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The Effect of Fiscal Decentralization on The Human Development Index and Its Components: A Panel Data Study*

Araştırma Makalesi /Research Article

Muhammed TÜMAY[1]

ABSTRACT: *Most countries worldwide in recent decades, particularly developing and transition countries, have implemented decentralization in their governance structures. The main purpose of decentralization is the idea that local government can deliver local needs and preferences to their communities more accurately. However, some researchers argue that decentralization has its limitations and point out an optimal fiscal decentralization size. This paper investigates the effect of fiscal decentralization on the human development index and its components by using panel data between the period 2000 to 2010 from 49 countries. Using robust OLS and Fixed Effect methods, results suggest that the revenue measure of fiscal decentralization has a significant and positive effect on the human development index. Furthermore, results show that this effect is non-linear may diminish once the degree of fiscal decentralization crosses a threshold.*

Keywords: Fiscal Decentralization, Human Development, Panel Data Models

JEL Codes: E62, C33, H75, O15

Mali Yerelleşmenin İnsani Gelişme Endeksi ve Bileşenleri Üzerindeki Etkisi: Panel Veri Çalışması

ÖZ: *Son yıllarda dünya çapındaki çoğu ülke, özellikle gelişmekte olan ülkeler ve geçiş ülkeleri, yönetim yapılarında ademi merkeziyetçiliği (yerelleşme) uygulamışlardır. Yerelleşmenin temel amacı, yerel yönetimin yerel ihtiyaçları ve tercihleri topluluklarına daha doğru bir şekilde sunabileceği fikridir. Bununla birlikte, bazı araştırmacılar ademi merkeziyetçiliğin sınırlamaları olduğunu iddia etmekte ve optimal bir mali yerelleşmenin boyutuna işaret etmektedir. Bu makale, mali yerelleşmenin insani gelişme endeksi ve bileşenleri üzerindeki etkisini 2000-2010 dönemi arasında 49 ülkeden panel verileri kullanarak incelemektedir. Sağlam En Küçük Kareler ve Sabit Etki yöntemlerini kullanan sonuçlar, mali yerelleşmenin gelir ölçüsünün insani gelişme endeksi üzerinde önemli ve olumlu bir etkisi olduğunu göstermektedir. Ayrıca sonuçlar, mali yerelleşme derecesi bir eşiği aştığında bu etkinin doğrusal olmadığını ve olumsuz etkilerin olduğunu göstermektedir.*

Anahtar Kelimeler: Mali Yerelleşme, İnsani Gelişme, Panel Veri Modelleri

JEL Kodu: E62, C33, H75, O15

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[1] Dr. Lecturer, Gümüşhane University, Faculty member in the Department of Economics, mtumay@gumushane.edu.tr, orcid.org/0000-0002-3226-3898.

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1. Introduction

Fiscal decentralization (FD) is not only an economic issue, but it is also a political issue. Moreover, FD means decentralizing revenue raising and/or expenditure of money to a lower level of government while maintaining financial responsibility. FD has been a political-economy trend for many countries (Limi, A., 2005). In theory, researchers believe that decentralization supports economic efficiency and effectiveness, providing economic potentials to local governments to deliver local needs and preferences to their communities accurately. However, an empirical point finds that it is questionable whether FD has any impact on economic growth.

There are many studies about the effect of FD on economic growth. Some studies' results find that FD can promote economic growth if it is implemented to a larger degree (Bahn and Linn, 1992; Oates, 1993), while other studies illustrate that FD has a negative impact on economic growth (Davoodi and Zou, 1998; Enikolopov and Zhuravskaya, 2007, etc.). Thus, FD has negative or positive effects, but it also has some risks, such as mismatching in central governments' revenue powers and expenditure responsibilities across to local government and macroeconomic stability (Martinez-Vazquez and McNab, 2003). As a result, there is no answer to whether FD has any effect (positive or negative) on economic growth. In addition to this, further research is widely open to finding the relationship between FD and economic growth.

There is also a strong relationship between economic growth and human development that exists. Ramirez et al. (2000) state, "Human development has been defined as enlarging people's choices in a way which enables them to lead longer, healthier and fuller lives." With this research, we can examine the relationship in two-way chain relations. In the first way chain, economic growth provides improvements in human development. These improvements support a higher quality of labor forces. In the second way chain, the higher quality of labor forces in any economy ensures resources can be used more efficiently, which are essential for economic growth.

Finally, as indicated in this study, we can say that there is also a relationship between FD and human development. According to Sepulveda and Martinez-Vazquez (2011), the human development index (HDI) does not need an arbitrary definition of poverty; instead, it refers to a country's overall level of development by considering other aspects of well-being in addition to income and consumption. Given that FD reform is, a countrywide process that can have a range of consequences on poverty, the HDI is better suited to capture the entire scope of FD's impact on poverty.

This study focuses on the relationships between FD and life expectancy, FD and year of education, FD and income, and finally FD and human development. The relationship between FD and human development is my main aspect.

