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HOW ETHNIC DIVERSITY AFFECTS ECONOMIC DEVELOPMENT?

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HOW ETHNIC DIVERSITY AFFECTS ECONOMIC DEVELOPMENT?*

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Abstract

This paper investigates the empirical relationship between the two concepts of ethnicity and economic growth. Ethnicity is assumed to affect economic growth through a number of possible transmission channels that are generally included in cross-country growth regressions by proposing an extended econometric system of equations to describe growth and the channel variables. The system incorporates new channel variables for the potential indirect effects of ethnicity that are important in the process of economic development. The results, based on a sample of 95 countries for the period 1960-1999, suggest that the concept of ethnic fractionalization is a strong predictive measure for the direct effect of ethnicity on growth, whereas the concept of ethnic polarization has non-negligible indirect economic effects through the specified channel variables.

Keywords: ethnic diversity; fractionalization; polarization; transmission channels; economic growth

JEL classification: O11; O5

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1. Introduction

In recent years, there has been growing research interest in the relationship between ethnic fractionalization and economic growth. In a seminal paper, Easterly & Levine (1997) showed that the growth rate of GDP per capita is inversely related to the degree of ethnic fractionalization using the Soviet ethnic measure from *Atlas Narodov Mira*. They argued that the poor economic performance of most of the African countries is due partly to the large number of different ethnic groups living in the same country and partly to the absurd borders drawn by former colonial powers. However, when controlling for other factors—namely, human capital, political instability, and economic indicators—the effect of the ethnic fractionalization measure was weaker. This may have been due to the variables included in a standard growth regression acting as transmission channels for the indirect impact of ethnic fractionalization on economic growth.¹ This point raises the question of whether highly fractionalized societies suffer indirectly from poor government performance. Although Easterly & Levine (1997) addressed this important issue by means of ethnic fractionalization and government performance indicators, they also provided a regression of government performance indicators on the only explanatory variable, ethnic fractionalization. They concluded that ethnic fractionalization is indeed accompanied by low school attainment, financial depth, and infrastructure quality. Furthermore, they showed that ethnic fractionalization leads to higher market distortions, captured by the black market premium.

A more comprehensive analysis of ethnic fractionalization and the quality of government was carried out by La Porta et al. (1999). In their article, they investigated the influence of a broader set of possible determinants of the quality of good government performance. They argued that good economic institutions, especially those in the public sector, promote per capita GDP growth—for example, by limiting the private influence of the government and establishing an uncorrupt bureaucracy and legal system that protects property rights and enforces contracts. One of their main conclusions is that ethnic fractionalized societies exhibit inferior government performance. The findings in Collier (2001) also suggest that ethnically fractionalized societies suffer from bad public sector performance, which in turn

¹Nevertheless, Easterly & Levine (1997) used four additional measures of ethnolinguistic fractionalization to check whether their results depend on the particular choice of the ethnic measure. In contrast to the Soviet ethnic measure, three of the other four ethnic measures showed a strong direct link to growth, even when controlling for the entire set of available explanatory variables, suggesting that ethnic fractionalization may have a direct impact on growth, independent of public policy decisions.

reduces economic performance.

An updated analysis of the findings in Easterly & Levine (1997) was performed by Alesina et al. (2003), providing new, on a highly disaggregated level, measures of ethnic, linguistic, and religious fractionalization for about 190 countries. They criticize the widely used ethnolinguistic measure from *Atlas Narodov Mira* for its inability to distinguish between ethnic and linguistic differences. Such a distinction may well be unproblematic in African and European countries, where people identify themselves by both ethnic group and language: in these contexts, the two criteria coincide. This is not the case in Latin American countries, where people are more or less homogeneous in terms of language (e.g., Spanish or Portuguese) but distinct in terms of ethnic membership. Alesina et al. (2003) reran the regressions of Easterly & Levine (1997), but on their fractionalization measure *Ethnic*, which relies on ethnic distinctions rather than linguistic distinctions. As they controlled for variables that can be interpreted as channels through which ethnic fractionalization affects growth (for example schooling, government consumption, infrastructure quality, etc.), the magnitude of the ethnic effect vanished and became statistically insignificant, suggesting once again that ethnic fractionalization may affect economic performance indirectly through these channels. Besides the variable for market distortions, the authors found a statistically significant relationship between ethnic fractionalization and schooling, political instability, financial depth, the fiscal surplus to GDP ratio, and infrastructure quality using the same econometric specification as Easterly & Levine (1997). However, the lack of specified transmission channels leads to the conjecture that the estimated effect of ethnic fractionalization in each of the loosely specified transmission channels suffers from omitted variables bias. It is not clear precisely what the fractionalization measure captures when the transmission channels are not well specified. Furthermore, the authors failed to explain the importance of each of the transmission channels for the economic development of ethnically fractionalized countries.

Another strand of literature investigates ethnic violence, especially civil wars, and its detrimental effects on economic performance. Garcia-Montalvo & Reynal-Querol (2005b) stressed the importance of political instability on economic development when countries exhibit a high degree of potential ethnic conflict. The authors found that in heterogeneous societies, the diffusion of ideas is impeded, especially when the different ethnic groups are in conflict. In such environments of latent ethnic violence, business as usual is impossible because all levels of economic activity are affected. Empirical studies of this problem

by Collier (2001) and Garcia-Montalvo & Reynal-Querol (2005b) reported no positive relationship between ethnic fractionalization and the incidence of civil wars. Instead, they found that high ethnic fractionalization makes societies safer because the coordination costs are higher and because no one ethnic group is large enough to dominate the others. Garcia-Montalvo & Reynal-Querol (2005b) found that not ethnic fractionalization but rather polarization is one of the main factors affecting the incidence of civil wars. Unfortunately, a measure of ethnic fractionalization is unable to capture ethnic polarization across countries. As the authors stressed, there is less violence in highly homogeneous and highly fractionalized societies, and the incidence of civil wars is the highest in societies where the ruling ethnic group dominates a non-negligible minority. Such cases require a measure of polarization, rather than fractionalization, that captures the latent danger of ethnic conflicts. Easterly & Levine (1997) used a measure of ethnic fractionalization to investigate this issue, despite asserting the potential consequences of ethnic polarization on policies that affect growth.

Despite the fact that ethnicity may have strong indirect effects on economic growth, the above articles deal primarily with its direct empirical quantification. A first attempt to assess the quantitative importance of possible transmission channels by which ethnicity indirectly affects growth was made by Garcia-Montalvo & Reynal-Querol (2005a). They specified and estimated a comprehensive system of equations determining growth and possible transmission channels through which ethnic fractionalization and polarization may affect growth. They argued that ethnic polarization negatively affects growth because it reduces the rate of investment and increases public consumption and the incidence of civil wars. By contrast, their results suggest that ethnic fractionalization does not affect growth indirectly through these channels but rather directly, for example, by reducing the diffusion of ideas across the economy. These results are in contrast to the estimates of Easterly & Levine (1997) and Alesina et al. (2003), who find a negative association between ethnic *fractionalization* on the one hand and fiscal stance and political stability on the other.

The starting point of this paper are the empirical findings of indirect effects of ethnicity on economic development reported in Garcia-Montalvo & Reynal-Querol (2005a). Studies on the relationship between ethnicity and economic growth have shown the importance of focusing on the effects of channel variables that are also important explanatory variables in reduced-form growth regressions. This issue deserves closer examination, both with regard to the ethnic measures used and the endogenization of the relevant channels. Opening the

black box on how ethnicity affects economic growth can contribute a more thorough understanding of its costs and allow its direct and indirect effects to be distinguished from its economic and political outcomes. The narrow focus on direct effects of ethnicity on social or political outcomes neglects important indirect effects, as discussed above. As will be shown, ethnicity directly plays an important role in the social and political institutions that influence economic development. An analysis of the indirect economic effects must, in a first step, formulate sound hypotheses explaining why ethnicity should affect economic growth through an explicit channel. For instance, it has been argued that ethnically divided societies may breed ethnic hatred, and in the worst case, may end up in civil war. But civil wars hinder the economic development of countries. So far, the economics literature on the indirect effects of ethnicity has focused primarily on the channels of investment, government expenditure, and civil war. Further research is needed on the remaining channel variables in cross-country growth regressions. For example, how does ethnicity affect economic development through schooling, political instability, market distortions, foreign trade, and the fertility rate? All these variables are generally known to affect the long-run economic development of countries and therefore need closer examination with respect to the transmission mechanisms involved. The methodology chosen here is to specify all relevant channel variables that appear on the right-hand side of the growth equation. In this paper, a widely used specification for each channel variable is selected from the political science and economic literature. This will serve to assess the direct and indirect effects of ethnicity on economic growth for each of the channel variables and ethnic measures. The empirical analysis suggests that the concept of ethnic fractionalization is a strong predictive measure for the direct effect of ethnicity on economic growth, whereas the concept of ethnic polarization has strong predictive power for the indirect effects. Furthermore, test statistics for the nonlinear combinations of estimators using the delta method are provided. The delta method makes it possible to highlight the statistical significance of the indirect effects of ethnic fractionalization and polarization through the proposed transmission channels on growth, providing the asymptotic distribution of the nonlinear combinations of the estimated parameter values. Contrary to most studies on ethnicity and economic development, an updated data set for the period 1960-1999 is used. One possible advantage of using an updated data set is that it allows us to test whether the relationship between ethnicity and growth can be confirmed. Furthermore, the updated data set delivers more observations for the extended econometric system and hence will improve the efficiency of the parameter estimates. Section 2 describes possible transmission

channels through which ethnicity may indirectly influence growth, and more importantly, discusses potential reasons why ethnicity may be related to each of the channel variables. The specifications of these channels rely broadly on existing specifications in the economics and political science literature, the subject of Section 3. Furthermore, Section 3 provides a brief discussion of the underlying data sources and highlights the econometric methodology in quantifying the economic effects of ethnicity on growth. The empirical results are given in Section 4. Section 5 checks the robustness of the results and presents further insights into how ethnicity is assumed to affect economic growth. Section 6 concludes.

2. Ethnic Diversity and Growth: Transmission Channels

The empirical analysis is based on the findings of Garcia-Montalvo & Reynal-Querol (2005a) regarding the indirect effects of ethnicity on economic growth through the channels of investment, government expenditures, and civil war. This kind of econometric methodology is quite common in the economic and political science literature. For instance, Alesina & Perotti (1996) studied the effects of income distribution on investment, choosing political instability as the channel that links these two variables. Tavares & Wacziarg (2001) analyzed the indirect effects of democracy on economic growth through several transmission channels in the framework of a simultaneous equations model. Annett (2001) also used system estimates to study whether ethnic fractionalization leads to higher political instability, in turn increasing government consumption to appease conflicts between ethnic groups. The starting point of this analysis is therefore the assumption that ethnicity influences growth through a number of possible transmission channels, which are generally included in a standard growth equation. Despite the progress made in Garcia-Montalvo & Reynal-Querol (2005a), several important questions remain unresolved. For instance, the literature on ethnicity and economic growth has highlighted the detrimental effect of ethnicity on the level of schooling (see below), although no attempt has been made to include a fully specified channel for schooling in assessing the effect of ethnicity on economic growth. Furthermore, theoretical and empirical studies on the fertility rate have predicted that countries with higher fertility rates will have lower per capita income growth. Hence, an open question is whether ethnicity is linked to economic growth through the fertility channel. The economic and political science literature provides explicit specifications for each of the transmission channels. Therefore, in specifying each channel equation, it is possible to estimate a full econometric system to determine the direct and indirect effects of ethnicity on economic

growth. All channels used in the analysis are affected by ethnicity from a theoretical and empirical point of view.

In the following section, the transmission channels are discussed and explanations why these channels may be influenced by ethnicity are provided. The selection of the transmission channels relies heavily on economic or political indicators that have a strong empirical relationship to long-run economic growth and are widely used in cross-country growth regressions.

