

The Impact of Information and Communication Technology on Financial Development (Using Panel Data)

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Abstract: This study aims to analyze the impact of information and communication technology (ICT) on financial development in six developed countries during the period (1996-2023) using panel data. After estimating the model, selecting the optimal model (random effects model), and addressing the autoregressive and heteroscedasticity issues, the results revealed a positive impact of ICT. The results also revealed a positive impact of research and development, and a strong positive impact on GDP per capita. These results support the main hypothesis of the study, highlighting the pivotal role of ICT in driving financial development by improving efficiency, reducing costs, providing liquidity, increasing transaction transparency, enhancing financial inclusion, and enabling financial innovation.

Keywords: Information and Communication Technology, Financial Development, Panel Data. Financial Inclusion, FinTech.

JEL Classification : O33, O16, C23, G21, G23

ملخص: تهدف هذه الدراسة إلى تحليل أثر تكنولوجيا المعلومات والاتصال (ICT) على التنمية المالية، في ست دول متقدمة خلال الفترة (1996-2023) باستخدام بيانات البانل. وبعد تقدير النموذج؛ واختيار النموذج الأمثل (نموذج التأثيرات العشوائية) ومعالجة مشكلات الانحدار الذاتي والتباين، كشفت النتائج عن وجود أثر إيجابي لتكنولوجيا المعلومات والاتصال. كما أسفرت أيضا عن وجود أثر إيجابي للبحث والتطوير، وأثر إيجابي وقوي لاجمالي الناتج المحلي للفرد. دعمت هذه النتائج الفرضية الأساسية للدراسة؛ مبرزة الدور المحوري لتكنولوجيا المعلومات والاتصال في دفع عجلة التنمية المالية عبر تحسين الكفاءة، خفض التكاليف وتوفير السيولة وزيادة الشفافية في المعاملات، تعزيز الشمول المالي وتمكين الابتكار المالي.

الكلمات المفتاحية : تكنولوجيا المعلومات والاتصالات، التنمية المالية، بيانات البانل، الشمول المالي، التكنولوجيا المالية.

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1.Introduction

Information and communication technology, or ICT, has undergone a massive revolution in recent decades and is now a key force behind financial and economic transformation. Financial systems and markets have undergone significant changes as a result of the advancement of digital communications technologies, the proliferation of smartphones and the internet, and the growth of digital services. This technology has made it feasible to access financial data fast, analyze it precisely, and lower transaction costs. Financial development, economic stability, and financial inclusion have all benefited from this. In this context, developed nations like the United States, Sweden, Switzerland, and Denmark,

As leaders in the adoption and application of digital technology to support financial development, the UK and Norway are deserving of examination. Consequently, we will try to respond to this question:

To what extent does information and communication technology contribute to enhancing financial development in the countries under study?

Hypothesis: Information and communication technology contributes effectively to advancing financial development.

Study Objective: Using panel data for a selection of top ICT-using nations from 1996 to 2023, this study attempts to quantify and examine the influence of ICT on financial development.

Relevance of the Research: The study's significance stems from its ability to shed light on financial development, the main economic driver. It also emphasizes how contemporary digital technologies impact it, particularly given the swift shift to a digital economy. Its findings also offer quantifiable proof that can assist policymakers in developing nations in creating financial and technological policies that capitalize on the best practices of other nations in this area.

2.Study content :

2.1 Literature Review

Claessens, S., Klingebiel, D., & Glaessner, T. (2002) investigated how e-finance affected the growth of the financial industry, especially in developing nations. Information and communication technology can improve financial inclusion, boost competition in the financial industry, and reduce barriers to entry for start-ups, according to the study. (Claessens, Glaessner and Klingebiel 2002)

Berger, A. N. (2003) concentrated on the impact of technological advancements (like online banking and ATMs) on bank expenses and efficiency. According to the findings, technology has increased the range of financial services offered, decreased transaction costs, and enhanced bank efficiency. (Berger 2003)

