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Toplumsal Cinsiyet Eşitliği ve BIT' in Çocuk Gelişimi Üzerine Etkisi: Bir Kesit Veri Analizi*

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ÖZ

Bu çalışma çocuk gelişimi ile toplumsal cinsiyet eşitliği, bilgi iletişim teknolojileri (BIT), ve kurumsal değişkenler gibi çocuk gelişimi belirleyicilerinin arasındaki ilişkiyi incelemek amacıyla 136 ülke için 2006 yılı kesit veri seti kullanılarak yapılmıştır. Çalışmamızda çocuk gelişiminin toplumsal cinsiyet eşitliği ile ilgili olup olmadığı, çocuk gelişimi ve toplumsal cinsiyetin birden fazla boyutunu ele alabilmek amacıyla, sırası ile Çocuk Gelişimi Endeksi (CDI) ve Toplumsal Cinsiyet Gelişim Endeksi (GDI) kullanılarak test edilmiştir. Çalışma, toplumsal cinsiyet eşitliğinin bütün regresyonlarda en güçlü ve en önemli değişken olduğunu ve etkisinin kurumsal kalite ve BIT gibi kontrol değişkenlerinin regresyona dahil edildiği durumda bile asla kaybolmadığını göstermiştir.

Anahtar Kelimeler: Toplumsal Cinsiyet Eşitsizliği, Çocuk Gelişimi, BIT, Kurumsal Kalite

JEL Sınıflandırması: D63, O15

The Impact of Gender Equality and ICT on Child Development: A Cross Country Analysis

ABSTRACT

The study uses a cross-sectional data set collected in 2006 for 136 countries in order to examine the relationship between child development and its determinants, such as the gender equality, information communication technology (ICT), and institutional variables. We test whether the child development is related to gender equality, by using Gender Development Index (GDI) and Child Development Index (CDI) to take into account more than one dimension of gender equality and child development, respectively. The study finds that the impact of gender equality is most robust and significant variable in all regressions and its impact never disappears when control variables, such as the institutional quality and ICT, are incorporated into the regressions.

Keywords: Gender Inequality, Child Development, ICT, Institutional Quality

JEL Classification: D63, O15

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1. INTRODUCTION

Child development refers to having both physical and psychological capabilities and strengths to make activities and have successful relationships, which are appropriate for their age and development, and it covers nutrition, immunization, breastfeeding, schooling etc. In our study, child development is defined in broad sense to include also child and infant mortality. It is commonly expected that the gender equality have positive impact on improving health and nutrition of children (World Bank 2003; Oster 2006; Save the Children 2008). Several studies also related technology and child development, especially on education side. It has been argued that technology should have positive impact on child's educational development (Atkinson et al. 2001; Kulik and Kulik 1991; Pierce 1994). The evidence on the impact of gender inequality and technology on child development until now has been mixed, if not confusing. Indeed, majority of the studies did not find much impact from gender inequality to child development and those that found significant effect noticed that the effect disappears when control variable are added.

This study differs from the previous studies in three ways. First, we utilize broader concepts of both child development and gender equality. The study uses gender inequality indexes, which are based on variables that measure several dimensions on gender inequality. Child development is not only measured by education, nutrition and mortality rates individually. We adopt a broader view of child mortality by constructing a child development index that accounts of several dimensions of child development. Second, our study defines technology again in a broader sense as the information and communication technology (ICT) developments. Several variables, such as the personal computers (per 1000 inhabitants), internet users (per 1000 people), telephone lines (per 1000 people), mobile cellular subscriptions (per 1000 people), information and communication technology expenditure per capita (current US$), information and communication technology expenditure (% of GDP), that capture both ICT access and availability is employed in the study. Third, we allow interaction between gender inequality and ICT. ICT development influences child development not only by making information more available and accessible, but also improving education and empowerment of mothers, and therefore an indirect but probably more important impact from ICT to child development exists. The study constructs the most extensive data set available in order to estimate cross-country regressions. The data set covers the 2000-2006 period, but it is transformed to a single time observation by aggregated to 2006. Several variants of the basic specification are estimated using more than dozen of control variables. Estimation controls for endogeneity by using instrumental variables estimation and heteroskedasticity by consistent estimation approaches.

The rest of the paper is organized as follows. In Section 2 and 3, we give the main theories behind this study and literature review. Section 4 and section 5 describe the data and present our methodology. Section 6 presents results based on the empirical analysis. And finally, section 7 concludes the paper.

2. THEORIES ON GENDER EQUALITY, ICT AND CHILD DEVELOPMENT

Children's well being refers the concept of having both physical and psychological capabilities and strengths to make some activities and to have successful relationships which are appropriate for their age and development (UN Human Development Report 2007). These also cover nutrition, immunization, breastfeeding, schooling and etc... Children have very important influence on future economic development of countries through transferring some development tools to the next generations.

There are two main theories behind this study; human capital approach and Sen's capability approach. Human capital approach refers investments in human capacities, which raise the productivity, such as education and health, job training programs, skills and abilities etc. Both

education and health allows people to develop their well-beings through directly or indirectly. Health and education indicators can be taken as the components of well-being. Human capital approach focuses on the indirect ability to increase the utility level of people by increasing incomes. However, Sen's capability approach criticizes this utility-based human capital approach. According to the Sen's capability approach, income should not taken as an adequate measure of well being and this approach is people centred rather than focusing on commodities, income or wealth (Robeyns 2003). Because, utility based approach does not criticize the distribution of utility or income among the people within the family. In recent years, indexes developed to measure gender inequalities can work parallel on Sen's approach by focusing on different dimensions of capabilities. Sen (1997: 1960) classified the roles of capabilities under three headings as i) their direct impacts on wellbeing and freedoms, ii) their indirect role on social change, and iii) their indirect role on economic production. According to Saito (2003), human capital approach analyses only indirect effects of capabilities through influencing economic production, while human capability approach covers all headings mentioned above. As a result, human capital approach focuses on the resources, while Sen's approach focuses on the abilities to use available resources. Sen (1997) emphasizes that capability approach should taken into consideration as complementary, rather than taking it as substitute to human capital approach. In this study, we tried to show that the ICT may be used as a tool to improve gender equality through increasing capabilities of women, and this improvement in gender equality causes an increase in the child development.

3. LITERATURE REVIEW ON GENDER EQUALITY, ICT AND CHILD DEVELOPMENT

Children may not have freedom in each respect. However, human capability approach can be still applicable for children. Even if they could not make their choices, especially in early ages, they show reactions to reflect their wants and needs, and they learn how they make their choices in the future among the alternatives through this way. Therefore, well beings of children plays very critical role on human development and economic development in the future.

