



Panel Analysis of the Relationship Between Main Socio-Economic Factors and New Business Density

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Abstract

The role of government management and the form of countries' economy play an important role in the development of the business environment. This article studies the effects of socio-economic factors like the rule of law, control of corruption, level of high-tech exports, and education spending of government on the number of new businesses. The article employs panel data models, like pooled ordinary least squares, fixed effect, and random effect models to model the data taken from the World Bank about socio-economic and business factors. The stationarity tests, tests for individual effect and its correlation with independent variables are conducted to select the correct data forms and models. Leveraging a panel data analysis, the research finds that countries with high levels of rule of law and lower corruption are better places for businesses. Also, if the country's economy is technology-based, then there is a better environment for new enterprises. It means that innovation and a technology-based economy help produce and attract better human capital and technology essential for developing a good business environment. If government management is fair, then there are no serious bureaucratic obstacles like corruption on the way to new businesses. Our study contributes to a greater knowledge of the numerous causes that drive entrepreneurial activity by explaining these complicated linkages, giving useful insights for policymakers and stakeholders trying to stimulate sustainable economic growth and development. Furthermore, there are more factors that affect the number of new businesses. However, this article tries to explain some of these factors.

Keywords: Small and medium enterprises, corruption, technology, economics, education

1. Introduction

Many countries in the world are suffering from a lack of support from the government for micro, small, and medium enterprises (MSMEs). Government support is especially important for startups that require sustainable financing mechanisms (Muriithi, 2017). Sometimes government tries to increase business activity within the economy, however, fails to contribute successfully. There are many reasons behind such kind of unsuccessful business development programs. In this article, we will focus on some of these problems. According to the scientific

literature, the rule of law, corruption, and level of technological and educational development play a significant role in the ease of doing business. Controlling the level of corruption decreases additional bureaucratic burdens on businesses and creates a better environment for innovative entrepreneurship (Anokhin & Schulze, 2009). By using the econometric analysis of panel data this will be tested again together with other variables. Also, the rule of law has a similar effect on the number of new businesses. The correlation between control of corruption and the rule of law is possible.

Moreover, government spending on education is an important factor for educational development. It is assumed that educational development leads to an increase in number of the new businesses registered. According to some literature, education has an outstanding effect on innovative entrepreneurship (Samoilikova et al., 2023). Using this assumption, we will test the effect of the education spending of the government on the number of new businesses registered. Furthermore, data on the share of high-tech exports on total manufactured exports is included in the panel analysis to capture the effect of the high-tech industry on further business development.

In the contemporary global landscape, the dynamics of economic development are shaped by multifaceted interactions among various socio-economic factors. This paper delves into a comprehensive analysis of panel data to discover the complex relationships among the above-mentioned variables that are crucial to understanding the pulse of economic growth.

2. Literature review

Many academic sources discuss the effect of education, new technologies, the rule of law, and corruption on business development. However, these sources employ various methods for research and do not always come to the same results. One of these studies asserts that corruption damages small and medium enterprises causing overregulation by the government in emerging countries (A. Lash & Batavia, 2019). The research uses regression analysis and examines several regulatory, legal, and macroeconomic indicators. According to the analysis, sometimes corruption arises because of the complex and burdensome regulation mechanism rather than weak regulation.

Another paper by D. Karama builds an ordinary least squares (OLS) regression model using cross-sectional data to study the relationship between ease of doing business, corruption, rule of law, gross domestic product (GDP) growth, and GDP per capita in 178 countries (D. Karama, 2014). The study shows that there are negative effects of corruption, bribery, and the rule of law on the ease of doing business in a country's economy on the macro level. It also asserts that there are positive effects of corruption, bribery, and the rule of law on a country's economy on the micro level. Thus, at the micro level, some big firms and wealthy individuals could benefit from corruption while the whole society loses.

Furthermore, in the paper of S. Anokhin and W. S. Schulze, the relationship between corruption and innovative entrepreneurship is studied. Authors prefer to use quantile regression to analyse different indicators including control of corruption, domestic innovation, and entrepreneurial activity in 64 different countries from 1996-2002 (Anokhin & Schulze, 2009). The study asserts that a corrupt environment damages the incentives for innovation, innovative entrepreneurship, and investment in innovation. It decreases business activities within the economy.

