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Abstract:

This paper investigates the nexus between financial development (FD), institutions, and economic growth by employing a spatial autoregressive model on a panel dataset covering 82 countries from 1990 to 2019. The spatial dependence between countries is measured via geographical and institutional proximities, the latter hitherto has rarely been explored in the finance-growth literature. Institutional proximity concept postulates that institutionally similar countries are expected to have similar level of economic growth and greater size of spillover once the spatial effects of FD and institutional quality are controlled for. Overall, the findings give empirical support to the above proposition, as FD and political institutions are shown to have significant positive effects on growth. In the case of FD, its growth-effect is beneficial up to a certain threshold beyond which it becomes negative. The results also find significant positive spatial lag growth term in the model indicating the presence of indirect spillover effects of FD and institutions onto the growth of neighbouring countries, both in geographical institutional spheres. Furthermore, the spatial growth model with institutional proximity matrix is shown to have higher rate of convergence and greater size of spillover than the model with geographical proximity. These findings are robust to various model specifications, and the paper concludes with some policy recommendations.

Keywords: Economic growth, financial development, institutional proximity, spatial fixed effects, spatial lag model.

JEL code: O16, O43, C31

1. Introduction and background

The nexus between financial development (FD) and economic growth has received a considerable investigation in the empirical literature; as evidenced by a number of meta-analysis studies such as Qasemi (2019); Bijlsma et al. (2018); Arestis et al. (2015); Valickova, et al. (2015); and Asongu (2015).[1] Since the seminal study by King & Levine (1993) and numerous studies afterwards, it has been theoretically proposed and empirically demonstrated that a sound and efficient financial system could create a favourable macroeconomic environment that matter for economic growth. Specifically, this is achieved by directing capital to its most productive uses, mobilising savings, boosting consumer spending, minimising issues with information asymmetry, and improving investments. Even though the dominant finding is the positive significant effect of FD on economic growth, the consensus in the finance-growth literature remains elusive. Ultimately, the estimated growth-effect of FD depends on various factors such as the choice of estimation techniques, the measurements of FD indicators, the dataset's time coverage and sample countries, as well as the control variables included in the model specification.

Three important findings are noteworthy from the FD-economic growth nexus. Firstly, as is shown by Law et al. (2013, 2018), Aluko & Ibrahim (2020), and Olaniyi & Oladeji (2020), FD would only matter for economic growth if it is embedded in a strong institutional framework. Sound institutions are expected to prevent corruption and political interference in the financial system and ensure resources are appropriately allocated into productive uses. Secondly, too much finance is harmful for economic growth; beyond a certain threshold the effect of FD on economic growth would become detrimental. This finding has been consistently shown by numerous empirical studies post-2008 global financial crisis, for example Cecchetti & Kharroubi (2012), Law & Singh (2014), and Cournede & Denk (2015).

Finally, the use of a formal spatial econometrics analysis is apparently scarce in the finance-growth studies. As a matter of fact, spatial econometrics analysis is gaining traction in the growth literature since the method is capable to capture the countries interdependence and examine the spillover effect of growth and its determinants across the neighbouring countries.

The growing countries interdependence is apparently the outcome of the globalization process where countries in the world are increasingly interacting with each other via multilateral economic activities like trade and investment, regional economic and governance cooperation, and socio-cultural integration. In the case of FD, financial reforms of one country that encourages more trade or attracts

[1] Meta-analysis is a systematic review and quantitative synthesis of empirical economic evidence on a given hypothesis, phenomenon, or effect. It seeks both to summarize and explain the wide, often disparate, variation routinely found among reported econometric results (Stanley, 2001) and Havranek et al. (2020).

more foreign direct investment are expected to have an impact on neighbouring countries as they may feel the competitive pressure to match these policies (Simmons & Elkins, 2004).

The following studies employ a formal spatial econometrics analysis to investigate the effect of FD on several dependent variables of interest, but the studies are limited to the context of intra-country analysis i.e. across provinces or counties within China: Wang et al. (2019) – the effect of FD on growth; Zhong & Li (2020) – on green total factor productivity; Ran et al. (2020) – on income inequality; and Zhu et al. (2021) – on poverty. Meanwhile, the following studies employ a multi-country spatial econometrics analysis on the effect of FD, but not on economic growth: Samreen & Majeed (2020) and Khezri et al. (2021) – on carbon emissions in 89 countries and 31 Asia-Pacific countries, respectively; and Al-Barakani et al. (2022) – on ecological footprints in 57 Belt and Road Initiatives (BRI) countries.

It is worth mentioning that the spatial econometrics analysis in the multi-country studies above captures the countries' spatial dependence via geographical measures only, due to the straightforward interpretation of spillover between the geographically closer countries. Nevertheless, Anselin (2002) argues that geographical distance may have limited explanatory power on the factors shaping economic relationship across space. This is since interdependence between countries can be a result of socio-political phenomena such as historically shared ties or levels of interactions, or other network structure (Beck et al. 2006; Ertur & Koch, 2011).

Spatial econometrics studies using non-geographical spatial matrix are gaining attention recently, such as Qu et al. (2021), Amidi & Majidi (2020), and Ho et al. (2018, 2013) – using trade-related matrices; Baysoy & Altug (2021), Ahmad, (2019), Ganau (2017), Ahmad & Hall, (2017), Arbia et al. (2010) – institutional proximity matrices; Zhang et al. (2020), Caragliu & Nijkamp (2016), Basile et al. (2012) - technological proximity matrices; Blanc-Brude et al. (2014) – GDP per capita and government spending matrices, and Alamá-Sabater et al. (2020) – corruption matrix.

On the back of this development, this paper formally employs spatial econometrics analysis to investigate the effects of FD and institutions on the growth process of the countries under study, and this constitute the paper's first contribution to the existing FD-growth literature. Secondly, apart from using the conventional geographical-based spatial dependence, this paper extends the measure to institutional proximity concept, apparently rarely explored in the FD-growth analysis. The final contribution of the paper is the use of extensive dataset covering 82 countries for 30 years period from 1990 to 2019.

Overall, we find evidence of positive significant effect of FD on economic growth, and its effect becomes growth-deterring beyond a certain threshold. We also find positive significant effect of political institutions on economic growth; this is however not the case for economic institutions.

Our findings also show that, if based on geography, the countries spatial dependence is best measured via 5-nearest neighbours and inversed squared distance, and via the countries' colonial origin if based on institutional proximity. This is since our spatial fixed effect estimations using these three matrices yield significant spatial lag growth term in the spatial autoregressive (SAR) model. The other measures of spatial dependence namely countries' contiguity, legal origin, and languages however yield insignificant spatial lag growth term. Finally, we are able to show that a growth model capturing the countries spatial dependence via institutional proximity matrix generates higher rate of growth convergence and greater size of growth spillover than the model with geographical proximity.

The novel findings of significant growth-effects of FD and political institutions, combined with the significant spatial lag growth in the spatial estimation using 5-nearest neighbours, inverse squared distance, and colonial origin matrices, allow us to infer that FD and political institutions significantly affect growth and subsequently transmitting the positive spillover effect onto the growth of neighbouring countries, be it in the geographical or institutional space. Our results are robust to various model specifications either via alternative institutional variables or additional control variables. Based in these findings, some policy recommendations are discussed in the concluding remark section.

The paper proceeds as follows: section 2 discusses and proposes a theoretical framework on the institutional proximity concept and explains how it is incorporated into the spatial FD-growth analysis. Section 3 explains the estimation model, empirical methodology, spatial matrix, and data sources, and Section 4 discusses the results. Section 5 concludes with some policy implications.

2. Institutional proximity framework in the spatial FD-growth analysis:

Spatial econometric modelling requires a measure of interdependence between units of observation to be specified (Corrado & Fingleton, 2012). Captured in the model via spatial weight matrix, this measure determines the degree of nearness (i.e. the proximity) that shapes the size of spillover effect across observations. Geographical distance matrix is often used with the assumption that closely located countries would have greater spatial dependence between them as compared to the countries located farther.[2]

[2] This is based on Tobler's (1970) first law of geography "everything is related to everything else, but near things are more related than distant things." Furthermore, the use of geographical matrix is theoretically supported as physical distance is frequently shown to be a good proxy for transportation costs and technological transfers (Crafts &Venables, 2003). Geographical matrix is also exogenous to the spatial model hence capable to avoid identification problems in the spatial estimation (Anselin & Bera, 1998).

In this paper, in addition to geographical distance matrix, we also utilize institutional proximity matrix in investigating the effect of FD on economic growth. Adapted from Ahmad & Hall (2017), we define institutional proximity as a situation where two or more countries sharing similar legal origin, colonial origin, and language.

These historical (or deep) determinants of institutions are used based on the arguments of the following important studies: Acemoglu et al. (2001, 2002) on the impact of colonial origin; La Porta et al. (1998), La Porta et al. (2008) and Glaeser & Shleifer (2002) on the impact of legal origin and religion to the current institutions; Alesina et al. (2003) on linguistic fractionalisation roles in explaining the institutions, and the proposition of Easterly et al. (2006) that social cohesion (instrumented with linguistic homogeneity) leads to better institutions (see Appendix for a summary of these studies' theoretical propositions).