I have organized this paper into sections. In Section 2, the literature review summarizes past work on FD on economic growth, poverty and income inequality, and human development. In Section 3, the analytical framework presented includes hypothesis, methodology, data, and econometric issues. In Section 4, I examine the results that show the effect of FD on life expectancy, the effect of FD on the year of schooling, the effect of FD on income, and the effect of FD on the HDI. Finally, in Section 5, the conclusion is provided.

2. Literature Review

FD is an important policy issue for developing, transition countries, and even developed countries. There are two basic assumptions in favor of decentralization (Tiebout, 1956): First, Local governments can deliver public services better than national governments by virtual information advantage. Second, regarding the first assumption, the local governments will act on the preferences of local communities.

Accordingly, FD, where local governments are more active in public service, leads to more rapid economic growth (Oates, 1993). Also, Martinez-Vazquez and McNab (2003) state that sub-national governments are better equipped to match varying preferences across jurisdictions based on the idea that public officials respond to the demands of their citizens.

FD is a complicated issue, so there are a lot of researches that examined the relationship between decentralization and economic growth empirically; Davoodi and Zou (1998) examine the relationship between decentralization and economic growth by using a panel data of 46 developing and developed countries for the years between 1970-1989 with the dependent variable *Average growth rate of real GDP per capita* and the independent variable (FD) *Share of sub-national government expenditure in general government expenditure*. They find a negative effect in developing countries and no significant relationship in developed countries using cross-country panel regressions methodology with country fixed, time fixed effect, and OLS estimation. Enikolopov and Zhuravskaya (2007) cover 75 transitional and developing countries for 1975-2000, using the *logarithm of the change in GDP per capita at purchasing power parity* as the dependent variable and two independent variables (FD). They find that 10% higher decentralization of revenue reduces real GDP growth per capita in developing countries by 0.14%-points (at 5% significance level). Their findings show that FD is negative at low degrees of political centralization, and thus political centralization has a negative impact at low levels of FD. To get positive outcomes, a country must strike a balance between FD and political centralization. They use Fixed Effect and OLS to achieve these results. Conversely, Oates (1995) covers 40 countries for the years 1974-1989 with the independent variable *Average growth rate of real GDP per capita* and two dependent variables (FD) (1) *Share of sub-national government expenditures in general government expenditures net of intergovernmental transfers (GFS)*; (2) *Self-reliance ratio: own revenues of sub-*

national governments as a share of their total revenues. He finds a significant and robust positive correlation between FD and per capita economic growth. However, the self-reliance variable is not itself statistically significant. Also, Yilmaz (1999) examines 46 countries using Fixed Effects Models, Time Dummies, and GLS for 1971-1990 with the dependent variable *Average growth rate of real GDP per capita* and the independent variable (FD) *Share of sub-national government expenditures in general government expenditures net of intergovernmental transfers (GFS)*. The results suggest that the local level's decentralization increases real GDP growth per capita in unitary states more than in federal countries. However, decentralization at the regional level is not significant. Moreover, Thiessen (2003) studies 26 Developed countries by using GLS methodology for 1981-1995 with the dependent variable *Average growth rate of real GDP per capita, Average growth rate of real gross fixed capital formation, TFPG,* and five independent variables (FD). For high-income nations, the research shows a hump-shaped relationship between per capita economic growth and capital formation on the one hand and foreign direct investment on the other. Capital development appears to be linked to increased self-reliance, according to empirical data. Decentralization of spending by 10% increases real GDP growth per capita by 0.12%-points (at 5% significance level). Furthermore, Limi (2005) explores 51 Developing and Developed Countries for 1997-2001 with the dependent variable *Average growth rate of real GDP per capita* and two independent (FD) variables: (1-2) *Share of sub-national government expenditures in general government expenditures net of intergovernmental transfers (GFS) and its interaction with political freedom (PF)*. The author applies OLS and IV to find that 10% higher decentralization of spending increases real GDP growth per capita by 0.6%-points (at 1% significance level). The result is robust, regardless of the inclusion of the interaction term FD*PF.

After the previous studies, Martinez-Vazquez and McNab (2003) attribute that there is no empirical result on the relationship between decentralization and economic growth.

On the other side, some research indicates that FD has an impact on Human Development, such as on Life expectancy, Year of Schooling, and on Income. In this way, it also directly affects poverty and inequality. According to Sepulveda and Martinez-Vazquez (2011), FD has significant effects on poverty and inequality. Especially if the share of sub-national expenditure is not greater than one-third of total government expenditure, FD may have a positive impact to decrease poverty. Moreover, also if the general government provides a significant share of the economy, such as twenty percent or more, FD has a positive effect of reducing income inequality. They use an unbalanced panel data of 65 countries, 41 developing and 24 developed, in the average of the five years between 1976 and 2000. They use HDI as a dependent variable and as dependent variables; (1) fiscal decentralization, (2) fiscal decentralization square, as control variables; (1) government size (% GDP), (2) log of per capita, (3) population growth (%), (4)

age dependency (%), (5) Urban population (%), (6) index of democracy, (7) average schooling years of total population and (8) openness to international trade. They find that FD has a significant (at 5% significance level) and positive effect on the HDI. Also, by using FD square as an independent variable, they find the turning point of FD effects of 32.4%. This implies that sub-national budgets achieve maximum efficacy in poverty reduction as assessed by HDI when sub-national expenditure comprises roughly one-third of overall expenditures; increasing FD beyond that point results in higher poverty levels.