Investment

As Easterly & Levine (1997) have shown, ethnically fractionalized societies may suffer from rent-seeking behavior by different ethnic groups that have difficulties agreeing on public goods such as infrastructure, education, and good government policy. Furthermore, as emphasized by Garcia-Montalvo & Reynal-Querol (2005a), when a society is ethnically divided, tensions and other cleavages may emerge along different ethnic lines. This in turn would lead some individuals to devote their resources (time, labor, capital, etc.) to achieving political influence. These social costs, along with rent-seeking behavior, imply a non-productive use of inputs and may reduce investments in productive sectors and thus inhibit economic growth. As noted by Annett (2001), ethnically heterogeneous societies may be characterized by uncertain political environments, to which investment activities are sensitive.²

Civil War

The potential causes of ethnic civil wars have been analyzed extensively in Collier (2001), Reynal-Querol (2002) and Garcia-Montalvo & Reynal-Querol (2005b). Civil wars are accompanied by human capital destruction when the repression and killing of subversives who do not share their government's ideology causes people to flee into exile.³ If these refugees are highly educated, the outflow of human capital will be severe and will hamper the country's economic development. Furthermore, the traumatic events of civil wars may have lasting repercussions, requiring decades for social life to recover. Civil wars also lead to

²See, e.g., the findings in Barro (1991), Alesina & Perotti (1996), and Tavares & Wacziarg (2001).

³Collier (2001) argued that a large diaspora in Europe and America is able to finance rebel groups in their home countries out of solidarity to their people. Such outcomes can lead to long-term ethnic conflicts in the particular country, producing adverse effects on a wide range of social activities.

a destruction of physical capital and to lower investment ratios. The prevailing atmosphere of uncertainty and risk may discourage investment in both physical and human capital accumulation, factors that are crucial for economic development. As mentioned by Collier (2001), ethnically polarized societies may lead to dysfunctional politics—of which civil wars may be viewed as the extreme manifestation—if the different groups do not find cooperative agreements. Ethnically divided societies are therefore more prone to ethnic violence, riots, and civil wars.⁴ However, the question remains why some ethnically divided countries have experienced civil wars and others have not. Kanbur et al. (2011) argued that the potential consequences of ethnic cleavages are mediated by the kind of state, political, and civil institutions. Ethnically based politics in polarized societies may lead to riots, which, in the worst case, may end in ethnic civil wars. Political and economic factors in ethnically divided countries, especially poor and nondemocratic ones, can shape the identity of a particular group and cause ethnic hatred.⁵

Human Capital

The provision of public goods like education in ethnic diversified countries are often not neutral but may be strategically designed to establish the state's authority over a population.⁶ However, the question arises whether ethnically diversified societies have lower schooling levels due to this non-neutral provision of education. Easterly & Levine (1997) noted that public goods like education may bring less satisfaction to everyone in a society when the country is highly ethnically fractionalized because of disagreements between ethnic groups on issues like the language of instruction, the learning content, location, etc. This may lead the society to invest less in human capital.

An anthropological perspective on lower school performance in ethnically divided societies is

⁴Vanhanen (1999) gave an overarching explanation of why so many conflicts take place along ethnic lines: He argues that a society's evolved predisposition to ethnic nepotism will lead people to seek influence allowing them to control the political situation for their own benefit. In this sense, Vanhanen (1999) noted that "the members of an ethnic group tend to favour their group members over non-members because they are more related to their group than to the remainder of the population." Such a tendency toward ethnic nepotism eventually ends in ethnic struggle when the members of an ethnic group tend to support one another in situations of conflict.

⁵Collier (2001) argued that outbreaks of secessionist movements in polarized societies increase when natural resources are discovered.

⁶Kanbur et al. (2011).

formulated in Ogbu's cultural-ecological theory of minority school performance.⁷ The theory states that differences in school performance in ethnically divided societies may be caused by the treatment of minority groups, both in society at large and in the school system, as well as by the minorities' own perceptions and responses to school resulting from their treatment. Ogbu & Simons (1998) argue that in the case of involuntary minorities⁸, their long experience of discrimination, racism, and conflict leads them to distrust institutions of the ruling ethnic group. Schools in particular are treated with suspicion because the minorities believe that the public schools will not educate their children as they do children from the ruling ethnic group. Societal discrimination against minority groups (e.g., denigration of the minority culture and language, social and residential segregation, etc.) discourage them from investing in schooling because of the perceived lower rewards of employment and wages for educational accomplishments. The perception that they are forced to adopt the attitudes of the ruling ethnic group (in terms of culture and language) and abandon their own identity in order to achieve social success places minority groups in an ambivalent situation. On the one hand, they perceive education as important in gaining occupational opportunities. On the other, they interpret their cultural and language differences as markers of collective identity that should be maintained rather than barriers to be overcome. These ambivalent feelings lead minorities to reduce their efforts in schooling.

Government Expenditures

Easterly & Levine (1997) emphasized that public goods provision in ethnically fractionalized societies with high rent-seeking behavior favor only the leading ethnic group. La Porta et al. (1999) argued that the adverse effects of ethnic fractionalization on growth through government consumption result from the fact that ethnic heterogeneity captures to some degree the predisposition of ethnic groups in power to redistribute wealth. Annett (2001) analyzed the relationship between the degree of ethnic fractionalization and both political instability and government consumption using a neoclassical growth model. His main hypothesis was that ethnic fractionalization inherently leads to higher levels of political instability and that this imposes a political cost on the government, which risks being overthrown and losing any rents from holding power. The government is forced to use

⁷See Ogbu & Simons (1998) for an overview.

⁸Involuntary minorities are people who have been conquered, colonized, or enslaved. Unlike immigrant groups, involuntary minorities are seen to be part of the ruling majority group against their will.

government expenditures to appease the competing groups and mitigate the latent danger of ethnic conflicts in order to reduce political instability and the resulting danger being overthrown.

Political Instability

Ethnic politics are more likely in societies divided along ethnic lines.⁹ Alesina & La Ferrara (2005) emphasized that in ethnically divided countries, dictators use ethnic hatred to mobilize support for one group over others in repressing ethnic conflict. La Porta et al. (1999) argued that in ethnically divided societies, it is common for the groups that come to power to create government policies that expropriate (or kill) the ethnic losers, restrict their freedom to organize opposition, and limit the rights of ethnic groups outside the ruling group to consume public goods. Therefore, as ethnic heterogeneity increases, government policies become less politically free, which may end in politically unstable situations. When countries are strongly divided along ethnic lines, they are likely to experience situations of political violence and are prone to frequent breakdowns of law and order (Annett, 2001). Moreover, Easterly & Levine (1997) argued that the politically unstable environment in ethnically fractionalized countries provide evidence of strong rent-seeking behavior and the inability to find cooperative agreements on the provision of public goods.

Market Distortions

La Porta et al. (1999) stressed that ethnically fractionalized societies are associated with less political freedom (e.g., less democracy) with the consequence that autocratic regimes may use their power more arbitrarily. Moreover, ethnically fractionalized societies may produce situations of uncoordinated government ministries, each pursuing its own rent-seeking strategy without taking into account the effect of its actions on others' rents (Easterly & Levine, 1997). For example, an overvalued official exchange rate and strict exchange rate controls benefit those in power who resell foreign currency on the black market. Furthermore, as Easterly & Levine (1997) argued, an overvalued official exchange rate creates incentives to invest domestic capital abroad because of the fear of devaluation. Therefore, it seems reasonable whether ethnically diversified countries also suffer from negative economic policy outcomes.

⁹See, e.g., La Porta et al. (1999), Collier (2001), and Alesina & Zhuravskaya (2011).

Trade Openness

A series of studies by Alesina & Spolaore (1997), Alesina & Wacziarg (1998), and Alesina, Spolaore & Wacziarg (2000) emphasize the determinants of the number and size of countries. The argument is that country size emerges from a trade-off between economies of scale in supplying public goods in large countries and the costs of ethnic and cultural heterogeneity, which may increase with the size of countries.¹⁰ According to their findings, in a world of free international trade, the size of a country does not determine the size of the market. Therefore, small and homogeneous countries can benefit from free trade without sharing public policies over which they differ in opinion (Alesina & La Ferrara, 2005). But, conditional on these determinants, some ethnic diversity in a country may be beneficial to international trade because of the existence of transnational ethnic or cultural networks (See, e.g., the findings in Rauch, 2001). This implies that, conditional on the size of the country (which is negatively associated with trade openness), more ethnic diversity would lead to higher integration into the world market.

Fertility

Recent studies provide evidence that a large proportion of variation in cross-country fertility and female labor force participation can be explained by cultural norms and beliefs.¹¹ Fernandez & Fogli (2009) argued that a woman's heritage influences her work and fertility outcomes because different countries pursue different norms and beliefs, which can be seen as different cultures, about the appropriate role of women in society, how much they should work when married, and what constitutes an ideal family size. The authors showed that, even when controlling for various characteristics of women (age, education, wealth, etc.), there remains a statistically significant effect of culture on women's work and fertility choices. The measures of ethnic diversity capture, to some extent, the degree of cultural diversity in a country.¹² The implication is that the cross-country differences in cultures captured by our ethnic measures should explain differences in the net fertility rates across countries.

¹⁰See also Alesina & Spolaore (1997), and Alesina & Wacziarg (1998).

¹¹See, e.g., Fernandez & Fogli (2006), who find that variation in fertility rates among U.S. immigrants from different ethnic backgrounds can be explained by the total fertility rate of the women's country of origin as a proxy for culture. See also Fernandez (2007) for evidence on female labor force participation.

¹²See, e.g., Fearon (2003).

3. Data and Estimation

The data set used for the empirical study is an updated version of the well-known Barro-Lee data set and consists of 95 countries with a total sum of 555 observations for the period 1960-1999. Because of the extended seemingly unrelated regression (SUR) model, the updated data set will deliver more observations and hence will improve the efficiency of the parameter estimates. *Table A3* gives a brief overview of the countries included and their corresponding values for ethnic fractionalization and polarization taken from Garcia-Montalvo & Reynal-Querol (2005b). Additional information regarding the definitions and sources of the variables used are given in *Table A8* in the appendix.

The empirical analysis consists of the following Barro-type growth regression¹³:

$$GROWTH_{it} = \alpha^{GR} + \beta_1^{GR} \times LNRGDPCH_{it} + \beta_2^{GR} \times LNRGDPCHSQ_{it} + \mathbf{TC}'_{it}\gamma^{GR} + \mathbf{X}'_{it}\theta^{GR} + u_{it}^{GR} \quad (1)$$

where $GROWTH_{it}$ (GR) is the growth rate of real per capita GDP of country i from 1960-1999 averaged in five-year periods ($t = 1960 - 64, 1965 - 69, etc.$), $LNRGDPCH$ is the log of real GDP per capita at the beginning of every five year period and $LNRGDPCHSQ$ is $LNRGDPCH$ squared.¹⁴ The vector \mathbf{TC} is a set of values for the transmission channels. These are, for example, the share of real investment to GDP (*Investment*), a measure for the political situation in countries proposed by the Barro-Lee data set (*Instability*), the ratio of real government consumption expenditure net of spending on defense and on education to real GDP (*Government*). The parameter vector γ^{GR} refers to the coefficients of the transmission channels in the growth equation. For example, the parameter γ_{INV}^{GR} measures the *direct* effect of the investment ratio on the growth rate of real GDP per capita. The vector \mathbf{x} incorporates other control variables that do not belong to the transmission channels. These are, e.g., regional dummies for East Asian (*asiae*), Sub-Saharan African (*safrica*) and Latin American (*laam*) countries, the number of political assassinations per million population per year (*assassp*),

¹³The growth equation is very similar to that of Barro (1991). This specification is the widely used form for cross-country growth analysis. Furthermore, it follows the argument of Garcia-Montalvo & Reynal-Querol (2005a) in choosing the most common specifications for the growth equation and for each of the transmission channels to avoid "variables fishing".