The following schematic theoretical framework is proposed to better understand the concept of institutional proximity:

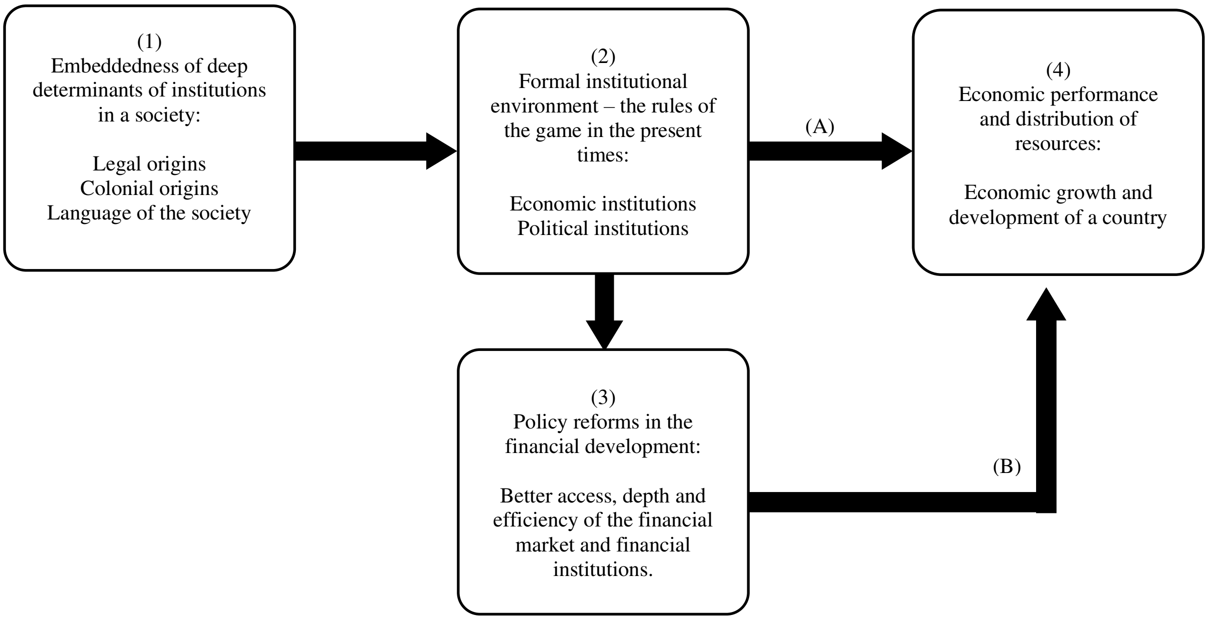

Figure 1: Proposed theoretical framework of historical determinants of institutional environment and financial development.
*Note: The directed arrow could be interpreted as "lead to", "influence", "shape", "determine", "affect" or "change."[3]

[3] Adapted from Acemoglu et al. (2005) page 392, as well as from article "*The role of institutions in economic development*," (2019), Figure 1 and 2. Figure 2 especially supports the concept of institutional proximity as it outlines the interaction between institutions in one country to the rest of the world, and greater interaction is expected when the two countries share similar institutional historical settings.

With regards to the positive effect of formal institutional environment on economic growth (link A), the empirical evidence supporting this link is already well-documented in the literature. In this paper, we capture this link by including institutional variables in the FD-growth model. Our focus is on the link between FD and economic growth (link B), and we extend our investigation of the FD-growth link by capturing the potential spillover between countries that share similar institutional characteristics, In other words, the similar institutions are expected to shape the effect of FD on these countries' growth in a somewhat similar way, hence the use of institutional proximity matrix in the spatial FD-growth model.

Thus, we posit that: "Institutional proximity –a situation when two or more countries sharing similar legal origin, colonial origin, and/or language– is expected to shape the countries' present-day institutional environment and its policies and setting-ups in a perceived similar process over a long term, and this natural process is assumed to eventually lead to creation of a conducive development in the financial sector supporting greater bilateral economic activities, higher rates of economic growth and more spillover between the countries."

To summarise the above theoretical argument, the following testable hypotheses are proposed:

1. ***Hypothesis 1***: Controlling for institutional quality, FD has positive significant effect on economic growth.
2. ***Hypothesis 2***: the FD's positive effect on economic growth has a threshold level beyond which it becomes negative.
3. ***Hypothesis 3***: FD has *indirect* spillover effect on economic growth in countries that are institutionally similar.

Nevertheless, an important caveat must be acknowledged when institutional proximity matrix is used in the spatial analysis of FD-growth. Unlike geographical-based matrix where the spillover between closely *located* countries can be explicitly captured, it is not so discernible to demonstrate the spillover effect of FD onto growth of closely *related* countries (countries sharing similar institutional characteristics). Consequently, the channel of effect from FD to growth between any two institutionally similar countries can only be assumed to run ***indirectly*** i.e., FD is expected to improve growth in one country, and the improved growth would subsequently have a spillover effect onto countries with similar historical institutional characteristics. Hence the use of '*indirect*' word in the Hypothesis 3 above.

3. Estimation model, empirical methodology, spatial weight matrix, and data sources:

3.1 Estimation model

An economic growth model based on Barro (1991) with FD and institutional quality as the variables of interest is adopted as the following:

$$growth_{it} = \beta_1 initial\ gdppc_{it} + \beta_2 findev_{it} + \beta_4 laworder_{it} + \beta_5 polity_{it} + X'\beta + \mu_i + \varepsilon_{it} \quad (1)$$

where $growth_{it}$ is the rate of GDP per capita growth in country i measured as average over 5-year interval; $initial\ gdppc_{it}$ is the GDP per capita at the start of 5-year period (in natural logarithmic term) to capture the convergence process; $findev_{it}$ is the FD index, and $findevsq_{it}$ which is squared FD index is also included to capture its threshold effects on growth; $laworder_{it}$ and $polity_{it}$ are the proxy for economic and political institutions, respectively; and X' captures other variables including the steady-state growth determinants such as investment and population growth as well as other controls in robustness check. μ_i captures the unobserved country specific effects, and ε_{it} represents the corresponding disturbance term where $\varepsilon \sim N(0,\sigma^2 I)$.

3.2 Empirical methodology

The growth model in Equation (1) forms the starting point in our spatial analysis and it is estimated via Ordinary Least Square (OLS). Subsequently, the presence of spatial dependence in the OLS residuals is tested using Moran's *I* test,[4] and once it is confirmed, the appropriate form of spatial model is determined via Lagrange Multiplier (LM) robust and non-robust LM tests (Anselin et al., 1996). Spatial model that passes these tests in most cases when estimated using different weight matrices will be preferred. Equation (1) thus must be expanded to account for the spatial dependence in the growth process, and naturally it is incorporated via the error structure as the following:

$$\varepsilon_{it} = \lambda W \varepsilon_{it} + u_{it} \quad (2)$$

where W is the NxN spatial weight matrix capturing the spatial connection between the i-th and j-th countries, λ is a spatial autoregressive parameter, ε_{it} is the $Nx1$ vector of spatially correlated errors, and u_{it} is the $Nx1$ spatial disturbance term with i.i.d. properties.

Equation (1) with error process of Equation (2) is called spatial error model (SEM) where the spatial dependence operates via the residuals. The spatial dependency in SEM is assumed to be present in the

[4] We follow Elhorst (2003, 2009, 2010) for the appropriate specifications of spatial panel models and Anselin et al. (1996) for the test statistics. If the spatial autocorrelation in the error term is present, the OLS estimate of the response parameter remains unbiased, but it loses its efficiency property, and in the case of specification containing spatially lagged dependent variable, the estimates are not only biased, but also inconsistent.

error terms due to the omission of some unobserved variables that can be spatially correlated. However, SEM also assumes the spatial spillover to be a "nuisance" only, hence making it a relatively less important in the model (Arbia et al., 2010).

Assuming the inverse $(I - \lambda W)^{-1}$ exists and I is the $Nx1$ identity matrix, Equation (1) can be rewritten in spatial autoregressive model (SAR) to capture a more substantive spatial effect as the following:

$$growth_{it} = \rho W growth_{it} + X'\beta + \mu_i + u_{it} \quad (3)$$

Equation (3) is an augmented model of Equation (1) with the presence of the term $\rho W growth_{it}$ among the right-hand side variables. This term, called spatially lagged dependent variable, captures the countries' spatial dependence in a more substantive manner, and shows that the growth rates of a home country depend in part on weighted average of the neighbours' growth rates. X' meanwhile represents all variables in the baseline equation (1) above, and the additional control variables in the robustness check. Although SAR model seems to be the preferred model, to decide which of the two models that best suited our data, we rely on the LM test statistics as earlier explained.

