Economic Diversity and Growth: Empirical Investigation on the Transmission Channels

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Abstract

This paper empirically assesses the total effect of economic diversity on growth and the contribution of some indirect transmission channels through which part of this effect is carried. Economic diversity, measured by the level of diversity in exports, is found to have a negative direct effect on growth in developing countries that is outweighed by the positive indirect effects through transmission channels, leading to a positive total effect. Overall, higher levels of diversity appear to have a greater positive influence on growth in developing countries in comparison to more advanced economies. For this latter group, although greater diversity tends to favor growth both directly and through some channels, it is also associated with lower openness to trade and contraction in physical capital accumulation, which are detrimental to growth. Human capital and foreign exchange reserve buildup are found to be the most influential transmission channels in the growth and diversity relationship.

1. Introduction

Economic diversity refers to the level of spreading of a country's economic activity across sectors (Imbs & Wacziarg, 2003). Greater levels of diversity are associated with more stability in income and unemployment. Indeed, spreading risks (and opportunities) over a wider range of sectors is intended to allow countries to more smoothly absorb the adverse effects of economic cycles and external shocks (Attaran, 1986; Malizia & Ke, 1993; Wagner & Deller, 1998; Deller & Watson, 2016; Sukadi A Sukadi, 2022). Beyond these stabilization properties, economic diversity is increasingly recognized as an instrument for growth, especially for countries at early stages of development (Herzer & Nowak-Lehnmann, 2006; Papageorgiou & Spatafora, 2012; Mania & Rieber, 2019). This is partly because by fostering economic stability, greater levels of diversity help consolidate the bases of economic growth (Gylfason, 2018). Moreover, developing countries that tend to specialize based on their comparative advantage may remain confined to either highly volatile natural resource sectors or to low-growth traditional manufacturing sectors (e.g., food, textile, apparel, etc.) (Sekkat, 2016).

Although the literature provides support of a linkage between higher diversity and growth, studies aimed at disentangling the mesh of that nexus remain scarce. Herzer & Nowak-Lehnmann (2006) and Gelb (2010) argue that export diversification comes along with positive externalities of learning-by-doing and learning-by-exporting due to international competition, resulting in accelerated growth. For many primary-based economies, the path to diversity has been through industrialization. Figure 1 shows a positive relationship between the weight of the manufacturing sector in the economy and the average level of diversity in exports for a sample of 141 countries over the 1998–2019 period. The literature has found the manufacturing sector to be associated with more positive externalities on growth than the other sectors (Levin & Raut, 1997; Matthee & Naude, 2007).

Papyrakis & Gerlagh (2004) analyzed the question through the prisms of the "resource curse" hypothesis and natural resource abundance. Indeed, economic concentration around a dominant sector is a common feature in commodity-rich countries. The authors identify dampened investments as the main channel through which a higher dependency on natural resources may undermine growth. The other channels, ranked by relative importance, include lower trade openness, less favorable terms of trade, lower education, and higher corruption levels.

This paper aims to assess the total effect of economic diversity on growth, as well as the relative importance of some channels through which this effect may be carried. Cross-sectional data for 196 countries over the period 1998–2019 are used for the analyses. The considered channels include some typical growth confounders, such as investment and education levels, along with corruption, the effects of which remain blurry. As countries diversify, an increasing number of products can be found locally, resulting in a reduced import bill and local currency appreciation (Alley, 2018). To account for these effects, some additional plausible international channels (i.e., openness to trade, foreign exchange reserves, and real effective exchange rate) are also considered. Chen (2016) mentions that economic diversity can be measured either in terms of the sectoral distribution of national income, total employment, or exports or as a country's dependency on the export of a certain commodity. In this paper, the IMF's export diversification index (EDI) is used to assess the level of economic diversity of countries. The rationale for this choice is two-fold: (1) the dependency on natural resources used by Papyrakis & Gerlagh (2004) appears to be connected with low levels of diversity (i.e., concentration); however, in line with Albassam (2015), this paper does not use these two concepts interchangeably. Figure 2 plots some observations of mean natural resources as a percentage of GDP and the level of economic diversity based on exports. The fitted Loess curve shows that higher levels of natural resource dependency correspond to lower levels of economic diversity. However, at low levels of natural resource rent, we observe a wide dispersion of observations along the economic diversity axis. The abundance of natural resources thus appears to be a fairly inaccurate measure of economic concentration (and diversification) for countries with low levels of natural resource rent. (2) Alsharif et al. (2017) show that employment-based diversification measures provide better insights into economic diversification than export-based measures for countries with important internal markets. For countries with smaller internal markets and thus more reliant on foreign markets on