¹⁴The inclusion of the square of log real GDP per capita in the growth equation incorporates the possibility that the rate of convergence depends on the level of GDP per capita. A positive coefficient on $LNRGDPCH$ and a negative coefficient on $LNRGDPCHSQ$ indicates that the convergence rate is a concave function of real GDP per capita. Thus, initial real per capita income that maximizes the catch-up effect lies around $\exp\left(\frac{\beta_1^{GR}}{-2\beta_2^{GR}}\right)$.

the percentage of secondary (SEC) and primary school enrollment (PRI), as well as the absolute value (PISH) and deviation (PPDEV) of the PPP value for investment goods. Both PISH and PPDEV capture market distortions for capital goods to some extent and therefore the consequences on growth.¹⁵ Garcia-Montalvo & Reynal-Querol (2005a) add to this basic growth regression the incidence of civil wars (*Civil War*), ethnic (religious) fractionalization (FRAC), and ethnic (religious) polarization (POL). Note that they only incorporate the variables for *Civil War*, *Investment*, and *Government* as fully specified transmission channels into their SUR system. Using the specification of Garcia-Montalvo & Reynal-Querol (2005a) two more transmission channels proposed by Tavares & Wacziarg (2001) are included in the system. These are the share of imports and exports to GDP (*Trade Openness*) to measure the effect of trade intensity on growth and a measure of government-induced distortions captured by the black market premium (*Market Distortions*). Furthermore, the log of (1+ average schooling years in the total population over 25) is used as a proxy for human capital accumulation (*Human Capital*) instead of the two variables (SEC) and (PRI), where the specification of this channel comes from Tavares & Wacziarg (2001). Furthermore, a full specification for the transmission channel *Political Instability* is included, which is measured as the number of political assassinations per million population and revolutions per year¹⁶ and a transmission channel for the net fertility rate (*Fertility*). The vector for the transmission channel therefore consists of the following eight transmission variables $\mathbf{TC}_{it} = (INV, CW, HC, GOV, INS, DIST, OPEN, FERT)'_{it}$, where *INV*, *CW*, *HC*, *GOV*, *INS*, *DIST*, *OPEN*, and *FERT* refers to the transmission channels *Investment*, *Civil War*, *Human Capital*, *Government Consumption*, *Political Instability*, *Market Distortions*, *Trade Openness* and the net *Fertility* rate. In every equation, the initial value of the log of real GDP per capita is included to control how poor the countries are. Then a measure of ethnic fractionalization and polarization is included separately in each structural equation to assess the direct and indirect effects on growth. For completeness, the base specification used for each transmission channel with the underlying source is given in the following:

¹⁵See Barro (1991).

¹⁶This is the definition of political instability used in the Barro-Lee data set. Because the transmission channel for *Political Instability* incorporates the variable *assassp*, the latter is dropped in every structural equation in which it appears with the *Political Instability* measure to avoid collinearity problems. In addition, the variable PPDEV in the growth equation is excluded because it appears to be statistically insignificant. The growth equation therefore consists (besides the intercept, regional dummies, and income variables) only of the variables for the transmission channels.

The transmission channel for *Investment* for each time period and country is similar to the specification in Garcia-Montalvo & Reynal-Querol (2005a), where the variables for revolutions, coups and political assassinations per year are replaced by a measure for *Political Instability* introduced above:

$$\begin{aligned} INV_{it} &= \alpha^{INV} + \beta_1^{INV} \times LNRGDPCH_{it} + \mathbf{TC}'_{it} \gamma^{INV} + \theta_1^{INV} \times PPDEV_{it} + \theta_2^{INV} \times PISH_{it} \\ &+ \phi_{FRAC}^{INV} \times ETHFRAC_i + \phi_{POL}^{INV} \times ETHPOL_i + u_{it}^{INV}, \end{aligned} \quad (2)$$

where $\gamma^{INV} = (0, \gamma_{CW}^{INV}, \gamma_{HC}^{INV}, \gamma_{GOV}^{INV}, \gamma_{INS}^{INV}, 0, 0, 0)'$. Notice, that the form of γ^{INV} indicates that the investment channel does not incorporate the variables *DIST*, *OPEN*, and *FERT* as explanatory variables.

To incorporate the potential effects of ethnic civil wars on growth, the linear probability model in Garcia-Montalvo & Reynal-Querol (2005a) for the incidence of civil wars is used:

$$\begin{aligned} CW_{it} &= \alpha^{CW} + \beta_1^{CW} \times LNRGDPCH_{it} + \theta_1^{CW} \times safrica + \theta_2^{CW} \times laam + \theta_3^{CW} \times asiae + \theta_4^{CW} \times LNPOP_{it} \\ &+ \theta_5^{CW} \times DEMP4_{it} + \phi_{FRAC}^{CW} \times ETHFRAC_i + \phi_{POL}^{CW} \times ETHPOL_i + u_{it}^{CW}. \end{aligned} \quad (3)$$

The main specification for the transmission channel *Human Capital* comes from Tavares & Wacziarg (2001):

$$\begin{aligned} HC_{it} &= \alpha^{HC} + \beta_1^{HC} \times LNRGDPCH_{it} + \mathbf{TC}'_{it} \gamma^{HC} + \theta_1^{HC} \times DEMP4_{it} + \theta_2^{HC} \times evercol + \theta_3^{HC} \times muslim \\ &+ \theta_4^{HC} \times confu + \theta_5^{HC} \times catho + \theta_6^{HC} \times othchri + \phi_{FRAC}^{HC} \times ETHFRAC_i + \phi_{POL}^{HC} \times ETHPOL_i + u_{it}^{HC}, \end{aligned} \quad (4)$$

where $\gamma^{HC} = (0, 0, 0, \gamma_{GOV}^{HC}, 0, 0, \gamma_{OPEN}^{HC}, 0)'$.

The transmission channel for *Government Consumption* is a slightly modified version of that in Garcia-Montalvo & Reynal-Querol (2005a), in the sense that it controls for the transmission channel *Political Instability*. This choice was made based on the empirical findings in Annett (2001), which reveal that political instability is also a channel by which ethnicity affects government consumption:

$$\begin{aligned} GOV_{it} &= \alpha^{GOV} + \beta_1^{GOV} \times LNRGDPCH_{it} + \mathbf{TC}'_{it} \gamma^{GOV} + \theta_1^{GOV} \times DEMP4_{it} \\ &+ \phi_{FRAC}^{GOV} \times ETHFRAC_i + \phi_{POL}^{GOV} \times ETHPOL_i + u_{it}^{GOV}, \end{aligned} \quad (5)$$

where $\gamma^{GOV} = (0, \gamma_{CW}^{GOV}, 0, 0, \gamma_{INS}^{GOV}, 0, 0, 0)'$.

The empirical specification for *Political Instability* comes from Tavares & Wacziarg (2001):

$$\begin{aligned} INS_{it} &= \alpha^{INS} + \beta_1^{INS} \times LNRGDPCH_{it} + \mathbf{TC}'_{it} \gamma^{INS} + \theta_1^{INS} \times LNPOP_{it} + \theta_2^{INS} \times DEMP4_{it} \\ &+ \theta_3^{INS} \times evercol + \theta_4^{INS} \times postwar + \theta_5^{INS} \times island + \theta_6^{INS} \times landlock \\ &+ \phi_{FRAC}^{INS} \times ETHFRAC_i + \phi_{POL}^{INS} \times ETHPOL_i + u_{it}^{INS}, \end{aligned} \quad (6)$$

where $\gamma^{INS} = (0, 0, 0, \gamma_{GOV}^{INS}, 0, 0, 0, 0)'$.

In addition, the contribution in Tavares & Wacziarg (2001) also delivers an empirical specification for the transmission channel *Market Distortions*:

$$\begin{aligned} DIST_{it} = & \alpha^{DIST} + \beta_1^{DIST} \times LNRGDPCH_{it} + \mathbf{TC}'_{it} \gamma^{DIST} + \theta_1^{DIST} \times DEMP4_{it} + \theta_2^{DIST} \times evercol \\ & + \theta_3^{DIST} \times muslim + \theta_4^{DIST} \times confu + \theta_5^{DIST} \times catho + \theta_6^{DIST} \times othchri + \theta_7^{DIST} \times postwar \\ & + \phi_{FRAC}^{DIST} \times ETHFRAC_i + \phi_{POL}^{DIST} \times ETHPOL_i + u_{it}^{DIST}, \end{aligned} \quad (7)$$

where $\gamma^{DIST} = (0, 0, \gamma_{HC}^{DIST}, \gamma_{GOV}^{DIST}, \gamma_{INS}^{DIST}, 0, \gamma_{OPEN}^{DIST}, 0)'$.

The transmission equation for *Trade Openness* incorporates mainly gravity variables, for example, country land area, landlocked country dummy, island dummy, oil exporter dummy, and a variable to incorporate the effects of terms of trade shocks:¹⁷

$$\begin{aligned} OPEN_{it} = & \alpha^{OPEN} + \beta_1^{OPEN} \times LNRGDPCH_{it} + \mathbf{TC}'_{it} \gamma^{OPEN} + \theta_1^{OPEN} \times LNPOP_{it} + \theta_2^{OPEN} \times DEMP4_{it} \\ & + \theta_3^{OPEN} \times postwar + \theta_4^{OPEN} \times island + \theta_5^{OPEN} \times landlock + \theta_6^{OPEN} \times LNAREA_i + \theta_7^{OPEN} \times TOT_{it} \\ & + \theta_8^{OPEN} \times oilcum + \phi_{FRAC}^{OPEN} \times ETHFRAC_i + \phi_{POL}^{OPEN} \times ETHPOL_i + u_{it}^{OPEN}, \end{aligned} \quad (8)$$

where $\gamma^{OPEN} = (0, 0, 0, \gamma_{GOV}^{OPEN}, 0, 0, 0, 0)'$.

The specification for the transmission channel *Fertility* comes from Barro (1991) with important determinants such as per capita income and schooling level:

$$\begin{aligned} FERT_{it} = & \alpha^{FERT} + \beta_1^{FERT} \times LNRGDPCH_{it} + \mathbf{TC}'_{it} \gamma^{FERT} + \theta_1^{FERT} \times PPDEV_{it} + \theta_2^{FERT} \times MORT04_{it} \\ & + \phi_{FRAC}^{FERT} \times ETHFRAC_i + \phi_{POL}^{FERT} \times ETHPOL_i + u_{it}^{FERT}, \end{aligned} \quad (9)$$

where $\gamma^{FERT} = (0, 0, \gamma_{HC}^{FERT}, \gamma_{GOV}^{FERT}, \gamma_{INS}^{FERT}, 0, 0, 0)'$.

The econometric methodology used to highlight the transmission effects of ethnicity on growth is based on panel data and SUR estimation procedures. The model consists of the nine structural equations (1)-(9), that is, one cross-country growth equation and eight structural transmission equations, each describing one of the channel variables introduced above. Each of the $M = 9$ relationships can be formulated for each of $T = 8$ time periods. The parameters of interest are the coefficients that describe the effect of a marginal change in the ethnic

¹⁷The specification for the *Openness* equation is similar to that in Tavares & Wacziarg (2001) with the exception that it dispenses with the variable measuring the distance from major trading partners. This variable is not available for many African countries and therefore leads to a reduction in sample size. A robustness check on the same observations shows that the results are not sensitive to the exclusion/inclusion of this variable.

fractionalization or polarization index, where ethnic fractionalization or polarization affects growth through the specified channel equations. To estimate the *indirect* effect of ethnic fractionalization or polarization through the transmission channels under consideration, the coefficient for *ETHFRAC* or *ETHPOL* in each transmission channel is multiplied by the coefficient of each channel in the growth equation. The standard deviation for this nonlinear combination of estimators is then based on the delta method. The SUR estimator used is different from ordinary least squares, particularly if each structural equation consists of a different set of exogenous variables.¹⁸ All equations are linked by their disturbances. This implies that for a particular country and time, all structural equations regarding growth, investment, education, etc. are linked by their disturbances. The intuition behind SUR estimation is that the disturbances in each structural equation include factors that are common to all other structural variables in a particular country: that is, worldwide aggregate demand shocks, wars, the general health status of the economy¹⁹, etc. are factors that affect every structural equation. Although the SUR estimator is superior to ordinary least squares in efficiency, it neglects the possibility of simultaneous equations bias arising when some of the endogenous variables appearing on the right-hand side of each structural equation are correlated with the disturbance term. It therefore seems reasonable to instrument the possible endogenous variables using adequate instrumental variables (IV) and to estimate the full system using Three Stage Least Squares (TSLS), which is an IV-GLS estimator. Despite the efficiency and consistency gains that result from using TSLS, any specification error in the structure of each structural equation of the model will be transmitted throughout the system. As mentioned by Garcia-Montalvo & Reynal-Querol (2005a), the SUR estimator has the advantage that it is potentially less sensitive to specification errors than the TSLS estimator.

4. Ethnic Diversity, Economic Performance and Growth

Table A4 in the appendix shows the system estimate of the base specification including the measure for ethnic fractionalization (*ETHFRAC*). As can be seen, the estimated coefficients for each channel have the expected signs. For example, a higher investment ratio is positively correlated with real GDP per capita growth, whereas higher government consumption, political instability, and the net fertility rate show a negative association with economic growth.²⁰

¹⁸See Zellner (1962).