Some other research represents that Jumadi et al. (2013) examine the relationship between FD and HDI by using panel data across districts and cities in East Java Province, consisting of 29 districts and 9 cities in 2007- 2010 for Indonesia. They find that there is a significant and positive relationship between FD and human development. Furthermore, Javed and Qaderi (2013) use panel data from 1990 and 2010 for Pakistan to examine the relationship between life expectancy, as a dependent variable, and FD, as an independent variable. The results of the empirical analysis suggest that there is a positive relation between FD and life expectancy in Pakistan. The final study is that Cantarero and Pascual (2008) cover panel data between 1992 and 2003 in Spain. The empirical analysis provides that income, decentralization, and health care resources have an important impact on infant mortality and life expectancy. Especially, decentralization is associated with greater life expectancy.

3. Analytic Framework

3.1 Hypothesis

This study has four hypotheses to result whether there is a significant and positive effect of FD on HDI. I use four hypotheses because I also examine the impact of FD on these components of HDI: *Life Expectancy, Year of Schooling,* and *Income per capita*.

The hypotheses are formed as follows:

H_1: Fiscal Decentralization Variables (FD_Rev and FD_Exp) have a significant and positive effect on Life Expectancy.

H_2: Fiscal Decentralization Variables (FD_Rev and FD_Exp) have a significant and positive effect on Year of Schooling.

H_3: Fiscal Decentralization Variables (FD_Rev and FD_Exp) have a significant and positive effect on GDP per capita.

H_4: Fiscal Decentralization Variables (FD_Rev and FD_Exp) have a significant and positive effect on Human Development Index.

Where *FD_Rev* is fiscal decentralization revenue and *FD_Exp* indicates fiscal decentralization expenditure.

As stated above, H_1, H_2, and H_3 help examine the main hypothesis (H_4); thus, we can conclude the relationship between FD and HDI.

3.2 Methodology

As specified above, the study estimates to the models present the relationships between FD and life expectancy, FD and year of schooling, FD and income per capita growth rate, also FD and HDI constitutively.

In the models, FD (revenue and expenditure) and the square of FD (revenue and expenditure) are as main independent variables. Also, some control variables as independent variables. For example, life expectancy, year of schooling, income per capita growth rate, and HDI are dependent variables (The period 2000-2010 for all variables).

The empirical models are as follows:

The first model:
$$Life\_Exp_i = \beta_0 + \beta_1 FD\_Rev_i + \beta_2 FD\_Revsq_i + X\gamma_i + \epsilon_i \quad (1)$$
$$Life\_Exp_i = \beta_0 + \beta_1 FD\_Exp_i + \beta_2 FD\_Expsq_i + X\gamma_i + \epsilon_i \quad (2)$$

The second model:
$$Year\_Schl_i = \beta_0 + \beta_1 FD\_Rev_i + \beta_2 FD\_Revsq_i + W\gamma_i + \epsilon_i \quad (3)$$
$$Year\_Schl_i = \beta_0 + \beta_1 FD\_Exp_i + \beta_2 FD\_Expsq_i + W\gamma_i + \epsilon_i \quad (4)$$

The third model:
$$Gpd\_pcap\_gr_i = \beta_0 + \beta_1 FD\_Rev_i + \beta_2 FD\_Revsq_i + Y\gamma_i + \epsilon_i \quad (5)$$
$$Gdp\_pcap\_gr_i = \beta_0 + \beta_1 FD\_Exp_i + \beta_2 FD\_Expsq_i + Y\gamma_i + \epsilon_i \quad (6)$$

The fourth model:
$$HDI_i = \beta_0 + \beta_1 FD\_Rev_i + \beta_2 FD\_Revsq_i + Z\gamma_i + \epsilon_i \quad (7)$$
$$HDI_i = \beta_0 + \beta_1 FD\_Exp_i + \beta_2 FD\_Expsq_i + Z\gamma_i + \epsilon_i \quad (8)$$

Where *Life_Exp* is life expectancy (year), *Year_Schl* is the year of schooling, *Gdp_pcap_gr* is GDP per capita growth rate (%), *HDI* is human development index (0 to 1), *FD_Rev* is fiscal decentralization revenue (%), *FD_Exp* is fiscal decentralization expenditure (%), *FD_Revsq* is fiscal decentralization revenue square (%), *FD_Expsq* is fiscal decentralization expenditure square (%), and ϵ indicates idiosyncratic error term.