Andrianaivo, M., & Kpodar, K. (2011) examined the function of information and communication technologies (ICTs) in fostering financial inclusion and economic growth in African nations. The results demonstrated that the proliferation of mobile phones exerts a substantial and direct influence on enhancing financial inclusion (via mobile banking services like M-Pesa), thereby fostering financial development and economic growth. (Andrianaivo and Kpodar 2011)

Information and communication technology (ICT) diffusion, financial development, and economic growth in the Middle East and North Africa were examined by Sassi, S., & Goaied, M. (2013). According to the study, ICT diffusion including the internet and telephone has a positive effect on financial development, which in turn influences economic growth. (Sassi and Goaied 2013)

In a recent study, Wang, Q., Yang, J., Chiu, Y. H., & Lin, T. Y. (2020) examined digital finance in China as a result of information and communication technology. According to the findings, digital finance increases financial system efficiency by lowering information asymmetries and increasing access to financial services. (Wang, et al. 2020)

2.2 The theoretical framework of the relationship between information and communication technology and financial development

Financial growth is not merely the expansion of the size of the financial system. Rather, it is a multifaceted process consisting of deepening of the financial markets, strengthening financial institutions, and increasing the efficiency of capital allocation. It can be defined by three main dimensions: First, the quantitative dimension (Goldsmith, 1971), or the financial depth as it is otherwise known, is measured by indicators such as the private sector domestic credit (% of GDP) and the broad money (M2) in relation to GDP. Second, the efficiency dimension (efficiency), or the ability of the financial system to reallocate saving into productive investment at least cost. Thirdly, the qualitative dimension (financial inclusion), delineating the extent of the provision of access to financial services by various strata of society. (King et Levine 1993)

In order to achieve financial inclusion, systemic efficiency, and sustainable economic growth, the relationship between information and communication technology has evolved from a simple connection to a prerequisite.

2.2.1 Promoting Financial Inclusion Information and communication technology: particularly the internet and mobile phones, reduce the cost of access to financial services and bridge geography. According to his book "Development as Freedom," Amartya Sen (1999) noted that technology assists in bridging economic disparities by providing equal access to markets and financial services and, thus, an inclusive financial system. This leads to an increasing of the savings base and lending to the private sector, which has a positive impact on financial development indicators. (Visser 2017)

2.2.2 Improving Efficiency and Reducing Costs: Digitization automates processes, reduces the cost of transactions, and minimizes human error. Peter Drucker (1985) notes in "Innovation and Entrepreneurship" that information technology is a significant contributor to financial efficiency because it enables organizations to improve internal processes and make more informed financial decisions based on real-time and reliable information. This has the effect of freeing up financial resources for reinvestment in productive activities, thus deepening the financial system. (Drucker 1986)

2.2.3 Enabling Financial Innovation (FinTech) Information and communication technology (ICT) : is the basis of modern financial technologies that enable innovative financial instruments and services. Skinner, C. (2014). explains in " Digital bank: Strategies to launch or become a digital bank " how electronic trading platforms and virtual financial services enable individuals and businesses to access new markets, reducing reliance on conventional intermediaries and reducing costs. New financial instruments

(such as crowd funding and digital wallets) diversify the financial market and make it more dynamic. (Skinner 2014)

2.2.4 Increased transparency and liquidity in markets: Information and communication technology (ICT) promotes higher financial market transparency and liquidity with swift and transparent communication of financial information, reduced information asymmetry, and improved investor decision-making. Here, Mandes (2016) highlights that technological innovation has resulted in the proliferation of sophisticated electronic trading platforms that process thousands of orders in fractions of a second, linking markets worldwide around the clock and facilitating trade continuity. Sophisticated algorithms have also played a role in analyzing huge amounts of data, improving pricing efficiency and depth of market. Cumulatively, these changes have imparted more trading volume, financial instrument heterogeneity, and increased resilience of the financial system to shocks, thus making the market more desirable and initiating a virtuous cycle of economic growth. (Mandes, 2016)

