# Migration, Diversity, and Economic Growth

## A Replication Study of Bove and Elia (*World Development, 2017)*

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### *Abstract*

A recent and well known paper, Bove and Elia (2017), argues that migrants' diversity, as captured by the indexes of both fractionalization and polarization, exerts a positive effect on GDP growth. In fact, by using the same dataset and methodology, we show that the impact of diversity cannot be distinguished from that of migration itself due to the very high correlation among the corresponding variables. Also, if one disentangles migration from diversity, following Alesina et al. (2016), only migration maintains a positive impact on growth while diversity, as captured by fractionalization, turns out to be weakly and positively associated with growth, but limitedly to the 1980-2010 time span. Polarization, on the other hand, does not seem to exert any effect on growth. The question as to whether diversity is more or less beneficial in terms of economic growth remains therefore an intriguing one, and calls for more theoretical and empirical analyses, possibly based on less (geographically) aggregated data.

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## 1 Introduction

Recently, Bove and Elia (2017) have explored the effect of immigration on development through its effect on the composition of the destination country over time. Furthermore, by examining the empirical relationship between cultural heterogeneity and growth, they explored whether this relationship depends on the country's level of development. The empirical results show that diversity, both in the form of fractionalization, i.e., the coexistence of many different ethnic communities in a given country, and polarization, i.e., the splitting of the migrants' community into two or more groups, may enhance economic growth. Thus, both diversity indices have a positive impact on real GDP growth and this effect seems to be stronger and more consistent in developing countries.

In this paper, it is shown that correlations between fractionalization, polarization and the share of migrants in total population may indeed have played a role in uncovering that empirical nexus, and that the share of migrants itself is sufficient to justify the positive impact on growth.

The very high correlation between those key variables has to be taken in due account while assessing the impact of diversity on economic growth, and this paper shows, by extending to polarization the approach taken by Alesina et al. (2016) with regard to fractionalization, that migration itself has a strong and positive impact on growth, and that only fractionalization exerts an additional positive effect, though rather weak, on growth. The empirical finding that migration, in and by itself, plays a positive role in growth continues to hold even when one accounts for endogeneity, by using a two stage approach based on a gravity model for migration, following Bove and Elia (2017).

The rest of the paper is organized as follows: section 2 reviews the recent literature on migration, diversity and growth. Section 3 discusses the measures of diversity and illustrates their decomposition in terms of their main constituents, as well as the main empirical strategy. Section 4 briefly illustrates the data used in the empirical analysis and the main statistics. Section 5 presents and comments upon the regression results, while section 6 concludes, with an eye to future research.

## 2 The Model and the Empirical Specification

The main ingredient of the empirical model used is diversity, as the aim of the analysis is that of assessing the impact of diversity on growth. Since diversity is a key variable of all the empirical models presented in the sequel, it is worth discussing it at some length, and in particular in relation to total migration. As in Bove and Elia (2017), two measures of diversity will be used, fractionalization and polarization, as they capture two distinct aspects of diversity. The former is a frequently used (as, for instance, in Ottaviano and Peri (2006) and in Alesina et al. (2016)) measure of diversity. For country $s$ in year $t$ this index is defined as:

$$DI_{st} = \sum_{i=1}^{M} s_{it}\,(1 - s_{it}) = 1 - \sum_{i=1}^{M} s_{it}^2 \tag{1}$$

where $s_{it}$ is the fraction of residents born in country $i$ over the total population of the country, at time $t$, and $M$ the number of different cultural/ethnic groups that are present on the territory.

The diversity (or fractionalization) index can be interpreted, therefore, as the probability that two individuals randomly drawn from the population of the state are born in different countries.

Noting that the share of native population $s_{1t} = \sum_{i=2}^{M} (1 - s_{it})$, by some straightforward algebraic manipulations (i.e. summing and subtracting the same term) we can rewrite expression (1) as:

$$DI_{st} = \sum_{i=1}^{M} s_{it} (1 - s_{it}) = s_{1t} (1 - s_{1t}) + (1 - s_{1t}) s_{it} + \sum_{i=2}^{M} s_{it} (1 - s_{it} - s_{1t}) \tag{2}$$

or

$$DI_{st} = \sum_{i=1}^{M} s_{it} (1 - s_{it}) = 2s_{1t} (1 - s_{1t}) + \sum_{i=2}^{M} s_{it} (1 - s_{it} - s_{1t}) \tag{3}$$

where the first term in the summation can be taken to represent diversity *between* natives and all foreign born, as if there were only natives and a unique group of foreign migrants, with respective shares of $s_{1t}$ and $1 - s_{1t}$. The second term in the summation can be taken to represent diversity *within* all foreign groups of migrants, excluding natives. In fact, as the share of the $jth$ group of migrants over the total of migrants is equal to $\frac{s_{it}}{1-s1t}$ we can rewrite expression (3) as:

$$DI_{st} = 2s_{1t} (1 - s_{1t}) + \sum_{i=2}^{M} \frac{s_{it}}{1 - s1t} \frac{(1 - s_{it} - s_{1t})}{1 - s_{1t}} (1 - s_{1t})^2 \tag{4}$$

or

$$DI_{st} = 2s_{1t} (1 - s_{1t}) + \sum_{j=1}^{I} s_{jt} \left(1 - s_{jt}\right) (1 - s_{1t})^2 \tag{5}$$

with $I = M - 1$. In sum, it can be seen that the Diversity index can be expressed as the sum of two components, one representing diversity *between* natives and all foreign born and the other representing diversity *within* the groups of immigrants, i.e.;

$$\begin{aligned} DI_{st} &= DI_{between} + DI_{within} = \\ &= 2 * Migration_{st} * (1 - Migration_{st}) + Migration_{st}^2 * DI_{mst} \end{aligned} \tag{6}$$

where $Migration_{st} = 1 - s_{1t}$ Therefore they both depend, in a multiplicative way, on the share of migrants over total population, which in turn implies that the correlation between the share of foreign born population and the diversity index is likely to be very high.