both the demand and supply sides, export-based measures tend to be better indicators of diversification. Following Sukadi A Sukadi (2022), this paper opts for an export-based indicator to assess the level of economic diversity given that large and self-sufficient internal markets tend to be a fairly non-widespread feature among countries. Moreover, access to quality data on sectoral employment is quite limited, which makes the computation of employment-base measures rather challenging for many countries.

The empirical analyses conducted in this paper allow us to identify both direct and indirect effects of economic diversity on growth. Potential endogeneity issues are addressed using 2SLS estimations. Moreover, as the manifestation of the nexus between diversity and growth may differ at various stages of development, some additional analyses are performed separately on subsamples of developing and developed countries.

Beyond this introductory section, the remainder of this paper is organized as follows: section 2 presents the envisaged transmission channels and the rationale for their selection. The empirical analyses are performed in section 3, and the conclusions drawn from the findings are presented in the last section of the paper.

2. Transmission Channels

2.1. Local channels

Successful diversification efforts tend to be associated with enhanced investment in physical and human capital, which in turn contribute to long-term growth (Mim & Ali, 2020). Rodrik (2005) argues that prosperous economies are characterized by diversified investments into a wide range of activities. Economic concentration on the other hand is linked to lower levels of investment. This negative relationship between concentration and investment may result from the fact that the lack of sectoral diversity bereaves investors from opportunities for portfolio diversification. Consequently, investment in such an environment may appear to be more vulnerable to market fluctuations and shocks, which can be discouraging for investors. This is particularly the case in resource-based economies, as recurrent fluctuations in resource prices tend to increase real exchange rate volatility, resulting in decreased investment in tradable sectors. Moreover, resource abundance also tends to foster rent-seeking behaviors from investors and producers, causing investments to be rechanneled from more socially profitable sectors (i.e., manufacturing and agriculture) to the resource sector (Gylfason & Zoega, 2006). This study considers investment as a channel through which economic diversity may influence growth, as physical capital accumulation is required both to stimulate new economic sectors and to keep them alive as they face international competition. This in turn contributes to long-term growth.

The literature recognizes education as an important driver of economic growth, as it contributes substantially to human capital accumulation (e.g., Barro & Lee, 1994; Krueger & Lindahl, 2001). Higher levels of economic diversity tend to be linked with enhanced schooling, as the variety of activity sectors translates into a variety in labor-skills needs (Mim & Ali, 2020). Economic concentration around sectors with relatively high-paying and low-skill jobs, which is a common feature in resource-based economies, tends to be detrimental to schooling and thus to human capital. Indeed, such a configuration tends to result in higher opportunity costs and lower returns on education, discouraging human capital accumulation (Cockx & Francken, 2016; Marchand & Weber, 2018). The crucial role of education in long-term growth along with its relationship with economic diversity suffice to envisage it as a plausible transmission channel.

Another local transmission channel considered in this study is corruption. The literature remains divided about the effect of corruption on economic growth. On the one hand, some researchers support the hypothesis of a desirable “grease the wheels” effect of corruption (e.g., Acemoglu & Verdier, 1998; Méon & Weill, 2010). The idea is that corruption may increase efficiency in the provision of government services by providing additional pecuniary incentives for bureaucrats to do their jobs. Moreover, bribery may help entrepreneurs avoid the burden of heavy and inefficient regulations (Mo, 2001). Méon & Weill (2010) find significant positive marginal effects of corruption on aggregate efficiency in countries with weak institutional frameworks. On the other hand, several studies (e.g., Mauro, 1995; Mo, 2001; Méon & Sekkat, 2005) show a detrimental “sand the wheels” effect of corruption on growth, as it may favor institutional instability and discourage investors. In this study, we remain agnostic about the effects of corruption on growth.