In 2000, The UN declared its third goals as promoting gender equality and empowers women, and the following goals were to reduce child mortality and improve maternal health. It is commonly expected that the gender equality has positive impact on improving health and nutrition of children (World Bank 2003; Oster 2006; Save the Children 2008). On the other hand, relationship between technology and child development examined in the literature many times as well, especially on education side, and again it is expected to have positive impact on child's educational development (Atkinson et al. 2001). However, not only nutrition and health after birth, but also maternal health also plays essential role on improving health and nutrition of new-born children.

While understanding the link between gender equality and child well being, some indicators were commonly used in the literature such as maternal mortality rates, mortality rates for infants, weight for heights as a measure of child nutrition, and mother's education as a measure of gender equality. The values of these indicators change from one country to another, and between the regions within same county. For instance, according to the World Bank data in 2009, Sub-Saharan Africa has still highest fertility and mortality rate, lowest immunization ratio for children ages between 18-23 months, and lowest ratio of girls to boys in primary and secondary education. Kirk and Pillet (1998) explain the reasons of positive relationship between fertility rates with rate of mortality in two ways; first reason is that both fertility rate and mortality rate can be explained by same determinants such as level of education and level of income. And second reason can be having short interval between the births.

A study by Cleland and Ginneken (1988) showed that each additional year on mother's education results 5-7% decrease in mortality rate of less than 5 years old child. However, they also

emphasized that other economic variables associated with education such as income, quality of house, and water sanitations etc. should be considered while analysing the relationship between education and the mortality rates.

Deasi and Alva (1998) examined the relationship between maternal education on children's height for age, infant mortality, and immunization status by using an econometric model for 22 developing countries. As a result of their study, they argued that maternal education has significant impact on these variables; however, its impact on infant mortality and children's height for age becomes weaker when introducing the control variables into the model, such as education of husband, having a clean water and toilet, while its significance on immunization remains reasonably strong. Chen and Li (2006) used sample of 2140 children in China, whose age between 0 and 4, and found similar results even they controlled the variables for income, health environment, and number of siblings as well. Additionally, they concluded that, mother's education has more impact on children's health than father's education. And also, Miller and Rodgers (2009) investigated the impact of mother's education on child nutrition for Cambodia by using the height for age which refers stunting as a long term nutrition indicator, and low weight for height which refers wasting as a short term nutrition indicator. They found that mother's education is not significant for size at birth when socioeconomic variables, such as father's education, types of occupation and earning, and household wealth, introduced to the equation. However, the results show that the mother's education is highly significant and inversely associated with stunting of children; 1/3 less stunting problem is seen for the children whose mother has at least secondary education. Miller and Rodgers (2009), on the other hand, mentioned that the mother's education is not related to wasting as much as stunting. Aslam and Kingdon (2010) also studied on pathways of parental education and child health in Pakistan and found that father's education and health knowledge is positively related to the immunization while mother's education, health knowledge, and empowerment within the home is strongly related to children's long term health outcomes.

A study conducted by Phukan et al. (2008) focused on the relationship between immunization which is another determinant of child health, and mother's education for India, and showed that the education level of mother has high significance on immunization, especially for children living in rural areas. However, according to the econometrics results of Burchi (2009) for Mozambique, marginal contribution of mother's education on children's nutrition is decreasing after the graduating from primary education, and graduating from secondary schooling has an indirect effect through increasing wealth for the households. And, interestingly, they found that the benefit getting from the mother's education does not depend on the location where they live in rural or urban. Another study considering the Mozambique by Garrett and Ruel (1999: 1971) showed that mother's education has a significant positive impact on child nutrition "above and beyond" the income effect (p.1971). They also concluded that higher combination of income and mother's education might lead less childhood malnutrition in long run.

There are many empirical studies in the literature analysing the link between maternal educations with child health indicators. Under the light of the findings in the above literature, it can be concluded that the education of mother is more effective determinant rather than father's education on child nutrition and well-being. Because, educated mother have higher ability to learn, participate, evaluate, and access to economic and health related services to provide better nutrition conditions for their children and protect them from some diseases through increasing their general knowledge and health knowledge.

On the other hand, some studies argued that increased status of women in labour market might cause a negative effect on their child well being due to spending less time with their children (Leslie 1989; Smith et al. 2002). For instance, women who work outside will have limited time for breastfeed or will have less time to play with their children. And such kinds of activities do not

have any substitute for the children and plays a very important role on children's psychological and physical developments.

This study differs from previous studies in some ways; a) it uses CDI (Child Development Index) as a measure of child development and GDI (Gender related Development Index) as a measure of gender equality, which account of several dimensions of child development and gender equality, b) it defines technology in a broader sense as ICT (Information and Communication Technology) with several ICT related variables that capture both availability and access, c) it uses some institutional variables as control variables and their interaction with ICT and gender equality.

In the literature, most studies related to technology and child developments focus on the educational technology and its impact on children's performance. However, there is no any empirical study, which shows the impact of ICT on children under 5 years old. In this study we tried to analyse the indirect effect of ICT, by considering the results of mother's ICT usage and its availability for them, on child development.

4. MEASURING THE CHILD DEVELOPMENT

Save the Children (2008) in UK developed a Child Development Index (CDI) to control and monitor of child well being for 88 countries in the first period (1990-1994), 118 countries in second period (1995-1999), and 136 countries in third period (2000-2006) by using three variables; i) under five years mortality rates as health indicator, ii) the percentage of under five who are moderately and severely underweight as nutrition indicator, iii) the percentage of primary school age children who are not enrolled in school as education indicator. All the variables have same weight within the index and zero is the minimum score which refers the situation where all children less than five years old are well nourished, survived, and enrolled in primary school while 100 is highest score which refers the situation where all children less than five years old are underweight and out of school. According to the results, the best country is the Japan with score 0.41 and the worst is the Niger with score 58.47.

On the other hand, there are several indexes in the literature to measure the level of gender equality and gender empowerment. The most popular gender indexes are Gender Development Index (GDI) and Gender Empowerment Measure (GEM). While analysing the gender equality and child development, comparison of these two gender equality indexes with the child development index can give meaningful interpretation to understand and show the relationship between them.

It can be easily seen from the Figure 1, GDI and GEM values are moves in same direction. However, CDI can be seen that it is moving against the GDI and GEM. Here, we should consider that the low values of CDI show high-level child development. Therefore, analysis of child and gender related indexes shows that the countries which have lower level gender equality and empowerment will lead low level child development. And also, when we look at the correlations among the indexes, the correlation between child development (CDI) and gender development index (GDI) equals to 0.92685 while the correlation between child development (CDI) and gender empowerment measure (GEM) equals to 0.60435. Therefore, both gender empowerment and gender development has positive impact on child development. However, gender development is expected to contribute to child development to higher extend than gender empowerment.