$X\gamma$ is the Control variables for the first model:

$$X\gamma_i = \gamma_1 gdp\_pcap\_gr_i + \gamma_2 health\_exp_i \quad (1.1)$$

Where *Gdp_pcap_gr* is GDP per capita growth rate (%), *Health_exp* is health expenditure ($).

$W\gamma$ is the Control variables for the second model:

$$W\gamma_i = \gamma_1 gdp\_pcap\_gr_i + \gamma_2 educ\_exp_i \quad (2.1)$$

Where *Gdp_pcap_gr* is GDP per capita growth rate (%), and *Educ_exp* is education expenditure ($).

$Y\gamma$ is Control variables for the third model:

$$Y\gamma_i = \gamma_1 life\_exp_i + \gamma_2 year\_educ_i + \gamma_3 govt\_exp_i \quad (3.1)$$

Where *Life_Exp* is life expectancy (year), *Year_Schl* is year of schooling, and *Govt_exp* is Government expenditure ($).

$Z\gamma$ is the Control variables for the fourth model:

$$Z\gamma_i = \gamma_1 gdp\_pcap\_gr_i + \gamma_2 govt\_exp_i + \gamma_3 life\_exp_i + \gamma_4 year\_schl_i \quad (4.1)$$

Where *Gdp_pcap_gr* is GDP per capita growth rate (%), *Govt_exp* is Government expenditure ($), *Life_Exp* is life expectancy, *Year_Schl* is year of schooling.

These are the reasons that I choose these control variables:

GDP per capita growth rate (%): is strongly correlated with all dependent variables. For example, if income per capita is high in a country, it shows that quality of life is also high, affecting life expectancy and schooling year. In this way, it affects the total HDI in the whole country.

Health expenditure: is correlated with life expectancy and income. For instance, when a country has higher health expenditure, it indicates that the country also has higher life expectancy but may have lower income per capita than before.

Education expenditure: is much correlated with year of schooling and income per capita. For example, if a government invests in education more; the government has a higher quality of labor forces that, in any sector, ensure resources to be used more efficiently are an important supporter to higher GDP. Therefore, Income per capita is higher than before.

Life expectancy: is also correlated with income per capita and one of the components of HDI. If life expectancy is higher than before, GDP per capita will decrease because morality will reduce and populations will increase, then GDP is divvied up between more people than before.

Year of schooling: is correlated with education expenditure and income per capita.

Government expenditure: is correlated with income per capita and HDI.

3.3 Data and Econometric Issues

I use publicly available data from "Quality of Government Institute," "United Nations Development Program," and "World Bank" for 49 countries during the period between 2000 and 2010.

The list of variables is shown in Table 1, which shows the summary of statistics. The average life expectancy is 75 years, where the minimum is at 51 years and the maximum at 82 years. The average year of schooling is almost 10 years which the minimum is at 3.6 years, and the maximum is at 13 years. The average HDI is 0.8, which is minimum at 0.5 and maximum at 0.94. Furthermore, the average FD revenue is 22.5% which the minimum is at 3.6%, and the maximum is at 55%.

Also, FD expenditure has almost the same summary of statistics, such as the mean is 28% which the minimum is at 2.5%, and the maximum is at 66%. The mean of FD revenue square is 6.8%, and the average of FD expenditure square is 9.9%. Also, the average of one of the control variables, which is health expenditure, is 1,852 US$ for each year, where the minimum is 15.46 US$, and the maximum is 8,694 US$. Average education expenditure is 5% of GDP, where the minimum is at 2.26% of GDP, and the maximum is at 9.5% of GDP. The mean of government consumption expenditure is 17% of GDP, where the minimum is at 6.5% of GDP, and the maximum is at 28% of GDP. Finally, the average income per capita growth rate is 10%, where the minimum is at -62%, and the maximum is at 50%.
The list of the variables is shown in Table A1, which presents the average of variables by countries the period between 2000 and 2010 in the appendix. According to Table A1, Switzerland and Iceland have the highest life expectancy that is 81 years. However, South Africa has the lowest life expectancy (53 years). Moreover, Czech Republic has the highest year of education that is 12.5 years, and Brazil has the lowest year of schooling (6.5 years). Furthermore, Kazakhstan has the highest income per capita growth rate (23%) between 2000 and 2010. However, United States has the lowest income per capita growth rate that is 3%. HDI is between 0 and 1. Thus, Norway has the HDI (0.93), and South Africa has the lowest HDI of 0.62. In addition, the country, Canada, has the highest FD revenue (53%) and FD expenditure (64%). Finally, Costa Rica has the lowest FD revenue (5%), and Iran has the lowest FD of spending that is 3%.