The paper that analyses unbalanced panel data from 16 West African countries from 2004 to 2017, shows that higher expected years of schooling and a high level of control of corruption positively affect the ease of doing business score. Also, the study finds that countries with lower

corruption scores tend to have lower scores of ease of doing business (Nageri & Gunu, 2020). There is another article that uses a similar model to analyse the relationship among new business density, institutional quality, regulatory environment, and financial and macroeconomic variables (Chambers & Munemo, 2019). Institutional quality is represented using variables like political stability and absence of violence, voice and accountability, regulatory quality, government effectiveness, rule of law, and control of corruption. The regression model is built over the panel data from 119 countries from 2001 to 2012. It is not surprising that a high level of institutional quality is followed by higher entrepreneurial activity. Moreover, the research shows that increasing startup procedures reduces business activity.

Foreign direct investment (FDI) is vital for business development too. The paper of A.B.Abille and S.Mumuni analyses the impact of institutional quality on ease of doing business and indirectly on FDI inflows through ease of doing business. The panel data from 50 African countries for the period of 2015-2019 was employed (Abille & Mumuni, 2023). According to the research if the institutional quality is low (e.g. rule of law is weak or the corruption rate is high) then an increase in the score of ease of doing business affects the FDI inflow negatively. In other words, to develop a business environment with FDI inflows, high-quality government management should be reached.

Technological and educational support from the government leads to business development too. The article about the government support system in SMEs that analyses SMEs in Pakistan suggests that governments should provide technological support for businesses to stimulate their growth (Marri et al., 2011). Also, government support for technological development is important for the survival of innovative SMEs. According to the study about barriers to technological innovations of SMEs, innovation is key to success for new businesses (Indrawati et al., 2020). Because of this, government support for technological development increases the chances of survival of new businesses. The same conclusions are made in the study about the sustainability of SMEs (Prasanna et al., 2019). It shows that technological innovation, technological transfer among business players, and adoption of information technologies (IT) positively affect the growth of SMEs.

Taking the above-mentioned literature, we can assume that educational and technological development, improvement in governance, and a low rate of corruption should create a good basis for business development. However, their combined impact should be studied further.

3. Data and methods

The panel regression method is employed to study the effect of different socio-economic factors and government decisions on business development. To conduct research 5 variables and 55 countries with different economic backgrounds for the period of 2010-2020 are selected. To study the other variables' impact on business development new business density data is collected from World Bank World Development Indicators. New business density is the number of new limited liability corporations registered per 1000 15-64 aged people for the given year. The limitation of the data is that it does not take into account other types of new businesses except limited liability companies (LLCs).

To measure corruption rate in the countries, control of corruption data from World Bank Data is considered. It is an estimated score of corruption that ranges from -2.5 to 2.5 where a 2.5 score means the best level of control over corruption. The same form of estimated score between -2.5 and 2.5 is considered for the rule of law. This variable shows how reliable and fair the law enforcement system in the country is.

Government expenditure on education as a percentage of GDP is used to measure the government support for education. Furthermore, the result of high technology exports as a percentage of total manufactured exports is employed to measure the technological development of a country. Because technologically developed countries export more high-tech products. All the above-mentioned data is taken from World Bank Data. Because in our model we are interested in the effect of other variables in business development, new business density data will be the dependent variable in our model while government spending on education, high-tech exports, rule of law, and control of corruption will be independent variables. Here we will measure how the level of corruption control, law enforcement quality, and technological and educational development affect the number of new formal businesses registered per 1000 people ages 15-64. 55 countries are selected such that there are no missing values for any variable for each country for the period of 2010-2020 (*World Development Indicators* | *DataBank*, 2023). The panel data of 5 variables, 55 countries, and 11 years is used to build panel regression and analyse the impact of socio-economic factors on business development.

Initially, the stationarity of panel data is tested using the Augmented Dickey-Fuller (ADF) and Levin-Lin-Chu (LLC) tests. The ADF test is a unit root test for time series data where the null hypothesis is the non-stationarity of the data. If we can reject the null hypothesis, it means that each variable of the panel data is stationary (Enders, 2015). However, the ADF test treats each variable as time series data and ignores the cross-sectional part. To take the cross-sectional part into account LLC test is conducted. The LLC test is an extension of the ADF test for panel data, which considers both cross-sectional and time-series dimensions.