The literature shows a negative link between the levels of economic diversity and corruption (e.g., Serra, 2006; Bhattacharyya & Hodler, 2010). The multiplication of activity sectors may help alleviate the strangleholds of autocratic leaders and pressure groups on the economy. Moreover, diversity helps reduce the reliance on resource rents while enhancing the role of tax proceeds as a source of revenue for the nation. These changes come along with increased demand for democratic accountability and institutional efficiency, which are associated with lower levels of corruption (McFerson, 2010; Badeeb et al., 2017).

2.2. International channels

Higher openness to trade comes along with more opportunities for countries, especially small states, to access larger markets and benefit from knowledge and technology transfers. This in turn contributes positively to their capacity for long-run growth (McIntyre et al., 2018). The level of economic diversity that a country exhibits is likely to influence its openness to trade. On the imports side, as more types of products become available locally, domestic consumption is expected to be enhanced. This results in lower import levels and in changes in the type of goods imported. On the other hand, exports are expected to be positively influenced by higher levels of diversification, as greater variety in production offers more opportunities to serve foreign markets. Gylfason (2018) argues that as countries diversify, they tend to be more efficient in their production processes and more open to trade. However, given the expected decrease in the imports bill and increase in exports, no clear-cut hypothesis can be made about the direction into which economic diversity may influence trade openness.

Krušković & Maričić (2015) show that the buildup of foreign exchange reserves has a stimulating effect on long-term growth in developing and emerging countries. A first argument is that the accumulation of reserves leads to exchange rate depreciations, which in turn discourage imports while fostering exports and thus enhancing growth. In addition to the export-led growth argument, another motivation for reserve accumulation is that it may help reduce the odds of currency crises and protect against subsequent output losses (Wyplosz, 2007). Indeed, larger reserves may contribute to increasing the trustworthiness of developing and emerging countries and act as a deterrent tool against speculative attacks. For developed countries, however, bearing the costs of excessive stock of reserves appears to be unworthy, as they can easily borrow in the international capital market when required (Krušković & Maričić, 2015).

Greater levels of economic diversity are expected to be associated with larger foreign exchange reserves. The idea is that as countries span their activities over a wider range of sectors, they increase their opportunities for trade and reach new trading partners. This is reflected in the amount of foreign currency inflows, as well as in the currency composition of reserves, which depends directly on the currency invoicing of trade (Ito & McCauley, 2020).

Through the diversification process, efforts to stimulate new activity sectors confront international competition, especially in the case of tradable sectors. Successful diversification strategies are thus accompanied by increased competitiveness. The real effective exchange rate (REER), which measures the real value of a country's currency in relation to the basket of the trading partners of the country, provides a gauge of international competitiveness (Darvas, 2012). REER appreciations appear to affect competitiveness and growth negatively, as they cause investments and resources to be rechanneled to nontradable sectors, while tradable goods become less affordable for consumers and less attractive for investors and thus more vulnerable to foreign competition (Comunale, 2017). Such schemes are common in resource-rich countries subject to Dutch Disease issues, especially those exhibiting high concentration levels around their resource sector (Badeeb et al., 2017). Alley (2018) analyzes the relationship between economic diversification (proxied by non-oil exports) and the exchange rate. The author argues that diversification stems currency depreciations in oil-exporting countries by decreasing the sensitivity of the currency to oil prices. Currency depreciations make local products more affordable for foreign consumers and thus stimulate exports. Moreover, as diversification allows more consumption needs to be satisfied by local production, it offers protection against imported inflation associated with currency depreciation.

3. Empirical Analysis

3.1. Cross-country regressions

The aim of this analysis is to assess the influence of economic diversity on growth. To that end, an estimation strategy is built following Barro (1991), Sachs & Warner (1995, 1997), Papyrakis & Gerlagh (2004) and Boulila et al. (2008). The study uses cross-sectional regressions covering a sample of 196 countries over the period 1998–2019. The explained variable is the growth rate of GDP per capita from 1998 (t_0) to 2019 (t_T), denoted by $G^i = (1/T)\, ln\left(Y_T^i / Y_0^i\right)$.