¹⁹See Greene (2008, p. 252).

²⁰The lack of statistical significance of schooling with economic growth is quite common in empirical growth

The coefficients on $LNRGDPCH$ and $LNRGDPCHSQ$ imply that the convergence rate is the highest for countries with a per capita income level of about \$1,687. Africa's average initial per capita income averaged from 1960-1999 is \$1,875. Therefore, Sub-Saharan African countries on average have already experienced the maximum catch-up effect. Notice that the effect of *Civil War* is not statistically significant at the 10% level due to possible collinearity problems in the proxy for *Political Instability*.²¹ The empirical findings for the channel equations are in line with existing results in the economic and political science literature. For example, the results for the *Investment* channel suggest that countries with higher log initial income and schooling levels also will have higher investment ratios (Barro, 1991). On the other hand, factors like civil wars, political instability, and market distortions on capital goods are negatively associated with physical capital accumulation. Therefore, as stated above, countries with an uncertain economic environment also have on average lower investment ratios and hence real per capita income growth. Proceeding in the same way for the *Fertility* channel, countries with higher schooling levels also have lower net fertility rates and therefore, indirectly, higher real per capita income growth (Barro, 1991). Furthermore, the results for the *Openness* channel are in line with the findings in Alesina & Wacziarg (1998), where country size is very significantly related to the degree of trade openness. The empirical results reveal that ethnic fractionalization has a negative *direct* association with real per capita GDP growth. This finding confirms the empirical results in Easterly & Levine (1997), Alesina et al. (2003), Garcia-Montalvo & Reynal-Querol (2005a), among others. As predicted by cultural theories of fertility rate differences, ethnically fractionalized countries seem to have on average higher net fertility rates, also controlling for socio-economic factors such as per capita income and schooling levels in the particular country. The results of the growth equation state that going from perfect homogeneity to perfect heterogeneity, a fully fractionalized society (i.e., Tanzania) has a 1.06% lower growth rate per year on average regressions and may be attributed to a variety of causes. One explanation may be measurement error in the education data (Krueger & Lindahl, 2001) or the influence of unrepresentative outliers (Temple, 1999). On the other hand, as Krueger & Lindahl (2001) noted, if one controls for the growth of capital, there is little or no signal in the schooling data to explain economic growth. Nevertheless, the lack of a positive relationship between schooling and economic growth does not mean that schooling is not important for the economic development of countries. As will be shown, schooling is positively related to physical capital accumulation and hence, indirectly, to growth.

²¹Section 5 will check the sensitivity of this result by excluding *Political Instability* from the base specification.

than a fully homogeneous society (i.e., South Korea). The following *Table 1* shows the indirect effects as well as the total effect going from full ethnic homogeneity (an index of 0) to full ethnic heterogeneity (an index of 1), for example, by redrawing the borders.

Table 1. How ETHFRAC affects growth.

Channel	Effect of ETHFRAC on the channel		Effect of the channel on growth		Effect of ETHFRAC on growth	
Investment	-0.0152	(1.13)	0.0887***	(5.72)	-0.0014	(1.10)
Civil war	0.0761	(1.16)	-0.0058	(1.53)	-0.0004	(0.92)
Human capital	-0.0193	(0.36)	0.0001	(0.04)	-0.0000	(0.04)
Government	0.0014	(0.10)	-0.0277*	(1.77)	-0.0000	(0.10)
Instability	0.0663	(0.78)	-0.0049*	(1.76)	-0.0003	(0.71)
Distortions	0.1320	(0.52)	-0.0015	(1.64)	-0.0002	(0.50)
Openness	0.1410*	(1.79)	0.0040	(1.39)	0.0006	(1.09)
Fertility	0.4109**	(2.43)	-0.0051***	(3.89)	-0.0021**	(2.06)
Total indirect effect	-	-	-	-	-0.0039*	(1.91)
Total effect	-	-	-	-	-0.0145***	(2.59)
<i>N</i>	-	-	-	-	555	

Notes: The second column shows the effect of ethnic fractionalization on the transmission channels. The third column corresponds to the channel effects on growth. The fourth column presents the product of the two coefficients. Absolute *t*-statistics in parentheses based on heteroskedasticity-consistent (robust) standard errors. Absolute *t*-statistics for the products of the two coefficients in column four based on the delta method.

*: Significant at the 10% level.

**: Significant at the 5% level.

***: Significant at the 1% level.

The estimates suggest that a change in ethnic fractionalization from 0 to 1 is accompanied by a 0.21% reduction in real per capita income growth through the transmission channel *Fertility* alone. The total *indirect* effect of ethnic fractionalization through the transmission channels on growth is small (-0.39%) compared to the total *direct* effect of -1.06%. The other transmission channels are not important for the effect of ethnic fractionalization on economic growth. In the case of the *Investment* channel, this does not mean that physical capital accumulation is not important for growth, but rather that this channel is not significantly affected by ethnic fractionalization. Alternatively, a one standard deviation change of *ETHFRAC* (0.28), would bring about a 0.41% decrease in real per capita income growth per year. The estimated effect is statistically significant at the 1% level and economically notable. Furthermore, if Cameroon (0.82) had the same ethnic fractionalization as Botswana²² (0.48) its per capita income growth rate would be 0.49% higher. Taken literally, a 0.49% higher per capita GDP growth rate would result in about 5.0% higher real per capita income

²²Botswana is an African success story, with average growth rates in per capita income of about 6.38% for the 1970-1999 period and is, by African standards, ethnically homogeneous. In contrast, Cameroon experienced a low growth rate of about 0.85% during the same period.

level after ten years.

Table A5 shows the empirical results including the measure for ethnic polarization in the base specification. The results are robust to the inclusion of *ETHPOL*, but the statistical significance of the transmission coefficients in the growth equation increases. Ethnic polarization has virtually no direct association with real per capita income growth. In contrast, there seem to be substantial *indirect* effects through the channels *Investment*, *Civil War*, *Human Capital*, *Government Consumption*, *Political Instability*, and the net *Fertility* rate. Interpreting the channel equation *Civil War*, note first that the linear probability model is somewhat inappropriate because it does not restrict the probabilities between zero and one. Especially the R^2 cannot be interpreted in the usual form when the dependent variable is binary and the explanatory variables are measured continuously (as is the case here). Apart from this shortcoming, a huge advantage of the linear probability model is its direct interpretation of the estimated coefficients. Taken literally, going from full to zero ethnic polarization decreases the incidence of a civil war by about 23%. The remaining coefficients are also of the expected signs: Higher opportunity costs in terms of initial per capita income lowers the probability of a civil war, whereas a higher population increases the probability of a civil war because of the huge pool available to rebel groups in such situations to recruit insurgents. Furthermore, a country with a high population is more difficult to govern and control than a small one. In addition, the coefficient on the democracy variable is positive but statistically insignificant. This result is not surprising if one takes into account that the dummy variable used for democracy also incorporates democracies classified as intermediate, which seems to increase the risk of ethnic conflicts. For example, ethnically divided democracies in which ethnic parties that fail to reach a given threshold in general elections are likely to fall into violent ethnic conflicts outside of party politics.²³ The following Table 2 shows the quantitative magnitudes going from zero polarization (an index of 0) to complete polarization (an index of 1). The total effect of *ETHPOL* on growth is 1.51% and statistically significant at the 1% level. The estimated magnitude is quite similar to that of *ETHFRAC*, but there are qualitative differences. Ethnic polarization primarily affects growth *indirectly* through the channels *Investment*, *Political Instability* and *Fertility*. There is also weak evidence that *ETHPOL* negatively affects growth through the transmission channels *Civil War*

²³It remains an interesting question whether democratic institutions lower the incidence of violent ethnic conflicts or help to institutionalize them in nonviolent form, in the sense that these conflicts take on political importance (see also Vanhanen (1999) and the references therein).

Table 2. How ETHPOL affects growth.

Channel	Effect of ETHPOL on the channel		Effect of the channel on growth		Effect of ETHPOL on growth	
Investment	-0.0295**	(2.15)	0.0881***	(5.66)	-0.0026**	(2.01)
Civil war	0.2293***	(3.69)	-0.0060	(1.55)	-0.0014	(1.43)
Human capital	-0.1203**	(2.22)	0.0004	(0.11)	-0.0000	(0.11)
Government	0.0376***	(2.71)	-0.0293*	(1.86)	-0.0011	(1.54)
Instability	0.2632***	(3.11)	-0.0054*	(1.95)	-0.0014*	(1.65)
Distortions	-0.2378	(0.94)	-0.0016*	(1.74)	0.0004	(0.82)
Openness	0.1025	(1.41)	0.0052*	(1.80)	0.0005	(1.11)
Fertility	1.0354***	(6.28)	-0.0053***	(3.96)	-0.0055***	(3.35)
Total indirect effect	-	-	-	-	-0.0111***	(4.20)
Total effect	-	-	-	-	-0.0151***	(2.73)
<i>N</i>	-	-	-	-	555	

Notes: The second column shows the effect of ethnic polarization on the transmission channels. The third column corresponds to the channel effects on growth. The fourth column presents the product of the two coefficients. Absolute *t*-statistics between parenthesis based on heteroskedasticity-consistent (robust) standard errors. Absolute *t*-statistics for the products of the two coefficients in column four based on the delta method.

*: Significant at the 10% level.

**: Significant at the 5% level.

***: Significant at the 1% level.

and *Government Consumption*. The total *indirect* effect of *ETHPOL* is about 1.11% and significant at the 1% level, whereas the *direct* effect of 0.40% is not statistically significant. Alternatively, a one standard deviation change of *ETHPOL* (0.24) is accompanied by about 0.36% decrease of real GDP per capita growth per year. The estimates suggest that if South Africa (0.72) had the same polarization index as South Korea (0.03), its per capita income growth per year would be about 1% higher. This growth difference is non-negligible and would result in a 10% higher real per capita income level after ten years.

The comparison of both concepts of ethnicity leads to qualitatively different conclusions. Ethnic fractionalization primarily affects economic development *directly*, whereas ethnic polarization has substantial *indirect* effects through the channels mentioned. Therefore, as also emphasized by Garcia-Montalvo & Reynal-Querol (2005a), there seems to be no empirical evidence that ethnic fractionalization affects growth primarily through the specified transmission channels. Ethnically fractionalized societies seem not to have worse public good performance than ethnically homogeneous societies. Furthermore, the extended SUR model gives evidence that the additional channels, namely *Openness* and *Fertility* for *ETHFRAC*, and *Human Capital*, *Political Instability* and *Fertility* for *ETHPOL* are important channels of indirect effects of ethnicity on the economic development of countries.

5. Sensitivity Analysis

The benchmark results regarding ethnic fractionalization and polarization may be sensitive to time and region effects, to the elimination of per capita income, to the specification of the benchmark model and to the sample coverage. In this section, the robustness of the results to several modifications of the benchmark model is examined. For ease of comparison, only the results in the growth equation and the coefficient for *ETHFRAC* or *ETHPOL* in each channel equation as shown in *Table A6* and *A7* are reported.²⁴

Table A6 and *A7* presents the results for ethnic fractionalization as well as polarization for several modifications. The second column corresponds to the benchmark results shown above and is given for comparison purposes. The third column shows the estimated effect of the ethnic variable, when the intercepts of each structural equation are allowed to vary over time. The fourth column allows for regional dummies in each channel equation, whereas column five allows for time and region effects in each equation. The direct effect of *ETHFRAC* is very robust to these modifications. The magnitude of *ETHFRAC* on growth virtually remains unchanged. On the other hand, *ETHPOL* retains its insignificant direct effect on economic growth but shows a strong association with the channel variables.

