0.323)	5.012 (0.449)	0.587*** (0.104)	-0.286 (0.294)	0.587*** (0.114)	0.398*** (0.156)	0.489** (0.225)
Inflation	-3.499** (4.963)	2.579 (0.565)	-4.578 (2.401)	-4.810** (5.016)	-1.953*** (6.631)	-0.020 (0.146)	4.435** (2.268)	-0.049 (0.662)	1.693** (0.832)	3.768*** (1.616)
Country and Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	39.107** (2.103)	37.334* (2.760)	34.538** (2.737)	31.732* (2.230)	48.225*** (2.836)	3.081 (1.846)	7.321 (2.157)	4.826 (1.772)	3.248 (1.195)	5.245 (1.644)
AR(2)	0.752	0.309	0.684	0.415	0.588	0.620	0.403	0.745	0.692	0.498
Sargan test	0.982	0.993	1.000	0.997	0.879	0.294	0.908	0.995	0.741	0.896

tricity generation (up to 80%) in the Arctic which is the renowned cause of greenhouse gas emission. Black carbon from burning diesel also reduces the albedo effect, leading to the rapid melting of ice and snow (Quitoras, Campana, & Crawford, 2020). Thus, the financial sector should be guided and supported to promote alternative eco-friendly technologies to meet energy demands. Although we have tried to opt for an optimal statistical technique to deal with statistical biases for the available panel data, the estimates should be considered with caution.

While the employed index of sustainable competitiveness is comprehensive and backed by quantitative methodologies, the limited time-series constrained us to test more advanced statistical techniques. Future studies may extend the time-series using alternative composite indexes developed in the existing literature to test co-integration or possible

non-linearity between financial development and sustainable competitiveness in the Arctic. For an enlarged version of the index, more regional socio-ecological data should be added. Additionally, future studies should also test the intervening role of technology, energy consumption, and innovation between financial development and sustainable development.

This study is also limited to the pre-COVID-19 period due to the unavailability of financial indicators data for the year 2020 or onward. However, it opens the door for future studies to fill the gap with relevant COVID-19 factors. The COVID-19 pandemic substantially disturbs financial activities as the global lockdown negatively influences the performance of ongoing projects and investors were reluctant to start new financial investments (Anser et al., 2021; Yahya, Shaohua, Abbas, & Waqas, 2021). Accordingly, ensuring progress toward SDGs and sustainable development decelerated for most of the countries in the absence of additional support (Barbier & Burgess, 2020). After the pandemic, researchers are redefining sustainability and utilizing green finance that offers an incentive to fund sustainable items leading to industrial growth initiatives and digital mobilization of renewable energy (Hakovirta & Denuwara, 2020). It is believed that the current COVID-19 stimulus packages including the exploration of non-renewable energy resources in the Arctic region will pave the path for environmental degradation. Therefore, we recommend that future studies should include the effect of COVID-19 while exploring the relationship between financial development and sustainable competitiveness for a more holistic view.

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