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Yamamura, Eiji

26 June 2011

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Eiji Yamamura

Department of Economics, Seinan Gakuin University

6-2-92 Sawara-ku, Nishijin, Fukuoka 814-8511, Japan

Tel: +81-(0)92-823-4543; Fax: +81-(0)92-823-2506; E-mail: yamaei@seinan-gu.ac.jp

Abstract

Empirical results from a random-effects regression model show that ethnic heterogeneity has a negative effect on growth. The negative effect is seen largely in the hampering of efficiency improvements, but not capital accumulation.

Keywords: Ethnic fractionalization, Ethnic polarization, Efficiency improvement, Capital accumulation, Random-effects model.

JEL classification: H11, O43

1. Introduction

Since the 1990s, there has been a growing interest among economic researchers in the relationship between ethnic diversity and economic performance (Alesina and La Ferrara, 2005). Easterly and Levine (1997) showed a negative association between ethnic heterogeneity and economic growth. Ethnic heterogeneity has a detrimental influence on economic development, affecting the probability of conflict and reducing investment (Mauro, 1995; Montalvo and Reynal-Querol, 2005a, 2005b).[1] Ethnic heterogeneity also possibly influences growth in other areas, an issue that is open for discussion. Thus, it is worthwhile to investigate through which channels ethnic heterogeneity affects growth.

To analyze channels of economic growth, data envelopment analysis (hereafter, DEA) constructs a world production frontier and then decomposes labor productivity growth to three components: technological catch-up, capital deepening, and technological change (Kumar and Russell, 2002). In addition, researchers can use regression analysis to examine how initial outputs per worker influence these components (Yamamura and Shin, 2007, 2008; Yamamura, 2011).

This paper aims to improve the above method and then apply it in an attempt to provide new empirical evidence through an investigation into the influence of ethnic heterogeneity on growth.

2. Data and Model

Kumar and Russell (2002) used DEA to construct a cross-country data set by

[1] Previous works examined the effect of religious heterogeneity on economic development, which relate to works exploring the influence of ethnic heterogeneity (Alesina et al., 2003; Montalvo and Reynal-Querol, 2003).

decomposing labor productivity growth into three components. They conducted a simple OLS regression model with output per worker from 1965 as the independent variables and the dependent variables were the percentage changes between 1965 and 1990 for output per worker, technological change, the efficiency index, and the capital accumulation index. In their estimations, both unobservable individual and time effects were ignored. This led to estimation bias.

Following Kumar and Russell (2002), this paper also uses DEA to construct a panel dataset for 57 countries, from 1965 to 1990, using the Penn World Table.[2] With this dataset, I used random-effects estimations to reduce omitted variable bias caused by the time-invariant features of the various countries.[3] I also incorporated year dummies into this model to capture individually invariant time-specific effects. The estimated function takes the following form:

$$Gr_{iT\text{-}to} = \alpha_0 + \alpha_1 \text{Ln}(Output)_{it0} + \alpha_2 (Ethnic\ polarization)_i + \alpha_3 (\text{Number of natural disasters})_{it0} + \alpha_4 (Government\ size)_{it0} + \alpha_5 (Years\ of\ schooling)_{it0} + \varepsilon_i + \nu_t + u_{it},$$

where $Gr_{iT\text{-}to}$ represents labor productivity growth and the change in any of the three dependent variables (i.e., *Efficiency, Capital,* and *Technique*) in country i from each base year t0 to year T (t0 = 1965, …, 1989 and T = 1966, …, 1990). α represents regression parameters, ε is the time-invariant individual effect of each country, ν represents the year specific effects, and u is an error term. As stated earlier, ε and ν are controlled. The key independent variable that captures ethnic heterogeneity is the ethnic polarization index. Classical works have previously used an ethnic

[2] Kumar and Russell (2002) admitted that their method includes the possibility of an implosion of the technological frontier. Henderson and Russell (2005) precluded an implosion of the frontier over time. In this paper, it is also precluded.
[3] The independent variables used in this paper were not available for 10 of the 57 countries. Hence, the data from only 47 countries were used in the estimation.

fractionalization index to capture ethnic heterogeneity (Mauro, 1995; Easterly and Levine, 1997). In addition to the ethnic fractionalization index, an ethnic polarization index has also been developed and used as an alternative measure (Montalvo and Reynal-Querol, 2005a, 2005b; Reynal-Querol, 2002). Thus, to check the robustness of the estimation results, I used both ethnic fractionalization and ethnic polarization as proxy variables for ethnic heterogeneity.[4] Ethnic heterogeneity is expected to result in conflict, hampering the cooperation and communication required to enhance technology diffusion and efficiency improvements. Proxies for ethnic heterogeneity hold time-invariant features. Hence, their effects cannot be estimated when a fixed-effects model is used. To examine these effects, a random-effects model is used in this paper.

The other independent variables used in this model are the values in the base year t0. I have incorporated per capita GDP taken in log-form in t0 to control for initial levels of productivity. These data are sourced from the Penn World Table (PWT 6.3).[5] Natural disasters are considered to influence economic growth (Skidmore and Toya, 2002). To capture this effect, the number of natural disasters that have occurred in the sample countries are included.[6] Government size is measured by a country's general government final consumption expenditure (% of GDP) sourced from the World Bank (2006). To capture the human capital effect, the number of years at school is incorporated, as used by Easterly and Levine (1997).[7]

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[4] Data on ethnic fractionalization and polarization is available at http://www.econ.upf.edu/~reynal/data_web.htm (accessed on June 1, 2011).