The other diversity index used in Bove and Elia (2017) is the so called polarization index, which measures the distance from a situation where the population is perfectly split in two groups (perfect polarization). Polarization can be written as:

$$POL_{st} = 4 \sum_{i=1}^{M} {s_{it}}^2 (1 - s_{it}) \tag{7}$$

where the variables have the same meaning as in (1), and the factor $4$ ensures that the index ranges between $0$ (zero polarization, i.e., an infinite number of small groups) to $1$, which stands for perfect

Table 1: Correlation coefficients

| | Fractionalization | Polarization | Migration |
|---|---|---|---|
| Fractionalization | 1.000 | | |
| Polarization | 0.934 | 1.000 | |
| Migration | 0.977 | 0.851 | 1.000 |

**Notes:** Diversity indexes are calculated as in equations (1) and (3) on the whole population (including natives) in Panel A Migration is the share of foreign born for each country and year.

polarization (in two distinct groups). Just like in the case of fractionalization, this index can be decomposed into a *between* and an *within* component, where the former is equal to[1]:

$$POL_{between} = 4 * Migration_{st} * (1 - Migration_{st}) \tag{8}$$

while the latter is given by:

$$POL_{within} = 4 * Migration_{st}^{3} * POL_{mst}$$

where $POL_{mst}$ is equal to $\sum_{i=1}^{M}((1 - Migration_{st}) * Migration_{st})$ and represents a polarization index of immigrants only, irrespective of the natives.

Therefore, the polarization index can be expressed as follows:

$$\begin{aligned} POL_{st} &= POL_{between} + POL_{within} = \\ &= 4 * Migration_{st} * (1 - Migration_{st})^2 + 4 * Migration_{st}^{3} * POL_{mst} \end{aligned} \tag{9}$$

Also in the case of polarization, the decomposition suggests that the correlation with the share of migrants might be very high. Indeed, in our sample the correlation of both measures of diversity is very high, as shown in Table 1.

The correlation between fractionalization and migration is almost 0.98, while that of polarization is about 0.85. What is also rather striking is that the correlation between the two measures of diversity, which in principle capture two opposite phenomena, is extremely high, 0.93. This should suggest that the dynamics of these two apparently diverse variables is very likely to be driven by a common factor, which the analytical decompositions stated above identify in the share of migrants.

In view of the correlations shown in Table 2 we cannot use both migration and diversity indexes as distinct regressors in the same specification, if diversity indexes are computed on the whole population. In their work, Bove and Elia (2017) do observe that the correlation between fractionalization and polarization is very high, which motivates their using those measures separately in the regressions, but do not suggest that this correlation is most likely spurious, and do not mention the

[1] Calculations are not reported for the sake of brevity but are available from the authors upon request.

very high correlation between fractionalization and migration, and that between polarization and migration. Since the goal of this note is to show that migration, alone, is the driver of the positive impacts on growth, we will adopt the following empirical strategy. The first step of the analysis consists in running the regressions:

$$\tilde{y}_s = \alpha + y_{st_0} + \gamma_2 \tilde{DI}_s + \gamma_3 X_s + \varepsilon_s \ , \tag{10}$$

where $\tilde{y}_s$ is the average growth rate of GDP over a given time span in country $s$, $y_{st_0}$ is the level of GDP at the start of the period in country $s$, $\tilde{DI}_s$ is the average growth rate of an index of diversity (either fractionalization or polarization) over the same time interval in country $s$, and $X_{it}$ is a vector of variables thought to affect GDP growth, all taken at the beginning of the reference period. Control variables will be mentioned in the section about data, along with their main statistics.

The second, and key step, in the analysis, will consist in running the following regressions:

$$\tilde{y}_s = \alpha + y_{st_0} + \gamma_1 \tilde{Mig}_s + \gamma_3 X_s + \varepsilon_s \ , \tag{11}$$

where $\tilde{DI}_{ms}$ is replaced by $\tilde{Mig}_s$, i.e. by the rate of growth in the share of migrants over the specified time period in country $s$, and all the other variables are the same as in the previous specifications. Finally, the main regressions of our empirical analysis will be a combination of (5) and (6), and take the form:

$$\tilde{y}_s = \alpha + y_{st_0} + \gamma_1 Mig_s + \gamma_2 D^* + \gamma_3 X_s + \varepsilon_s \ , \tag{12}$$

where both the growth rate in the share of migrants, $\tilde{Mig}_s$, and the residuals of the diversity index (fractionalization or polarization, according to the equations),$D^*$, are included, where these residuals are obtained by regressing growth rates in both indices on growth rates in the share of migrants. These residuals will therefore represent a pure component of diversity growth, controlling for growth in the share of migrants. As residuals are generated regressors, bootstrapped standard errors will be used. All the other variables and controls are the same as in the previous specifications. This is the main specification in the empirical analysis, as it will allow to disentangle the effect of migration from that of pure diversity.

Acknowledging the potential endogeneity of migration and the related diversity measures, and following Bove and Elia (2017), equations (5) - (7) have also been estimated by a two stage, instrumental variable, procedure. In particular, building on the work by Docquier, Lodigiani, Rapoport, and Schiff (2015) and taking advantage of the bilateral nature of the dataset on migration, a gravity model is estimated and used to predict countries' bilateral migration stocks by a set of exogenous bilateral variables. We then use the bilateral predicted immigration stocks to construct indices of fractionalization and polarization; finally, these gravity-based predicted diversity indices are used as instruments for birthplace diversity (fractionalization and polarization).

The gravity model of bilateral migration stocks has been implemented by pooling data relative to the complete time span (1960 to 2010), and the exogenous variables used as instruments are: a dummy for contiguous states; dummy variables for a colonial relationship, for a common colonizer,

for a common language, or for belonging to the same country in the past; the log of the country of origin's population and the capital-to-capital distance. Also, as in Docquier et al. (2015) interactions between geographic distance and time dummies are also used as instruments, capturing changes in impediments to migration, as well as interactions between country of origin and destination and time dummies.

## *3 Data*

The dataset employed in the analysis includes variables from different sources, covering a time span of several decades, 1960-2010. Table 2 illustrates the main descriptives of the variables used in the analysis.