As in the ADF test, the LLC test examines whether the panel data series has a unit root or not. If the null hypothesis of a unit root is rejected, it suggests that the variable is stationary, meaning it does not have a stochastic trend. The main superiority of the LLC test is in its consideration of the potential cross-sectional dependence and heterogeneity often present in panel data. It provides a more robust analysis compared to traditional unit root tests that may not account for these features (Levin et al., 2002).

After stationarity tests, we select a suitable panel data model. We will examine three main models: Pooled Ordinary Least Squares (POLS), Random Effect (RE), and Fixed Effect (FE) models. Each model has its specifications. Firstly, we must define a general formula for the panel data model. It is as follows:

$$y_{it} = \gamma + \beta X_{it} + \alpha_i + \varepsilon_{it}. \quad (3.1)$$

y_{it} – is a dependent variable for i-th group at time t

γ – is an intercept

β – is a vector of the parameters of dependent variables

X_{it} – is a vector of independent variables for the i-th group at time t

α_i – is a group-specific constant parameter, which is time-invariant

ε_{it} – is the error term for the i-th group at time t. It is assumed to be distributed $N \sim (0, \sigma^2)$

We may use the pooled OLS model to describe the relationship between business development and the above-mentioned socio-economic factors. In that case, we suppose that there is no time-invariant group-specific constant parameter. In other words, there are no individual-specific effects, and the same set of coefficients applies to all countries. The pooled OLS formula is as follows:

$$y_{it} = \gamma + \beta X_{it} + \varepsilon_{it}. \quad (3.2)$$

This model assumes that there are no unobserved group-specific variables, and we can include all observed variables in the model and estimate parameters using OLS. However, if there are unobserved group-specific variables then we should use either a fixed or random effects model (Greene, 2008). The fixed effect model assumes that unobserved group-specific variables are correlated with independent variables and their effect is captured by the group-specific constant parameters. For each country, we will include different intercept parameters (Baltagi, 2006). The formula of the fixed effects model is as follows:

$$y_{it} = \beta X_{it} + \alpha_i + \varepsilon_{it}. \quad (3.3)$$

Moreover, if unobserved group-specific variables are uncorrelated with independent variables, then we should use the random effect model:

$$y_{it} = \beta X_{it} + \alpha + \theta_i + \varepsilon_{it}, \quad (3.4)$$

$$\alpha_i = \alpha + \theta_i. \quad (3.5)$$

Here α is a mean of unobserved heterogeneity, in other words, a mean of unobserved and uncorrelated group-specific variables. The random heterogeneity or residual part of unobserved group-specific variables is denoted by θ_i , which is assumed to have zero conditional mean and constant conditional variance as ε_{it} (Greene, 2008).