[5] The data are available from Center of International Comparisons at the University of Pennsylvania. http://pwt.econ.upenn.edu/ (accessed May 1, 2007).

[6] The data were obtained from the International Disaster Database http://www.emdat.be (accessed on June 1, 2011).

[7] The number of years at school are not available for some years. Therefore, to construct panel data additional data were generated by interpolation based on the assumption of constant changes in rates to make up for this deficiency. The data are available from http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,content

3. Results

The estimation results of the random-effects model with year dummy variables from 1966 to 1990 are reported in Tables 1 and 2. Table 1 presents the results when the ethnic polarization index is used as a proxy for ethnic heterogeneity, while Table 2 exhibits the results when ethnic fractionalization is used. In each table, the results for the dependent variables output per capita change are shown in column (1). The results for efficiency change, capital accumulation, and technological progress are shown in columns (2), (3), and (4).

In Tables 1 and 2, the Hausman test does not reject the null-hypothesis that the differences in coefficients between a fixed-effects model and a random-effects model are not systematic. This result implies that the random-effects model is valid and preferred. I will now focus on the results of the proxy for ethnic heterogeneity. I see from Table 1 that ethnic polarization yields the negative sign in columns (1)–(4). Furthermore, ethnic polarization is statistically significant at the 1% level in columns (1) and (2), but not statistically significant in columns (3) and (4). Table 2 also indicates the negative sign for ethnic fractionalization in columns (1)–(4) and statistical significance at the 1% level in columns (1)–(2), but not in columns (3)–(4). Thus, it follows that while ethnic heterogeneity has a detrimental effect on growth and efficiency improvement, it does not affect capital accumulation and technological progress.

These estimation results provide evidence that ethnic heterogeneity hampers economic growth via an impediment of efficiency improvement, rather than in a reduction of capital accumulation and technological progress.

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4. Conclusions

This study used panel data from 47 countries, from 1965 to 1989, to decompose the effect of ethnic heterogeneity, and to examine how it influences economic growth. Using a random-effects regression model with year dummies, I found that ethnic heterogeneity has a negative effect on growth, mainly by hampering efficiency improvement, but not capital accumulation. I interpret these results to imply that ethnic heterogeneity hinders cooperation and communication among individuals; however, cooperation and communication are important for technology diffusion as well. As a consequence, efficiency improvement is hampered, thereby impeding economic growth.

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Table 1 Random-effects estimates when ethnic polarization index is used (1965–1989)

	Growth	*Efficiency improvement*	*Capital accumulation*	*Technological progress*
	(1)	(2)	(3)	(4)
Ln(Output)	-0.002	-0.001	0.004	-0.0001
	(-0.72)-	(-0.84)-	(1.06)-	(-0.11)-
Ethnic polarization	-0.036***	-0.023***	-0.008	-0.0003
	(-4.51)	(-3.70)	(-1.33)	(-0.15)
Number of natural disasters	0.001**	0.001*	0.0003	0.0003***
	(2.22)	(1.70)	(1.07)	(2.60)
Government size	-0.001	0.0003	-0.0008**	-0.0001
	(-1.06)	(0.90)	(-2.39)	(-0.84)
Years of schooling	0.001	0.0001	-0.0001	0.0002
	(0.72)	(0.19)	(-0.06)	(0.54)
Constant	1.07***	1.01***	1.00***	1.00***
	(35.8)	(53.5)	(28.9)	(107.9)
Hausman test	11.2	28.1	24.6	6.57
	p-value=0.99	p-value=0.45	p-value=0.64	p-value=1.00
Groups	47	47	47	47
Observations	1121	1121	1121	1121

Note: Not reported here, year dummies are included in all estimations as independent variables. Numbers in parentheses are z statistics calculated based on the robust standard error clustered within a country. *, **, and *** indicate significance at the 10%, 5% and 1% levels, respectively.

Table 2 Random-effects estimates when ethnic fractionalization index is used (1965–1989)

	Growth (1)	*Efficiency improvement* (2)	*Capital accumulation* (3)	*Technological progress* (4)
Ln(Output)	-0.007**	-0.004*	0.003	-0.0003
	(-2.10)	(-1.87)	(0.70)	(-0.23)
Ethnic Fractionalization	-0.044***	-0.023***	-0.012	-0.001
	(-4.56)	(-3.16)	(-1.50)	(-0.46)
Number of natural disasters	0.001***	0.001***	0.0003	0.0003**
	(3.52)	(2.61)	(1.15)	(2.50)
Government size	-0.0004	0.0005	-0.0008**	-0.0001
	(-0.88)	(1.25)	(-2.39)	(-0.80)
Years of schooling	0.001	0.0002	-0.0001	0.0002
	(0.86)	(0.25)	(-0.07)	(0.56)
Constant	1.11***	1.03***	1.01***	1.00***
	(35.9)	(47.9)	(26.1)	(98.1)
Hausman test	8.99	28.1	28.8	5.97
	p-value=0.99	p-value=0.45	p-value=0.41	p-value=1.00
Groups	47	47	47	47
Observations	1121	1121	1121	1121

Note: Not reported here, year dummies are included in all estimations as independent variables. Numbers in parentheses are z statistics calculated based on the robust standard error clustered within a country. *, **, and *** indicate significance at the 10%, 5% and 1% levels, respectively.