Table 2: Descriptive Statistics.

| Variable | Observations | Mean | Standard Deviation | Min | Max |
|---|---|---|---|---|---|
| Fractionalization | 1060 | 0.103 | 0.13 | 0 | 0.851 |
| Residual of Fractionalization | 1061 | 2.04e-10 | 0.229 | -2.903 | 1.703 |
| Polarization | 1060 | 0.172 | 0.175 | 0 | 0.755 |
| Residual of Polarization | 1,061 | 8.95e-11 | 0.568 | -7.590 | 3.783 |
| Share of Migrants | 1061 | 0.059 | 0.088 | 0 | 0.966 |
| Per capita GDP | 922 | 8.287 | 1.279 | 5.193 | 11.376 |
| Schooling | 828 | 1.700 | 0.622 | 0.013 | 2.669 |
| Investments (% GDP) | 922 | 2.990 | 0.599 | 0.361 | 4.539 |
| Openness (% GDP) | 922 | 4.025 | 0.739 | 0.651 | 6.014 |
| Gov't consumption (% GDP) | 922 | 2.274 | 0.658 | -1.129 | 4.186 |
| Population growth rate | 884 | 1.826 | 1.250 | -1.281 | 9.847 |
| Ethnic inequality | 1007 | 0.430 | 0.256 | 0 | 0.966 |
| Latin American countries | 1061 | 0.175 | 0.380 | 0 | 1 |
| Sub-Saharan countries | 1061 | 0.259 | 0.438 | 0 | 1 |
| Developed countries | 1061 | 0.158 | 0.365 | 0 | 1 |

**Notes:** Fractionalization and polarization are computed according to equations (1) and (3), on the whole sample and on the subsample of migrants, for all countries and periods for which migration is positive. All continuous variables are expressed in logs, except for growth rates and the index of ethnic inequality. The last three variables are indicator variables, taking value one if the country belongs to the corresponding group of countries.

Data on migration are taken from the World Bank, and integration thereof. The number of countries covered by the data is quite large, 135, mostly developing, according to the definition of the World Bank. Data on GDP, population, investment share, government consumption share, trade to GDP ratio come from the Penn World Tables, version 7.1.7. Data on human capital, and notably the average years of school attainment, are drawn from the Barro and Lee dataset. The ethnic inequality index comes from Alesina et al (2016). More specific details on the datasets and variables used in the empirical analyses can be found in the data section of Bove and Elia (2017), to which we refer the interested reader. In fact, the main descriptives are almost identical to the ones

in Table 1 by Bove and Elia (2017), with the addition of fractionalization and polarization computed only on the subset of the migrant population. It is interesting to notice that both fractionalization and polarization, when computed on the subsample of migrants, are much larger in mean, and that their relative ranking is reversed. Also, variability in the two indexes, as expressed by the coefficient of variation, is much lower when those measures are computed on the subsample of migrants, only.

## *4 Results*

Empirical results are presented in Tables 3 - 10[2].

A cursory inspection of these tables reveals a somewhat striking result. In fact, although fractionalization and polarization tell in principle two very different stories, their impact on growth is strikingly similar, as revealed by the corresponding coefficients' estimates. From expressions (1) and (7) we know that when fractionalization is large, polarization is small, and vice versa, as a large number of small migrant communities increase diversity, and decrease polarization. It is thus peculiar that the coefficients attached to the corresponding variables are extremely similar in both absolute value and statistical significance, which begs an explanation.

The reason for this apparent puzzle is to be found in the high correlations (displayed in Table 2) between the two variables, when they are computed on the whole population, and between the two diversity variables and the variable expressing the share of migrants.

As a further confirmation, Table 5 above contains results for the same regression, in which fractionalization and polarization have been replaced by the share of migrants.

[2]Tables 3 4 8 9 show both our results and those of Bove and Elia (2017). For these tables $*p < 0.10, **p < 0.05, ***p < 0.01$. Huber-White robust standard errors in parentheses; Columns report regressions' coefficients for 5 consecutive time spells, as indicated in the headings and in Bove and Elia (2017) dummies for Latin American and Sub-Saharan countries and a constant are included but not shown.

Table 3: Growth and Diversity - OLS results.