Table 1: Summary Statistic of the Models

Variable	Obs.	Mean	Std. Dev.	Min	Max
Life Expectancy	572	75.025	5.673	51.558	82.337
Year of Schooling	567	9.983	1.982	3.600	13.100
HDI	567	0.795	0.096	0.484	0.939
FD_Rev	509	0.225	0.133	0.036	0.552
FD_Exp	497	0.278	0.148	0.025	0.665
FD_Rev Square	509	0.068	0.073	0.001	0.305
FD_Exp Square	497	0.099	0.096	0.0006	0.442
Income Per Capita Growth	520	0.100	0.129	-0.624	0.495
Health Expenditure	572	1852.668	2010.915	15.456	8694.291
Education Expenditure	490	5.132	1.264	2.256	9.510
Government Expenditure	569	17.410	4.549	6.532	28.064

To estimate the FD effect on dependent variables (Life expectancy, Year of schooling, Income per capita growth rate, and mainly HDI), I use robust OLS and Fixed Effect estimations. The Hausman test tests the null hypothesis that the

coefficients estimated by the efficient random effects estimator are the same as those estimated by the consistent fixed effects estimator. If they are (insignificant P-value, Prob>chi2 larger than .05), it is safe to use random effects. On the other hand, if we get a significant P-value, we should use fixed effects (Wooldridge, 2009). So, in this study, I get the significant P-value, and I should use Fixed Effects, although there is no systematic difference between Fixed Effects and Random Effects. Also, the fixed-effects model accounts for all time-invariant variations between individuals; the calculated coefficients cannot be skewed by missing time-invariant features (like culture, religion, gender, race, etc.) (Kohler, U., & Kreuter, F., 2005). Furthermore, the Ordinary Least Square method with standard error is used in the study.

4. Result

4.1 Fiscal Decentralization on Life Expectancy

As shown in Table 2, robust OLS with FD_Rev (1) results that FD revenue has a significant (at 5% significance level) and negative effect on life expectancy. Also, such as a control variable, income per capita growth rate has the same level of significance (at 5% significance level) and negative effect on life expectancy. Conversely, FD revenue square has a positive impact but not significant. Moreover, health expenditure has a highly significant and positive impact.

Robust OLS with FD_Exp (2) results that all independent variables, besides FD_Rev (1), have highly significant effects on life expectancy. Such as FD_Rev (1), FD expenditure, and income per capita growth rate have negative effects. Also, the square of FD of spending, and health expenditure have positive effects.

I use the base examination method that is Fixed Effect that can "estimate the effect of time-varying independent variables in the presence of time-constant omitted variables, so fixed effect eliminates the variety of natural environment, economic structures and demographic characteristic in countries" (Wooldridge, 2009: 506). As shown in Table 2 at column (3), Fixed Effects with FD_Rev (1) results that FD revenue has a significant (at 5% significance level) and positive effect on life expectancy. However, the square of FD_Rev has a negative impact. Also, the income per capita growth rate has a highly significant and negative effect, but health expenditure has a positive and highly significant effect. As shown in column (4), FE with FD_Exp (2) indicates that FD_Exp and FD_Expsq also have the same impact, but unlike robust OLS, they are not significant. Other variables also have the same effects on life expectancy. For example, when FD_Rev is increased by 1%, life expectancy will increase by 9.8%. However, if FD_Exp is increased by 1%, life expectancy will decrease by 4.8%. Furthermore, income per capita is increased by 1%; life expectancy will reduce by 1.2%. Unfortunately, health expenditure has a very weak effect, %0.7, on life expectancy.

Table 2: Estimation Results with OLS and Fixed Effects Dependent variable: *Life Expectancy*

VARIABLES	(1) OLS FD_Rev	(2) OLS FD_Exp	(3) FE FD_Rev	(4) FE FD_Exp
FD_Rev (%)	-14.02**		9.762**	
	(6.191)		(4.037)	
FD_Revsq (%)	0.847		-15.59**	
	(11.72)		(6.974)	
Income Per Capita (%)	-3.772**	-4.496***	-1.253***	-1.125***
	(1.758)	(1.669)	(0.228)	(0.227)
Health Expenditure ($)	0.00181***	0.00186***	0.000718***	0.000707***
	(0.000118)	(0.000139)	(3.80e-05)	(3.76e-05)
FD_Exp ($)		-19.90***		-4.781
		(4.438)		(3.156)
FD_Expsq ($)		20.27***		0.725
		(5.940)		(5.475)
Constant	75.14***	75.53***	72.98***	75.42***
	(0.655)	(0.591)	(0.500)	(0.412)
Observations	463	452	463	452
R-squared	0.505	0.467	0.505	0.527
Number of countries			49	49

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4.2 Fiscal Decentralization on Year of Schooling

As an indicated in Table 3, robust OLS with FD_Rev (3) results that FD revenue has an insignificant and negative effect on the year of schooling. Also, such as a control variable, income per capita growth rate has an insignificant and negative impact on schooling. Conversely, FD revenue square has a positive effect but not significant. Moreover, education expenditure has a highly significant and positive impact.

Robust OLS with FD_Exp (4) results that all independent variables, besides FD_Rev (3), have significant effects on the year of schooling, except income per capita growth rate. FD expenditure and education expenditure have highly significant and negative impacts. However, the square of FD of spending has a negative effect.