Due to the earlier discussed caveat, we must limit our spatial modelling to either spatial error model (SEM) or spatial lag model (SAR) and exclude spatial Durbin model (SDM)[5] since the latter contains not only spatially lagged dependent variable, but also spatially lagged explanatory variables.

Via spatially lagged explanatory variables, SDM explicitly captures a *direct* spillover of the independent variable (in our case, the FD spillover from home country onto economic growth of neighbouring country). This would obscure a clearer interpretation on how institutional proximity could influence the effect of FD on growth, regardless of the countries' geographical location. In other words, the use of SAR or SEM in examining the effect of FD on growth is to allow us to capture the spatial autocorrelation emanated from the countries' institutional similarity that exists in the FD-growth model.

Finally, we employ spatial panel fixed effects estimation technique based on Elhorst (2003, 2009) and Anselin et al. (2008) to the spatial Equation (3) that is capable to overcome issue of unobserved heterogeneity due to omitted variable bias that may influence growth process. We also include time dummies to capture the shocks and both time-invariant random component of the error term and time-varying unobserved component and this consequently preclude the use of spatial panel random effects.[6]

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[5] Empirically, Florax et al. (2003) argue that using spatial lag model as the point to begin the analysis, conditional on the results of misspecification tests, will outperform the general-to-specific approach via Spatial Durbin model suggested by LeSage & Pace (2009).

[6] Furthermore, the spatial panel random effects model concerns with the spatial autocorrelation in the error term of regression. Recall Equation (1) can be rewritten as $\varepsilon_{it} = (I - \lambda W)^{-1} u_{it}$ and when W satisfies the condition that $(I - \lambda W)$ is non-singular for all λ thus, the equation can be rewritten in stacked form $\varepsilon = (i_T \otimes I_N)\alpha + (I_T \otimes (I - \lambda W)_N^{-1} u$ where the first term on the right hand side of the error specifies serial correlation

We check for robustness of the baseline results via two ways, firstly by using alternative institutional variables, and secondly by including additional control variables into the baseline model. The alternative economic institutions variables are $ruleoflaw_{it}$ and $corruption_{it}$ used in place of $laworder_{it}$, and for political institutions $polcon_{it}$ and $checks_{it}$ are used instead of $polity_{it}$. The additional control variables meanwhile are human capital, trade openness, and inflation; all have been well-documented in the literature as among the significant growth determinants.

3.3 Spatial weight matrix

W in the Equation (3) above is the spatial weight matrix to conceptualise the spatial dependence between the countries, and in this study both geographical and institutional matrices are utilized.

For geographical weight matrices, three measures are used:

a) *w_contig*: a simple binary contiguity matrix where countries are defined as neighbours if they share common borders, and its element $w_{ij} = 1$ if the country i and j have common borders, $w_{ij} = 0$ otherwise,

b) *w_knn*: *k*-nearest neighbours matrix and *k* is equal to five, beyond which the spatial dependence is considered negligible, and its element $w_{ij} = 1$ if the country j is located within 5 nearest neighbours to country i, $w_{ij} = 0$ otherwise, and

c) *w_invsq*: inverse squared distance matrix based on the concept of exponential distance decay, and a cut-off distance must be specified at a minimum threshold which will guarantee that each country in the sample will have at least one neighbour. The element of *w_invsq* is given by:

$$w_{ij} = d_{ij}^{-2} / \sum_j d_{ij}^{-2} \text{ if } d_{ij}^{-2} \leq \overline{d^{-2}}$$

where d_{ij} is the Great Circle distance[7] between the capitals of country i and j, $\bar{d}$ is the critical distance cut-off beyond which spatial effect is considered negligible, i.e. $w_{ij} = 0$ if $d_{ij}^{-2} > \overline{d^{-2}}$.

On the other hand, to capture the institutional proximity, three spatial matrices are created using deep determinants of institutions i.e., legal origin, colonial origin, and language similarity, respectively. The latter is the opposite of language fractionalization since spatial matrix measures proximity (or degree of nearness). The use of legal origin, colonial origin, and language as spatial matrices offer a clear

and the second term specifies the spatial correlation. Santos & Faria (2012) argue that the focus of the analysis of spatial panel random effects model is on the spatial error and not on the spatial lag.

[7] The distance calculation for both *w_knn* and *w_invsq* matrix is done via Great Circle distance computation using latitude and longitude coordinates of the countries' capitals (Le Gallo & Ertur, 2003).

advantage as they are time-invariant, therefore exogenous to the model, a necessary requirement in spatial econometrics analysis.

Data on legal origin and colonial origin can be easily transformed into binary matrices of institutional proximity. A binary matrix of language similarity is developed using the spoken language of any two countries paired, and this similarity is determined using their official and second languages. When the official and second languages have no neighbours (i.e., the other countries in the pair not speaking the same official and second languages), the next largest spoken language by the immigrants is used, since the matrix requires that at least there must be one neighbour for each individual country.

Therefore, these three institutional proximity matrices would be in the form binary matrix whose element w_{ij} = 1 if countries *i* and *j* share legal origin, colonial origin, or spoken language that are identical to each other, and w_{ij} = 0 otherwise. These matrices are denoted as follow:

a) *w_legor*: based on similar legal origin,
b) w_color: based on similar colonial origin, and
c) *w_lang*: based on similar official or spoken language.

Finally, all matrices are row standardized, and the elements of the main diagonal of all geographical and institutional matrices are set equal to zero by convention since a country cannot be a neighbour to itself.

3.4 Variable measurements and data sources

A panel dataset is used in this study consisting of observations for 82 countries for a period of 30 years beginning from 1990 to 2019. Number of countries included in the sample is determined based on two criteria: Firstly, any country must have at least one neighbour when specifying the institutional matrices, since this is a requirement to make the spatial econometrics analysis work. Secondly, it is a prerequisite in spatial estimation that the dataset must have no missing observation whatsoever. All variables used in the study are collected in annual frequency and some variables do have missing observations, hence the reason they are converted into 5-year average.[8] Data for institutional matrices namely legal origin, colonial origin, and language, are time-invariant hence constant across the sample period of study.

[8] If a country is without an institutionally similar neighbour (no other countries have similar legal or colonial origins or language to that country) then it must be excluded from the sample. Similarly, if a country has severe missing observations, say, it has no observations for more than five consecutive years, hence preventing the averaging process, it is also excluded. Another reason for using 5-year average data is that such data can eliminate yearly fluctuations in the countries' growth process, since the changes in FD and institutions are undoubtedly more pronounced over a longer period than annually.

Thus, there are six non-overlapping 5-year average periods used in this study, with total observations of 492. Summary statistics and pairwise correlation are reported in Table A1 and A2, respectively, whereas detailed information of the variables including definition, time-period, frequency, and sources of dataset is presented in Table A3 (see Appendix).

The variable of interest of this study is FD and institutional quality variables. FD variable is an index from the International Monetary Fund (IMF, 2019), a comprehensive measure combining several indicators to reflect the development of the financial institutions and markets, in term of their depth, access, and efficiency, in a country. The institutional quality variable meanwhile is meant for capturing the modern-day institutional environment of a country, as well to proxy for the heterogeneity in the sample due to diverse level of economic development of the countries under study. Two variables are used: Law and Order from International Country Risk Guide dataset (The PRS Group, 2017) – to represent the level of economic institutions; and Polity 2 from Polity V dataset (Marshall & Gurr, 2020) – to capture political institutions.

Additionally, in robustness check estimations, we utilize two alternative variables for the economic institutions namely Rule of Law from the Worldwide Governance Index (The World Bank, 2020) and Corruption from the ICRG (The PRS Group, 2017). The two alternative variables tor political institutions are Polcon 3 from the Political Constraints Index (Henisz, 2017), and Checks from the Database of Political Institutions (DPI 2020) by Cesi et al. (2021).

The data for institutional proximity matrices are obtained from the sources as following: (1) Legal Origin are obtained from La Porta et al. (1998) which identifies the legal origin of the Company Law or Commercial code for each country from five possible origin; (2) Colonial Origin are obtained from Wahman et al. (2013) and Teorell & Wahman (2018) that classify the former colonial rulers of the country into ten categories, but there are also countries in the sample which had never been colonized; (3) Language data meanwhile are obtained from the CIA World Factbook 2019-2020 (The Central Intelligence Agency, 2020) cross-referenced against Wikipedia page: "List of official languages by country and territory" (The Wikipedia, 2020).

4. Estimation results and discussions:

4.1 OLS estimation, Moran's I test and LM test

The standard OLS estimation results in Table 1 below apparently fit the stylized facts about neoclassical growth process with the presence of conditional convergence process in the countries' growth, the significant steady-state growth determinants together with the expected positive significant effects of

FD and institutions variables. However, the presence of spatial autocorrelation in the error term would cause model misspecification and biased OLS estimates. This is shown by Moran's *I* of global autocorrelation test statistics of each variable that are all significant even when tested using different type of matrices, indicating that these set of variables has a functional relationship across space. Furthermore, the Moran's *I* test statistics for the null hypothesis of no spatial autocorrelation in the residuals of the OLS estimation are significant in four occasions (four matrices) out of six.