2.3 data analysis, results

This study aims to identify the role of information and communication technology in enhancing financial development in six leading countries in this field: Sweden, Switzerland, Denmark, the United States, the United Kingdom, and Norway, for the period (1996-2023). The study uses Panel data models ; The study model is in the form:

$$\text{LnFD} = \beta_0 + \beta_1 \text{LnTIC}_{it} + \beta_2 \text{LnRD}_{it} + \beta_3 \text{LnGDPP}_{it} + \varepsilon \dots \dots \dots (01)$$

Financial Development Index; It is an indicator installed in the way of analyzing the basic compounds PCA, which contains two variables:

M2: cash supply in its broad sense (% of GDP).

DCP: local credit submitted to the private sector (% of GDP).

TIC: Institute of Interest and Communication Technology; It is a PCA method, which contains three variables:

MT: percentage of mobile phone users per 100 people

FT: percentage of fixed phone users per 100 people

IT: Internet users per 100 people

RD: total patent registration requests for residents, and for non -residents. It expresses research and development

GDPP per capita output of the gross domestic product

LN: icon the Nubi Logartment β : Model parameters. ε : Random error limit

2.3.1 Principal Component Analysis (PCA) of the study variables,

We examined the main components (PCA) of financial development indicators. To create a composite index of financial development, we used the Principal Component

Analysis (PCA) technique, which allows us to reduce the number of variables and extract a composite factor that represents the overall dimension of financial development while retaining as much variance as possible in the original data. In this context, two main variables were used: broad money supply (M2) as a percentage of GDP, which reflects the depth and breadth of the financial intermediation base; and domestic credit provided to the private sector as a percentage of GDP, which reflects financial institutions' ability to mobilize and allocate resources efficiently to support investment and growth.

Table (1): Correlation matrix and KMO test for financial development variables

Variable	M2	DCP	Variable	Kmo
M2	1.0000		M2	0.5000
DCP	0.3833	1.0000	DCP	0.5000
			Overall	0.5000

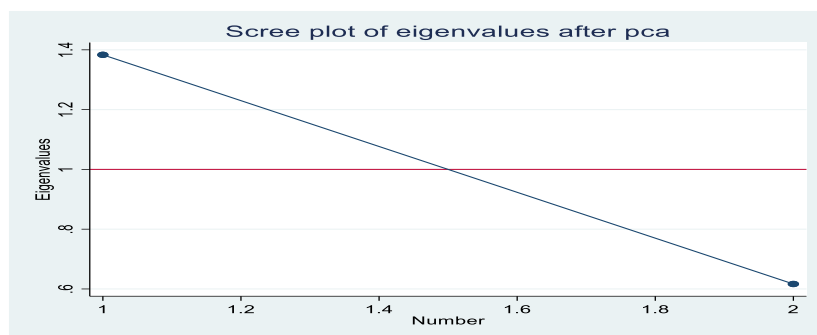
Source: (Prepared by researchers based on STATA 17)

From the correlation matrix, we note that the broad money supply index and domestic credit to the private sector are related to each other at a relatively low rate, but statistically sufficient to use the basic component analysis method. This is supported by the KMO test, which yields an estimated value of 50%.

Table (2): Covariance matrix for financial development variables

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.38335	0.766692	0.6917	0.6917
Comp2	0.616654	.	0.3083	1.0000

Source: (Prepared by researchers based on STATA 17)



Source: (Prepared by researchers based on STATA 17)

Figure (1): Scree Plot of eigenvalues after PCA for financial development variables**Table (3):** Number of components using the Kassiar method for financial development variables

Component	Variance	Difference	Proportion	Cumulative
Comp1	1.38335	.	0.6917	0.6917

Source: (Prepared by researchers based on STATA 17)

Using the Scree Plot and the Kaiser method, we can see that the wide money supply index and domestic credit to the private sector may be represented by a single root, accounting for the majority of the fluctuation, estimated at 69.17%. This qualifies it as a composite index for the study, representing the level of financial progress in a succinct and comprehensive manner.