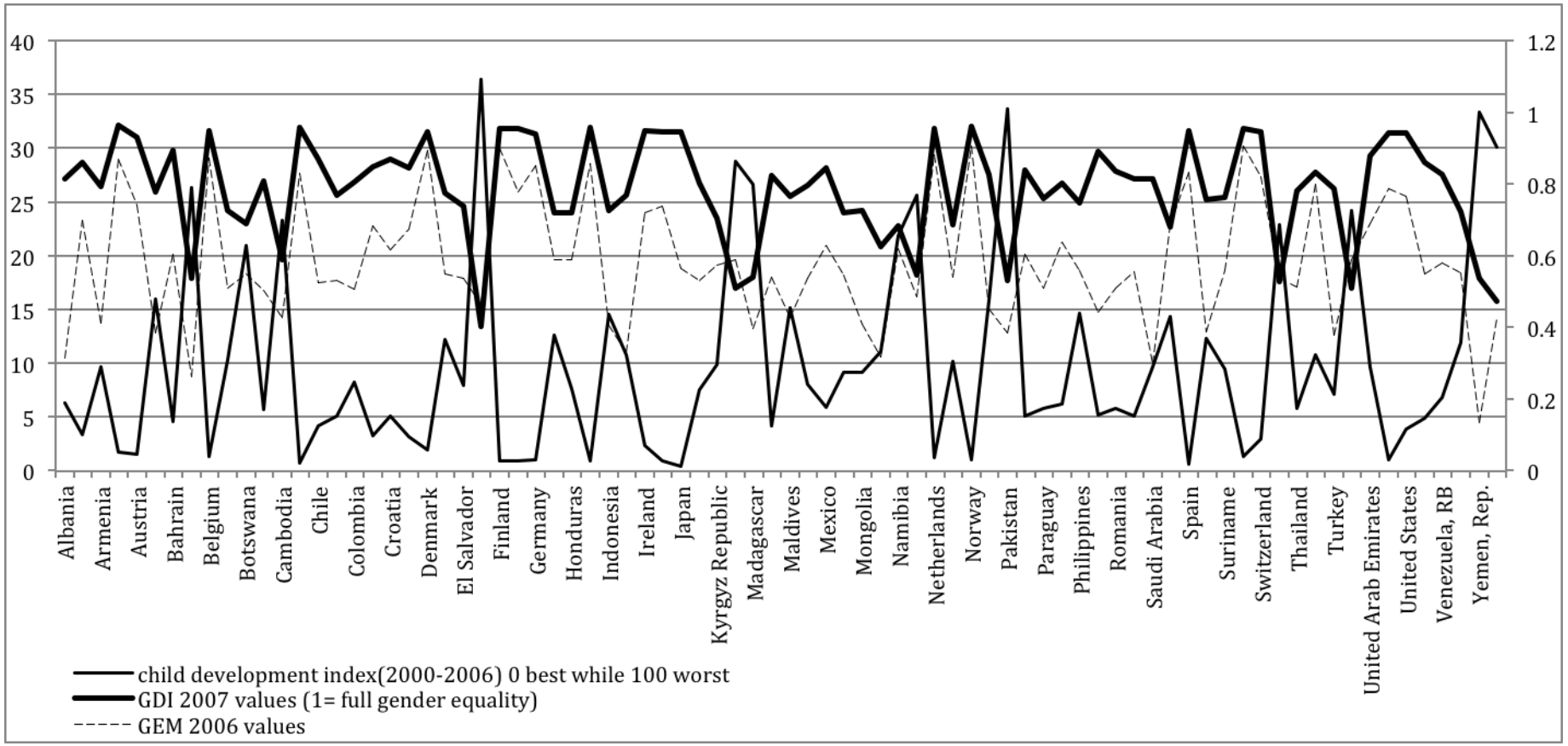

FIGURE 1. THE COMPARISION BETWEEN GDI, GEM AND CDI (SOURCE: WB FOR GDI AND GEM VALUES, AND SAVE THE CHILDREN FOR CDI VALUE)

5. EMPIRICAL METHODOLOGY

The focus of this study is to investigate impact of gender equality and ICT in child development. The main hypothesis is that the child development improves when ICT and gender equality is better in the countries.

The study uses average values of the data set for the period from 2000 to 2006 for 136 countries to investigate (1) the impact of gender equality on child development, (2) the impact of ICT on child development. The econometric estimation uses the gender development index (GDI) as a measure of gender equality, child development index (CDI) as a measure of child development, and six indicators of the ICT infrastructure or availability. The variables for ICT include i) Personal computers per 100 people inhabitants, ii) Internet users per 100 people, iii) Telephone lines per 100 people, iv) Mobile cellular subscriptions per 100 people, v) Information and communication technology expenditure per capita (current US$), vi) Information and communication technology expenditure (% of GDP). Due to the high correlation between the different ICT measures each variable is used in a separate regression. As a measure of institutional infrastructure quality, using principal component analysis for six variables obtained from Political Risk Group (PRS) forms an institutional quality index (INSTQ). These six variables are i) bureaucratic quality, which shows the bureaucratic quality of countries as a shock absorber, ii) composite risk rating, which shows the risk rates of countries in economical, political, and financial environment, ii) corruption, which is failure of governance in economic, political, and financial environment, iv) democratic accountability, as a measure of governance responsiveness to its citizenships, v) government stability, as a measure of ability of governments to stay in office and manage its programs, vi) law and order, as a measure of strength of legal system of the country. Eigenvector corresponding the first principal component is used to weight each variable.

In some regressions, variables such as GDP per capita, health expenditure per capita in current prices, urbanization ratio, literacy rate of adult female and public spending on education used as control variables. As a proxy for the countries level of development, GDP per capita is used. Public spending on education, literacy rate of female, and health expenditure variables indicate the improvement in education and health. Urbanization ratio is considered as a control variable, because, people in rural areas have more rigid views on gender roles dictated by society, and they are generally more conservative.

This study uses several empirical specifications to measure the impact of gender equality and ICT on child development. Specifications are different in terms of using the different forms of the independent variable, which is GDI, and some control variables as well because of their non linear relationship between dependent variable, which is child development index.

We estimate several variant of the following basic cross-section regression specification:

$$CDI_i = m + b_1 GDI_i + b_2 ICT_i + b_3 INSTQ_i + g' X_i + e_i \qquad (5.1)$$

where i denotes the country. However, we used the average values of each variable between 2000-2006 periods because of having limited data for some variables in some periods.

CDI = Child Development Index

GDI = Gender Development Index

ICT = measure of ICT density or access, or ICT Index created by authors using factor analysis

INSTQ = a measure of Institutional Quality, or Institutional Quality Index created by using factor analysis

X = vector of control variables, which also includes interaction terms among GDI, ICT, and INSTQ

ε = Error Term.