| | 60-10 | | 70-10 | | 80-10 | | 90-10 | | 00-10 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Original | Replicated | Original | Replicated | Original | Replicated | Original | Replicated | Original | Replicated |
| Fractionalization | 0.148*** | 0.148*** | 0.113*** | 0.111** | 0.131*** | 0.129*** | 0.061* | 0.058* | -0.040 | -0.043* |
| | (0.046) | (0.046) | (0.042) | (0.043) | (0.039) | (0.040) | (0.033) | (0.034) | (0.024) | (0.025) |
| per capita GDP,$t_0$ | -1.127*** | -1.133 *** | -0.957*** | -0.960*** | -0.968*** | -0.971*** | -0.677*** | -0.723*** | -1.208*** | -1.202*** |
| | (0.171) | (0.173) | (0.139) | (0.140) | (0.156) | (0.158) | (0.203) | (0.202) | (0.197) | (0.197) |
| Population growth rate | -0.374** | -0.376** | -0.195 | -0.197 | -0.275* | -0.281* | -0.287* | -0.258* | -0.515** | -0.508** |
| | (0.181) | (0.181) | (0.150) | (0.150) | (0.152) | (0.153) | (0.159) | (0.146) | (0.221) | (0.221) |
| Investments (%GDP) | 0.551*** | 0.550*** | 0.385* | 0.386* | 0.132 | 0.132 | 0.511 | 0.516* | 0.598 | 0.602 |
| | (0.152) | (0.152) | (0.230) | (0.231) | (0.277) | (0.279) | (0.309) | (0.311) | (0.436) | (0.436) |
| Schooling | 0.882*** | 0.888*** | 0.938*** | 0.938*** | 1.038*** | 1.035*** | 0.495 | 0.452 | 0.824 | 0.843 |
| | (0.291) | (0.292) | (0.285) | (0.285) | (0.374) | (0.376) | (0.521) | (0.509) | (0.638) | (0.637) |
| Openness (%GDP) | 0.182 | 0.185 | 0.147 | 0.151 | 0.029 | 0.033 | -0.044 | -0.089 | -0.231 | -0.234 |
| | (0.154) | (0.154) | (0.157) | (0.157) | (0.203) | (0.203) | (0.244) | (0.226) | (0.427) | (0.426) |
| Gov't Consumption (%GDP) | 0.122 | 0.118 | 0.082 | 0.081 | 0.116 | 0.116 | 0.289 | 0.296 | 0.067 | 0.071 |
| | (0.125) | (0.124) | (0.192) | (0.192) | (0.222) | (0.223) | (0.322) | (0.319) | (0.428) | (0.428) |
| Ethnic inequality | -0.969* | -0.954* | -0.863 | -0.852 | -1.057* | -1.043* | -0.000*** | -0.766 | 1.024 | 1.027 |
| | (0.546) | (0.546) | (0.587) | (0.588) | (0.624) | (0.626) | (0.000) | (0.619) | (0.821) | (0.819) |
| Latin American countries | | -0.562** | | -0.624** | | -0.751*** | | -0.108 | | -0.817* |
| | | (0.246) | | (0.255) | | (0.286) | | (0.373) | | (0.458) |
| Sub-Saharan countries | | -1.616*** | | -1.713*** | | -1.582*** | | -1.656*** | | -2.248*** |
| | | (0.295) | | (0.350) | | (0.401) | | (0.420) | | (0.561) |
| Constant | | 8.951*** | | 7.572*** | | 8.499*** | | 6.380*** | | 11.229*** |
| | | (1.235) | | (1.175) | | (1.443) | | (1.909) | | (2.162) |
| Observations | 95 | 95 | 118 | 118 | 118 | 118 | 127 | 127 | 135 | 135 |
| R2 | 0.607 | 0.606 | 0.505 | 0.503 | 0.456 | 0.453 | 0.307 | 0.307 | 0.369 | 0.372 |

Table 4: Growth and Diversity - OLS results.

| | 60-10 | | 70-10 | | 80-10 | | 90-10 | | 00-10 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Original | Replicated | Original | Replicated | Original | Replicated | Original | Replicated | Original | Replicated |
| Polarization | 0.152*** | 0.152*** | 0.113** | 0.112** | 0.132*** | 0.130*** | 0.062* | 0.059* | -0.042* | -0.045* |
| | (0.047) | (0.047) | (0.043) | (0.044) | (0.040) | (0.041) | (0.033) | (0.034) | (0.025) | (0.025) |
| per capita GDP,$t_0$ | -1.114*** | -1.120*** | -0.939*** | -0.942*** | -0.946*** | -0.950*** | 0.664*** | -0.712*** | -1.220*** | -1.215*** |
| | (0.171) | (0.173) | (0.138) | (0.139) | (0.156) | (0.158) | (0.203) | (0.201) | (0.196) | (0.196) |
| Population growth rate | -0.389** | -0.391** | -0.190 | -0.193 | -0.266* | -0.271* | 0.278* | -0.248* | -0.523** | -0.517** |
| | (0.176) | (0.176) | (0.149) | (0.149) | (0.150) | (0.151) | (0.159) | (0.146) | (0.218) | (0.217) |
| Investments (%GDP) | 0.548*** | 0.548*** | 0.382 | 0.383 | 0.124 | 0.124 | 0.510 | 0.517* | 0.599 | 0.602 |
| | (0.153) | (0.153) | (0.230) | (0.232) | (0.276) | (0.278) | (0.309) | (0.310) | (0.435) | (0.434) |
| Schooling | 0.867*** | 0.873*** | 0.933*** | 0.932*** | 1.036*** | 1.033*** | 0.494 | 0.455 | 0.831 | 0.848 |
| | (0.291) | (0.292) | (0.286) | (0.286) | (0.374) | (0.376) | (0.521) | (0.508) | (0.637) | (0.635) |
| Openness (%GDP) | 0.191 | 0.194 | 0.153 | 0.156 | 0.039 | 0.042 | -0.041 | -0.085 | -0.238 | -0.242 |
| | (0.155) | (0.155) | (0.158) | (0.158) | (0.204) | (0.204) | (0.244) | (0.226) | (0.426) | (0.425) |
| Gov't Consumption (%GDP) | 0.120 | 0.115 | 0.074 | 0.073 | 0.106 | 0.106 | 0.285 | 0.294 | 0.071 | 0.075 |
| | (0.124) | (0.123) | (0.192) | (0.193) | (0.221) | (0.222) | (0.321) | (0.318) | (0.427) | (0.427) |
| Ethnic inequality | -0.944* | -0.930* | -0.862 | -0.851 | -1.053* | -1.040* | -0.000*** | -0.764 | 1.024 | 1.027 |
| | (0.547) | (0.547) | (0.588) | (0.589) | (0.624) | (0.626) | (0.000) | (0.620) | (0.819) | (0.817) |
| Latin American countries | | -0.577** | | -0.643** | | -0.776*** | | -0.116 | | -0.806* |
| | | (0.245) | | (0.255) | | (0.284) | | (0.374) | | (0.459) |
| Sub-Saharan countries | | -1.617*** | | -1.720*** | | -1.588*** | | -1.658*** | | -2.248*** |
| | | (0.294) | | (0.350) | | (0.401) | | (0.420) | | (0.562) |
| Constant | | 8.883*** | | 7.455*** | | 8.338*** | | 6.261*** | | 11.348*** |
| | | (1.240) | | (1.179) | | (1.452) | | (1.900) | | (2.150) |
| Observations | 95 | 95 | 118 | 118 | 118 | 118 | 127 | 127 | 135 | 135 |
| R2 | 0.606 | 0.606 | 0.503 | 0.501 | 0.455 | 0.452 | 0.307 | 0.307 | 0.370 | 0.372 |

Table 3 and Table 4 almost exactly replicate Table 3, Panels A and B, in Bove and Elia (2017), with minor differences due to small differences in data (periodic data revisions) and to data trimming.