As shown in Table 3 at column (3), Fixed Effects with FD_Rev (3) results that FD_Rev, FD_Revsq, and education expenditure have insignificant and positive effects on the year of schooling. However, the income per capita growth rate has a

highly significant and negative impact. For example, when a country increases FD_Rev by 1%, the year of schooling will increase by 0.6%. Moreover, if the government increases education expenditure by 1%, the year of education will increase by 0.05%. However, they are insignificant. Furthermore, when income per capita increases by 1%, the year of schooling will decrease by 0.48%, which is highly significant.

Table 3: Estimation Results with OLS and Fixed Effects Dependent variable: *Year of Schooling*

VARIABLES	(1) OLS FD_Rev	(2) OLS FD_Exp	(3) FE FD_Rev	(4) FE FD_Exp
FD_Rev (%)	-0.198		0.577	
	(3.337)		(2.553)	
FD_Revsq (%)	0.175		0.819	
	(6.557)		(4.694)	
Income per Capita (%)	-0.684	-0.904	-0.481***	-0.555***
	(0.592)	(0.591)	(0.141)	(0.141)
Education Expenditure ($)	0.436***	0.304***	0.0546	0.0418
	(0.0660)	(0.0799)	(0.0422)	(0.0426)
FD_Exp (%)		6.506***		-6.444***
		(2.130)		(2.032)
FD_Expsq (%)		-6.469**		12.06***
		(2.854)		(3.456)
Constant	8.190***	7.770***	9.949***	10.90***
	(0.512)	(0.453)	(0.381)	(0.370)
Observations	404	393	404	393
R-squared	0.097	0.128	0.050	0.087
Number of countries			49	49

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

As indicated in column (4) in Table 3, FE with FD_Exp (4) shows results that FD_Exp and FD_Expsq are highly significant, but FD_Exp has a negative effect, unlike FD_Expsq. Also, the income per capita growth rate has a significant and negative impact. However, education expenditure has a positive effect but not significant on the year of schooling. For example, when a country raises education expenditure by 1%, the year of education will increase by 0.04% but not significantly. Moreover, if the government raises FD_Exp by 1%, the year of education will decrease by 6.4%. Also, if income per capita increases by 1%, the year of education will reduce by 0.6%.

4.3 Fiscal Decentralization on GDP Per Capita Growth Rate

As shown in Table 4, robust OLS with FD_Rev (5) results that FD revenue and year of schooling have positive effects but not significant on income per capita. Moreover, FD_Revsq, life expectancy, and government expenditure have negative effects, but FD_Revsq is not significant by contrast with life expectancy and government expenditure are highly significant.

Robust OLS with FD_Exp (6) indicates that FD_Exp and year of schooling have a positive effect, but FD_Expsq has a negative effect on income per capita; also, they are not significant. Furthermore, government expenditure and life expectancy have positive and highly significant effects on income per capita, such as OLS with FD_Rev column (1).

Table 4: Estimation Results with OLS and Fixed Effects Dependent variable: *GDP per capita growth rate (%)*

VARIABLES	(1) OLS FD_Rev	(2) OLS FD_Exp	(3) FE FD_Rev	(4) FE FD_Exp
FD_Rev (%)	0.142		-1.600*	
	(0.188)		(0.818)	
FD_Revsq (%)	-0.446		2.563*	
	(0.352)		(1.441)	
Life Expectancy (Year)	-0.00479***	-0.00541***	-0.0291***	-0.0208**
	(0.00152)	(0.00147)	(0.0101)	(0.0103)
Year of Schooling (Year)	0.00550	0.00538	0.000889	-0.0229
	(0.00339)	(0.00365)	(0.0233)	(0.0238)
Government Expenditure ($)	-0.00567***	-0.00474***	-0.0326***	-0.0379***
	(0.00169)	(0.00169)	(0.00521)	(0.00514)
FD_Exp		0.0653		-0.389
		(0.136)		(0.643)
FD_Expsq		-0.134		1.324
		(0.194)		(1.123)
Constant	0.506***	0.535***	3.060***	2.577***
	(0.103)	(0.0985)	(0.607)	(0.641)
Observations	457	446	457	446
R-squared	0.086	0.091	0.161	0.188
Number of countries			49	49

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

As shown in Table 4 at column (3), Fixed Effects with FD_Rev (5) results that FD_Rev and FD_Revsq are significant (at 10% significance level), but FD_Rev has a negative effect on income per capita. For example, if FD revenue rises by 1%, income per capita decreases by 1.6%. Furthermore, life expectancy and

government expenditure have highly significant and negative effects on income per capita. For instance, life expectancy increases by 1 year, income per capita decreases by 2.9%, holding other factors unchanged. Finally, the year of schooling has a positive effect but not significant.