In line with Papyrakis & Gerlagh (2004), we base the equations on the hypothesis of growth convergence. It is expected that advanced economies exhibit lower growth rates than countries at earlier stages of development. G^i is thus assumed to depend negatively on $ln\left(Y_0^i\right)$ (i.e., the logarithm of the initial GDP per capita). The explanatory variables include the level of economic diversity proxied by the average level of export diversification over the period of

analysis, and a vector of variables composed of the considered transmission channels denoted $\overrightarrow{TC}^i$. Details on the definitions, sources and timeframes of the variables are provided in appendix A, while Table 1 displays the descriptive statistics.

Table 1
Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Growth	183	0.022	0.018	-0.018	0.085
Diversity	185	0.324	0.122	0.157	0.673
Openness	196	94.224	57.887	21.630	368.709
Reserves	168	20.713	2.561	13.332	26.096
Investment	182	24.074	6.572	9.715	51.994
REER	176	4.790	0.408	4.207	7.422
$REER_{170}$	176	4.664	0.232	4.167	6.508
Corruption	185	0.306	0.134	0.105	0.862
$Corruption_{New}$	178	0.029	0.014	0.011	0.110
Schooling	195	76.006	29.613	5.932	156.873
Tertiary Education	189	32.602	25.981	0.648	115.296

The initial equation for cross-country regressions takes the following form:

$$G^i = \alpha_0 + \alpha_1 ln\left(Y_0^i\right) + \alpha_2 Diversity^i + \alpha_3 \overrightarrow{TC}^i + \epsilon^i, \quad (1)$$

where the superscript i indicates countries.

Table 2 shows the results of the OLS estimation of Eq. (1). First, G^i is only regressed upon the initial level of income and the measure of economic diversity. As expected, the results presented in the first column of the table show a positive and statistically significant relationship between growth and diversity. Moreover, the convergence hypothesis appears to hold, as growth tends to be negatively linked to the initial level of income. The other independent variables are then gradually added to the estimation. The expansion of the $\overrightarrow{TC}$ vector in the estimation increases the adjusted R^2 while reducing the magnitude and significance of the coefficient of diversity. This tends to confirm that some share of the impact of diversity on growth is carried through the considered transmission channels. Note, however, that the inclusion of the trade openness and investment variables does not seem to reduce the coefficient of diversity. This raises questions about the pertinence of these two variables as transmission channels.

Table 2
OLS estimation of growth regressions as in Eq. (1)

Dependent variable: ***Growth***	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Ln Y 1998	-0.00553***	-0.00718***	-0.00895***	-0.00845***	-0.00900***	-0.00923***	-0.0120***
	(0.00107)	(0.00106)	(0.00122)	(0.00119)	(0.00104)	(0.00159)	(0.00176)
Diversity	0.0383***	0.0469***	0.0230*	0.0293**	0.0290***	0.0279**	0.0137
	(0.0109)	(0.0108)	(0.0120)	(0.0121)	(0.0111)	(0.0116)	(0.0118)
Openness		9.20e-05***	0.000108***	7.75e-05***	7.62e-05***	7.54e-05***	6.58e-05***
		(1.76e-05)	(2.30e-05)	(1.91e-05)	(1.74e-05)	(1.74e-05)	(1.62e-05)
Reserves			0.00224***	0.00226***	0.00220***	0.00218***	0.00196***
			(0.000731)	(0.000765)	(0.000721)	(0.000734)	(0.000742)
Investment				0.00118***	0.00124***	0.00123***	0.00119***
				(0.000199)	(0.000196)	(0.000213)	(0.000200)
REER					-0.00887***	-0.00891***	-0.00793***
					(0.00276)	(0.00277)	(0.00242)
Corruption						-0.00460	0.0126
						(0.0178)	(0.0175)
Schooling							0.000311***
							(6.84e-05)
Constant	0.0552***	0.0579***	0.0335**	0.000267	0.0466**	0.0512**	0.0521**
	(0.00828)	(0.00829)	(0.0132)	(0.0132)	(0.0190)	(0.0241)	(0.0221)
Observations	173	167	153	149	146	145	141
Adj. R-squared	0.143	0.198	0.260	0.410	0.466	0.461	0.560
Robust standard errors in parentheses							
*** p < 0.01, ** p < 0.05, * p < 0.1							