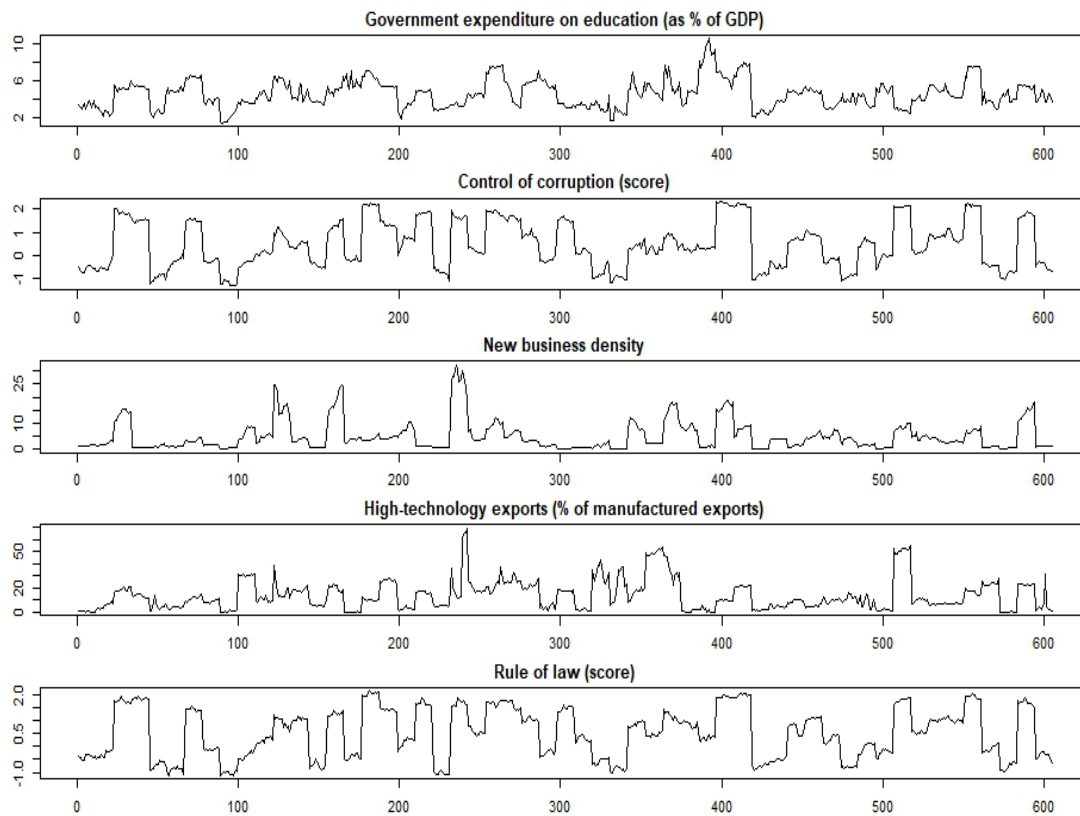
We will test all three models to find a suitable one for our panel data. Firstly, the Lagrange Multiplier (LM) test will be conducted to test whether an individual effect exists in the model. If it exists, the Hausman test will be employed to test whether this individual effect is correlated with independent variables or not. In other words, using the LM test we decide between pooled OLS and fixed/random effect models, while using the Hausman test we decide between fixed and random effects models (Greene, 2008).

All tests are conducted and models are built using the R programming language. In order to analyse the panel data, “plm” package is employed in RStudio.

4. Results and discussion

We have panel data for 55 countries, 11 years, and 5 variables. As mentioned above, the panel data analysis starts with a stationarity check. Here we have two approaches: firstly, the stationarity is checked as in ordinary time series data ignoring country-specific differences using the ADF test. Secondly, panel data stationarity is tested using the LLC test. Figure 1 shows the plot of all data (55 countries x 11 years) per variable.

Figure 1: Plot of all data per variable



Source: World Development Indicators | DataBank, 2023

Stationarity is not clearly visible from the plot. However, the ADF test for all 5 variables shows that they are stationary. We can reject the null hypothesis of non-stationarity with 0.01 significance level. To consider the differences by countries in the stationarity test we should use the panel data stationarity test (LLC). In R we test panel data stationarity using the “purtest()” function. Table 1 shows the results of stationarity tests.

Table 1: Stationarity test results

	Government expenditure on education, total (% of GDP)	Control of Corruption: Estimate	Rule of Law: Estimate	High-technology exports (% of manufactured exports)	New business density (new registrations per 1,000 people ages 15-64)
ADF test statistic	-5.7386	-6.7641	-6.8667	-6.4194	-7.6917
ADF test p-value	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LLC test statistic	-3.0632	-7.4834	-6.9079	-7.538	-1.9254
LLC test p-value	< 0.01	< 0.01	< 0.01	< 0.01	0.02709

Source: Generated by RStudio using the data from World Development Indicators | DataBank, 2023

Table 1 shows that we can reject the null hypothesis of non-stationarity with a 1 % significance level except for the new business density variable in the LLC test. However, we can reject the null hypothesis for new business density with a 5 % significance level. In general, we can reject the null hypothesis with a 5 % significance level for all variables in both ADF and LLC stationarity tests.

In the next phase, we form the 3 above-mentioned models using the “plm()” function in RStudio. The variables are noted for simplicity as *ne.bus.den* (new business density), *Gov.ex.edu* (government expenditure on education, total (% of GDP)), *Cor.control* (control of corruption), *Rul.law* (rule of law), and *hi.texp* (high-technology exports (% of manufactured exports)). In a pooled ordinary least squares model where new business density is a dependent variable, we can rewrite formula (3.2) as follows:

$$\begin{aligned} ne.bus.den_{it} = & 3.1446 - 0.1504 * Gov.ex.edu_{it} + 1.413 \\ & * Cor.control_{it} + 1.4274 * Rul.law_{it} + 0.0841 \\ & * hi.texp_{it} + \varepsilon_{it}. \end{aligned} \quad (4.1)$$

Except in *Gov.ex.edu*, parameter estimates, and intercept are significantly different from 0 with at least 95 % confidence. However, the coefficient of determination (R-squared) of the model is about 32 %.