ICT is one of the following measures of ICT access and density,

IU = Internet users (per 100 people)

MCS = Mobile cellular subscriptions (per 100 people)

PC = Personal Computers (per 100 inhabitants)

TL = Telephone lines (per 100 people)

ICTEPC = Information and communication technology expenditure per capita (current US$)

ICTEPGDP = Information and communication technology expenditure (% of GDP)

We estimate various functional forms of regression for the countries with available data to control for possible nonlinearities. However, CDI data is available for three-time period, and we used third time period, which covers the years of 2000-2006 in our study. Therefore, we first calculated the mean values of all other variables for the time period 2000-2006 to make them comparable. First, simple regressions are estimated, due to likely high multicollinearity. And also, according to the Breusch Pagan and White test results, we used generalized least squares using White method to get consistent estimators to correct the t values and p values for the effect of heteroskedasticity. Then, general to specific modelling is used to obtain reduced models from the most general ones with or without interaction terms.

6. EMPIRICAL RESULTS

The study uses the data set, which covers 136 countries for the period between 2000-2006 years. The data set obtained from different sources. CDI values obtained from the Save the Children in UK. Gender related variables and control variables are obtained from the World Development Indicators (WDI) database. We used six different variables of ICT, which are obtained from International Telecommunication Union's (ITU) ICT indicators database. Table 1 gives the definition of variables, and Table 2 shows the descriptive statistics of variables.

Table 1: Variable Definitions

Variable	Description
CDI	Child Development Index
GDI	Gender Development Index
GDPPC2005	GDP per capita in 2005 (current US$)
GDPCLCU	GDP per capita in local currency unit
HEGDP	Health Expenditure per capita (current US$)
UR	Urban population (% of total)
LRF	Literacy rate, adult female (% of females ages 15 and above)
PSGDP	Public spending on education, total (% of GDP)
IU	Internet users (per 100 people)
MCS	Mobile cellular subscriptions (per 100 people)
PC	Personal Computers (per 100 inhabitants)*
TL	Telephone lines (per 100 people)
ICTEPC	Information and communication technology expenditure per capita (current US$)
ICTEPGDP	Information and communication technology expenditure (% of GDP)
ICTI	Information and communication technology index
BQ	Bureaucracy Quality (L)
CR	Composite Risk Rating
CO	Corruption (F)
DA	Democratic Accountability (K)
GS	Government Stability (A)
LO	Law & Order (I)
INSTQ	Institutional Quality Index

Table 2: Descriptive Statistic

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability	Observations
CDI	16.97	10.89	58.47	0.41	14.48	0.88	2.82	17.74	0.00	136
BQ	2.15	2.00	4.00	0.00	1.15	0.05	2.28	2.99	0.22	137
CO	2.62	2.37	6.00	0.18	1.13	0.89	3.53	19.74	0.00	137
CR	69.63	69.32	91.34	37.85	10.88	-0.28	2.90	1.79	0.41	137
DA	3.87	4.14	6.00	0.00	1.70	-0.50	2.27	8.85	0.01	137
GDI	0.73	0.76	0.97	0.31	0.18	-0.60	2.24	12.94	0.00	154
GDPPC2005	11149.58	6029.09	68270.74	261.56	12834.88	1.69	5.83	169.97	0.00	210
GDPCLCU	2.16E+13	1.73E+11	1.60E+15	1.65	1.37E+14	9.04	95.18	73527.55	0.00	200
GS	9.08	9.02	11.41	5.42	1.11	-0.24	3.02	1.33	0.52	137
HEGDP	637.48	164.23	5654.11	3.97	1131.82	2.40	8.27	453.25	0.00	214
ICTEPC	846.70	271.96	3817.60	9.57	953.63	1.01	2.84	15.16	0.00	88
ICTEPGDP	5.75	5.58	12.63	2.45	1.81	0.92	4.68	22.63	0.00	88
ICTI	445.05	172.87	1841.81	8.79	476.38	0.95	2.67	11.35	0.00	73
INSTQ	71.04	70.34	94.21	37.39	11.55	-0.23	2.86	1.36	0.51	137
IU	16.27	7.94	72.97	0.00	18.65	1.28	3.57	65.74	0.00	230
LO	3.78	4.00	6.00	1.00	1.34	-0.02	1.94	6.42	0.04	137
LRF	73.46	81.41	99.79	12.24	24.56	-0.82	2.49	18.37	0.00	148
MCS	33.47	25.58	109.15	0.00	30.05	0.73	2.31	25.07	0.00	233
PC	12.72	4.43	77.29	0.00	18.14	1.86	5.49	157.22	0.00	188
PSGDP	4.61	4.30	12.85	0.61	1.94	1.21	5.67	103.57	0.00	191
TL	21.55	13.56	87.57	0.02	20.89	0.92	2.94	33.16	0.00	233
UR	55.86	56.23	100.00	9.03	23.87	0.02	1.98	10.38	0.01	238

Since six measure of ICT, which are internet users (IU), mobile cellular subscriptions per 100 people (MCS), personal computers per 100 inhabitants (PC), telephone lines per 100 people (TL), information and communication technology expenditure per capita (ICTEPC), and information and communication technology expenditure as a share of GDP (ICTEPGDP), are highly correlated, we used them in separate regressions.

The main focus of this study is to analyze the impact of gender equality on child development. Figure 2 plots each of six measures of ICT availability and infrastructure against child development and it shows that all variables have positive direct impact on child development. Since all measure of ICT access and availability are highly correlated, each variables enter to the regression equation separately, leading to six regressions for each specifications in. From Figure 3 and Figure 4, we can make similar conclusion for relationship between measures of institutional quality variables and control variables with child development. Figure 4 plots the CDI against the GDI as a measure of equality and against control variables. The linear regression fits are also given in the graph. Figure 4 shows that there is a strong relationship between child development and gender equality. High values of child development index correspond to the low level of child development. Although it seems there is negative relationship between gender equality with child development due to the structure of the child development index, it shows positive relationship between them and supports our hypothesis as well.