The successive columns of Table 2 show that all the variables enter the estimation with the expected signs and maintain it as $\overrightarrow{TC}$ is expended, except for the measure of corruption. Indeed, the negative, yet insignificant, coefficient exhibited by corruption in column (6) becomes positive when the level of education is considered. This raises concerns about the robustness of the model, as potential endogeneity issues in the estimation are suspected. For that matter, the full model is estimated using the two-stage least square (2SLS) method, and the corresponding results are presented in Table 3. The coefficient of economic diversity remains significant, which shows the presence of some direct positive effects of diversity on growth. The 2SLS estimation confirms the positive and significant effects of trade openness, foreign exchange reserves, investment and schooling on growth observed with the OLS estimation. The assumption of convergence in growth also appears to hold. The negative, yet nonsignificant, coefficient of corruption tends to go in the sense of a “sand the wheels” effect of corruption on economic activity. As expected, real effective exchange rate appreciations and the subsequent competitiveness deterioration appear to affect growth negatively.

Table 3
2SLS of growth regressions as in Eq. (1)

	(1)
Variables	*Growth*
Diversity	0.00616
	(0.00996)
Openness	5.87e-05***
	(1.11e-05)
Reserves	0.00186***
	(0.000700)
Investment	0.00104***
	(0.000222)
REER	-0.00732***
	(0.00207)
Corruption	-0.0144
	(0.0187)
Schooling	0.000262***
	(8.18e-05)
Ln Y 1998	-0.0126***
	(0.00186)
Constant	0.0754***
	(0.0242)
Observations	137
Adj. R-squared	0.543
Robust standard errors in parentheses	
*** p < 0.01, ** p < 0.05, * p < 0.1	

3.2. Magnitude of the transmission channels

To assess the indirect effects of economic diversity on growth, the variables of transmission channels encompassed in the vector $\overrightarrow{TC}$ are regressed successively upon the measure of diversity as follows:

$$\overrightarrow{TC}^{i} = \beta_0 + \beta_1 Diversity^{i} + \mu^{i}. (2)$$

Table 4 shows significant effects with expected signs of economic diversity on foreign exchange reserves, international competitiveness, corruption, and human capital. The first column of Table 4 shows that the level of openness to trade does not seem to be significantly influenced positively by diversity. This tends to be in line with the questions raised earlier about the pertinence of this transmission channel, as diversity may influence trade both by decreasing exports and increasing imports. More surprisingly, the coefficient of diversity in the investment channel carries a negative sign.

Table 4
2SLS estimation of indirect transmission channels

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	*Openness*	*Reserves*	*Investment*	*REER*	*Corruption*	*Schooling*
Diversity	-26.26	12.23***	-6.990**	-0.957***	-0.514***	125.9***
	(25.33)	(0.978)	(3.247)	(0.187)	(0.0559)	(14.03)
Constant	98.48***	16.85***	27.06***	5.106***	0.468***	35.26***
	(10.50)	(0.437)	(1.455)	(0.0912)	(0.0241)	(5.811)
Observations	141	141	141	141	141	141
Adj. R-squared	0.001	0.415	0.026	0.082	0.308	0.338
Robust standard errors in parentheses						
*** p < 0.01, ** p < 0.05, * p < 0.1						

3.3. Total effect of economic diversity and relative contribution of channels

The regressions performed in the previous subsection show some significant effects of economic diversity on most of the transmission channels considered. To compute the total effect of diversity on growth, Eq. (2) is substituted into Eq. (1), leading to the following equation:

$$G^i = (\alpha_0 + \alpha_3\beta_0) + \alpha_1 ln\left(Y_0^i\right) + (\alpha_2 + \alpha_3\beta_1)\, Diversity^i + \alpha_3\mu^i + \epsilon^i, (3)$$

where the coefficient $(\alpha_2 + \alpha_3\beta_1)$ embodies the two components of the effect of economic diversity on growth. Table 5 reports the absolute and relative contributions of each transmission channel to the total effect. The human capital channel appears to carry most of the indirect effect, followed by the accumulation of exchange reserves. The channels of corruption, real effective exchange rate and investment tend to have similar weights of about 10 to 11 percent of the total effect. Note however the negative contribution of the investment channel. As expected, openness to trade makes the smallest contribution, amounting to approximately − 2 percent of the total effect of economic diversity on growth.