To examine the basic components of information and communication technology (ICT) (PCA), we repeat the processes described before. This indicator employs three variables that indicate information and communication technology: Internet users, fixed-line telephone users, and mobile phone users.

Table (4): Correlation matrix and KMO test for TIC variables

Variable	MT	FT	INT	Variable	Kmo
MT	1.0000			MT	0.5801
FT	0.5595	1.0000		FT	0.7747
INT	0.9384	0.6467	1.0000	INT	0.5620
				Overall	0.6068

Source: (Prepared by researchers based on STATA 17)

The correlation matrix shows that the variables are closely connected. We also see that the KMO test results exceed 60%, meeting the criterion for utilizing the PCA approach.

Table (5): Number of components using the Kassiar method for TIC variables

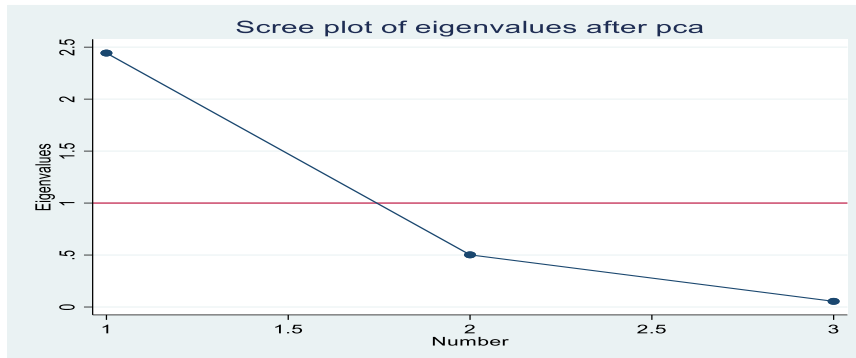
Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	2.44311	1.94102	0.8144	0.8144
Comp2	0.50209	0.447295	0.1674	0.9817
Comp3	0.054795	.	0.0183	1.0000

Source: (Prepared by researchers based on STATA 17)

Table (6): Number of components using the Kassiar method for TIC variables

Component	Variance	Difference	Proportion	Cumulative
Comp1	2.44311	.	0.8144	0.8144

Source: (Prepared by researchers based on STATA 17)



Source: (Prepared by researchers based on STATA 17)

Figure (2): Scree Plot of eigenvalues after PCA for TIC variables

Using the Scree Plot and the Kaiser method, we note that the three variables (percentage of fixed-line users, percentage of mobile phone users, and percentage of internet users) can be represented by a single root, which expresses the largest amount of variance, estimated at 81.44%.

2.3.2 Statistical Description of Study Variables,

The statistical description of the study variables, as well as the correlation matrix test between the explanatory variables, aid in identifying potential linkages between them, hence detecting multicollinearity. This phase is critical for verifying that the model is free of one of the most common issues that can impair estimate accuracy.

Table (7): Statistical description of the study variables

Variable	Obs	Mean	Std, dev,	Min	Max
LnFD	168	0,8944779	0,7905667	-3,173162	1,673994
LnTIC	168	1,178269	0,685149	-2,400551	1,781183
LnRD	168	9,035914	2,007072	7,151485	13,33982
LnGDPP	168	10,85409	0,3505151	10,1026	11,59725

Source: (Prepared by researchers based on STATA 17)

Table (8): Correlation Matrix

	LnFD	LnTIC	LnRD	LnGDPP
LnFD	1			
LnTIC	0,4420	1		
LnRD	0,3565	-0,1572	1	
LnGDPP	0,3447	0,6572	-0,2908	1

Source: (Prepared by researchers based on STATA 17)

According to **Table (7)**, the statistical description reveals that the number of observations reached 168, indicating a balanced sample. It also found substantial variation in financial development and information technology, as well as a clear divergence in R&D spending, despite relative homogeneity in per capita GDP. **Table (8)** shows positive correlations between most variables, particularly information technology and per capita GDP (0.6572), confirming the significance of digital transformation in promoting economic growth. Meanwhile, weak negative connections emerged between research and development and a few other characteristics. Overall, the results show that there is no difficulty with huge multicollinearity, indicating that the data is suitable for conventional analysis.