As for the appropriate spatial model to choose, based on the results of LM test statistics, spatial lag model is apparently a better fit for the data. In all matrix specifications, the spatial lag model attained significant non-robust LM test statistics, and in three matrices if robust LM tests are used. Whereas spatial error model has only four significant non-robust LM test statistics, and only one if robust LM tests are used.

<Insert Table 1 here>

4.2 Baseline results

Now we turn our attention to the baseline estimation of Equation (1), firstly the via non-spatial fixed effects estimation followed by the spatial autoregressive (spatial lag) fixed effects estimations using six different weight matrices. The baseline results are presented in Table 2.

Results of non-spatial fixed effects are presented for comparison purpose since they are biased due to the presence of spatial autocorrelation in the model. Nevertheless, it is well documented in the literature that fixed effects estimation is able to overcome omitted variable bias and endogeneity issue due to unobserved heterogeneity factor in the error term. Our interest in the baseline results is on the coefficients of FD and institutions variables as well as the spatial lag (ρ) terms.

<Insert Table 2 here>

In line with the previously documented evidence in the finance-growth literature, the results in Table 2 reveal that FD is indeed a significant determinant of economic growth, and apparently its growth-effects have a threshold level beyond which the effects would be growth-deterring (evidence for Hypotheses 1 and 2).

In all estimations either non-spatial or spatial fixed effects via different matrices, FD variable is consistently positively significant at 1% level when both its level and quadratic terms are included in the model (it is however at 5% significant level in non-spatial fixed effects model). If the quadratic term is omitted, FD coefficients become insignificant in majority of the estimations. Our model specification is therefore correct as it finds an inverted U-shaped relationship as often demonstrated in the previous finance-growth literature. Therefore, both level and quadratic terms of FD must be included in the model. Our subsequent discussion of the results will thus focus on all estimation models when both terms of FD are present (all even number estimation models in Table 2).

Meanwhile, the proposition of institutions' positive significant effects on economic growth are fully supported by both economic and political institutions variables in the model. As is seen in Table 2, Polity 2 variable is consistently significant across all non-spatial and spatial fixed effects estimations at 5% level. Law and Order variable is significant at 5% level in four occasions (four matrices), but only marginally significant at 10% when *w_contig* and *w_legor* matrices are used. However, in non-spatial fixed effects, the Law and Order variable is completely insignificant. These findings therefore give a strong support to the proposition of political prominence theory by Acemoglu et al. (2005) over the property rights institutions as proposed by North (1990) and many similar studies thereafter.

The final variable of interest in this study is the spatially lagged growth term. Its coefficient ρ (rho) would show the size of growth spillover from neighbours, and the positive sign of ρ would indicate countries with similar growth levels tend to cluster together (country with higher growth clusters with high growth neighbours, vice versa). From Table 2 above, spatial lag terms are consistently positive, and the Wald tests for the null hypothesis of $\rho = 0$ are overwhelmingly rejected, a convincing evidence to the presence of positive spillover of growth across the countries under study.

Nevertheless, the spatial lag terms are significantly different from zero at 5% level in spatial estimations using *w_knn*, *w_invsq*, and *w_color* only. In other words, our estimated results are only meaningful and valid when the concept of spatial dependence between countries in the sample are measured via 5-nearest neighbours and inverse squared distance (geographical distance) and via colonial origin of the country (institutional proximity).

Thus, our interpretation of the spatial spillover effects in the estimated results must be restricted to estimations using these three matrices only. Based on the size of the spatial lag terms in spatial estimations using the three matrices above, geographically closer countries would transmit spillovers across each other by the size of 16 to 18% (16% via *w_invsq* and 18% via *w_knn*), whereas institutionally similar countries (based on *w_color*) are found to have greater size of growth spillovers of 32%.

Combining the significance of FD and political institution variables, and the spatially lagged growth term, we can thus confirm the presence of indirect FD and institutions positive spillover effects between the countries in the sample. In other words, FD and institutions are expected to positively support economic growth of a country, and subsequently the country's improved growth would transmit a spillover effect onto the neighbouring countries' economic growth.

The finding of significant spatial lag term in estimation using *w_color* matrix (evidence for Hypothesis 3) thus contributes to the previous evidence on institutional proximity's significant spatial spillover effect, such as by Baysoy & Altug (2021), Ahmad, (2019), Ganau (2017), Ahmad & Hall (2017) and Arbia et al. (2010), and in line with other spatial studies utilizing non-geographical matrices such as those papers cited in the introduction section.

Finally, all estimated results yield a significant support on the conditional convergence hypothesis when the coefficients of initial real GDP per capita are negative and significant across all estimations. The rate of growth convergence of -0.92% when it is spatially modelled using institutional proximity matrix (*w_color*) is more than the spatial model using geographical distance matrices (-0.86% and -0.87% for *w_knn* and *w_invsq*, respectively) or when it is not spatially modelled (-0.87% in OLS estimation in Table 1).

The rate of growth convergence of -0.92% in the estimation using institutional proximity matrix thus lend some evidence to support the argument of higher rate of convergence when growth process is spatially modelled (albeit only a little, as this is not the case when geographical matrices are used) as shown in many spatial growth studies such as Arbia et al. (2010), Ahmad & Hall (2012) and Ho et al. (2013) to name a few. The other growth determinants i.e., investment and population growth are significant with the expected coefficient signs.

4.3 Robustness checks

The first procedure to test for the robustness of baseline estimation results, regarding the significant effects of FD and institutions on growth and its spillovers, is by using alternative variables for economic and political institutions. The alternative variables for economic institutions are Rule of Law and Corruption (each is individually paired with the baseline political institutions of Polity 2), and the estimation results are presented in Table 3. Subsequently, alternative variables of political institutions are used namely Polcon 3 and Checks (similarly each is individually paired with the baseline economic institutions of Law and Order), and the estimation results are presented in Table 4.

<Insert Table 3 and Table 4 here>

As shown in Tables 3 and 4, FD variable and spatial lag term are both statistically significant identical to that of baseline estimations. FD variable in its level and quadratic terms are both consistently significant, although now at 10% and 5% levels, respectively. Thus, the results further confirm the presence of FD's threshold effect on economic growth, as is shown in the baseline estimations.

Also similar to baseline findings, the coefficients for spatial lag terms (ρ) are all positive and significant when matrix of 5-nearest neighbours, inverse squared distance, and colonial origin are used. Overall, the size of growth spillovers in estimations using the two geographical matrices range from 20% (*w_invsq*) to 30% (*w_knn*), whereas it is around 30% in estimations using institutional matrix (*w_color*). Again, the results in Table 3 and 4 show the superiority of 5-nearest neighbours matrix over the other two based on its higher LLF and lower AIC values.

Table 3 also reveals that both Rule of Law and Corruption variables are not significant in all estimations notwithstanding the type of matrices used. Thereby, these results do not find any empirical support with regards to the significant effects of economic institutions towards economic growth and its spillovers. Recall in baseline estimations earlier, the results on economic institutions coefficients (Law and order) are somewhat mixed as they are significant at 5% in four estimations and weakly significant at 10% in the other two.

Meanwhile in Table 4, only the Polcon 3 coefficients are consistently significant across all estimations, whilst Checks are not. Nevertheless, this is apparently better in comparison to economic institutions alternative variables. These findings therefore could be an indication of the potential evidence leaning towards the Acemoglu's (2005) political prominence theory over the North's (1990) property rights institutions.

Overall, the first robustness check results show that the FD variables and the spatial lag terms (ρ) continue to be significant notwithstanding the results of alternative economic and political institutions. Combining with significant of political institutions variable, these findings therefore further underline the presence of growth spillovers between countries supported by the countries' FD and political institutions.

The second procedure to test for the robustness of baseline estimation results is done by including three additional control variables into the baseline model. As earlier stated, the three additional controls are human capital, trade openness, and inflation; firstly, each of them is included individually in the model and finally all three are included concurrently in the 'general' model. The results are reported in Table 5 and 6, where Table 5 is for spatial lag estimations using geographical distance matrices, and Table 6 using institutional proximity matrices. In both tables, we report the variables of interest only, namely the FD variable in level and quadratic terms, the economic and political institutions variables, and the spatial lag term (ρ).

As shown in Table 5 and 6, FD (in both level and quadratic terms), Polity 2 variable, and spatial lag term (ρ) are all statistically significant as they are in the baseline results. Of the three matrices where the spatial estimations yield significant spatial lag term, the size of growth spillovers (as indicated by the size of coefficient of spatial lag term) continues to be the highest when colonial origin matrix is used. Nevertheless, matrix of 5-nearest neighbours retains its superiority with greater LLF and smaller AIC values on average. The results of FD and Polity 2 too mirror that of baseline.