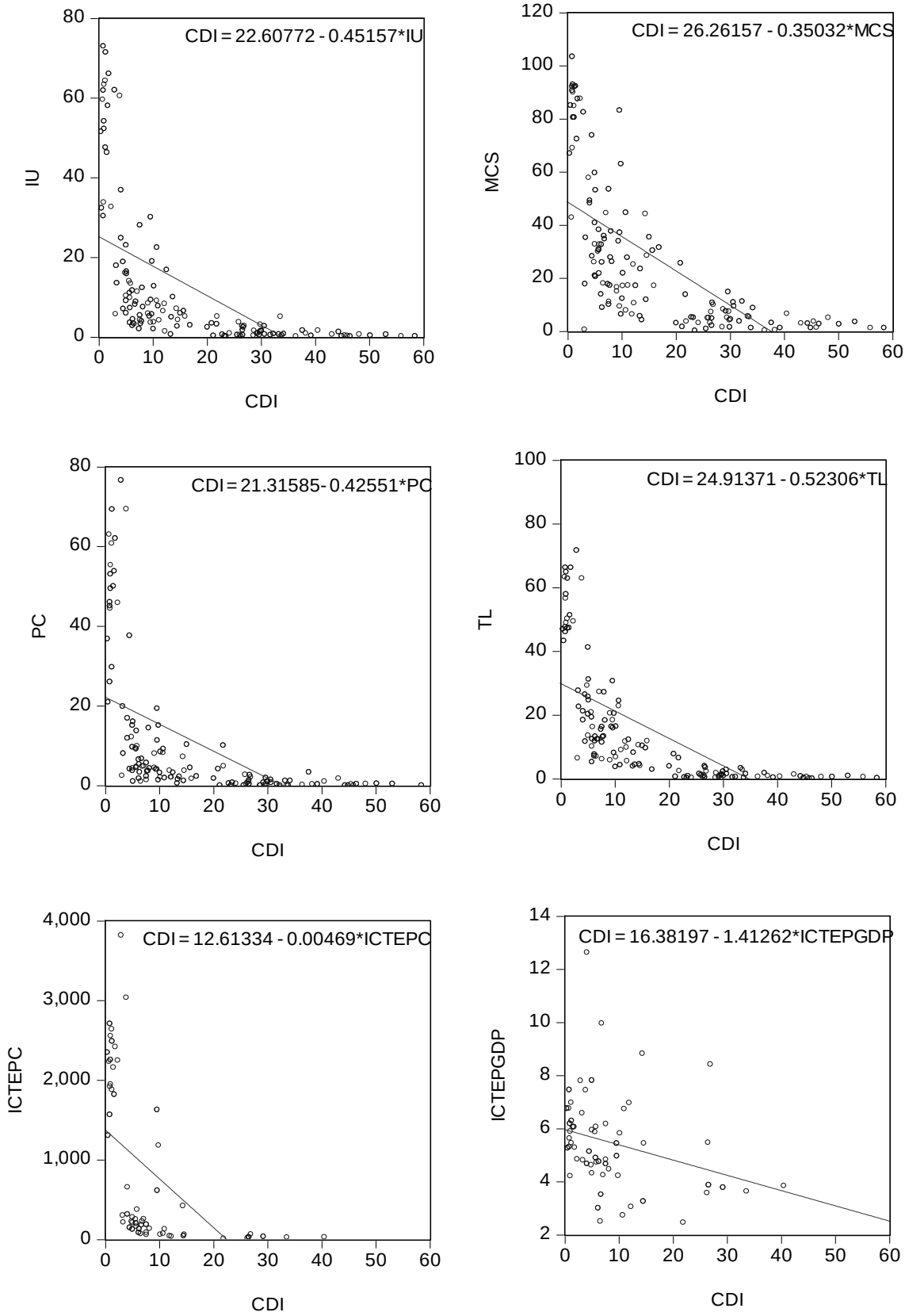

FIGURE 2. CHILD DEVELOPMENT AND ICT VARIABLES

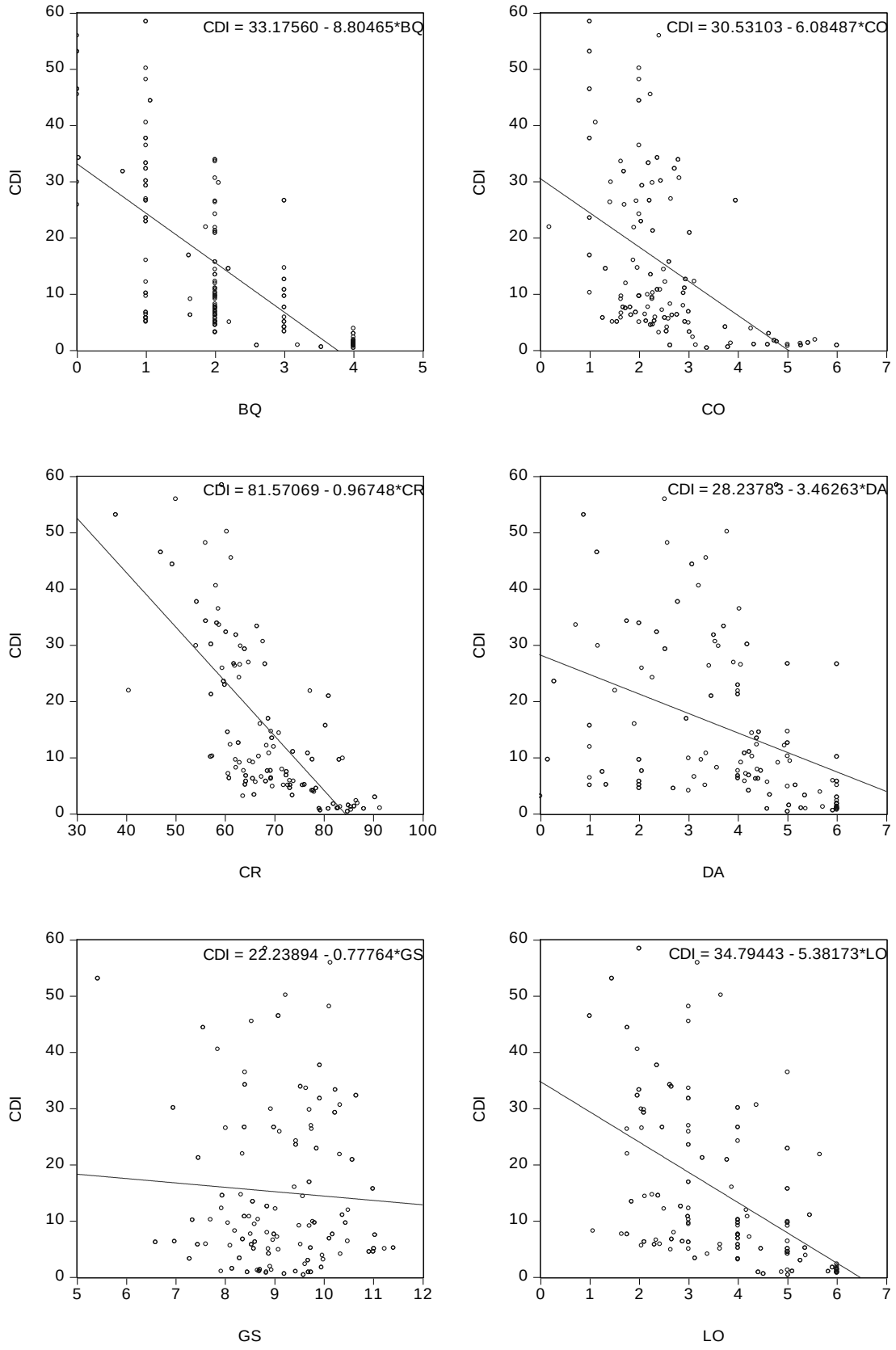

FIGURE 3. CHILD DEVELOPMENT AND INSTITUTIONAL VARIABLES

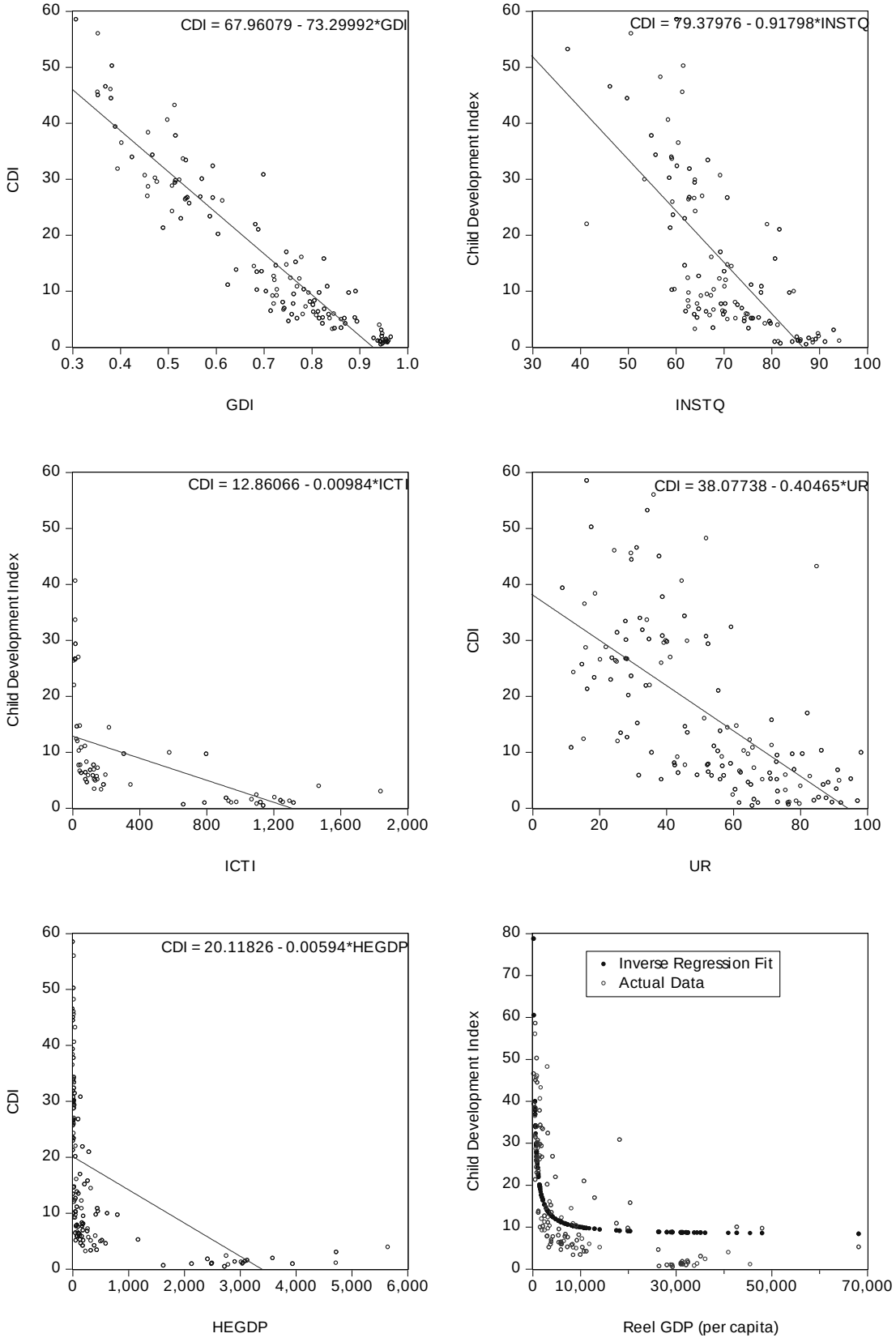

FIGURE 4. CHILD DEVELOPMENT, GENDER EQUALITY, AND CONTROL VARIABLES

Table 3 shows the estimates of the CDI equations with various functional forms and specifications. Estimation results show that GDI and African dummy are always significant in all specifications, even if we used GDI in different forms. Table 4 presents the simple estimates of CDI equation with the ICT variables. All ICT variables are highly significant in all regressions. Table 5 shows the estimates of CDI equation against the institutional quality variables, and as a result, we can say that all variables except the government stability are highly significant. However, due to the high collinearity between the ICT variables and between the institutional quality variables, we created an ICT index (ICTI) and institutional quality index (INSTQ) by using the principal component analysis to get rid of multicollinearity problem. Therefore, first, simple regressions are estimated. Generalized Least Squares (using White method) is used against heteroscedasticity. Table 6 and Table 7 shows the most general models by using ICT variables with other control variables and interaction terms as well. However, it is easy to see from the results that, while ICT variables are loosing their significance when we use them with other control variables, gender development index is still highly significant and it keeps its significance in all regressions. It is used too many estimations with the available data used in this study to check the robustness of the results. And, now, we can conclude that all variables including ICT and institutional variables used in the study have significant impact on child development in overall when they are used in simple regressions separately. However, only the measure of the gender equality, which is GDI, keeps its significance in all regressions even the other variables enter into the regressions. Therefore, one can say that child development will improve in the countries with having higher gender equality.

7. DISCUSSION

The results show that eliminating gender inequalities in the society will bring better-developed children in turn. Therefore, countries must invest in promoting the socio economical status of women tends to have healthy and educated next generations. Therefore, countries should develop some supportive programs that will improve the economic, social, and political empowerment of women while simultaneously advancing democracy, laws and rights, and other socio economic infrastructure. However, this paper does not explain the reasons of lower level child development in some countries in detail. And also, further studies can be conducted on analysing the relationship between single dimensions of child development with single dimension of gender equality or compare the different roles of parents on development of their children.