Table 5: Growth and Diversity - OLS results.

| | 60-10 | 70-10 | 80-10 | 90-10 | 00-10 |
|---|---|---|---|---|---|
| Share of migrants | 0.146*** | 0.111*** | 0.127*** | 0.059* | -0.041* |
| | (0.045) | (0.042) | (0.039) | (0.033) | (0.024) |
| per capita GDP, $t_0$ | -1.139*** | -0.967*** | -0.981*** | -0.731*** | -1.197*** |
| | (0.173) | (0.141) | (0.158) | (0.202) | (0.198) |
| Population growth rate | -0.373** | -0.202 | -0.288* | -0.261* | -0.503** |
| | (0.184) | (0.151) | (0.154) | (0.147) | (0.223) |
| Investments (% GDP) | 0.551*** | 0.388* | 0.134 | 0.517* | 0.596 |
| | (0.152) | (0.231) | (0.280) | (0.312) | (0.436) |
| Schooling | 0.896*** | 0.942*** | 1.040*** | 0.460 | 0.835 |
| | (0.292) | (0.285) | (0.376) | (0.508) | (0.639) |
| Openness (% GDP) | 0.182 | 0.148 | 0.028 | -0.091 | -0.227 |
| | (0.154) | (0.157) | (0.203) | (0.226) | (0.427) |
| Gov't Consumption (% GDP) | 0.118 | 0.083 | 0.119 | 0.296 | 0.070 |
| | (0.124) | (0.192) | (0.223) | (0.318) | (0.428) |
| Ethnic inequality | -0.960* | -0.849 | -1.038 | -0.754 | 1.015 |
| | (0.544) | (0.588) | (0.626) | (0.619) | (0.820) |
| Latin American countries | -0.559** | -0.618** | -0.745** | -0.098 | -0.821* |
| | (0.246) | (0.255) | (0.286) | (0.373) | (0.458) |
| Sub-Saharan countries | -1.616*** | -1.708*** | -1.577*** | -1.652*** | -2.251*** |
| | (0.295) | (0.350) | (0.401) | (0.420) | (0.561) |
| Constant | 8.993*** | 7.628*** | 8.579*** | 6.422*** | 11.194*** |
| | (1.232) | (1.174) | (1.440) | (1.913) | (2.171) |
| Observations | 95 | 118 | 118 | 127 | 135 |
| $R^2$ | 0.607 | 0.504 | 0.453 | 0.308 | 0.370 |

$*p < 0.10, **p < 0.05, ***p < 0.01$. Huber-White robust standard errors in parentheses.
Columns report regressions' coefficients for 5 consecutive time spells, as indicated in the headings.
Growth rates of GDP, migrants' share and diversity indexes are average over periods.

As expected, the estimated coefficients of the variable "share of migrants" are extremely close, in value and statistical significance, to both the coefficients of fractionalization and of polarization in Table 3 and 4, for all time periods, revealing that the common factor driving those results is, indeed, the share of migrant population over total population. Needless to say, the same share of migrants is, a priori, compatible with many different values for both fractionalization and polarization. We can conclude, therefore, that the positive effects on growth previously ascribed to diversity and polarization should, in fact, be imputed to the share of migrant population.

Nevertheless, the additional relevant question is whether or not fractionalization and polarization do retain some explanatory power for economic growth, over and above the explanatory power featured by the share of migrants. In other words: is migration sufficient to bring about some pos-

itive effects on growth, or should it be accompanied by diversity, in order to exert its beneficial effects?

To evaluate the effects of both migration and diversity on growth we resort to an alternative identification strategy, in the spirit of Alesina et al. (2016), whereby we use as independent variables both the share of foreign born and, alternatively, the residuals of fractionalization and polarization ($DI_{ms}$ and $POL_{ms}$, computed as in equation (12).

The estimation results for the two regressions are presented in Tables 6 and 7. In both OLS regressions, the variable “share of migrants” displays coefficients which are very close to those in Table 5, and even closer to those in Table 3 for fractionalization and polarization, in Bove and Elia (2017). Tables 6 and 7 show that, unlike for growth in the share of migrants, both "pure" fractionalization and polarization do not appear to affect growth.

To interpret these results, it is important to remember that the level of aggregation of the analysis is the entire country, which makes the interpretation of fractionalization quite tricky. In fact, it may be the case that even though, at the country level, fractionalization is high, as many conspicuous communities of different geographic origin coexist, at a more geographically disaggregated level (region, province, city, village) the situation might be completely different, and maybe feature high polarization.

Table 6: Growth and Diversity - OLS results.

| | 60-10 | 70-10 | 80-10 | 90-10 | 00-10 |
|---|---|---|---|---|---|
| Share of migrants | 0.152*** | 0.121*** | 0.128*** | 0.0660* | -0.0300 |
| | (0.0546) | (0.0467) | (0.0444) | (0.0361) | (0.0261) |
| Residual of Fractionalisation | -0.872 | -0.794 | 0.0476 | -0.333 | -0.680* |
| | (1.734) | (1.253) | (1.514) | (0.451) | (0.398) |
| per capita GDP, $t_0$ | -1.169*** | -1.017*** | -0.980*** | -0.771*** | -1.301*** |
| | (0.184) | (0.162) | (0.185) | (0.216) | (0.224) |
| Population growth rate | -0.356 | -0.235 | -0.285 | -0.283* | -0.636** |
| | (0.225) | (0.173) | (0.184) | (0.163) | (0.256) |
| Investments (% GDP) | 0.558*** | 0.405* | 0.137 | 0.532 | 0.640 |
| | (0.161) | (0.243) | (0.284) | (0.325) | (0.471) |
| Schooling | 0.938*** | 0.969*** | 1.039*** | 0.511 | 0.855 |
| | (0.308) | (0.301) | (0.385) | (0.533) | (0.651) |
| Openness (% GDP) | 0.161 | 0.130 | 0.0303 | -0.0993 | -0.319 |
| | (0.160) | (0.164) | (0.213) | (0.230) | (0.405) |
| Gov't Consumption (% GDP) | 0.118 | 0.0974 | 0.116 | 0.292 | 0.0811 |
| | (0.141) | (0.213) | (0.237) | (0.324) | (0.437) |
| Ethnic inequality | -1.001* | -0.834 | -1.045* | -0.689 | 1.124 |
| | (0.560) | (0.608) | (0.629) | (0.634) | (0.818) |
| Latin American countries | -0.547** | -0.585** | -0.742** | -0.0482 | -0.733 |
| | (0.262) | (0.257) | (0.304) | (0.377) | (0.480) |
| Sub-Saharan countries | -1.617*** | -1.681*** | -1.579*** | -1.639*** | -2.182*** |
| | (0.322) | (0.367) | (0.410) | (0.437) | (0.587) |
| Constant | 9.244*** | 8.019*** | 8.562*** | 6.649*** | 12.31*** |
| | (1.350) | (1.360) | (1.772) | (2.123) | (2.329) |
| Observations | 1,061 | 1,061 | 1,061 | 1,061 | 1,061 |
| R-squared | 0.609 | 0.508 | 0.455 | 0.312 | 0.380 |