<Insert Table 5 and Table 6 here>

Overall, it can be concluded that our baseline results, with regards to significant spatial effects of FD and political institutions on growth and its spillovers, seem robust to specification changes either via alternative institutions variables or when additional controls are added.

5. Concluding remarks:

Employing a panel fixed effect estimation on spatial growth model of 82 countries for a 30-year period, this paper investigates the effects of FD and institutional quality on economic growth. Hitherto has rarely been explored in the spatial FD-growth analysis, institutional proximity concept is used in this paper to capture the spatial dependence between countries. The aim is to show that any two institutionally similar countries, regardless of their geographical locations, would be expected to have similar level of economic growth and greater spillovers between them, as a result of the significant spatial effects of FD and institutional environment of the countries.

Overall, the finding of this study is able support the above proposition, albeit it is limited to the institutional similarity measured via colonial origin only. Specifically, this paper extends the previous findings in the finance-growth literature with regards to the positive significant effect of FD on economic growth, and the effect comes with a certain threshold beyond which it becomes harmful to growth. Furthermore, it also finds positive significant effect of political institutions on growth, although this is not the case for economic institutions.

If the spatial dependence between countries is geographically measured, this paper shows that 5-nearest neighbours and inversed squared distance are the best measures, whilst matrix of similar colonial origin is shown to be the only valid measure of institutional dependence. In all estimations using these three spatial matrices, the spatial lag growth term is significant indicating a positive spatial effect of FD and institutions *indirectly* propagated across the neighbouring countries via growth spillovers.

Overall, our novel findings of significant growth-effects of FD and political institutions combined with the significant spatial lag growth in the estimation using 5-nearest neighbours, inverse squared distance, and colonial origin matrices, allow us to infer that these growth determinants are able to generate positive spillover effects onto neighbouring countries, be it in the geographical or institutional space.

Furthermore, the findings also show that institutionally similar countries are expected to have greater convergence rate and more growth spillovers across them given their FD and institutional quality levels. The results are robust to various model specifications either via alternative institutional variables or additional control variables.

The above findings thus constitute a new insight into the approach to devising policies with regards to financial sector development and institutional environment that matter for economic growth.

Firstly, the role of spatial interdependence must not be ignored in the decision-making process by policymakers, notwithstanding the dependence is due to closer geographical location or similar institutional characteristics. The results show that economic growth of a country is not only locally determined by its own FD and institutions per se, but also influenced by the neighbouring countries growth-determinants, albeit indirectly. Thus, policymakers must regard this spatial association as an important variable in devising appropriate development policies, since closeness in term of location and institutional characteristics would have an important bearing on the successful implementation of the policies.

Secondly, the spatial effects of FD and institutional quality are shown to cause greater growth convergence and more spillovers when the countries' interdependence is measured via institutional proximity. Thus, policymakers in the low-income or developing country could somewhat imitate the developed countries in their development of the financial sector and institutional environment, and when this is attained, the two countries with relatively similar FD and institutional characteristics, even though they are geographically apart, are then expected to have greater economic interactions and positive spillovers between them and eventually to converge to similar levels of growth.

Finally, the significant growth-effect of political institutions measured by Polity 2 and Political Constraint index in the FD-growth analysis may offer an interesting insight to policymakers with regards to the key institutional characteristics that may complement and enhance the financial sector development policies and eventually lead to greater economic growth and spillover. Both variables reflect that a more democratic political institution that limits the feasibility of policy change due to the preference of one political actor must be appropriately established to ensure the positive outcome in the interplay between FD and economic growth. Hence, this finding illustrates one of the crucial strategies for aspiring countries (among low income and developing countries) to focus on improving their institutional environment similar to that of higher income countries.

Results table:

Table 1: Results of OLS regression, Moran's *I* tests and LM tests

OLS estimation results	Independent variables:	Coefficients	Standard Error
Dependent variable: Real GDP per capita growth	FD	1.425	0.715**
	Rule of Law	0.236	0.987**
	Polity 2	0.041	0.019**
	Initial GDP per capita	-0.868	0.115***
	Investment	0.159	0.016***
	Population growth	-0.559	0.105***

Moran's *I* test for global spatial autocorrelation of each variable in the model based on different matrices:

Independent variable:	***w_contig***	***w_knn***	***w_invsq***	***w_legor***	***w_color***	***w_lang***
Real GDP per capita growth	0.167***	0.126***	0.135***	0.069***	0.040**	0.029
FD	0.437***	0.286***	0.320***	0.152***	0.378***	0.055**
Rule of Law	0.42***	0.308***	0.321***	0.095***	0.223***	0.066***
Polity 2	0.326***	0.255***	0.258***	0.046***	0.233***	0.099***
Initial GDP per capita	0.284***	0.215***	0.205***	0.052***	0.196***	-0.035
Investment	0.178***	0.127***	0.140***	0.028*	0.037**	0.002
Population growth	0.227***	0.216***	0.270***	0.057***	0.187***	-0.010

Moran's *I* test for spatial dependence in the OLS regression with different matrices and LM test for spatial error and spatial lag model:

Independent variable:	***w_contig***	***w_knn***	***w_invsq***	***w_legor***	***w_color***	***w_lang***
Moran's *I* test statistics	1.485	2.715***	2.238**	1.615	4.312***	2.511**
Spatial error:						
Lagrange multiplier	1.882	6.435**	4.287**	1.965	15.676***	5.585**
Robust Lagrange multiplier	1.547	0.034	1.093	1.115	5.720**	1.218
Spatial lag:						
Lagrange multiplier	4.515**	8.215***	8.739***	4.949**	10.819***	4.368**
Robust Lagrange multiplier	4.179**	1.814	5.45**	4.909**	0.863	0.001

Note: ***, ** and * denote significance at 1%, 5% and 10% respectively. Year dummies are included in all estimations. *w_contig* = contiguity matrix, *w_knn* = 5-nearest neighbours matrix, *w_invsq* = inversed squared distance matrix, *w_legor* = legal origin matrix, *w_color* = colonial origin matrix and *w_lang* = language matrix.

Table 2: Panel fixed effects estimations for non-spatial model and spatial lag model with geographical distance matrices and institutional proximity matrices

Estimation models:	Non-spatial model		Spatial lag model with different matrices											
	(1)	(2)	***w_contig***		***w_knn***		***w_invsq***		***w_legor***		***w_color***		***w_lang***	
			(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Spatial lag (ρ)	-	-	0.104**	0.0583	0.232***	0.182**	0.216***	0.157**	0.141	0.0908	0.357**	0.318**	0.0832	0.0609
	-	-	(0.047)	(0.047)	(0.080)	(0.078)	(0.072)	(0.071)	(0.117)	(0.114)	(0.139)	(0.136)	(0.078)	(0.076)
FD	-0.361	10.852**	1.069	9.352***	0.870	9.068***	0.909	8.992***	1.279*	9.754***	1.248*	9.622***	1.192	9.725***
	(1.705)	(5.516)	(0.749)	(1.807)	(0.753)	(1.785)	(0.750)	(1.797)	(0.744)	(1.766)	(0.741)	(1.754)	(0.751)	(1.769)
FD squared		-9.686**		-8.508***		-8.427***		-8.294***		-8.805***		-8.700***		-8.842***
		(3.994)		(1.698)		(1.672)		(1.684)		(1.673)		(1.661)		(1.669)
Law and Order	-0.185	-0.230	0.208**	0.195*	0.240**	0.219**	0.243**	0.220**	0.215**	0.199*	0.226**	0.209**	0.232**	0.212**
	(0.198)	(0.189)	(0.105)	(0.103)	(0.105)	(0.103)	(0.105)	(0.103)	(0.106)	(0.103)	(0.105)	(0.102)	(0.108)	(0.105)
Polity 2	0.117***	0.117***	0.0411**	0.0451**	0.0364*	0.0420**	0.0345*	0.0406**	0.0417**	0.0460**	0.0334*	0.0393**	0.0374*	0.0431**
	(0.038)	(0.039)	(0.019)	(0.018)	(0.019)	(0.018)	(0.019)	(0.018)	(0.019)	(0.019)	(0.019)	(0.018)	(0.019)	(0.018)
Initial GDP per capita	-3.252***	-3.605***	-0.773***	-0.889***	-0.748***	-0.856***	-0.766***	-0.873***	-0.813***	-0.913***	-0.825***	-0.919***	-0.828***	-0.924***
	(0.572)	(0.643)	(0.118)	(0.117)	(0.118)	(0.117)	(0.116)	(0.116)	(0.116)	(0.115)	(0.115)	(0.113)	(0.116)	(0.114)
Investment	0.184***	0.171***	0.159***	0.148***	0.156***	0.145***	0.157***	0.147***	0.159***	0.148***	0.164***	0.151***	0.162***	0.150***
	(0.039)	(0.037)	(0.016)	(0.016)	(0.016)	(0.015)	(0.016)	(0.015)	(0.016)	(0.015)	(0.016)	(0.015)	(0.016)	(0.016)
Population growth	-0.601**	-0.521**	-0.520***	-0.462***	-0.508***	-0.445***	-0.511***	-0.451***	-0.521***	-0.456***	-0.566***	-0.490***	-0.552***	-0.476***
	(0.301)	(0.311)	(0.106)	(0.104)	(0.106)	(0.104)	(0.105)	(0.104)	(0.108)	(0.106)	(0.105)	(0.103)	(0.105)	(0.103)
Constant	27.46***	28.58***	4.528***	4.410***	4.040***	3.889***	4.186***	4.065***	4.659***	4.425***	4.255***	3.949***	4.889***	4.549***
	(4.667)	(4.743)	(0.968)	(0.944)	(0.998)	(0.974)	(0.976)	(0.953)	(1.017)	(0.991)	(0.987)	(0.963)	(0.962)	(0.938)
Threshold point of FD		0.56		0.55		0.54		0.54		0.55		0.55		0.55
Sample Size	492	492	492	492	492	492	492	492	492	492	492	492	492	492
Cross Sections Number	82	82	82	82	82	82	82	82	82	82	82	82	82	82
Wald Test	-	-	127.446	123.146	106.667	99.168	109.149	104.386	106.875	101.543	103.280	101.629	106.237	100.861
F-Test	9.71***	8.50***	10.62***	9.473***	8.72***	7.628***	9.10***	8.03***	8.906***	7.811***	8.607***	7.818***	8.853***	7.759***
Adjusted R-squared	0.425	0.434	0.424	0.434	0.438	0.449	0.432	0.441	0.424	0.434	0.432	0.439	0.427	0.436
Root MSE (Sigma)	-	-	1.793	1.778	1.771	1.754	1.781	1.766	1.793	1.777	1.781	1.769	1.789	1.775
Log Likelihood Function	-	-	-933.31	-928.516	-927.184	-921.911	-930.032	-925.141	-933.280	-928.256	-930.045	-925.926	-932.038	-927.515
Akaike Info. Criterion	-	-	2.776	2.734	2.708	2.661	2.740	2.697	2.776	2.731	2.739	2.705	2.762	2.723