The benchmark specification includes per capita income in each channel equation to control how poor each country is. Since ethnic fractionalization and initial per capita income are negatively correlated (-0.51), it may be hard to disentangle the indirect effects of *ETHFRAC* from the income effects. La Porta et al. (1999) argued that if ethnic fractionalization undermines government performance, and poor government performance reduces per capita income, then including per capita income together with variables of ethnicity in the same regression would reduce the estimated effect of ethnic fractionalization on the dependent variable. Therefore, for illustrative purposes, initial per capita income is excluded from every channel equation. The above indications would lead one to expect an overall rise in the statistical significance of ethnic fractionalization in each channel equation. Indeed, the effect of *ETHFRAC* through the channels *Investment*, *Civil War*, *Human Capital*, and *Government Consumption* changes substantially and becomes statistical significant at the 5% level. However, it remains interesting to test whether this result is due to multicollinearity problems or to the outcome of omitted variable bias due to the exclusion of initial income. If the results regarding *ETHFRAC* suffer from collinearity problems with initial income, then

²⁴The compounding results regarding the indirect channel effects of ethnic fractionalization and polarization on economic growth are available from the author upon request.

it will indeed be difficult to disentangle the income from the ethnic effect. Nevertheless, the point estimates of *ETHFRAC* are still unbiased, also in the case of multicollinearity, but the standard error of the estimator may be too large, which translates into less accurate hypotheses. Because of the lower negative correlation between *ETHFRAC* and initial income, collinearity should not be a serious problem causing the results excluding initial income to suffer from omitted variable bias. Consider, for example, the *Investment* channel: because of the negative correlation between *ETHFRAC* and initial income and the positive effect of initial income on investment, excluding initial income from the *Investment* channel should result in a downward bias of *ETHFRAC*. Indeed, the estimate for *ETHFRAC* excluding initial income decreases from -0.0152 to -0.0256. The remaining channels can be interpreted in a similar way. Furthermore, if these sensitivity results are mainly driven by collinearity problems between *ETHFRAC* and initial income, then one would expect an overall increase in the significance level of *ETHFRAC* in the *Openness* channel, but this is not the case. Rather, excluding initial income from the base specification leads to a statistically insignificant effect of *ETHFRAC* on the *Openness* channel. Excluding initial income in the specification for *ETHPOL* results in insignificant channel effects for *Investment* and *Human Capital*, but as mentioned above, initial income is a strong explanatory variable in each channel variable, and excluding it would result in omitted variable bias.

The analysis for each of the ethnic measures is also restricted to geographic coverage by excluding Sub-Saharan African, Latin American, East-Asian, and OECD countries subsequently to highlight whether the effect of ethnicity depends on the regional pattern.

Restricting the analysis to non-Sub-Saharan African countries, the overall magnitude and significance level of *ETHFRAC* in the growth equation vanishes and becomes insignificant. Excluding countries from the benchmark model which are highly fractionalized reveals an interesting pattern: *ETHFRAC* seems to have non-negligible indirect effects in the remaining less heterogeneous countries through the channels *Investment*, *Civil War*, *Government Consumption*, *Political Instability*, and *Fertility*. One implication of this analysis may be the different effects of *ETHFRAC* conditional on the level of ethnic fractionalization in the particular country. Furthermore, the channel effects of *ETHPOL* remain important, also excluding Sub-Saharan African countries.

An important consideration is whether the results are driven primarily by the inclusion of developed countries, for example, OECD members. Concentrating on less-developed countries is of great interest from the standpoint of policy because these are precisely the countries

in which the economic effects of ethnicity are most debated. Restricting the sample to non-OECD members therefore leads to interesting results: Ethnic fractionalization in developing countries seems to have virtually no indirect effect on economic growth through the channels under consideration. The indirect effect of *ETHFRAC* on the channels is not statistically significant. In addition, the results regarding *ETHPOL* state that polarized societies still suffer from lower schooling levels, higher government consumption, and higher political instability. Interestingly, excluding the OECD members from the estimation sample leads to a reversal of the coefficient for *ETHPOL* in the *Investment* channel.²⁵ The results lead to the conclusion that not ethnic fractionalization but rather ethnic polarization is a strong predictive measure for the indirect effects of ethnicity in both developed and developing countries. This result is somewhat puzzling and contradicts the findings in Easterly & Levine (1997) and Alesina et al. (2003) but is in line with the findings reported by Garcia-Montalvo & Reynal-Querol (2005a).

Political instability is difficult to define and measure in a way that can be used for econometric work.²⁶ For example, Alesina & Perotti (1996) identifies factors of political instability that capture the idea of adverse effects on property rights and abrupt changes in executive power (i.e., coups d'état). Because of these difficulties in constructing an adequate measure of political instability, this measure is excluded from the benchmark model in order to determine how the results change. The benchmark results are not affected by the exclusion of the *Political Instability* channel for both specifications, aside from the fact that the channel effect for *Civil War* becomes highly statistically significant. This result may be due to the politically unstable environment that generally accompanies civil wars, making it difficult to disentangle the effects when both measures are included in the same regression.

Overall, the sensitivity results underscore the general pattern of ethnic fractionalization showing a direct negative association with growth, whereas ethnic polarization seems to have strong indirect effects.

6. Conclusions

This paper investigates the economic effects of ethnic fractionalization and polarization and explores the relative importance of these two concepts through an extended SUR model. It

²⁵This result may be due to the fact that polarized societies are by definition more ethnically homogeneous than ethnically fractionalized societies, suggesting that measures to increase homogeneity (e.g., by redrawing borders) may be beneficial for physical capital accumulation in the non-OECD countries.

²⁶See Alesina & Perotti (1996).

contributes to the existing literature in several ways. First, it provides an updated data set for an extended number of important explanatory variables for 95 countries. Second, this paper deals with an extended SUR model in which every transmission channel appearing in the growth equation is specified on the grounds of existing empirical work in the economic and political science literature. The SUR specification takes into account further equations that seem to be important transmission channels for the effects of ethnicity on growth—namely, schooling, political instability, market distortions, trade openness, and the fertility rate—but that have not been analyzed so far in the existing literature. Furthermore, the full system is jointly estimated using the SUR estimator and presents detailed evidence of direct and indirect effects of ethnicity on economic growth with the corresponding significance levels. The results suggest, for instance, that ethnic fractionalization produces positive indirect effects through international trade and higher net fertility rates, which may be beneficial in advanced economies through higher international trade integration and the possibility to rejuvenate the population. Third, the distinction between the two concepts of ethnicity leads to qualitatively opposite conclusions: Ethnic fractionalization seems primarily direct effects on growth, whereas ethnic polarization seems to have substantial indirect effects. Because of the same underlying data used in constructing both indices, the question remains whether this result is truly the consequence of high ethnic heterogeneity or polarization or of pure data transformation. Further research on this topic is needed, especially due to the complexity in measuring the multidimensional pattern of both ethnic measures. For instance, it has been argued that in measuring the potential consequences of ethnic conflict, one should take into account the political relevance of ethnic groups in the particular country. In addition, the sensitivity results show that the effects of ethnicity on economic growth may be conditional on the level of ethnicity and the development status of the countries. Further research should therefore investigate this issue and highlight whether the creation of social-political institutions in a country depends on its particular ethnic composition. For instance, the effect of increasing ethnic fractionalization in countries (e.g., advanced economies) with relatively good political institutions may be different from effects in countries with bad political institutions. Furthermore, it may be interesting to investigate to what extent bad political institutions shape perceptions of ethnic groups.

Appendix

Table A1. Correlation matrix between ethnic fractionalization/polarization, growth and its determinants.

	ETHPOL	ETHFRAC	Growth	Log initial income	Investment	Civil war	Human capital	Government	Instability	Distortions	Openness	Fertility
ETHPOL	1.0000											
ETHFRAC	0.6019	1.0000										
Growth	-0.1235	-0.1883	1.0000									
Log initial income	-0.1800	-0.5104	0.0503	1.0000								
Investment	-0.1696	-0.3100	0.3193	0.4742	1.0000							
Civil war	0.1430	0.1501	-0.1079	-0.1851	-0.1751	1.0000						
Human capital	-0.2154	-0.4246	0.0594	0.7900	0.4538	-0.1248	1.0000					
Government	0.1515	0.1691	-0.0622	-0.3279	-0.1429	0.0063	-0.1749	1.0000				
Instability	0.1443	0.0773	-0.1257	-0.0342	-0.1312	0.4160	-0.0146	0.0053	1.0000			
Distortions	0.0074	0.1496	-0.1243	-0.2148	-0.1738	0.2097	-0.1730	0.0791	0.0644	1.0000		
Openness	0.1229	0.0860	0.1093	-0.1884	0.1455	-0.1148	-0.1424	0.2473	-0.1383	-0.0225	1.0000	
Fertility	0.3146	0.4465	-0.1458	-0.7538	-0.4554	0.1458	-0.7730	0.2358	0.0104	0.1394	0.1982	1.0000

Number of observations: 555.

Table A2. Summary statistics for ethnic fractionalization/polarization, growth and its determinants.

	Mean	Std. Dev.	Min	Max
ETHPOL*	0.5180	0.2352	0.0199	0.9824
ETHFRAC*	0.4593	0.2802	0.0100	0.9586
Growth	0.0214	0.0310	-0.1383	0.1553
Log initial income	8.3990	1.0629	6.2086	10.9838
Investment	0.1659	0.0928	0.0102	0.9197
Civil war	0.1459	0.3538	0.0000	1.0000
Human capital	1.5852	0.5844	0.2377	2.5995
Government	0.1304	0.0824	0.0014	0.4829
Instability	0.2236	0.4747	0.0000	4.1000
Distortions	0.3063	1.3478	-0.2602	18.3260
Openness	0.5930	0.4621	0.0558	5.5916
Fertility	3.9937	1.5858	1.1584	7.1145

Number of observations: 555.

*: Number of countries = 95.

Table A3. Data on ethnic fractionalization and polarization.

country	safrica	laam	asiae	oecd	ETHPOL	ETHFRAC	Frequency
ALGERIA	0	0	0	0	0.5139	0.2986	5
ARGENTINA	0	1	0	0	0.5788	0.4079	8
AUSTRALIA	0	0	0	1	0.4918	0.3154	8
AUSTRIA	0	0	0	1	0.2398	0.1281	5
BANGLADESH	0	0	0	0	0.1318	0.0684	5
BELGIUM	0	0	0	1	0.8707	0.5439	6
BENIN	1	0	0	0	0.4364	0.8683	2
BOLIVIA	0	1	0	0	0.7666	0.7084	8
BOTSWANA	1	0	0	0	0.6502	0.4845	4
BRAZIL	0	1	0	0	0.7732	0.6441	7
BURUNDI	1	0	0	0	0.5123	0.2859	4
CAMEROON	1	0	0	0	0.5756	0.8166	6
CANADA	0	0	0	1	0.6724	0.7668	8
CENTRAL AFRICAN REPUBLIC	1	0	0	0	0.5778	0.7870	4
CHILE	0	1	0	1	0.7226	0.4316	8
COLOMBIA	0	1	0	0	0.7889	0.6747	8
CONGO	1	0	0	0	0.6737	0.7214	5
COSTA RICA	0	1	0	0	0.4204	0.2408	5
COTE D'IVOIRE	1	0	0	0	0.4319	0.8743	6
CYPRUS	0	0	0	0	0.6522	0.3565	1
DENMARK	0	0	0	1	0.0967	0.0492	8
DOMINICAN REPUBLIC	0	1	0	0	0.7254	0.4598	6
ECUADOR	0	1	0	0	0.8372	0.6566	7
EGYPT	0	0	0	0	0.4270	0.2468	7
EL SALVADOR	0	1	0	0	0.2791	0.1453	6
FINLAND	0	0	0	1	0.2941	0.1481	8
FRANCE	0	0	0	1	0.2944	0.1472	7
GABON	1	0	0	0	0.5188	0.8338	1
GAMBIA, THE	1	0	0	0	0.6893	0.7279	5
GERMANY	0	0	0	1	0.2274	0.1234	2
GHANA	1	0	0	0	0.6610	0.7310	8
GREECE	0	0	0	1	0.1861	0.0988	8
GUATEMALA	0	1	0	0	0.9547	0.5201	6
HAITI	0	1	0	0	0.2070	0.1045	2
HONDURAS	0	1	0	0	0.4296	0.2541	4
INDIA	0	0	0	0	0.3482	0.9012	6
INDONESIA	0	0	1	0	0.5288	0.7934	5
IRAN	0	0	0	0	0.5984	0.7563	3
IRAQ	0	0	0	0	0.6649	0.3905	3
IRELAND	0	0	0	1	0.1406	0.0723	8
ISRAEL	0	0	0	1	0.5477	0.2856	5
ITALY	0	0	0	1	0.1540	0.0798	8
JAMAICA	0	1	0	0	0.6002	0.3538	4
JAPAN	0	0	0	1	0.0672	0.0336	8
JORDAN	0	0	0	0	0.9824	0.5152	8
KENYA	1	0	0	0	0.3813	0.8902	7
KOREA, SOUTH	0	0	1	1	0.0278	0.0139	8