The fixed and random effect models are shown using the formulas (4.2) and (4.3) respectively (a “within” transformation applied).

$$\begin{aligned} ne.bus.den_{it} = & -0.1182 * Gov.ex.edu_{it} + 1.8388 * Cor.control_{it} \\ & + 1.6055 * Rul.law_{it} + 0.027 * hi.texp_{it} + \alpha_i + \varepsilon_{it} \end{aligned} \quad (4.2)$$

$$\begin{aligned} ne.bus.den_{it} = & 4.2859 - 0.1344 * Gov.ex.edu_{it} + 1.803 \\ & * Cor.control_{it} + 1.6 * Rul.law_{it} - 0.0215 * hi.texp_{it} \\ & + u_i + \varepsilon_{it} \end{aligned} \quad (4.3)$$

As in model (4.1), in (4.2) except for *Gov.ex.edu*, parameter estimates are significantly different from 0 with at least a 95 % confidence level. But the coefficient of determination is as low as 7,3 %. In the random effects model (4.3) *Cor.control* and *Rul.law* parameter estimates and intercept estimates are significantly different from 0 with at least 95 % confidence level, while *hi.texp* parameter estimate is significant with only a 90 % confidence level. *Gov.ex.edu* parameter estimate is insignificant. Also, the coefficient of determination is just 9.6 %. Small R-squared values could be because of the short time series period and big differences among countries’ economic backgrounds that our model doesn’t take into account. So, the models explain only a small portion of the variability in the dependent variable.

In the final step of the analysis, we compare all 3 models. Initially, we use the Breusch-Pagan Lagrange Multiplier (LM) test to select between pooled ordinary least squares and fixed effect models. The test statistic is 2485.7 and the corresponding p-value is less than 0.01, which means that we reject the null hypothesis and conclude that there is an individual effect. In other words, we should prefer a fixed effect model. Using the Hausman test we compare random effect and fixed effect models. The test statistic is calculated using the coefficient estimates and asymptotic covariance matrix from both models. If we reject the null hypothesis, it means that the random effects model is inconsistent, and we should prefer the fixed effect model. However, in the Hausman test statistic result is 4.7623 and the corresponding p-value is equal to 0.3126. We fail to reject the null hypothesis and prefer the random effects model (4.3).

As mentioned above, the random effects model shows that the control of corruption score and the rule of law score positively affect the new business density. So, better governance and transparency lead to a better environment for the new businesses which could lead to strong economic growth and welfare increase in countries. Also, we may conclude that countries with a bigger portion of high-tech exports in their total manufactured exports tend to have more

business density. It could have several reasons. First, more high-tech exports may show that there is a better technological and scientific environment, which creates a suitable environment and human capital for new businesses. Secondly, more high-tech exports could be because of the higher foreign investment which creates diverse business opportunities. Our model doesn't show any significant impact of government expenditure on new business density. However, it doesn't mean that there is no relationship between them. The effect of government educational expenditure on the business environment could be indirect and complex. So, the model fails to explain such an interrelation.

5. Conclusion

The result of the panel data analysis shows that scores of control of corruption and rule of law and weight of high tech exports as a percentage of total manufactured exports positively affect the new business registrations per 1,000 people ages 15-64. Although, government expenditure on education doesn't have a strong direct effect on business density. The random effects model means that many unobserved country-specific variables are uncorrelated with new business density and are not included in the panel data regression. These uncorrelated variables could be income level, economic specifications, or macroeconomic indicators of the countries. In this research, only 4 socio-economic factors' effect on new business density is examined.