2.3.3 To detect the presence of unit roots for time series,

Table (9): Time series stationarity test results

	IPS		LLC	
	1st Difference	Level	1st Difference	Level
LnFD	/	-1.40924 (0.0794)	/	-2.57407 (0.0050)
LnTIC	-6.00090 (0.0000)	0.91707 (0.8204)	-5.67144 (0.0000)	-0.28486 (0.3879)
LnRD	-4.35339 (0.0000)	-0.36348 (0.3587)	/	-3.24724 (0.0006)
LnGDPP	/	-17.1152 (0.0000)	/	-17.8327 (0.0000)

Source: (Prepared by researchers based on STATA 17)

we use the (Levin, Lin, Chu) test, and the (Im, Pesaran & Shin) test. The results are shown in **Table. 9** attached to the appendices. The results were The chains LnFD, LnRD, LnGDPP are stable in the plane, while the chain LnTIC is stable in the first difference.

2.3.4 To estimate the panel models,

Table (10): Estimation results of the three models

Number of countries: 6			Dependent variable: LnFD			
Total views:168			period: (1996-2023)			
variables	Randome_model		Fixed_model		Poold_model	
	P-value	Coef	P-value	Coef	P-value	Coef
LnTIC	0.000	0.4944945	0.000	0.5126234	0.000	0.4041661
LnRD	0.125	0.1160778	0.788	-0.0345509	0.000	0.1914026
LnGDPP	0.075	0.4010603	0.217	0.2959185	0.002	0.5768911
Constant	0.053	-5.090184	0.404	-2.609258	0.000	-7.572864
R-squared	0.4143		0.4193		0.4162	

F-test	0.34480	38.28	38.97
Prob > F	0.0000	0.0000	0.0000

Source: (Prepared by researchers based on STATA 17)

we used three models in this study: the pooled regression model, the fixed effects model, and the random effects model, as shown in **Table 10**. The results showed that the probability corresponding to the Fisher's χ statistic is less than 5%, and therefore the fixed effects model is the best model. Secondly, we compared the random model and the pooled model using the Breusch and Pagan test. From the probability corresponding to its χ statistic, which is less than 5%, we concluded that the appropriate model is the random effects model. Finally, we compared the fixed effects model and the random effects model using the Hausman test. The results showed that the probability corresponding to this test is greater than 5%, and therefore the appropriate model for the study is the random effects model (See **Table. 11**).

Table (11): Model tests

Trests	calculated value	Prob- value	Models
Ficher	15.59	0.0000	Fixed effects
Breusch and Pagan	186.07	0.0000	Random effects
Hausman	1.88	0.5971	Fixed effects

Source: (Prepared by researchers based on STATA 17)

To know the validity of the estimated model, we conduct some tests, which are summarized in **Table. 12**, where:

Table (12): Model validity tests

Test	S-value	P-value
Wooldridge test for autocorrelation	202.456	0.0000
Test for groupwise heteroskedasticity	379.2	0.0000
Pesaran's test of cross sectional independence	0.684	0.5300

Source: (Prepared by researchers based on STATA 17)

-*Wooldridge test for autocorrelation*: To detect autocorrelation, the results showed that the probability corresponding to this test is less than 5%, which indicates that the estimated model suffers from autocorrelation.

-*Test for groupwise heteroskedasticity*: To detect heteroskedasticity. From the results, we note that the probability corresponding to this test is less than 5%, which indicates that the estimated model suffers from heteroskedasticity.

-*Pesaran's test of cross-sectional independence*: To detect correlation between sections. From the results, we note that the probability corresponding to this test is greater than 5%, indicating that the estimated model does not suffer from cross-sectional correlation.