Note: Dependent variable is real GDP per capita growth. Standard error is in parentheses. Year dummies are included in all estimations. Wald test is for null hypothesis that $\rho = 0 \sim \chi^2(12)$ - for model without FD squared variable, or $\rho = 0 \sim \chi^2$ (13) for model with FD squared variable. ***, ** and * denote significance at 1%, 5% and 10% respectively. *w_contig* = contiguity matrix, *w_knn* = 5-nearest neighbours matrix, *w_invsq* = inversed squared distance matrix, *w_legor* = legal origin matrix, *w_color* = colonial origin matrix and *w_lang* = language matrix.

Table 3: Robustness check 1 – Growth estimations using alternative economic institutions variables (Rule of Law and Corruption)

Estimation models:	Panel fixed effects estimation of spatial lag model with different matrices:											
	w_contig		***w_knn***		***w_invsq***		***w_legor***		***w_color***		***w_lang***	
	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
Spatial lag (ρ)	0.0473	0.0468	0.300***	0.297***	0.199**	0.196**	-0.166	-0.173	0.304**	0.299**	0.160	0.160
	(0.060)	(0.061)	(0.094)	(0.094)	(0.093)	(0.093)	(0.181)	(0.180)	(0.134)	(0.136)	(0.110)	(0.110)
FD	10.52*	10.47*	10.33*	10.45*	10.21*	10.31*	10.79*	10.74*	9.441*	9.522*	9.851*	9.859*
	(5.607)	(5.466)	(5.570)	(5.465)	(5.532)	(5.421)	(5.660)	(5.517)	(5.491)	(5.409)	(5.718)	(5.572)
FD	-9.335**	-9.357**	-9.321**	-9.723**	-9.165**	-9.441**	-9.589**	-9.604**	-8.407**	-8.651**	-8.912**	-9.061**
squared	(4.228)	(3.969)	(4.169)	(3.973)	(4.155)	(3.931)	(4.281)	(4.015)	(4.101)	(3.912)	(4.290)	(4.034)
Rule of Law	-0.014		-0.087		-0.058		-0.012		-0.052		-0.039	
(Alternative 1)	(0.268)		(0.257)		(0.259)		(0.272)		(0.264)		(0.264)	
Corruption		-0.074		-0.065		-0.033		-0.089		-0.048		-0.080
(Alternative 2)		(0.223)		(0.228)		(0.226)		(0.221)		(0.225)		(0.224)
Polity 2	0.107***	0.108***	0.106***	0.106***	0.0985**	0.0986**	0.106***	0.107***	0.103***	0.104***	0.109***	0.110***
	(0.038)	(0.038)	(0.037)	(0.037)	(0.039)	(0.039)	(0.037)	(0.037)	(0.039)	(0.040)	(0.039)	(0.039)
Sample Size	492	492	492	492	492	492	492	492	492	492	492	492
Cross Sections Number	82	82	82	82	82	82	82	82	82	82	82	82
Wald Test	133.26***	129.94***	101.35***	101.87***	105.802	107.72***	102.49***	104.83***	103.89***	106.09***	102.24***	104.29***
F-Test	10.251***	9.996***	7.796***	7.836***	8.139***	8.286***	7.883***	8.064***	7.991***	8.111***	7.865***	8.023***
Adjusted R-squared	0.431	0.432	0.447	0.447	0.439	0.439	0.432	0.432	0.438	0.438	0.434	0.434
Root MSE (Sigma)	1.782	1.781	1.758	1.778	1.769	1.769	1.781	1.780	1.772	1.772	1.778	1.777
Log Likelihood Function	-929.493	-929.383	-922.809	-922.794	-925.983	-925.993	-929.313	-929.150	-926.825	-926.802	-928.462	-928.343
Akaike Info. Criterion	2.745	2.743	2.671	2.671	2.706	2.706	2.743	2.741	2.715	2.715	2.733	2.731

Note: Refer note in Table 2 for information on dependent variable, standard error, significance levels and matrices. Coefficients for steady state growth determinants namely initial GDP per capita, investment, and population growth are not reported to conserve space.

Table 4: Robustness check 1 – Growth estimations using alternative political institutions variables (Polcon3 and Checks).

Estimation models:	Panel fixed effects estimation of spatial lag model with different matrices:											
	w_contig		***w_knn***		***w_invsq***		***w_legor***		***w_color***		***w_lang***	
	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)
Spatial lag (ρ)	0.0515 (0.062)	0.0505 (0.061)	0.301*** (0.096)	0.302*** (0.097)	0.200** (0.092)	0.214** (0.092)	-0.183 (0.172)	-0.195 (0.170)	0.294** (0.137)	0.318** (0.135)	0.141 (0.112)	0.153 (0.110)
FD	10.06* (5.391)	9.735* (5.560)	10.04* (5.372)	9.715* (5.541)	9.892* (5.317)	9.596* (5.474)	10.37* (5.426)	10.08* (5.595)	9.095* (5.309)	8.726 (5.456)	9.470* (5.504)	9.113 (5.657)
FD squared	-9.715** (3.973)	-9.765** (4.073)	-10.07** (3.964)	-10.11** (4.061)	-9.749** (3.920)	-9.806** (4.013)	-10.00** (4.002)	-10.07** (4.100)	-8.986** (3.901)	-8.976** (3.984)	-9.434** (4.041)	-9.450** (4.133)
Law and order	-0.182 (0.199)	-0.143 (0.198)	-0.180 (0.195)	-0.142 (0.196)	-0.171 (0.196)	-0.136 (0.196)	-0.192 (0.196)	-0.155 (0.195)	-0.175 (0.204)	-0.139 (0.205)	-0.177 (0.201)	-0.141 (0.201)
Polcon 3 (Alternative 1)	2.054*** (0.784)		2.044*** (0.776)		1.877** (0.767)		2.031*** (0.784)		1.910** (0.802)		2.005** (0.795)	
Checks (Alternative 2)		0.0248 (0.083)		0.0295 (0.081)		0.0232 (0.082)		0.0302 (0.085)		0.0268 (0.083)		0.0334 (0.084)
Sample Size	492	492	492	492	492	492	492	492	492	492	492	492
Cross Sections Number	82	82	82	82	82	82	82	82	82	82	82	82
Wald Test	119.02***	115.36***	103.34***	103.29***	109.08***	107.08***	102.89***	103.70***	105.00***	108.45***	106.22***	103.64***
F-Test	9.155***	8.874***	7.950***	7.946***	8.390***	8.237***	7.915***	7.977***	8.077***	8.342***	8.171***	7.972***
Adjusted R-squared	0.431	0.423	0.446	0.438	0.439	0.432	0.432	0.423	0.437	0.429	0.432	0.425
Root MSE (Sigma)	1.781	1.795	1.758	1.771	1.770	1.781	1.782	1.794	1.774	1.785	1.780	1.792
Log Likelihood Function	-929.68	-933.269	-922.968	-926.598	-926.174	-929.192	-929.451	-932.937	-927.274	-930.372	-929.032	-932.413
Akaike Info. Criterion	2.747	2.787	2.673	2.712	2.708	2.741	2.744	2.783	2.720	2.755	2.740	2.777

Note: Refer note in Table 2 for information on dependent variable, standard error, significance levels and matrices. Coefficients for steady state growth determinants namely initial GDP per capita, investment, and population growth are not reported to conserve space.