As mentioned in the literature review section of this article, many studies have reached the same conclusions. Corruption and the rule of law positively affect the business environment, innovative approaches, and technological development. Unlike this article, previous researches analyse the impact of education and technology separately. In our models, all these factors are included altogether and we couldn't see significant coefficients for education spending. However, in previous studies, there were cases where a positive interrelation between the business environment and education was observed. As high-tech development, effective strategy on innovation growth, and successful research and development implementations are impossible without a properly constructed educational system, then it would be naïve to believe that education does not affect business development.

Moreover, there was one interesting case in the literature review - D. Karama's study – that is worth mentioning. It is a positive effect of corruption on businesses at the micro level. Some monopolistic firms could benefit from bribery and remove bureaucratic problems from their way. However, our study doesn't cover this case. Because the models developed in this research use only the number of newly established businesses as a dependent variable. On the other hand, based on the previous research papers we can conclude that corruption destroys the innovation environment, which prevents companies from surviving. Even if at a micro level some monopolistic firms benefit from bribery, this anomaly could be short-term.

Thus, it could be concluded that countries with low levels of corruption and effective governance may create better business conditions, especially for micro, small, and medium enterprises. The technological development may also increase the number of new businesses, especially in the innovation sector like startups. These new businesses in the future could become unicorns and multinational companies, increase tax income to the state budget, and decrease unemployment and poverty levels in the economy. So, the countries should take action to create better government management and stimulate the development of high-tech industry.

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Appendix 1

R code and output

```
library(tseries)
library(vars)
library(urca)
library(dplyr)
library(lmtest)
library(plm)
library(gplots)

> ### Data
> pnl <- read.csv("C:/.../article_main_data.csv",
+               header=TRUE, skip=0, sep=";", dec=".", na.strings = ".")
> colnames(pnl) <- c("Year", "Country", "C.ID", "Gov.ex.edu", "Cor.control", "R
ul.law", "ne.bus.den", "hi.texp")
>
> panel <- pdata.frame(pnl, index = c("Country", "Year"))

> ### Stationarity
> adf.test(panel${Variable_Name})
```

Augmented Dickey-Fuller Test

```
data: panel$Gov.ex.edu
Dickey-Fuller = -5.7386, Lag order = 8, p-value = 0.01
alternative hypothesis: stationary
```

```
data: panel$Cor.control
Dickey-Fuller = -6.7641, Lag order = 8, p-value = 0.01
alternative hypothesis: stationary
```

```
data: panel$Rul.law
Dickey-Fuller = -6.8667, Lag order = 8, p-value = 0.01
alternative hypothesis: stationary
```

```
data: panel$ne.bus.den
Dickey-Fuller = -7.6917, Lag order = 8, p-value = 0.01
alternative hypothesis: stationary
```

```
data: panel$hi.texp
Dickey-Fuller = -6.4194, Lag order = 8, p-value = 0.01
alternative hypothesis: stationary
```

```
warning message:
In adf.test(panel$hi.texp) : p-value smaller than printed p-value
```

```
> purtest(panel${Variable_Name}="intercept", test = "levlin", pmax = 2)
```

Levin-Lin-Chu Unit-Root Test (ex. var.: Individual Intercepts)

```
data: panel$ne.bus.den
z = -1.9254, p-value = 0.02709
alternative hypothesis: stationarity
```

```
data: panel$Gov.ex.edu
z = -3.0632, p-value = 0.001095
```

alternative hypothesis: stationarity

Warning message:

In selectT(1, theTs) : the time series is short

data: panel\$Ru1.law

z = -6.9079, p-value = 2.459e-12

alternative hypothesis: stationarity

Warning message:

In selectT(1, theTs) : the time series is short

data: panel\$Cor.control

z = -7.4834, p-value = 3.621e-14

alternative hypothesis: stationarity

Warning message:

In selectT(1, theTs) : the time series is short

data: panel\$hi.texp

z = -7.538, p-value = 2.387e-14

alternative hypothesis: stationarity

Warning message:

In selectT(1, theTs) : the time series is short

> ### Models

> ### Pooled OLS

> OLS <- plm(ne.bus.den~Gov.ex.edu+Cor.control+hi.texp+Ru1.law,data=panel,
model="pooling")

> summary(OLS)

Pooling Model

Call:

plm(formula = ne.bus.den ~ Gov.ex.edu + Cor.control + hi.texp +
Ru1.law, data = panel, model = "pooling")

Balanced Panel: n = 55, T = 11, N = 605

Residuals:

Min.	1st Qu.	Median	3rd Qu.	Max.
-8.51706	-2.78341	-0.66139	1.51952	24.14316

Coefficients:

	Estimate	Std. Error	t-value	Pr(> t)	
(Intercept)	3.144556	0.771004	4.0785	5.144e-05	***
Gov.ex.edu	-0.150436	0.159078	-0.9457	0.34470	
Cor.control	1.413034	0.677014	2.0872	0.03730	*
hi.texp	0.084051	0.017199	4.8869	1.316e-06	***
Ru1.law	1.427354	0.715304	1.9955	0.04645	*

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares: 20055

Residual Sum of Squares: 13670

R-Squared: 0.31838

Adj. R-Squared: 0.31384

F-statistic: 70.0648 on 4 and 600 DF, p-value: < 2.22e-16

> ### Fixed effect

> fixed <- plm(ne.bus.den~Gov.ex.edu+Cor.control+hi.texp+Ru1.law,data=pane
l, model="within")

> summary(fixed)

Oneway (individual) effect within Model

Call:

plm(formula = ne.bus.den ~ Gov.ex.edu + Cor.control + hi.texp +
Ru1.law, data = panel, model = "within")

Balanced Panel: n = 55, T = 11, N = 605

Residuals:

Min.	1st Qu.	Median	3rd Qu.	Max.
-7.672781	-0.403135	-0.023546	0.406309	7.284119

Coefficients:

	Estimate	Std. Error	t-value	Pr(> t)
Gov.ex.edu	-0.118241	0.119183	-0.9921	0.3215920
Cor.control	1.838751	0.495308	3.7123	0.0002264 ***
hi.texp	-0.026957	0.012366	-2.1798	0.0296951 *
Rul.law	1.605472	0.621099	2.5849	0.0099992 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares: 1090.7

Residual Sum of Squares: 1011.5

R-Squared: 0.07262

Adj. R-Squared: -0.025893

F-statistic: 10.6888 on 4 and 546 DF, p-value: 2.3988e-08

```
> ### Random effect
> random <- plm(ne.bus.den~Gov.ex.edu+Cor.control+hi.texp+Rul.law,data=panel, model="random")
> summary(random)
Oneway (individual) effect Random Effect Model
(Swamy-Arora's transformation)
```

Call:

```
plm(formula = ne.bus.den ~ Gov.ex.edu + Cor.control + hi.texp +
    Rul.law, data = panel, model = "random")
```

Balanced Panel: n = 55, T = 11, N = 605

Effects:

	var	std.dev	share
idiosyncratic	1.853	1.361	0.076
individual	22.520	4.746	0.924
theta:	0.9138		

Residuals:

Min.	1st Qu.	Median	3rd Qu.	Max.
-6.69932	-0.59767	-0.15719	0.36037	8.20415

Coefficients:

	Estimate	Std. Error	z-value	Pr(> z)
(Intercept)	4.285945	0.851440	5.0338	4.809e-07 ***
Gov.ex.edu	-0.134410	0.116329	-1.1554	0.2479144
Cor.control	1.802992	0.475418	3.7924	0.0001492 ***
hi.texp	-0.021535	0.012111	-1.7782	0.0753757 .
Rul.law	1.599981	0.561438	2.8498	0.0043748 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares: 1231.5

Residual Sum of Squares: 1112.7

R-Squared: 0.096429

Adj. R-Squared: 0.090406

Chisq: 64.0322 on 4 DF, p-value: 4.1144e-13

```
> ### Model tests
>
> ### LM test (fixed versus OLS)
> plmtest(OLS,effect="individual",type="bp")
```

Lagrange Multiplier Test - (Breusch-Pagan)

data: ne.bus.den ~ Gov.ex.edu + Cor.control + hi.texp + Rul.law

```
chisq = 2485.7, df = 1, p-value < 2.2e-16  
alternative hypothesis: significant effects
```

```
> ### Hausman test (random versus fixed)  
> phtest(fixed,random)
```

Hausman Test

```
data: ne.bus.den ~ Gov.ex.edu + Cor.control + hi.texp + Ru1.law  
chisq = 4.7623, df = 4, p-value = 0.3126  
alternative hypothesis: one model is inconsistent
```