Also, as illustrated in Table 4 in column (4), FD_Exp has a negative effect like FD_Rev in column (3), but it is not significant like FD_Expsq. For example, if FD_Exp increases by 1%, income per capita decreases by 0.4% but not significant. Moreover, government expenditure and life expectancy have negative effects and significant. In column (4), the year of schooling, besides the other columns, has a negative effect on income per capita. For instance, when the year of education raises by 1 year, income per capita decreases by 2.3%, but it is insignificant. As a result, increasing FD_Rev, and FD_Exp have a negative effect on GDP per capita.

4.4 Fiscal Decentralization on Human Development Index

Fixed Effect with FD_Rev indicates that almost all variables have a highly significant effect on HDI, but only income per capita growth rate is significant at 5% significance level. Also, not including FD_Revsq and government expenditure, all variables have positive effects on HDI. For example, if income per capita increases by 1%, HDI will increase by approximately 0.7%. However, if government expenditure rises by 1%, HDI will decrease by 0.09%, holding other factors unchanged.

Using FD and FDsq, in the same model, provide me to find the turning point of effects of FD on HDI when I take derivation of:

$$\frac{\partial G}{\partial Fd\_Rev} = \beta_1 + \beta_2 FD\_Rev = 17.8\% + 2 \text{ x } (-35.7\%) * FD\_Rev \qquad (9)$$

$71.4\% * FD\_Rev = 17.8\%$

$FD\_Rev = 0.2492 = 25\%$

$$\frac{\partial G}{\partial Fd\_Exp} = \beta_1 + \beta_2 * FD\_Exp = 3.89\% + 2 \text{ x } (-14.8\%) * FD\_Exp \qquad (10)$$

$29.6\% * FD\_Exp = 3.89\%$

$FD\_Exp = 0.1314 = 13\%$

When we plug the results into the third model, holding other variables remain unchanged, we will find that the effect of FD on HDI. If a country has FD_Rev that is bigger than 25%, the country's HDI has a disadvantage; otherwise, it has an advantage. Also, if the country has FD_Exp that is bigger than 13%, the country's HDI has a disadvantage. For example, Canada has a disadvantage of HDI because the average FD_Rev (52.9%) is bigger than 25%, and also FD_Exp (63.7%) is bigger than 13%. However, Iran has an advantage of HDI because the average FD_Rev (6.5%) is lower than 25%, and also FD_Exp (3.4%) is lower than 13%.

For example, Iran has a positive effect of FD_Rev, which is 13%, on HDI. If Iran increases FD_Rev by adding 10% from 6.5% to 16.5%, the effect of FD_Rev will decrease by 46% from 13% to 6%. As a result, after the turning point, each value is added has a negative effect on HDI.

Table 5: Estimation Results with OLS and Fixed Effects Dependent variable: *Human Development Index*

VARIABLES	(1) OLS FD_Rev	(2) OLS FD_Exp	(3) FE FD_Rev	(4) FE FD_Exp
FD_Rev (%)	0.0907**		0.178***	
	(0.0386)		(0.0466)	
FD_Revsq (%)	-0.0943		-0.357***	
	(0.0695)		(0.0820)	
Income Per Capita (%)	0.00803	0.0115	0.00680**	0.00518*
	(0.00901)	(0.00856)	(0.00282)	(0.00295)
Government Expenditure ($)	0.00219***	0.00183***	-0.000920***	-0.00150***
	(0.000300)	(0.000283)	(0.000309)	(0.000321)
Life Expectancy (Year)	0.00997***	0.0102***	0.00938***	0.00958***
	(0.000408)	(0.000435)	(0.000578)	(0.000606)
Year of Schooling (Year)	0.0223***	0.0213***	0.0189***	0.0185***
	(0.000673)	(0.000724)	(0.00132)	(0.00139)
FD_Exp (%)		0.151***		0.0389
		(0.0232)		(0.0376)
FD_Expsq (%)		-0.152***		-0.148**
		(0.0325)		(0.0658)
Constant	-0.230***	-0.245***	-0.0958***	-0.0760**
	(0.0266)	(0.0284)	(0.0355)	(0.0383)
Observations	457	446	457	446
R-squared	0.934	0.942	0.790	0.789
Number of countries			49	49

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

5. Conclusion

FD is an important policy issue for developing countries, transition countries, and even developed countries (Thiessen, 2003). Using the panel data of 49 countries from 2000 to 2010, I examine the relationships between FD and components of HDI, which leads to estimating the relationship between FD and HDI. The results suggest that the FD revenue has a significant and positive effect on HDI. Conversely, the FD of spending has a positive impact, but it is not significant.

Furthermore, FDsq results show that we have turning points for FD. If the country has a higher FD, such as Canada, it has a disadvantage on HDI. For example, for FD_Exp, the turning point is 13%. This indicates that when a country's FD expenditure represents about one-ninth of total expenditure, the country reaches the minimum level of FD expenditure effect in HDI reduction. After reaching the turning point, increasing FD of spending has a negative impact on HDI. By this means, I can explain how the FD affects HDI. According to Sepulveda and Martinez-Vazquez (2011), the turning point of FD effects is 32.4% by using FD square as an independent variable. This implies that Sub-national budgets achieve maximum efficacy in poverty reduction as measured by HDI when sub-national expenditures account for roughly one-third of overall expenditures; increasing FD beyond that point results in higher poverty levels.