Table 5: Robustness check 2 – Growth estimations with additional control variables (human capital, trade openness and inflation)

Estimation models:	Panel fixed effects estimation of spatial lag model with **geographical** distance matrices											
	w_contig				***w_knn***				***w_invsq***			
	With human capital (39)	With trade openness (40)	With inflation (41)	With all three controls (42)	With human capital (43)	With trade openness (44)	With inflation (45)	With all three controls (46)	With human capital (47)	With trade openness (48)	With inflation (49)	With all three controls (50)
Spatial lag (ρ)	0.0492 (0.061)	0.0494 (0.062)	0.0514 (0.061)	0.0519 (0.062)	0.299*** (0.095)	0.298*** (0.094)	0.304*** (0.094)	0.307*** (0.096)	0.196** (0.093)	0.192** (0.092)	0.201** (0.094)	0.198** (0.094)
FD	10.89* (5.689)	10.91* (5.549)	10.65* (5.631)	10.54* (5.765)	10.70* (5.666)	10.87** (5.524)	10.44* (5.622)	10.21* (5.747)	10.61* (5.628)	10.68* (5.480)	10.31* (5.566)	10.17* (5.704)
FD squared	-9.738** (4.143)	-9.920** (4.028)	-9.563** (4.077)	-9.652** (4.176)	-9.974** (4.128)	-10.27** (4.016)	-9.802** (4.071)	-9.796** (4.161)	-9.727** (4.095)	-9.935** (3.973)	-9.517** (4.023)	-9.565** (4.123)
Law and order	-0.232 (0.191)	-0.235 (0.189)	-0.224 (0.187)	-0.225 (0.189)	-0.225 (0.190)	-0.231 (0.187)	-0.215 (0.184)	-0.214 (0.187)	-0.217 (0.189)	-0.221 (0.187)	-0.206 (0.184)	-0.206 (0.187)
Polity 2	0.116*** (0.038)	0.119*** (0.039)	0.115*** (0.038)	0.117*** (0.039)	0.114*** (0.038)	0.117*** (0.039)	0.112*** (0.038)	0.114*** (0.038)	0.107*** (0.039)	0.109*** (0.040)	0.105*** (0.039)	0.107*** (0.040)
Sample Size	492	492	492	492	492	492	492	492	492	492	492	492
Cross Sections Number	82	82	82	82	82	82	82	82	82	82	82	82
Wald Test	122.83***	127.26***	127.45***	131.60***	99.23***	103.68***	105.59***	111.42***	104.30***	108.93***	110.58***	115.27***
F-Test	8.773***	9.090***	9.104***	8.225***	7.088***	7.406***	7.542***	6.964***	7.450***	7.781***	7.899***	7.204***
Adjusted R-squared	0.432	0.434	0.433	0.432	0.447	0.449	0.448	0.448	0.440	0.442	0.441	0.440
Root MSE (Sigma)	1.780	1.777	1.780	1.781	1.756	1.753	1.755	1.756	1.768	1.765	1.767	1.769
Log Likelihood Function	-928.508	-927.616	-928.317	-927.411	-921.836	-920.949	-921.456	-920.439	-925.118	-924.371	-924.799	-924.017
Akaike Info. Criterion	2.745	2.734	2.743	2.755	2.671	2.662	2.667	2.678	2.707	2.699	2.704	2.717

Note: Refer note in Table 2 for information on dependent variable, standard error, significance levels and matrices. Coefficients for steady state growth determinants namely initial GDP per capita, investment, and population growth are not reported to conserve space, and so are the coefficients of additional control variables included for the purpose of this robustness test.

Table 6: Robustness check 2 – Growth estimations with additional control variables (human capital, trade openness and inflation)

Estimation models:	Panel fixed effects estimation of spatial lag model with **institutional** proximity matrices:											
	w_legor				***w_color***				***w_lang***			
	With human capital (51)	With trade openness (52)	With inflation (53)	With all three controls (54)	With human capital (55)	With trade openness (56)	With inflation (57)	With all three controls (58)	With human capital (59)	With trade openness (60)	With inflation (61)	With all three controls (62)
Spatial lag (ρ)	-0.182 (0.179)	-0.199 (0.177)	-0.180 (0.179)	-0.198 (0.178)	0.300** (0.134)	0.288** (0.131)	0.319** (0.136)	0.308** (0.135)	0.159 (0.109)	0.160 (0.108)	0.159 (0.109)	0.160 (0.109)
FD	11.20* (5.704)	11.26** (5.568)	10.99* (5.663)	10.92* (5.773)	9.966* (5.600)	9.953* (5.447)	9.401* (5.542)	9.433* (5.665)	10.35* (5.790)	10.29* (5.667)	10.07* (5.740)	10.03* (5.869)
FD squared	-10.02** (4.157)	-10.25** (4.044)	-9.872** (4.108)	-10.00** (4.184)	-9.050** (4.067)	-9.182** (3.933)	-8.639** (3.992)	-8.804** (4.077)	-9.492** (4.209)	-9.618** (4.100)	-9.291** (4.149)	-9.426** (4.244)
Law and order	-0.242 (0.187)	-0.246 (0.185)	-0.234 (0.184)	-0.237 (0.185)	-0.225 (0.196)	-0.227 (0.194)	-0.210 (0.193)	-0.212 (0.194)	-0.230 (0.193)	-0.232 (0.191)	-0.222 (0.190)	-0.224 (0.192)
Polity 2	0.116*** (0.037)	0.118*** (0.038)	0.115*** (0.037)	0.117*** (0.038)	0.112*** (0.039)	0.114*** (0.040)	0.110*** (0.039)	0.112*** (0.040)	0.118*** (0.039)	0.121*** (0.040)	0.117*** (0.039)	0.119*** (0.040)
Sample Size	492	492	492	492	492	492	492	492	492	492	492	492
Cross Sections Number	82	82	82	82	82	82	82	82	82	82	82	82
Wald Test	101.42***	106.98***	106.62***	112.58***	101.43***	105.36***	108.77***	112.97***	100.66***	104.35***	107.14***	111.58***
F-Test	7.245***	7.641***	7.616***	7.037***	7.245***	7.526***	7.770***	7.061***	7.190***	7.453***	7.653***	6.973***
Adjusted R-squared	0.433	0.435	0.433	0.433	0.48	0.440	0.439	0.438	0.435	0.437	0.435	0.434
Root MSE (Sigma)	1.779	1.776	1.779	1.780	1.771	1.769	1.769	1.771	1.777	1.773	1.776	1.777
Log Likelihood Function	-928.247	-927.231	-928.103	-927.072	-925.927	-925.270	-925.443	-924.795	-927.515	-926.603	-927.365	-926.451
Akaike Info. Criterion	2.742	2.731	2.740	2.751	2.716	2.709	2.711	2.726	2.734	2.724	2.732	2.744

Note: Refer note in Table 2 for information on dependent variable, standard error, significance levels and matrices. Coefficients for steady state growth determinants namely initial GDP per capita, investment, and population growth are not reported to conserve space, and so are the coefficients of additional control variables included for the purpose of this robustness test.

Abbreviations:
AIC: Akaike Information Criteria; CIA: Central Intelligence Agency; DPI: Database of Political Institutions; FD: Financial Development; GDP: Gross domestic product; ICRG: International Country Risk Guide; LLF: Log likelihood function; LM: Lagrange Multiplier; OLS: Ordinary least square; SAR: Spatial autoregressive model; SEM: Spatial error model.

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Authors' contributions:
XX has done the introduction, methodology, and results sections, while YY contributed to literature review and modelling parts and has revised and improved the manuscript language. All authors read and approved the final manuscript.

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The authors declare that they have no competing interests.