$*p < 0.10, **p < 0.05, ***p < 0.01$. Huber-White robust standard errors in parentheses.
Columns report regressions' coefficients for 5 consecutive time spells, as indicated in the headings.
Growth rates of GDP, migrants' share and diversity indexes are average over periods.

Table 7: Growth and Diversity - OLS results.

| | 60-10 | 70-10 | 80-10 | 90-10 | 00-10 |
|---|---|---|---|---|---|
| Share of migrants | 0.146*** | 0.118*** | 0.130*** | 0.0636* | -0.0349 |
| | (0.0515) | (0.0432) | (0.0425) | (0.0349) | (0.0260) |
| Residual of Polarisation | -0.0336 | -0.223 | -0.0412 | -0.0653 | -0.150 |
| | (0.499) | (0.368) | (0.420) | (0.225) | (0.154) |
| per capita GDP, t0 | -1.143*** | -1.011*** | -0.993*** | -0.753*** | -1.264*** |
| | (0.186) | (0.154) | (0.184) | (0.221) | (0.226) |
| Population growth rate | -0.370* | -0.222 | -0.294* | -0.277 | -0.563** |
| | (0.211) | (0.173) | (0.177) | (0.178) | (0.244) |
| Investments (% GDP) | 0.552*** | 0.402* | 0.141 | 0.520 | 0.602 |
| | (0.161) | (0.231) | (0.280) | (0.318) | (0.463) |
| Schooling | 0.899*** | 0.958*** | 1.042*** | 0.467 | 0.851 |
| | (0.316) | (0.300) | (0.388) | (0.521) | (0.656) |
| Openness (% GDP) | 0.180 | 0.133 | 0.0240 | -0.0953 | -0.270 |
| | (0.159) | (0.169) | (0.211) | (0.229) | (0.404) |
| Gov't Consumption (% GDP) | 0.118 | 0.103 | 0.121 | 0.297 | 0.0862 |
| | (0.140) | (0.210) | (0.243) | (0.321) | (0.442) |
| Ethnic inequality | -0.967* | -0.849 | -1.042 | -0.744 | 1.035 |
| | (0.559) | (0.608) | (0.648) | (0.637) | (0.813) |
| Latin American countries | -0.554** | -0.575** | -0.730** | -0.0786 | -0.764 |
| | (0.268) | (0.266) | (0.315) | (0.377) | (0.477) |
| Sub-Saharan countries | -1.616*** | -1.687*** | -1.574*** | -1.647*** | -2.234*** |
| | (0.314) | (0.352) | (0.405) | (0.429) | (0.576) |
| Constant | 9.023*** | 7.955*** | 8.673*** | 6.609*** | 11.88*** |
| | (1.364) | (1.333) | (1.723) | (2.165) | (2.385) |
| Observations | 1,061 | 1,061 | 1,061 | 1,061 | 1,061 |
| R-squared | 0.607 | 0.507 | 0.455 | 0.310 | 0.373 |

$*p < 0.10, **p < 0.05, ***p < 0.01$. Huber-White robust standard errors in parentheses.
Columns report regressions' coefficients for 5 consecutive time spells, as indicated in the headings.
Growth rates of GDP, migrants' share and diversity indexes are average over periods.

Table 8: Growth and Diversity - 2SLS results.