From the previous tests, we conclude that the estimated model (random-effects model)

suffers from autocorrelation and heteroskedasticity.

2.3.5 To address these issues through an error correction model, we used PCSE estimation,

Table (13): Panel corrected errors

LnFD	Coef	std,	std, err,	z	P> z 	[95% conf,	interval]
LnTIC	0,40417		0,08570	4,72	0,000	0,23620	0,57213
LnRD	0,19140		0,02441	7,84	0,000	0,14355	0,23925
LnGDPP	0,57689		0,16614	3,47	0,001	0,25126	0,90252
_cons	-7,57286		1,85912	-4,07	0,000	-11,21668	-3,92905
R-squared	0,41620		Wald chi2(3)	118,02	Prob>ch2	0,00000	

Source: (Prepared by researchers based on STATA 17)

which corrects the standard errors of the parameters to eliminate standard deviation problems. The final results are shown in **Table 13**, where the probability corresponding to Fisher's statistic is less than 5%, and thus the model is significant. From the coefficient of determination R^2 , which is equal to (0.4162), we conclude that the independent variables explain the dependent variable by 41.62%. The probability corresponding to Student's test of the model parameters is also shown to be less than 5%, meaning that all variables are significant. The mathematical equation explains more:

$$\text{LnFD} = -7.57286 + 0.40417 \text{ LnTIC} + 0.19140 \text{ LnRD} + 0.57689 \text{ LnGDPP} \dots \dots (2)$$

2.3.6 The results are interpreted as follows:

- Information and communication technology (ICT) had a positive and significant effect at the 1% significance level; a 1% increase in ICT leads to a 0.40% increase in financial development. This reflects the pivotal role of digital infrastructure, such as the internet, mobile phones, and landlines, in facilitating financing and financial trading operations and improving financial inclusion.
- Research and development had a significant positive effect; a 1% increase in patent applications leads to a 0.19% increase in financial development, indicating that technological innovation contributes to the diversification of financial instruments and the development of markets.
- GDP per capita also showed a strong positive effect; a 1% increase in ICT leads to a 0.57% increase in financial development. This reflects the important role of

economic growth in raising the level of savings and investment, thus enhancing financial development

3. CONCLUSION

Through a scrutiny of panel data for selected countries from (1996-2023), the study established that information and communication technology (ICT) plays a huge role in fueling financial growth. The results showed that comprehensive coverage of digital infrastructure, high usage levels of the internet and mobile phones, and higher resource allocation efficiency have contributed substantially to widening the base of financial services, increasing savings and investment rates, and achieving higher efficiency in the allocation of resources. The results also substantiated that technology and innovation in research and development (R&D) are a key source of dynamism for the financial sector, by way of the creation of new products and technologies that increase transparency and reduce costs.

These results support the hypothesis that ICT possesses the potency to lead to financial development. Investment in IT is no longer a technical choice but has become an indispensable economic policy for the achievement of financial stability and inclusion. These findings are particularly relevant to developing countries, including Algeria, as it tries to diversify the economy away from the rentier economy. Investment in digitization, R&D, and institutional strengthening are crucial measures towards developing a more efficient financial sector to maintain pace with evolving global dynamics. Recommendations and Suggestions:

Following these recommendations, the following can be suggested:

To policymakers of developed countries:

- Incorporate more spending on high-tech digital infrastructure
- Promote public-private partnerships in financial innovation programs
- Improve regulatory systems to adapt to the needs of digital transformation

To developing countries (using the case of Algeria):

- Develop a national digital transformation strategy for the financial sector
- Support tax and customs incentives to promote research and development programs
- Construct telecommunication infrastructure and enhance the coverage of digital financial inclusion

For researchers and academics:

- Enhance the coverage of research to other developing countries.
- Include new variables such as the quality of governance.

- Study the impact of specific forms of new technology, e.g., artificial intelligence and algorithmic software, on finance.