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Appendix:

Summary of underlying theoretical support for the institutional proximity concept based on the previous literature:

The embeddedness of deep determinants of institutions in a society and their roles towards the setting-up of the formal modern-day institutional environment, are postulated based on the following theoretical arguments:

a) **Acemoglu, Johnson, and Robinson (2001, 2002) on the impact of colonial origin on current institutions:**

By using settlers' mortality as a proxy for settlement strategy, Acemoglu et al., (2001, 2002) show that European colonizers settled down and replicated their home institutions in colonies with low or no disease environment. On the other hand, at the other colonies with unfavourable environment for settlement, colonizers merely set up extractive states to transfer resources home. Thus, conditional on settlement strategy, we assume different colonizers adopted and replicated different institutions and that differences persisted until today. Similarly, non-colonised countries are assumed to have developed a different set of institutions too.

b) **La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998), La Porta, Lopez-de-Silanes, and Shleifer (2008) and Glaeser and Shleifer (2002) on the impact of legal origin to the current institutions:**

Meanwhile, legal origin theory according to La Porta et al., (1998, 2008) explains the transplanting process of ideas and strategies of the common and civil laws (developed by England and France respectively centuries ago) into specific legal rules, onto the organization of the legal systems, the human capitals, and the beliefs of its participants in much of the world typically via conquest and colonisation. Despite a much-localised legal evolution, the fundamental strategies, and ideas of the two legal systems survived and have continued to exert substantial influence on economic outcomes. We therefore assume these different types of legal origin to eventually have developed distinctive legal systems leading to different economic outcomes.

c) **Alesina, Devleeschauwer, Easterly, Kurlat, and Wacziarg (2003)'s arguments on the role of linguistic fractionalisation in explaining the institutions,** and **the proposition by Easterly, Ritzen, and Woolcock, (2006) that social cohesion (instrumented with linguistic homogeneity) leads to better institutions.**

Although Alesina et al. (2003) provide new measures of ethnic, linguistic, and religious fractionalisation and re-estimate these measures' impact on the quality of institutions and growth, we are only interested in their finding with regards to linguistic fractionalisation. They indeed find negative impact of linguistic fractionalisation on the quality of institutions measured by the extent of corruption and political freedom. In the same vein, Easterly et al. (2006) show that societies with linguistic homogeneity have more social cohesion and thus better institutions, and that these better institutions lead to higher growth. Thus, in brief, legal origin, colonial origin and language are perceived as the deep determinants of the current level of institutions thereby constituting the first part of the above framework.

Table A1: Summary statistics of variables

Variable	Mean	Std. Dev.	Min	Max	Observations
Real GDP per capita growth	2.013	2.363	-7.937	10.883	492
FD	0.368	0.245	0.032	0.953	492
Law and Order	3.766	1.380	1	6	492
Polity 2	5.049	5.793	-10	10	492
Rule of Law	0.186	0.988	-2.231	2.069	410
Corruption	3.081	1.235	0.5	6	492
Political Constraint index	0.336	0.184	0	0.722	492
Checks	3.223	1.519	1	17	492
Initial GDP per capita	14,874.62	18,504.57	215.548	90,029.36	492
Investment	22.441	5.974	3.958	49.728	492
Population growth	1.510	1.079	-1.240	7.126	492
Human capital index	2.460	0.660	1.069	3.989	492
Trade openness	76.325	47.914	15.566	407.120	492
Inflation	15.788	99.865	-3.273	1677.41	492

Table A2. Pairwise correlation between variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Real GDP per capita growth (1)	1													
FD (2)	0.013	1												
Law and Order (3)	-0.026	0.678*	1											
Polity 2 (4)	-0.042	0.556*	0.412*	1										
Rule of Law (5)	-0.052	0.792*	0.795*	0.634*	1									
Corruption (6)	-0.115*	0.571*	0.689*	0.518*	0.7622*	1								
Political constraint index (7)	0.030	0.453*	0.316*	0.664*	0.4426*	0.3540*	1							
Checks (8)	-0.027	0.394*	0.282*	0.651*	0.3709*	0.3395*	0.6028*	1						
Initial GDP per capita (9)	-0.165*	0.823*	0.652*	0.630*	0.7778*	0.6281*	0.4621*	0.4326*	1					
Investment (10)	0.315*	0.233*	0.199*	-0.063	0.1252*	0.0517	-0.0054	-0.0945*	0.1483*	1				
Population growth (11)	-0.110*	-0.549*	-0.346*	-0.581*	-0.4624*	-0.3717*	-0.4375*	-0.3611*	-0.5574*	-0.081	1			
Human capital index (12)	-0.005	0.781*	0.558*	0.649*	0.7280*	0.5348*	0.4850*	0.4314*	0.8327*	0.1667*	-0.6350*	1		
Trade openness (13)	0.079	0.143*	0.174*	0.016	0.2343*	0.0624	-0.0052	-0.0559	0.1752*	0.2482*	-0.0604	0.2111*	1	
Inflation (14)	0.0585	-0.529*	-0.464*	-0.329*	-0.4943*	-0.2961*	-0.2751*	-0.2096*	-0.5007*	-0.1381*	0.3074*	-0.4857*	-0.2163*	1

Table A3: Variables definition and data sources

Variable name	Definition	Time period	Data frequency*	Sources
Growth, FD and steady-state determinants:				
Real GDP per capita growth	Annual percentage growth rate of GDP per capita constant 2010 U.S. dollars.	1990-2019	5-year average	World Development Indicators
FD index	Summarizes how developed financial institutions and financial markers are in terms of their depth (size and liquidity), access (ability of individuals/companies to access financial services), and efficiency (ability of institutions to provide financial services at low cost and with sustainable revenues and the level of activity in capital markets).	1990-2019	5-year average	International Monetary Fund
Initial GDP per capita	In natural log	1990-2019	First year of the 5-year period	World Development Indicators
Population growth	Annual population growth rate	1990-2019	5-year average	World Development Indicators
Investment	Gross fixed capital formation (% of GDP)	1990-2019	5-year average	World Development Indicators
Additional control variables:				
Human capital	Human capital index - Human capital index, based on years of schooling (Barro and Lee, 2010) and assumed returns, based on Mincer equation estimates around the world.	1990-2019	5-year average	Penn World Table (Feenstra et al., 2015)
Trade openness	Trade, ie the sum of exports and imports of goods and services, as % of GDP	1990-2019	5-year average	World Development Indicators
Inflation	Annual percentage of GDP deflator	1990-2019	5-year average	World Development Indicators
Institutions (economic and political institutions variables):				
Main: Law and order	Law is the strength and impartiality of the legal system, while Order is an assessment of popular observance of the law (0-6) lower score higher risk	1990-2017	5-year average (last period 3-year average)	International Country Risk Guide
Alternative: Rule of law	The perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. (Scores -2.5 to 2.5), higher values better	1996-2019	5-year average	World Development Indicator (World Bank Governance Index^)
Alternative: Corruption	Corruption within the political system and becoming a threat to foreign investment. (0-6) lower score higher risk	1990-2017	5-year average (last period 3-year average)	International Country Risk Guide
Main: Polity 2	The polity score is a polity scale ranges from +10 (strongly democratic) to -10 (strongly autocratic). -10 to + 10	1990-2019	5-year average	Polity V dataset (Marshall and Gurr, 2020)
Alternative: Political constraint index	An index that demonstrates political environments that limit the feasibility of policy change, and these environments are an important determinant of investment in infrastructure (Score 0 to 1)	1990-2019	5-year average	Political Constraint Index dataset (Henisz, 2017)
Alternative: Checks	Checks and balance score rating (0-18)		5-year average	Database of Political Institutions (Cesi, et al, 2021)
Institutional proximity matrix variables				
Legal origin	Identifies the legal origin of the Company Law or Commercial code of each country. There are five possible origin: 1. English Common Law 2. French Commercial Code 3. Socialist/Communist Laws 4. German Commercial Code 5. Scandinavian Commercial Code	Constant, no time series	Matrix of 82 by 82 (based on the number of cross-sectional units – 82 countries).	(Porta et al., 1999)

Colonial origin	10 codes to reflect each country that has been colonized since 1700. In cases of several colonial powers, the last one is counted, if it lasted for 10 years or longer. The categories are the following: 0. Never colonized by a Western overseas colonial power 1. Dutch 2. Spanish 3. Italian 4. US 5. British 6. French 7. Portuguese	Constant, no time series	Matrix is converted into panel of 6 periods, becoming matrix of 82*6 by 82*6 (492 by 492)	The authoritation regime dataset (Wahman et al., 2013); (Teorell and Wahman, 2018)
Language	The spoken language of any two countries paired, and this similarity is determined using their official and second languages. When the official and second languages have no neighbours (i.e. the other countries in the pair not speaking the same official and second languages), the next largest spoken language by the immigrants is used, since the matrix requires that at least there must be one neighbour for each individual country.	Year 2000 data, assumed to be constant		Language data are obtained from the CIA World Factbook 2019-2020 (Central Intelligence Agency, 2020) cross-referenced against Wikipedia page: "List of official languages by country and territory" (Wikipedia, 2020).

*Data are collected annually from the original sources. 5-year average data are based on authors' own computation.

^World Bank's Worldwide Governance Index (WGI) started in 1996, therefore when using Rule of Law variable in the spatial estimations, the STATA spatial estimation command requires blank observations in the first period of the 5-year average data (1990-1994) to be replaced with zero. Since the WGI original score ranges from -2.5 and 2.5, zero is thus an arithmetic mean for the -2.5 and 2.5 scores, and imputing zero to the blank observations are therefore not expected to cause any deviation from the actual results whatsoever.