| | 60-10 | | 70-10 | | 80-10 | | 90-10 | | 00-10 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Original | Replicated | Original | Replicated | Original | Replicated | Original | Replicated | Original | Replicated |
| Fractionalization | 0.209** | 0.213*** | 0.270*** | 0.270*** | 0.273** | 0.268*** | 0.123 | 0.149 | 0.025 | 0.030 |
| | (0.082) | (0.079) | (0.089) | (0.088) | (0.095) | (0.093) | (0.168) | (0.158) | (0.153) | (0.145) |
| per capita GDP,$t_0$ | -1.206*** | -1.219*** | -1.100*** | -1.109*** | -1.028*** | -1.034*** | -0.686*** | -0.739*** | -1.268*** | -1.274*** |
| | (0.170) | (0.171) | (0.158) | (0.160) | (0.161) | (0.162) | (0.195) | (0.194) | (0.218) | (0.220) |
| Population growth rate | -0.382** | -0.385** | -0.141 | -0.147 | -0.242 | -0.254 | -0.281* | -0.251 | -0.596** | -0.604** |
| | (0.194) | (0.196) | (0.185) | (0.185) | (0.173) | (0.172) | (0.165) | (0.158) | (0.240) | (0.241) |
| Investments (%GDP) | 0.547*** | 0.546*** | 0.363* | 0.365* | 0.100 | 0.099 | 0.445 | 0.423 | 0.481 | 0.475 |
| | (0.145) | (0.145) | (0.217) | (0.219) | (0.266) | (0.270) | (0.307) | (0.303) | (0.479) | (0.470) |
| Schooling | 0.915*** | 0.926*** | 0.977*** | 0.976*** | 0.991** | 0.987** | 0.420 | 0.340 | 0.625 | 0.605 |
| | (0.280) | (0.281) | (0.314) | (0.313) | (0.397) | (0.397) | (0.561) | (0.561) | (0.795) | (0.797) |
| Openness (%GDP) | 0.222 | 0.229 | 0.131 | 0.139 | 0.018 | 0.026 | -0.040 | -0.086 | -0.168 | -0.164 |
| | (0.140) | (0.140) | (0.143) | (0.143) | (0.203) | (0.203) | (0.230) | (0.223) | (0.389) | (0.393) |
| Gov't Consumption (%GDP) | 0.132 | 0.126 | 0.046 | 0.043 | 0.122 | 0.122 | 0.316 | 0.336 | 0.070 | 0.068 |
| | (0.115) | (0.114) | (0.191) | (0.192) | (0.222) | (0.222) | (0.318) | (0.313) | (0.402) | (0.404) |
| Ethnic inequality | -0.887 | -0.861 | -0.850 | -0.824 | -0.123* | -1.093* | -0.000*** | -0.758 | 0.798 | 0.788 |
| | (0.546) | (0.544) | (0.611) | (0.614) | (0.643) | (0.643) | (0.000) | (0.610) | (0.878) | (0.857) |
| Latin American countries | | -0.469* | | -0.459 | | -0.536 | | -0.022 | | -0.765* |
| | | (0.261) | | (0.289) | | (0.335) | | (0.382) | | (0.438) |
| Sub-Saharan countries | | -1.618*** | | -1.683*** | | -1.437*** | | -1.573*** | | -2.226*** |
| | | (0.289) | | (0.357) | | (0.404) | | (0.404) | | (0.561) |
| Constant | | 9.362*** | | 8.714*** | | 8.966*** | | 6.695*** | | 12.445*** |
| | | (1.198) | | (1.250) | | (1.461) | | (1.840) | | (3.517) |
| Observations | 95 | 95 | 118 | 118 | 118 | 118 | 127 | 127 | 135 | 135 |
| R2 | 0.595 | 0.592 | 0.422 | 0.420 | 0.372 | 0.374 | 0.283 | 0.258 | 0.335 | 0.328 |
| *First stage F-stat* | 45 | | 49 | | 13 | | 4 | | 3 | |

Table 9: Growth and Diversity - 2SLS results.

| | 60-10 | | 70-10 | | 80-10 | | 90-10 | | 00-10 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Original | Replicated | Original | Replicated | Original | Replicated | Original | Replicated | Original | Replicated |
| Polarization | 0.221** | 0.225*** | 0.281*** | 0.282*** | 0.281*** | 0.276*** | 0.126 | 0.155 | 0.027 | 0.032 |
| | (0.086) | (0.083) | (0.092) | (0.091) | (0.097) | (0.096) | (0.170) | (0.162) | (0.156) | (0.149) |
| per capita GDP,$t_0$ | -1.195*** | -1.208*** | -1.066*** | -1.076*** | -0.983*** | -0.990*** | -0.659*** | -0.709*** | -1.261*** | -1.266*** |
| | (0.168) | (0.169) | (0.156) | (0.158) | (0.161) | (0.161) | (0.195) | (0.194) | (0.197) | (0.200) |
| Population growth rate | -0.404** | -0.408** | -0.127 | -0.132 | -0.221 | -0.233 | -0.263 | -0.225 | -0.592*** | -0.598*** |
| | (0.188) | (0.190) | (0.185) | (0.185) | (0.172) | (0.171) | (0.174) | (0.167) | (0.227) | (0.230) |
| Investments (%GDP) | 0.543*** | 0.543*** | 0.353 | 0.354 | 0.081 | 0.081 | 0.443 | 0.421 | 0.480 | 0.473 |
| | (0.147) | (0.146) | (0.219) | (0.221) | (0.266) | (0.270) | (0.308) | (0.305) | (0.478) | (0.471) |
| Schooling | 0.897*** | 0.907*** | 0.966*** | 0.966*** | 0.986** | 0.980** | 0.415 | 0.342 | 0.619 | 0.599 |
| | (0.280) | (0.281) | (0.317) | (0.316) | (0.398) | (0.398) | (0.560) | (0.556) | (0.804) | (0.807) |
| Openness (%GDP) | 0.238* | 0.245* | 0.145 | 0.152 | 0.038 | 0.045 | -0.034 | -0.076 | -0.163 | -0.158 |
| | (0.141) | (0.140) | (0.144) | (0.144) | (0.207) | (0.206) | (0.230) | (0.223) | (0.389) | (0.393) |
| Gov't Consumption (%GDP) | 0.129 | 0.123 | 0.023 | 0.020 | 0.101 | 0.102 | 0.309 | 0.332 | 0.067 | 0.065 |
| | (0.114) | (0.113) | (0.193) | (0.193) | (0.220) | (0.220) | (0.314) | (0.311) | (0.405) | (0.408) |
| Ethnic inequality | -0.844 | -0.818 | -0.847 | -0.820 | -1.117* | -1.088* | -0.000*** | -0.754 | 0.796 | 0.786 |
| | (0.553) | (0.551) | (0.616) | (0.620) | (0.647) | (0.647) | (0.000) | (0.614) | (0.874) | (0.857) |
| Latin American countries | | -0.484* | | -0.495* | | -0.579* | | -0.037 | | -0.773* |
| | | (0.258) | | (0.290) | | (0.330) | | (0.378) | | (0.439) |
| Sub-Saharan countries | | -1.620*** | | -1.700*** | | -1.443*** | | -1.575*** | | -2.225*** |
| | | (0.289) | | (0.359) | | (0.407) | | (0.406) | | (0.562) |
| Constant | | 9.298*** | | 8.501*** | | 8.641*** | | 6.398*** | | 12.372*** |
| | | (1.199) | | (1.254) | | (1.468) | | (1.809) | | (3.201) |
| Observations | 95 | 95 | 118 | 118 | 118 | 118 | 127 | 127 | 135 | 135 |
| R2 | 0.592 | 0.590 | 0.412 | 0.411 | 0.366 | 0.368 | 0.282 | 0.253 | 0.333 | 0.326 |
| *First stage F-stat* | 44 | | 49 | | 25 | | 4 | | 3 | |