Table 3. Estimates of the CDI Equations with Various Functional Forms and Specifications

	Eq 1.1	**Eq 1.2**	**Eq 1.3**	**Eq 1.4**	**Eq 1.5**	**Eq 1.6**	**Eq 1.7**	**Eq 1.8**	**Eq 1.9**	**Eq 1.10**	**Eq 1.11**	**Eq 1.12**
CONSTANT	67.960795	1.865410	0.921918	-0.895711	-30.629249	87.532821	63.916175	1.847861	0.918494	1.439674	-30.028822	69.946309
	(2.2227)***	(0.5077)***	(0.1169)***	(2.2650)	(6.2526)***	(5.1545)***	(2.8989)***	(0.4903)***	(0.1146)***	(2.2905)	(7.2153)***	(4.6803)***
GDI	**-0.732999**						**-0.690251**					
	(0.0282)***						**(0.0352)*****					
LOG(GDI)		**-0.468116**	**-0.034876**	**-0.467406**	**-0.585759**			**-0.445849**	**-0.031909**	**-0.445676**	**-0.583038**	
		(0.0142)***	**(0.0022)*****	**(0.0146)*****	**(0.0309)*****			**(0.0196)*****	**(0.0026)*****	**(0.0199)*****	**(0.0408)*****	
LOG(GDPCLCU)				-0.035400						-0.014888		
				(0.0759)						(0.0783)		
LOG(GDPPC2005)					2.865460	**-8.439417**					2.806476	**-6.891371**
					(0.6135)***	**(0.5759)*****					(0.7029)***	**(0.5065)*****
AFRICA							**2.490094**	**2.029332**	**0.269960**	**2.016024**	**0.067199**	**10.488115**
							(1.1859)**	**(1.1827)***	**(0.1254)****	**(1.1905)***	**(1.1606)**	**(1.5443)*****
Observations:	124	124	124	124	123	132	122	122	122	122	121	130
R-squared:	0.8760	0.9022	0.7371	0.9023	0.9165	0.6075	0.8809	0.9049	0.7422	0.9049	0.9156	0.7247
Log Likelihood:	-375.6082	-360.9040	-112.7301	-360.8506	-348.3324	-476.1250	-367.2952	-353.5566	-110.0870	-353.5471	-343.4962	-446.0733
S.E.R:	5.0445	4.4804	0.6055	4.4969	4.1594	8.9863	4.9735	4.4438	0.6040	4.4623	4.2067	7.5691
SBC:	6.1359	5.8988	1.8960	5.9368	5.7813	7.2880	6.1394	5.9141	1.9228	5.9534	5.8362	6.9750
F-statistic:	861.9719	1125.3320	341.9975	558.5866	658.4774	201.1835	440.0252	566.2066	171.3149	374.3635	423.1936	167.1409
Prob(F-stat):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
WhiteTest:	14.6367***	5.3491**	3.3580*	2.8982*	5.0512***	5.7327**	13.5294***	12.4009***	3.1785**	8.1081***	8.6918***	13.4993***
BPG Test:	15.7043***	9.4302***	10.9624***	4.6637**	7.2596***	5.7454**	13.8235***	12.7751***	5.3933***	8.4634***	8.0587***	13.3083***
Jarque Bera Test:	3.4053	15.1985***	12.0453***	15.4294***	12.0277***	17.6500***	2.0563	8.3064**	12.0693***	8.4696**	10.6096***	8.9811**

Note: *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

Table 4. Estimates of CDI Equation with ICT Variables

Dep. Var:	**Eq 1.1 CDI**	**Eq 1.2 CDI**	**Eq 1.3 CDI**	**Eq 1.4 CDI**	**Eq 1.5 CDI**	**Eq 1.6 CDI**
CONSTANT	22.607717	21.315848	24.913704	26.261567	12.613336	16.381967
	(1.3691)***	(1.3373)***	(1.3776)***	(1.5019)***	(1.5746)***	(4.0142)***
IU	**-0.451568**					
	(0.0435)*					
PC		**-0.425506**				
		(0.0456)*				
TL			**-0.523056**			
			(0.0472)*			
MCS				**-0.350317**		
				(0.0291)*		
ICTEPC					**-0.004688**	
					(0.0008)*	
ICTEPGDP						**-1.412619**
						(0.6573)
Observations:	135	132	135	135	60	60
R-squared:	0.3344	0.2883	0.4497	0.4534	0.2873	0.0811
Log Likelihood:	-524.4433	-514.6901	-511.5982	-511.1394	-206.7871	-214.4095
S.E.R:	11.8614	12.0355	10.7848	10.7482	7.7250	8.7715
SBC:	7.8422	7.8723	7.6519	7.6451	7.0294	7.2835
F-statistic:	66.8111	52.6658	108.6935	110.3420	23.3789	5.1199
Prob(F-stat):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0274
WhiteTest:	4.3950**	3.6165*	2.6698	7.9631***	2.5907	0.4986
BPG Test:	9.0016***	7.6512***	7.5012***	15.0751***	4.9810**	0.8869
Jarque Bera Test:	14.9143***	13.8585***	15.9927***	8.9908**	43.7860***	36.4640***

Table 5. Estimates of CDI Equation with Institutional Quality Variables

Dep. Var:	**Eq 1.1 CDI**	**Eq 1.2 CDI**	**Eq 1.3 CDI**	**Eq 1.4 CDI**	**Eq 1.5 CDI**	**Eq 1.6 CDI**
CONSTANT	33.175602	81.570693	30.531036	28.237835	22.238943	34.794436
	(2.5924)***	(7.2968)***	(3.0096)***	(3.8087)***	(13.5931)	(3.8114)***
BO	**-8.804652**					
	(0.8859)* **					
CR		**-0.967487**				
		(0.0978)* **				
CO			**-6.084877**			
			(0.8542)* **			
DA				**-3.462635**		
				(0.8181)* **		
GS					-0.777641	
					(1.4621)	
LO						**-5.381732**
						(0.8356)* **
Observations:	111	111	111	111	111	111
R-squared:	0.4548	0.5025	0.2244	0.1505	0.0034	0.2570
Log Likelihood:	-419.4472	-414.3652	-439.0129	-444.0594	-452.9248	-436.6263
S.E.R:	10.6862	10.2080	12.7461	13.3389	14.4480	12.4750
SBC:	7.6425	7.5509	7.9950	8.0859	8.2457	7.9520
F-statistic:	90.9253	110.0964	31.5283	19.3140	0.3707	37.7030
Prob(F-stat):	0.0000	0.0000	0.0000	0.0000	0.5439	0.0000
WhiteTest:	19.1194***	17.1676***	8.1192***	8.0043***	0.9141	10.9641***
BPG Test:	23.3092***	17.8669***	9.4587***	7.5394***	1.1321	11.2713***
Jarque Bera Test:	5.9886*	7.4275**	21.3050***	26.5911***	25.6314***	19.7970***