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Appendices

Appendix (I): Estimation Results of the Pooled Model

. reg LnFD LnTIC LnRD LnGDPP						
Source	SS	df	MS	Number of obs	=	168
Model	43.4414292	3	14.4804764	F(3, 164)	=	38.97
Residual	60.9328586	164	.371541821	Prob > F	=	0.0000
				R-squared	=	0.4162
				Adj R-squared	=	0.4055
Total	104.374288	167	.624995736	Root MSE	=	.60954
LnFD	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
LnTIC	.4041661	.0914439	4.42	0.000	.2236068	.5847253
LnRD	.1914026	.0245897	7.78	0.000	.1428494	.2399559
LnGDPP	.5768911	.1844973	3.13	0.002	.2125948	.9411874
_cons	-7.572864	2.004008	-3.78	0.000	-11.52985	-3.615882

Appendix (II): Estimation Results of the Fixed Effects Model

. xtreg LnFD LnTIC LnRD LnGDPP, fe						
Fixed-effects (within) regression			Number of obs	=	168	
Group variable: pays			Number of groups	=	6	
R-squared:			Obs per group:			
Within = 0.4193			min =		28	
Between = 0.4637			avg =		28.0	
Overall = 0.1392			max =		28	
corr(u_i, Xb) = -0.2683			F(3,159)		=	38.28
			Prob > F		=	0.0000
LnFD	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
LnTIC	.5126234	.0957763	5.35	0.000	.3234656	.7017813
LnRD	-.0345509	.1280153	-0.27	0.788	-.2873806	.2182789
LnGDPP	.2959185	.2387234	1.24	0.217	-.1755594	.7673964
_cons	-2.609258	3.121479	-0.84	0.404	-8.774166	3.555651
sigma_u	.61387242					
sigma_e	.50710633					
rho	.59438741	(fraction of variance due to u_i)				
F test that all u_i=0: F(5, 159) = 15.59				Prob > F = 0.0000		

Appendix (III): Estimation of the Random Effects Model

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. xtreg LnFD LnTIC LnRD LnGDPP, re
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Random-effects GLS regression
Group variable: pays

Number of obs = 168
Number of groups = 6

R-squared:
Within = 0.4143
Between = 0.3448
Overall = 0.3811

Obs per group:
min = 28
avg = 28.0
max = 28

corr(u_i, X) = 0 (assumed)

Wald chi2(3) = 114.85
Prob > chi2 = 0.0000

LnFD	Coefficient	Std. err.	z	P> z	[95% conf. interval]	
LnTIC	.4944945	.0939828	5.26	0.000	.3102917	.6786974
LnRD	.1160778	.0756	1.54	0.125	-.0320955	.2642512
LnGDPP	.4010603	.2249989	1.78	0.075	-.0399294	.8420501
_cons	-5.090184	2.633046	-1.93	0.053	-10.25086	.0704919
sigma_u	.42952854					
sigma_e	.50710633					
rho	.41773825	(fraction of variance due to u_i)				

Appendix (IV): Estimation Results of the Error Correction Model

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. xtpcse LnFD LnTIC LnRD LnGDPP, rhotype (dw) hetonly
```

Linear regression, heteroskedastic panels corrected standard errors

Group variable: pays
Time variable: t
Panels: heteroskedastic (balanced)
Autocorrelation: no autocorrelation

Number of obs = 168
Number of groups = 6
Obs per group:
min = 28
avg = 28
max = 28

Estimated covariances = 6
Estimated autocorrelations = 0
Estimated coefficients = 4

R-squared = 0.4162
Wald chi2(3) = 118.02
Prob > chi2 = 0.0000

LnFD	Het-corrected		z	P> z	[95% conf. interval]	
	Coefficient	std. err.				
LnTIC	.4041661	.0856993	4.72	0.000	.2361985	.5721337
LnRD	.1914026	.0244127	7.84	0.000	.1435547	.2392506
LnGDPP	.5768911	.1661427	3.47	0.001	.2512575	.9025248
_cons	-7.572864	1.859123	-4.07	0.000	-11.21668	-3.929049