(continued on next page)

Table A3. Continued.

country	safrica	laam	asiae	oecd	ETHPOL	ETHFRAC	Frequency
KUWAIT	0	0	0	0	0.9798	0.5130	3
LESOTHO	1	0	0	0	0.3428	0.1850	6
LIBERIA	1	0	0	0	0.3904	0.8905	3
MALAWI	1	0	0	0	0.7359	0.6844	7
MALAYSIA	0	0	1	0	0.7616	0.6950	8
MALI	1	0	0	0	0.4199	0.8620	4
MAURITANIA	1	0	0	0	0.5361	0.3339	3
MAURITIUS	1	0	0	0	0.8031	0.4822	5
MEXICO	0	1	0	1	0.6536	0.5765	8
MOROCCO	0	0	0	0	0.8974	0.4747	8
MOZAMBIQUE	1	0	0	0	0.4986	0.8379	3
NETHERLANDS	0	0	0	1	0.2137	0.1133	8
NEW ZEALAND	0	0	0	1	0.3658	0.1959	8
NICARAGUA	0	1	0	0	0.6809	0.4962	6
NIGER	1	0	0	0	0.6977	0.7185	5
NORWAY	0	0	0	1	0.0902	0.0454	8
PAKISTAN	0	0	0	0	0.6976	0.6084	6
PANAMA	0	1	0	0	0.5862	0.0476	7
PAPUA NEW GUINEA	0	0	1	0	0.6687	0.3537	1
PARAGUAY	0	1	0	0	0.3096	0.1739	8
PERU	0	1	0	0	0.8170	0.6581	8
PHILIPPINES	0	0	1	0	0.4965	0.8429	8
PORTUGAL	0	0	0	1	0.0199	0.0100	5
RWANDA	1	0	0	0	0.4013	0.2213	7
SAUDI ARABIA	0	0	0	0	0.1139	0.0589	2
SENEGAL	1	0	0	0	0.5596	0.8093	5
SIERRA LEONE	1	0	0	0	0.6002	0.7927	2
SOUTH AFRICA	1	0	0	0	0.7178	0.4693	4
SPAIN	0	0	0	1	0.6933	0.4359	7
SRI LANKA	0	0	0	0	0.7493	0.4519	8
SUDAN	1	0	0	0	0.6994	0.7114	4
SWAZILAND	1	0	0	0	0.3184	0.1777	4
SWEDEN	0	0	0	1	0.3368	0.1891	8
SWITZERLAND	0	0	0	1	0.7242	0.5604	8
SYRIA	0	0	0	0	0.3726	0.2066	4
TANZANIA	1	0	0	0	0.2710	0.9586	6
THAILAND	0	0	1	0	0.5823	0.3608	8
TOGO	1	0	0	0	0.6733	0.7325	8
TRINIDAD AND TOBAGO	0	1	0	0	0.8417	0.6625	3
TUNISIA	0	0	0	0	0.1673	0.0872	7
TURKEY	0	0	0	1	0.3424	0.1851	6
UGANDA	1	0	0	0	0.2786	0.9319	5
UNITED KINGDOM	0	0	0	1	0.5706	0.3730	8
UNITED STATES	0	0	0	1	0.6913	0.5828	8
URUGUAY	0	1	0	0	0.4264	0.2595	8
VENEZUELA	0	1	0	0	0.7579	0.5394	6
ZAMBIA	1	0	0	0	0.6063	0.7874	7
ZIMBABWE	1	0	0	0	0.6978	0.5338	5
<i>N</i>	30	21	6	26			555

Table A4. System estimate of the base specification for ETHFRAC.

	Growth	Investment	Civil war	Human capital	Government	Instability	Distortions	Openness	Fertility
Constant	-0.2714*** (2.88)	-0.0549 (1.34)	0.4510** (2.04)	-2.0388*** (11.55)	0.3781*** (10.27)	-0.2062 (0.62)	2.2320** (2.28)	1.5514*** (5.84)	9.9290*** (13.98)
safrica	-0.0103** (2.36)		-0.0805 (1.52)						
laam	-0.0087** (2.38)		-0.0466 (1.21)						
asiae	0.0091* (1.69)		0.1135** (2.00)						
LNRGDPCH	0.0889*** (3.94)	0.0232*** (4.33)	-0.0871*** (4.26)	0.3755*** (21.51)	-0.0302*** (7.23)	-0.0428 (1.45)	-0.2116* (1.85)	0.0113 (0.45)	-0.4843*** (6.69)
LNRGDPCHSQ	-0.0061*** (4.52)								
Investment	0.0887*** (5.72)								
Civil war	-0.0058 (1.53)	-0.0175* (1.83)		-0.0228** (2.18)					
Human capital	0.0001 (0.04)	0.0389*** (4.50)							
Government	-0.0277* (1.77)	0.0082 (0.20)		0.5826*** (3.62)		0.2298 (0.98)	-0.0007 (0.00)	0.7643*** (3.49)	-1.3232*** (8.96)
Instability	-0.0049* (1.76)	-0.0253*** (3.66)			0.0043 (0.57)		0.2095* (1.75)		0.4448 (0.87)
Distortions	-0.0015 (1.64)								-0.0773 (0.93)
Openness	0.0040 (1.39)			-0.0328 (1.19)			-0.2206* (1.70)		
Fertility	-0.0051*** (3.89)								0.0195 (0.68)
PPDEV		0.0540*** (8.13)							
PISH		-0.0528*** (8.70)							
LNPOP			0.0426*** (3.53)						
DEMP4			0.0435 (1.28)	0.2177*** (7.24)	0.0146* (1.86)	0.0754*** (4.81)	-0.0705 (0.49)	-0.1054*** (6.71)	
evercol				0.1322*** (3.64)		0.0150 (0.31)	-0.0588 (0.34)	-0.0479 (1.19)	
muslim				-0.0857 (1.54)		0.1653*** (2.90)	-0.1955 (0.76)		
confu				0.5655*** (7.83)			-0.3754 (1.07)		
catho				0.2177*** (4.26)			-0.2244 (0.86)		
othchri				0.3798*** (6.93)			-0.0245 (0.09)		
postwar						-0.2161*** (4.25)	0.1509 (0.84)	0.1455*** (3.20)	
island						-0.0076 (0.14)		0.0325 (0.67)	
landlock						-0.0177 (0.32)		-0.1155** (2.40)	
LNAREA								-0.0502*** (3.52)	
TOT								0.0002 (0.07)	
oildum								0.3024*** (3.84)	
MORT04									-0.0444 (0.04)
ETHFRAC	-0.0106** (2.01)	-0.0152 (1.13)	0.0761 (1.16)	-0.0193 (0.36)	0.0014 (0.10)	0.0663 (0.78)	0.1320 (0.52)	0.1410* (1.79)	0.4109** (2.43)
N	555	555	555	555	555	555	555	555	555
R ²	0.230	0.339	0.095	0.761	0.115	0.088	0.063	0.263	0.657

Notes: The sample includes 95 countries for the period 1960-1999. The method of estimation is Seemingly Unrelated Regression. The absolute *t*-statistics between parenthesis are based on heteroskedasticity-consistent (robust) standard errors. *: Significant at the 10% level. **: Significant at the 5% level. ***: Significant at the 1% level. The specification for each structural equation are the most common one in the economic and political science literature: **Growth** (Barro-type growth equation); **Investment**, **Civil War** and **Government Consumption** (Garcia-Montalvo & Reynal-Querol, 2005a); **Human Capital**, **Political Instability**, **Market Distortions** and **Trade Openness** (Tavares & Vaccziarg, 2001); **Fertility** (Barro, 1991).

Explanatory variables: **Investment**, investment share of real GDP per capita (SH v. 6.2); **Civil War**, takes value 1 if the country experienced a civil war during the five-year periods (Doyle & Sambanis (2000)/compiled by Garcia-Montalvo & Reynal-Querol (2005b)); **Human Capital**, log of (1+ avg. schooling years in the total population over age 25), (Barro & Lee, 2010); **Government Consumption**, ratio of real government ^aconsump-

tion" expenditure net of spending on defense and on education to real GDP (SH v. 6.2; UNESCO; World Bank; own calculations); **Political Instability**, measure of political instability, $(0.5 \times \text{assasp} + 0.5 \times \text{Revolutions})$, (Banks, 2011); **Market Distortions**, measured by the black market premium (Easterly, 2001); **Trade Openness**, exports plus imports divided by GDP (SH v. 6.2); **Fertility**, net fertility rate calculated as $\text{TPR} \times (1 - \text{MORT04})$, (World Bank); PISH, price level of investment (PPP I/Xrate relative to U.S.), (SH v. 6.2); PPDEV, magnitude of the absolute deviation of PISH from the sample mean; LNPOP, log of the population at the beginning of each five-year period (SH v. 6.2); DEMP4, democracy score (0=low; 10=high), the democracy score is transformed into a dummy variable that takes value 1 if the democracy score is equal to or higher than 4, (Polity IV data set/compiled by Garcia-Montalvo & Reynal-Querol (2005b)); evercol, takes value 1 if the country was ever a colony since 1776 (Barro & Lee (1993)/completed by Tavares & Wacziarg (2001)); muslim, takes value 1 if majoritarian religion is Muslim (EB/compiled by Tavares & Wacziarg (2001)); confu, takes value 1 if majoritarian religion is Buddhism, Xintoism, Confucianism, etc., excluding Hindu, (EB/compiled by Tavares & Wacziarg (2001)); catho, takes value 1 if majoritarian religion is Catholicism (EB/compiled by Tavares & Wacziarg (2001)); othchri, takes value 1 if majoritarian religion is Christian, but not Catholicism (Source: *Encyclopedia Britannica* (EB)/compiled by Tavares & Wacziarg (2001)); postwar, takes value 1 if country gained independence after the Second World War (Barro & Lee (1993)/completed by Tavares & Wacziarg (2001)); island, takes value 1 if country is an island (Australia is not an island), (Tavares & Wacziarg (2001)); landlock, takes value 1 if country has no coastline (CIA World Fact Book (1996)); LNAREA, log of area in 1000s of square kilometers (Barro & Lee (1993)/completed by Tavares & Wacziarg (2001)); TOT, terms of trade shock, growth rate of export prices minus growth rate of import prices (World Bank); oilidum, takes value 1 if country is oil exporter (Barro & Lee (1993)/completed by Tavares & Wacziarg (2001)); MORT04, children mortality rate (ages 0-4) (World Bank).

Table A5. System estimate of the base specification for ETHPOL.