Table 6. Estimates of CDI Equation with ICT and Other Control Variables

Dep. Var:	**Eq 1.1 CDI**	**Eq 1.2 CDI**	**Eq 1.3 CDI**	**Eq 1.4 CDI**	**Eq 1.5 CDI**	**Eq 1.6 CDI**	**Eq 1.7 CDI**
CONSTANT	73.727671	71.712952	72.518437	74.279536	63.797830	67.528585	68.153903
	(6.0448)***	(5.0829)***	(6.1887)***	(5.7026)***	(6.4909)***	(7.0554)***	(11.0518)***
GDI	**-0.779569**	**-0.754295**	**-0.755748**	**-0.798367**	**-0.849153**	**-0.767758**	**-0.819906**
	(0.1037)* **	**(0.0925)*** **	**(0.1092)*** **	**(0.0971)*** **	**(0.1344)*** **	**(0.1233)*** **	**(0.1487)*** **
LOG(GDPCLCU)	-0.038463	-0.007053	-0.029687	-0.033635	0.226269	0.070988	0.226577
	(0.1669)	(0.1618)	(0.1653)	(0.1696)	(0.1183)*	(0.1701)	(0.1302)*
IU	-0.026834						
	(0.0935)						
HEGDP	0.005858	0.004647	0.006869	0.004916	-0.001951	0.003408	-0.002348
	(0.0029)**	(0.0027)*	(0.0031)**	(0.0031)	(0.0020)	(0.0018)*	(0.0022)
UR	-0.009083	-0.024217	-0.009944	-0.009530	0.027129	0.014717	0.024030
	(0.0338)	(0.0296)	(0.0340)	(0.0325)	(0.0412)	(0.0410)	(0.0429)
LRF	-0.017182	-0.017577	-0.017796	-0.013911	0.072332	0.039996	0.059600
	(0.0475)	(0.0479)	(0.0477)	(0.0466)	(0.0839)	(0.0838)	(0.0844)
PSGDP	-0.287285	-0.310249	-0.299341	-0.285868	-0.888600	-0.654619	-0.785156
	(0.3065)	(0.3140)	(0.3081)	(0.3190)	(0.4394)*	(0.5943)	(0.4068)*
PC		0.047808					
		(0.0944)					
TL			-0.084631				
			(0.0936)				
MCS				0.016984			
				(0.0454)			
ICTEPC					0.007047		
					(0.0028)**		
ICTEPGDP						-0.500447	
						(0.4562)	
ICTI							0.016449
							(0.0071)**
INSTQ							-0.088270
							(0.1669)
Observations:	81	80	81	81	31	31	31
R-squared:	0.8905	0.8923	0.8915	0.8906	0.9105	0.8892	0.9088
Log Likelihood:	-238.3687	-231.6147	-238.0195	-238.3505	-74.5368	-77.8513	-74.8438
S.E.R:	4.8350	4.6132	4.8142	4.8339	3.1103	3.4613	3.2119
SBC:	6.3197	6.2286	6.3110	6.3192	5.6950	5.9089	5.8256
F-statistic:	84.8271	85.1976	85.6518	84.8699	33.4448	26.3735	27.3890
Prob(F-stat):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
WhiteTest:	1.3039	1.0106	1.5374	1.2233	2.5924**	1.6585	2.5211**

BPG Test:	1.5569	1.2420	1.8612*	1.3439	3.6569***	1.7368	2.9635**
Jarque Bera Test:	5.2135*	5.5290*	4.5353	5.8473*	0.7626	2.3182	0.8743

Table 7. Estimates of CDI Equation Control Variables and Interaction Terms

Dep. Var:	**Eq 1.1 CDI**	**Eq 1.2 CDI**	**Eq 1.3 CDI**	**Eq 1.4 CDI**	**Eq 1.5 CDI**	**Eq 1.6 CDI**
CONSTANT	198.884933	67.877302	76.825654	167.746305	168.888866	14.574273
	(73.0172)**	(9.3275)***	(11.5585)***	(82.5938)*	(88.3284)*	(23.1397)
GDI	**-2.483653 (0.8914)****	**-0.734839 (0.1329)*****	**-0.649315 (0.1476)*****	**-2.032211 (1.0391)***	**-1.977085 (1.0092)***	
LOG(GDPCLCU)	0.226461	0.235790	0.186140	0.232720	0.217074	0.220276
	(0.1291)*	(0.1506)	(0.1612)	(0.1389)	(0.1577)	(0.1618)
ICTI	0.008389	-0.209122	-0.178913	-0.142275	-0.145308	-0.213765
	(0.0046)*	(0.1224)	(0.0813)**	(0.1379)	(0.1352)	(0.1299)
HEGDP	-0.003470	-0.012302	-0.000098	-0.009937	-0.006519	-0.006775
	(0.0020)*	(0.0055)**	(0.0018)	(0.0054)*	(0.0130)	(0.0131)
UR	0.021661	0.054691	0.022310	0.042960	0.034206	0.012758
	(0.0417)	(0.0276)*	(0.0352)	(0.0286)	(0.0359)	(0.0442)
LRF	0.020195	0.003973	0.026511	0.008101	-0.003429	-0.020559
	(0.0592)	(0.0786)	(0.0772)	(0.0655)	(0.0687)	(0.0783)
PSGDP	-0.586750	-0.477302	-0.487727	-0.425497	-0.413840	-0.320325
	(0.4475)	(0.4074)	(0.4312)	(0.3907)	(0.4125)	(0.4654)
INSTQ	-2.131224	-0.115087	-0.321604	-1.665679	-1.707052	-0.612167
	(1.1455)*	(0.1428)	(0.2036)	(1.2939)	(1.4233)	(1.0840)
INSTQ*GDI	2.661072			2.031044	1.995275	0.402916
	(1.3746)*			(1.5780)	(1.5944)	(1.0901)
ICTI*GDI		0.262693		0.177681	0.107207	0.106372
		(0.1419)*		(0.1615)	(0.3179)	(0.3266)
ICTI*INSTQ			0.002302		0.000750	0.001618
			(0.0010)**		(0.0020)	(0.0022)
LOG(GDI)						-54.320059
						(42.0513)
Observations:	31	31	31	31	31	31
R-squared:	0.9313	0.9274	0.9265	0.9386	0.9391	0.9280
Log Likelihood:	-70.4398	-71.3038	-71.4902	-68.7084	-68.5861	-71.1820
S.E.R:	2.8521	2.9327	2.9504	2.7638	2.8244	3.0711
SBC:	5.6522	5.7080	5.7200	5.6513	5.7542	5.9217

F-statistic:	31.6425	29.8003	29.4162	30.5637	26.6188	22.2477
Prob(F-stat):	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
WhiteTest:	1.2624	2.2178*	2.2640*	1.2742	1.0772	1.5503
BPG Test:	1.2964	2.0419*	2.5107**	1.0707	1.0346	1.3392
Jarque Bera Test:	9.0134**	3.0936	1.2688	7.1541**	8.4633**	3.2174

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