Table 10: Growth and Diversity - 2SLS results.

| | 60-10 | 70-10 | 80-10 | 90-10 | 00-10 |
|---|---|---|---|---|---|
| Share of migrants | 0.207*** | 0.265*** | 0.265*** | 0.153 | 0.030 |
| | (0.077) | (0.087) | (0.093) | (0.162) | (0.148) |
| per capita GDP, $t_0$ | -1.225*** | -1.125*** | -1.054*** | -0.758*** | -1.280*** |
| | (0.172) | (0.161) | (0.163) | (0.197) | (0.236) |
| Population growth rate | -0.381* | -0.158 | -0.270 | -0.260* | -0.610** |
| | (0.199) | (0.186) | (0.175) | (0.158) | (0.259) |
| Investments (% GDP) | 0.548*** | 0.370* | 0.104 | 0.423 | 0.476 |
| | (0.144) | (0.218) | (0.270) | (0.304) | (0.469) |
| Schooling | 0.936*** | 0.986*** | 0.995** | 0.357 | 0.604 |
| | (0.281) | (0.313) | (0.398) | (0.557) | (0.804) |
| Openness (% GDP) | 0.223 | 0.133 | 0.015 | -0.090 | -0.167 |
| | (0.139) | (0.142) | (0.202) | (0.224) | (0.395) |
| Gov't Consumption (% GDP) | 0.126 | 0.048 | 0.128 | 0.337 | 0.068 |
| | (0.114) | (0.191) | (0.223) | (0.314) | (0.404) |
| Ethnic inequality | -0.872 | -0.817 | -1.082* | -0.727 | 0.790 |
| | (0.541) | (0.612) | (0.642) | (0.614) | (0.854) |
| Latin American countries | -0.468* | -0.449 | -0.520 | 0.006 | -0.761* |
| | (0.261) | (0.289) | (0.337) | (0.393) | (0.439) |
| Sub-Saharan countries | -1.618*** | -1.674*** | -1.426*** | -1.562*** | -2.222*** |
| | (0.289) | (0.357) | (0.404) | (0.408) | (0.559) |
| Constant | 9.408*** | 8.830*** | 9.135*** | 6.812*** | 12.507*** |
| | (1.198) | (1.255) | (1.465) | (1.871) | (3.779) |
| Observations | 95 | 118 | 118 | 127 | 135 |
| $R^2$ | 0.594 | 0.422 | 0.373 | 0.253 | 0.328 |

$*p < 0.10, **p < 0.05, ***p < 0.01$. Huber-White robust standard errors in parentheses.
Columns report regressions' coefficients for 5 consecutive time spells, as indicated in the headings.
Growth rates of GDP, migrants' share and diversity indexes are average over periods.

In that case, and if fractionalization is the kind of diversity that fosters growth, as suggested in much of the literature, our econometric analysis might not detect the corresponding positive effect, as fractionalization would in fact be hiding a locally polarized situation.

As a further robustness check, Tables 8 - 10 display the results of the same analysis as the one contained in Tables 4 - 6, but using instruments to account for the potential endogeneity in variables like fractionalization, polarization, and the share of migrants. The instruments used in the two-stage regressions have been obtained by adopting the same strategy as in Bove and Elia (2017), to which we refer the reader for more details. In a nutshell, the procedure consists in modeling bilateral migration by a gravity model based on presumably exogenous variables and then using the predictions of bilateral migration flows to compute instruments for the share of migrants, fractionalization, and polarization. Two stage OLS regressions have then been performed by using such instruments for the share of migrants, fractionalization and polarization. Tables 8 - 10 confirm the intuition we got from the previous OLS regressions, illustrated in Tables 3-5, in that the estimated coefficients of the share of migrants variable are extremely close to those of either

fractionalization and polarization, which are again very close to each other. Instrumenting for both the share of migrants and fractionalization or polarization[3] does not yield interesting results, as both sets of variables lose statistical significance with respect to two stage regressions only including the share of migrants, and both fractionalization and polarization never turn out to significantly affect growth over the various time intervals. Two stage least squares regressions, therefore, confirm that what is really relevant in terms of growth is migration itself, and that diversity does not appear to be influential, at least at this level of geographical aggregation.

## *5 Conclusion*

In a recent paper, Bove and Elia (2017) presented some important results linking diversity, in the form of both fractionalization and polarization, to economic growth. Unfortunately, these findings are seriously impaired by a very large correlation between both measures of diversity and the share of migrants over the total population. This correlation has at least two important consequences: 1) the effect of diversity on growth is originated by migration itself, independent of whether migration is accompanied by a higher or lower degree of fractionalization or polarization, and 2) fractionalization and polarization exert almost the same effect on economic growth, which is definitely puzzling, in as much as the two forms of diversity represent very different, if not opposite, aspects of migration diversity.

By using an analytical decomposition illustrated by Alesina et al. (2016), it becomes apparent that we should expect such a large correlation between fractionalization, polarization and the share of migrants. Moreover, replicating the results in Bove and Elia (2017) also clearly shows that the impact on growth previously ascribed to diversity should just be imputed to the share of migrants over the total population, without necessary reference to its feature in terms of fractionalization or polarization.

To disentangle the effect of diversity from that of migration itself, we used the residuals obtained from the regression of fractionalization and polarization on the share of migrants, and these measures are used as regressors in addition to the share of migrants in the total population. The results of the regressions confirm that there is no effect of polarization and fractionalization on growth. In view of these results, it seems reasonable to conjecture that less (geographically) aggregated data should be used to assess the impact of diversity on economic growth, and especially to evaluate the relative impact of fractionalization and polarization, which should constitute the focus of further empirical research.

[3] Results not included for brevity, but available on request from the author.

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