	Growth	Investment	Civil war	Human capital	Government	Instability	Distortions	Openness	Fertility
Constant	-0.3074*** (3.31)	-0.0685* (1.88)	0.3331 (1.51)	-2.0714*** (13.28)	0.3519*** (11.18)	-0.2169 (11.18)	2.3660** (2.55)	1.5865*** (6.11)	9.8752*** (14.51)
safrica	-0.0128*** (3.06)	-0.0712 (1.48)	-0.0711* (1.85)						
laam	-0.0092** (2.50)		0.1185** (2.12)						
asiae	0.0070 (1.31)		-0.0866*** (4.37)						
LNRGDPCH	0.0969*** (4.35)	0.0266*** (5.22)		0.3812*** (23.53)	-0.0293*** (7.83)	-0.0528* (1.86)	-0.2080* (1.85)	0.0009 (0.04)	-0.5455*** (7.89)
LNRGDPCHSQ	-0.0065*** (4.91)								
Investment	0.0881*** (5.66)								
Civil war	-0.0060 (1.55)	-0.0163* (1.70)			-0.0235** (2.26)				
Human capital	0.0004 (0.11)	0.0341*** (3.92)							
Government	-0.0293* (1.86)	0.0213 (0.51)		0.6076*** (3.79)		0.1150 (0.49)	-0.0284 (0.15)	0.7465*** (3.41)	-1.1720*** (8.15)
Instability	-0.0054* (1.95)	-0.0230*** (3.32)			-0.0002 (0.03)		0.2362** (1.96)		-0.1665** (2.04)
Distortions	-0.0016* (1.74)								
Openness	0.0052* (1.80)			-0.0286 (1.04)			-0.2252* (1.74)		
Fertility	-0.0053*** (3.96)								0.0259 (0.94)
PPDEV		0.0561*** (8.45)							
PISH		-0.0550*** (9.06)							
LNPOP			0.0458*** (4.04)						
DEMP4			0.0483 (1.43)	0.2187*** (7.31)	0.0158** (2.02)	0.0783*** (5.18)	-0.0530 (0.36)	-0.1030*** (6.49)	
evercol				0.1603*** (4.31)		0.0233 (0.49)	0.0006 (0.00)	-0.0453 (1.13)	
muslim				-0.0654 (1.20)		0.1175** (2.03)	-0.2065 (0.81)		
confu				0.5697*** (8.26)			-0.4428 (1.30)		
catho				0.2305*** (4.59)			-0.2365 (0.91)		
othchri				0.3879*** (7.20)			-0.0430 (0.16)		
postwar						-0.1986*** (3.96)	0.1704 (0.96)	0.1655*** (3.78)	
island						-0.0084 (0.16)		0.0347 (0.72)	
landlock						-0.0206 (0.38)		-0.1161** (2.42)	
LNAREA								-0.0443*** (3.32)	
TOT								0.0007 (0.25)	
oildum								0.2992*** (3.81)	0.3741 (0.34)
MORT04									
ETHPOL	-0.0040 (0.75)	-0.0295** (2.15)	0.2293*** (3.69)	-0.1203** (2.22)	0.0376*** (2.71)	0.2632*** (3.11)	-0.2378 (0.94)	0.1025 (1.41)	1.0354*** (6.28)
N	555	555	555	555	555	555	555	555	555
R ²	0.226	0.345	0.109	0.764	0.125	0.100	0.064	0.264	0.675

Notes: The sample includes 95 countries for the period 1960-1999. The method of estimation is Seemingly Unrelated Regression. The absolute *t*-statistics between parenthesis are based on heteroskedasticity-consistent (robust) standard errors. *: Significant at the 10% level. **: Significant at the 5% level. ***: Significant at the 1% level. The specification for each structural equation are the most common one in the economic and political science literature: **Growth** (Barro-type growth equation); **Investment**, **Civil War** and **Government Consumption** (Garcia-Montalvo & Reynal-Querol, 2005a); **Human Capital**, **Political Instability**, **Market Distortions** and **Trade Openness** (Tavares & Vacczarg, 2001); **Fertility** (Barro, 1991).
Explanatory variables: **Investment**, investment share of real GDP per capita (SH v. 6.2); **Civil War**, takes value 1 if the country experienced a civil war during the five-year periods (Doyle & Sambanis (2000))/compiled by Garcia-Montalvo & Reynal-Querol (2005b); **Human Capital**, log of (1+ avg. schooling_years in the total population over age 25), (Barro & Lee, 2010); **Government Consumption**, ratio of real government ^aconsump-

tion" expenditure net of spending on defense and on education to real GDP (SH v. 6.2; UNESCO; World Bank; own calculations); **Political Instability**, measure of political instability, $(0.5 \times \text{assasp} + 0.5 \times \text{Revolutions})$, (Banks, 2011); **Market Distortions**, measured by the black market premium (Easterly, 2001); **Trade Openness**, exports plus imports divided by GDP (SH v. 6.2); **Fertility**, net fertility rate calculated as $\text{TPR} \times (1 - \text{MORT04})$, (World Bank); PISH, price level of investment (PPP I/Xrate relative to U.S.), (SH v. 6.2); PPDEV, magnitude of the absolute deviation of PISH from the sample mean; LNPOP, log of the population at the beginning of each five-year period (SH v. 6.2); DEMP4, democracy score (0=low; 10=high), the democracy score is transformed into a dummy variable that takes value 1 if the democracy score is equal to or higher than 4, (Polity IV data set/compiled by Garcia-Montalvo & Reynal-Querol (2005b)); evercol, takes value 1 if the country was ever a colony since 1776 (Barro & Lee (1993)/completed by Tavares & Wacziarg (2001)); muslim, takes value 1 if majoritarian religion is Muslim (EB/compiled by Tavares & Wacziarg (2001)); confu, takes value 1 if majoritarian religion is Buddhism, Xintoism, Confucianism, etc., excluding Hindu, (EB/compiled by Tavares & Wacziarg (2001)); catho, takes value 1 if majoritarian religion is Catholicism (EB/compiled by Tavares & Wacziarg (2001)); othchri, takes value 1 if majoritarian religion is Christian, but not Catholicism (Source: *Encyclopedia Britannica* (EB)/compiled by Tavares & Wacziarg (2001)); postwar, takes value 1 if country gained independence after the Second World War (Barro & Lee (1993)/completed by Tavares & Wacziarg (2001)); island, takes value 1 if country is an island (Australia is not an island), (Tavares & Wacziarg (2001)); landlock, takes value 1 if country has no coastline (CIA World Fact Book (1996)); LNAREA, log of area in 1000s of square kilometers (Barro & Lee (1993)/completed by Tavares & Wacziarg (2001)); TOT, terms of trade shock, growth rate of export prices minus growth rate of import prices (World Bank); oilidum, takes value 1 if country is oil exporter (Barro & Lee (1993)/completed by Tavares & Wacziarg (2001)); MORT04, children mortality rate (ages 0-4) (World Bank).

Table A6. Sensitivity analysis for ETHFRAC.

VARIABLES	Base model	Time effects	Region effects	Region/Times effects	excl. initial income	excl. Sub-S. Africa	excl. Latin America	excl. East Asia	excl. OECD	No Instability equ.
safrica	-0.0103** (2.36)	-0.0044 (1.04)	-0.0095** (2.17)	-0.0028 (0.67)	-0.0098** (2.25)	-	-0.0117** (2.52)	-0.0102** (2.25)	-0.0068 (1.28)	-0.0102** (2.33)
laam	-0.0087** (2.38)	-0.0084** (2.45)	-0.0082** (2.24)	-0.0083** (2.42)	-0.0081** (2.24)	-0.0098** (2.97)	-	-0.0088** (2.34)	-0.0017 (0.33)	-0.0098** (2.72)
asiae	0.0091* (1.69)	0.0098* (1.93)	0.0081 (1.50)	0.0094* (1.84)	0.0099* (1.84)	0.0093* (1.94)	0.0083 (1.46)	-	0.0146** (1.98)	0.0094* (1.73)
LNRGDPCH	0.0889*** (3.94)	0.0933*** (4.36)	0.0892*** (3.96)	0.0944*** (4.42)	0.0935*** (4.15)	0.0816*** (2.71)	0.0973*** (4.12)	0.0909*** (3.93)	0.1091*** (3.43)	0.0856*** (3.79)
LNRGDPCHSQ	-0.0061*** (4.52)	-0.0062*** (4.90)	-0.0061*** (4.55)	-0.0063*** (4.96)	-0.0062*** (4.60)	-0.0057*** (3.30)	-0.0067*** (4.76)	-0.0062*** (4.53)	-0.0073*** (3.77)	-0.0059*** (4.37)
Investment	0.0887*** (5.72)	0.0654*** (4.23)	0.0892*** (5.76)	0.0664*** (4.30)	0.0873*** (5.63)	0.1024*** (5.16)	0.0745*** (4.23)	0.0928*** (5.70)	0.0647*** (3.19)	0.0908*** (5.84)
Civil war	-0.0058 (1.53)	-0.0015 (0.42)	-0.0057 (1.49)	-0.0017 (0.45)	-0.0055 (1.44)	-0.0069* (1.85)	-0.0058 (1.29)	-0.0038 (0.92)	-0.0026 (0.53)	-0.0086** (2.44)
Human capital	0.0001 (0.04)	0.0020 (0.53)	0.0007 (0.18)	0.0027 (0.73)	-0.0023 (0.61)	-0.0021 (0.49)	0.0032 (0.76)	0.0018 (0.46)	-0.0041 (0.87)	0.0005 (0.12)
Government	-0.0277* (1.77)	-0.0247* (1.67)	-0.0283* (1.81)	-0.0242 (1.64)	-0.0242 (1.55)	-0.0201 (1.12)	-0.0295* (1.71)	-0.0312* (1.95)	-0.0222 (1.18)	-0.0281* (1.79)
Instability	-0.0049* (1.76)	-0.0038 (1.41)	-0.0050* (1.81)	-0.0037 (1.41)	-0.0050* (1.79)	-0.0047* (1.95)	-0.0096** (1.99)	-0.0046 (1.60)	-0.0054 (1.42)	-
Distortions	-0.0015 (1.64)	-0.0014 (1.59)	-0.0014 (1.61)	-0.0013 (1.57)	-0.0014 (1.58)	-0.0038*** (3.05)	-0.0011 (1.13)	-0.0012 (1.15)	-0.0016 (1.52)	-0.0014 (1.61)
Openness	0.0040 (1.39)	0.0059** (2.14)	0.0041 (1.42)	0.0052* (1.88)	0.0045 (1.56)	-0.0043 (1.20)	0.0067** (2.04)	0.0041 (1.36)	0.0093** (2.46)	0.0043 (1.48)
Fertility	-0.0051*** (3.89)	-0.0063*** (4.86)	-0.0053*** (3.97)	-0.0063*** (4.84)	-0.0052*** (3.91)	-0.0048*** (3.52)	-0.0067*** (4.42)	-0.0053*** (3.79)	-0.0049*** (2.80)	-0.0049*** (3.69)
ETHFRAC	-0.0106** (2.01)	-0.0104** (2.09)	-0.0107** (2.04)	-0.0108** (2.17)	-0.0077 (1.47)	-0.0062 (1.20)	-0.0104* (1.72)	-0.0089 (1.57)	-0.0121 (1.60)	-0.0111** (2.12)
Constant	-0.2714*** (2.88)	-	-0.2722*** (2.89)	-	-0.3014*** (3.20)	-0.2349* (1.80)	-0.2917*** (2.96)	-0.2803*** (2.89)	-0.3532*** (2.70)	-0.2600*** (2.76)
N	555	555	555	555	555	410	422	517	368	555
R ²	0.230	0.538	0.229	0.317	0.231	0.297	0.261	0.194	0.204	0.225

Effect of ETHFRAC on the Channel										
Investment	-0.0152 (1.13)	-0.0125 (0.95)	-0.0105 (0.76)	-0.0136 (1.02)	-0.0256* (1.95)	-0.0334*** (2.70)	-0.0323** (2.08)	-0.0049 (0.34)	0.0190 (1.06)	-0.0174 (1.28)
Civil war	0.0761 (1.16)	0.0930 (1.44)	0.0624 (0.83)	0.0805 (1.23)	0.1572** (2.42)	0.2075*** (2.78)	0.0423 (0.59)	0.0295 (0.43)	-0.1448 (1.54)	0.0648 (0.97)
Human capital	-0.0193 (0.36)	-0.0427 (0.87)	-0.0361 (0.65)	-0.0163 (0.33)	-0.4086*** (5.94)	0.0211 (0.37)	-0.0049 (0.08)	-0.1231** (2.21)	-0.0026 (0.03)	-0.0192 (0.35)
Government	0.0014 (0.10)	-0.0000 (0.00)	0.0086 (0.59)	0.0102 (0.70)	0.0462*** (3.56)	0.0326** (2.27)	-0.0069 (0.41)	-0.0039 (0.26)	0.0085 (0.42)	0.0018 (0.13)
Instability	0.0663 (0.78)	0.0524 (0.62)	0.0278 (0.30)	0.0593 (0.65)	0.1194 (1.44)	0.2062* (1.65)	-0.0062 (0.10)	0.0390 (0.43)	0.0888 (0.80)	-
Distortions	0.1320 (0.52)	0.1469 (0.59)	0.1009 (0.39)	0.1152 (0.44)	0.2417 (0.97)	0.0594 (0.28)	0.2062 (0.64)	0.0587 (0.26)	0.0171 (0.04)	0.1694 (0.67)
Openness	0.1410* (1.79)	0.1413* (1.82)	0.1373 (1.62)	0.1811** (2.18)	0.1158 (1.54)	0.0831 (1.19)	0.2614*** (2.90)	0.0629 (0.76)	-0.0688 (0.59)	0.1408* (1.78)
Fertility	0.4109** (2.43)	0.4957*** (2.98)	0.3162* (1.85)	0.3424** (2.04)	0.4767*** (2.77)	0.6250*** (3.26)	0.6072*** (3.24)	0.2929 (1.63)	0.0035 (0.02)	0.3965** (2.35)

Notes: Absolute t-statistics between parenthesis are based on heteroskedasticity-consistent (robust) standard errors.