Limitation of the data makes the study not include certain factors such as technological progress and mobility factors that can capture economic efficiency. However, the study provides a long sample space of 11 years, so it may be able to reflect the long-run of FD on HDI. In addition, unlike previous studies in the latter 1990s, this study addresses FD revenue and FD expenditure.

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Table A1: Mean of Some Variables by Country

Country Name	Life Expectancy	Year of Schooling	Income per capita growth rate	Human Development Index	Fiscal Decentralization Revenue	Fiscal Decentralization Expenditure
Argentina	74.73222	9.136364	0.094673	0.766601	0.449232	0.398821
Australia	80.66763	12.17285	0.099447	0.912246	0.388817	0.383745
Austria	79.35366	9.938944	0.069264	0.854239	0.226366	0.308304
Belarus	69.33756	10.46667	0.176186	0.754608	0.364255	0.336743
Belgium	78.98359	10.51041	0.070569	0.870471	0.154579	0.363919
Bolivia	64.67565	8.304029	0.073337	0.636209	0.373878	0.241617
Brazil	71.6986	6.488428	0.127221	0.709329	0.440024	0.412154
Bulgaria	72.51375	10.02823	0.155758	0.746372	0.152569	0.150274
Canada	80.15958	11.9775	0.074258	0.886581	0.529202	0.637336
Chile	78.03684	9.402041	0.102547	0.783787	0.112471	0.118714
Costa Rica	78.47262	8.027318	0.069581	0.725828	0.049261	0.035719
Croatia	75.22867	9.90944	0.112245	0.779833	0.117632	0.097922
Czech Republic	76.08248	12.55899	0.132617	0.838372	0.174002	0.258015
Denmark	77.74501	11.54229	0.068258	0.884178	0.335206	0.616672
Estonia	72.44601	11.87285	0.147227	0.81242	0.147669	0.269558
Finland	78.82616	9.643656	0.070789	0.86455	0.263166	0.3822
France	80.28492	10.41953	0.064624	0.865132	0.20034	0.196213
Germany	78.97317	12.10364	0.061318	0.883643	0.343716	0.375892
Greece	79.22084	9.597083	0.09025	0.839335	0.063941	0.051153
Hungary	72.86408	11.05509	0.117015	0.800125	0.131025	0.248473
Iceland	81.10732	9.874144	0.04308	0.879032	0.259139	0.285894
India	64.02723	4.001634	0.123365	0.527005	0.486013	0.429636
Iran	71.44033	6.969799	0.142577	0.686	0.06468	0.03367
Ireland	78.80355	11.40013	0.069045	0.886453	0.089043	0.28129
Israel	80.25233	12.22755	0.042086	0.866972	0.085194	0.117056
Italy	80.91774	9.378034	0.063427	0.852817	0.185596	0.31217
Kazakhstan	66.4845	10.15488	0.232203	0.722852	0.379777	0.355893
Latvia	71.59579	10.42209	0.146382	0.779746	0.249615	0.222092
Lithuania	71.87871	11.73	0.148671	0.800661	0.216668	0.207101
Mexico	75.48547	7.530788	0.03557	0.7237	0.366486	0.318315
Moldova	67.77526	9.391558	0.172525	0.632149	0.246625	0.213863
Mongolia	65.12348	8.209136	0.181619	0.632272	0.116689	0.170789
Netherlands	79.33659	11.48399	0.071917	0.889438	0.111774	0.344715
New Zealand	79.698	12.22739	0.100797	0.890648	0.089277	0.105048
Norway	79.89135	12.35915	0.091852	0.929308	0.151265	0.330881
Paraguay	71.20924	6.930551	0.08768	0.647369	0.083779	0.079355
Peru	72.33088	8.228004	0.102284	0.697123	0.252503	0.200013
Poland	74.97805	11.3274	0.11447	0.804179	0.238124	0.292068
Portugal	77.83415	7.137752	0.072792	0.794301	0.099474	0.144788
Romania	72.01641	10.20924	0.18514	0.748839	0.217976	0.18904
Slovakia	74.06053	11.49143	0.124687	0.803597	0.096935	0.1425
Slovenia	77.51475	11.55467	0.091836	0.851815	0.115562	0.190952
South Africa	53.08253	9.036405	0.104741	0.621029	0.397535	0.366775
Spain	80.32151	8.946543	0.080277	0.844768	0.297951	0.469222
Sweden	80.54324	11.44665	0.065854	0.889699	0.355056	0.453828
Switzerland	81.14745	11.89206	0.071325	0.899422	0.477246	0.541935
Thailand	72.3407	6.62944	0.096692	0.683372	0.148305	0.059801
United Kingdom	78.98825	12.06477	0.043909	0.882749	0.093675	0.287079
United States	77.44302	12.80912	0.029008	0.896596	0.442536	0.500087