*: Significant at the 10% level.

**: Significant at the 5% level.

***: Significant at the 1% level.

Table A7. Sensitivity analysis for ETHPOL.

VARIABLES	Base model	Time effects	Region effects	Region/Times effects	excl. initial income	excl. Sub-S. Africa	excl. Latin America	excl. East Asia	excl. OECD	No Instability equ.
safrica	-0.0128*** (3.06)	-0.0070* (1.71)	-0.0121*** (2.87)	-0.0054 (1.32)	-0.0121*** (2.90)	-	-0.0140*** (3.13)	-0.0124*** (2.89)	-0.0096* (1.95)	-0.0128*** (3.04)
laam	-0.0092** (2.50)	-0.0090*** (2.58)	-0.0088** (2.36)	-0.0089** (2.55)	-0.0085** (2.29)	-0.0100*** (2.98)	-	-0.0093** (2.45)	-0.0023 (0.45)	-0.0105*** (2.85)
asiae	0.0070 (1.31)	0.0076 (1.52)	0.0060 (1.12)	0.0072 (1.42)	0.0076 (1.43)	0.0080* (1.73)	0.0062 (1.11)	-	0.0116 (1.65)	0.0072 (1.34)
LNRGDPCH	0.0969*** (4.35)	0.1010*** (4.77)	0.0975*** (4.37)	0.1026*** (4.85)	0.1022*** (4.59)	0.0857*** (2.87)	0.1054*** (4.51)	0.0989*** (4.34)	0.1156*** (3.65)	0.0939*** (4.20)
LNRGDPCHSQ	-0.0065*** (4.91)	-0.0067*** (5.30)	-0.0066*** (4.95)	-0.0068*** (5.38)	-0.0067*** (5.02)	-0.0059*** (3.47)	-0.0072*** (5.15)	-0.0067*** (4.92)	-0.0077*** (3.98)	-0.0064*** (4.77)
Investment	0.0881*** (5.66)	0.0645*** (4.15)	0.0883*** (5.67)	0.0653*** (4.21)	0.0864*** (5.55)	0.1018*** (5.12)	0.0758*** (4.28)	0.0909*** (5.58)	0.0612*** (3.00)	0.0901*** (5.78)
Civil war	-0.0060 (1.55)	-0.0016 (0.42)	-0.0058 (1.50)	-0.0017 (0.45)	-0.0056 (1.44)	-0.0071* (1.87)	-0.0057 (1.26)	-0.0038 (0.91)	-0.0033 (0.67)	-0.0090** (2.53)
Human capital	0.0004 (0.11)	0.0024 (0.63)	0.0008 (0.21)	0.0030 (0.80)	-0.0026 (0.67)	-0.0021 (0.50)	0.0034 (0.81)	0.0018 (0.46)	-0.0035 (0.75)	0.0008 (0.20)
Government	-0.0293* (1.86)	-0.0265* (1.79)	-0.0301* (1.92)	-0.0262* (1.77)	-0.0251 (1.60)	-0.0218 (1.21)	-0.0301* (1.73)	-0.0322** (2.01)	-0.0270 (1.42)	-0.0298* (1.89)
Instability	-0.0054* (1.95)	-0.0043 (1.63)	-0.0056** (2.01)	-0.0043 (1.60)	-0.0056** (2.00)	-0.0049** (2.03)	-0.0106** (2.19)	-0.0049* (1.69)	-0.0061 (1.59)	-
Distortions	-0.0016* (1.74)	-0.0015* (1.70)	-0.0016* (1.74)	-0.0015* (1.71)	-0.0015* (1.65)	-0.0039*** (3.08)	-0.0011 (1.22)	-0.0013 (1.23)	-0.0016 (1.53)	-0.0015* (1.70)
Openness	0.0052* (1.80)	0.0072*** (2.60)	0.0055* (1.90)	0.0067** (2.40)	0.0057** (1.99)	-0.0032 (0.89)	0.0075** (2.24)	0.0054* (1.81)	0.0105*** (2.81)	0.0056* (1.93)
Fertility	-0.0053*** (3.96)	-0.0065*** (4.93)	-0.0054*** (4.05)	-0.0065*** (4.93)	-0.0054*** (4.02)	-0.0049*** (3.57)	-0.0068*** (4.47)	-0.0054*** (3.80)	-0.0049*** (2.80)	-0.0050*** (3.74)
ETHPOL	-0.0040 (0.75)	-0.0041 (0.81)	-0.0041 (0.77)	-0.0040 (0.78)	-0.0041 (0.76)	-0.0030 (0.60)	-0.0038 (0.62)	-0.0041 (0.73)	-0.0001 (0.01)	-0.0045 (0.84)
Constant	-0.3074*** (3.31)	-	-0.3097*** (3.34)	-	-0.3385*** (3.65)	-0.2532* (1.95)	-0.3279*** (3.38)	-0.3161*** (3.33)	-0.3853*** (2.97)	-0.2979*** (3.20)
N	555	555	555	555	555	410	422	517	368	555
R ²	0.226	0.535	0.225	0.313	0.227	0.295	0.256	0.192	0.198	0.220

Effect of ETHPOL on the Channel										
Investment	-0.0295** (2.15)	-0.0274** (2.05)	-0.0058 (0.41)	-0.0050 (0.37)	-0.0204 (1.44)	-0.0356*** (3.13)	-0.0330** (2.04)	-0.0269* (1.88)	0.0529** (2.44)	-0.0337** (2.44)
Civil war	0.2293*** (3.69)	0.2259*** (3.73)	0.1971*** (3.15)	0.1914*** (3.14)	0.2545*** (4.05)	0.2255*** (3.44)	0.1772*** (2.60)	0.2261*** (3.60)	0.1390 (1.39)	0.2080*** (3.33)
Human capital	-0.1203** (2.22)	-0.0968** (1.97)	-0.0782 (1.42)	-0.0446 (0.92)	-0.0233 (0.30)	-0.1047** (2.01)	-0.0764 (1.20)	-0.1207** (2.16)	-0.1935** (2.21)	-0.1202** (2.21)
Government	0.0376*** (2.71)	0.0383*** (2.76)	0.0375*** (2.58)	0.0384*** (2.66)	0.0492*** (3.39)	0.0587*** (4.59)	0.0345** (1.99)	0.0355** (2.38)	0.0745*** (3.12)	0.0376*** (2.72)
Instability	0.2632*** (3.11)	0.2707*** (3.25)	0.1885** (2.18)	0.1997** (2.35)	0.2698*** (3.19)	0.2899*** (2.75)	0.0706 (1.11)	0.3393*** (3.77)	0.2634** (2.07)	-
Distortions	-0.2378 (0.94)	-0.2750 (1.09)	-0.2445 (0.83)	-0.2890 (1.11)	-0.2523 (0.99)	-0.2625 (1.36)	-0.2211 (0.68)	-0.1939 (0.84)	-0.4940 (1.11)	-0.1744 (0.69)
Openness	0.1025 (1.41)	0.1044 (1.46)	0.2341*** (3.09)	0.2608*** (3.51)	0.1120 (1.54)	0.1177** (2.05)	0.2322*** (2.60)	0.0347 (0.46)	-0.0083 (0.07)	0.1036 (1.42)
Fertility	1.0354*** (6.28)	1.0436*** (6.48)	0.7442*** (4.42)	0.7385*** (4.49)	0.8806*** (5.08)	1.0665*** (6.24)	0.9103*** (4.75)	1.0567*** (6.21)	0.2255 (0.91)	0.9861*** (6.03)

Notes: Absolute t-statistics between parenthesis are based on heteroskedasticity-consistent (robust) standard errors.

*: Significant at the 10% level.

** : Significant at the 5% level.

***: Significant at the 1% level.

Table A8. Data Description.

Growth	Growth of real GDP per capita (Chain): rgdpch [Base year: 2000] for 1960-1999, constant price entries. Source: Heston, Summers & Aten (2006), Penn World Table Version 6.2 (SH v. 6.2).
ETHPOL	Index of ethnolinguistic polarization calculated using the data from the <i>World Christian Encyclopedia</i> (WCE). Source: Garcia-Montalvo & Reynal-Querol (2005b).
ETHFRAC	Index of ethnolinguistic fractionalization calculated using the data of the WCE. Source: Garcia-Montalvo & Reynal-Querol (2005b).
safrica	Dummy for Sub-Saharan African countries.
laam	Dummy for Latin-American countries.
asiae	Dummy for East Asian countries.
oecd	Dummy for OECD countries.
LNRGDPCH	Log of per capita GDP at the beginning of each five-year period. Source: SH v. 6.2.
LNRGDPCHSQ	Log of per capita GDP squared at the beginning of each five-year period. Source: SH v. 6.2.
Investment	Investment share of real GDP per capita (Laspeyres): ki [Base year: 2000], constant price entries. Source: SH v. 6.2.
Civil war	Takes value 1 if the country experienced a civil war during the five-year periods. Source: Doyle & Sambanis (2000)/compiled by Garcia-Montalvo & Reynal-Querol (2005b).
Human capital	Log of (1+ avg. schooling years in the total population over age 25). Source: Barro & Lee (2010).
Government	Ratio of real government "consumption" expenditure net of spending on defense and on education to real GDP (Missing values for 1990-94 replaced by OLS trend estimates). Source: SH v. 6.2; UNESCO; World Bank; own calculations.
Instability	Measure of political instability. $(0.5 \times \text{assassp} + 0.5 \times \text{Revolutions})$.
Distortions	Black market premium. Source: Easterly (2001).
Openness	Exports plus imports divided by GDP (rgdpl) [Base year: 2000], constant price entries. Source: SH v. 6.2.
MORT04	Children mortality rate (ages 0-4). Source: World Bank.
TFR	Total fertility rate (children per woman). Source: World Bank.
Fertility	Net fertility rate calculated as $\text{TFR} \times (1 - \text{MORT04})$.
PISH	Price level of investment (PPP I/Xrate relative to U.S.) (U.S.=1.0). Source: SH v. 6.2.
PPDEV	Magnitude of the absolute deviation of the Price Level of Investment (PISH) from the sample mean. Source: SH v. 6.2.
LNPOP	Log of the population at the beginning of each five-year period. Source: SH v. 6.2.
DEMP4	Democracy score (0=low; 10=high). The democracy score is transformed into a dummy variable that takes the value 1 if the democracy score is equal to or higher than 4. Source: Polity IV data set/compiled by Garcia-Montalvo & Reynal-Querol (2005b).
evercol	Takes value 1 if the country was ever a colony since 1776. Source: Barro & Lee (1993)/completed by Tavares & Wacziarg (2001).

(continued on next page)

Table A8. Continued.

muslim	Takes value 1 if majoritarian religion is Muslim. Source: <i>Encyclopedia Britannica</i> /compiled by Tavares & Wacziarg (2001).
confu	Takes value 1 if majoritarian religion is Buddhism, Xintoism, Confucianism, etc. (excluding Hindus). Source: <i>Encyclopedia Britannica</i> /compiled by Tavares & Wacziarg (2001).
catho	Takes value 1 if majoritarian religion is Catholicism. Source: <i>Encyclopedia Britannica</i> /compiled by Tavares & Wacziarg (2001).
othchri	Takes value 1 if majoritarian religion is Christian, but not Catholicism. Source: <i>Encyclopedia Britannica</i> /compiled by Tavares & Wacziarg (2001).
postwar	Takes value 1 if country gained independence after the Second World War. Source: Barro & Lee (1993)/completed by Tavares & Wacziarg (2001).
island	Takes value 1 if country is an island (Australia is not an island). Source: Tavares & Wacziarg (2001).
landlock	Takes value 1 if country has no coastline. Source: CIA World Fact Book (1996).
LNAREA	Log of area in 1000s of square kilometers. Source: Barro & Lee (1993)/completed by Tavares & Wacziarg (2001).
TOT	Terms of trade shock; Growth rate of export prices minus growth rate of import prices. Source: World Bank.
oildum	Takes value 1 if country is oil exporter. Source: Barro & Lee (1993)/completed by Tavares & Wacziarg (2001).
assassp	Number of political assassinations per million population per year. Source: Banks (2011).
Coups	Number of coups per year. Source: Banks (2011).
Revolutions	Number of revolutions per year. Source: Banks (2011).

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