Table 5
Relative importance of direct effect and transmission channels

Transmission channels	$\alpha 3$	$\beta 1$	Contribution to $\alpha_2 + \alpha 3\beta 1$	Relative contribution
Direct	0,00616	1	0,0062	9%
Openness	0,0000587	-26,26	-0,0015	-2%
Reserves	0,00186	12,23	0,0227	34%
Investment	0,00104	-6,99	-0,0073	-11%
REER	-0,00732	-0,957	0,0070	10%
Corruption	-0,0144	-0,514	0,0074	11%
Schooling	0,000262	125,9	0,0330	49%
Total			0,0675	100%

3.4. Alternative variables

As the choice of variable used to embody the transmission channels may influence the outcomes of the study, attention should be paid to the robustness of the results to alternative measures. In our view, three channels require special care due to the way in which the variables that represent them are measured. First, the variable of REER employed to embody the channel of international competitiveness is a narrow version of the estimator that compares the real value of country i's currency against a basket of 65 trading partners. Darvas

(2012, 2021) provides a broad version of the index that considers more than 170 trading partners. Second, the corruption perception index (CPI) used to assess the corruption channel measures the perceived level of public sector corruption and assigns scores from 0 (highly corrupt) to 10 (very clean). Data from 1995 to 2011 are provided by Transparency International (TI). Due to some methodological changes in the computation of the CPI, a new version of the index (with a scale of 0 (highly corrupt) to 100 (very clean)) has been provided since 2012 (Saisana & Saltelli, 2012). Finally, the education channel is envisaged at a higher stage using enrollment in tertiary education. Indeed, economic diversification may consist of the enhancement of more sophisticated sectors requiring more skillful and more educated workers.

Using these new measures for international competitiveness ($REER_{170}$), corruption ($Corruption_{New}$), and education (*Tertiary Education*), some alternative versions of the model are estimated to provide more diversity in the analyses. Table 6 shows the results of the estimation of Eq. (1) with different combinations of variables, including the alternative measures. The impact of international competitiveness on growth appears to be more important when measured with the broader version of the real effective exchange rate index. The new measure of corruption, which is obtained by averaging the data over the period 2012–2019, seems to have no significant impact on growth. Although non-significant, the negative signs of the coefficients of $Corruption_{New}$ tend to corroborate the "sand the wheels" hypothesis. The coefficients of tertiary education are broadly similar to those obtained with secondary education. The tables related to the estimation of the indirect effects using these new variables are presented in Appendix B.

Table 7 displays the relative contribution of each channel after re-estimating Equations (1) and (2) using the alternative measures. The results tend to confirm the figures obtained with the main specification. The level of education remains the most important transmission channel, with relative contributions running from 48 to 52 percent of the total effect depending on the specification. Next is the foreign exchange reserves channel, accounting for about 33 to 36 percent of the effect. The positive impact of economic diversity through the reduction of corruption then follows with a share of the total effect amounting up to 17 percent when the alternative measure of corruption is employed in the latest specification. The negative impact of the investment channel lies between − 11 and − 16 percent of the total effect. International competitiveness then comes with a positive contribution of approximately 6 to 7 percent of the total effect when considering 170 trading partners and 10 to 11 percent with the narrower version of the REER. The indirect effect of diversity via the channel of openness to trade closes the ranking with contributions amounting to -2 percent of the total effect regardless of the specification.

Table 6
2SLS estimation of growth regressions with alternative variables

Dependent variable: *Growth*	**(1)**	**(2)**	**(3)**	**(4)**
Ln Y 1998	-0.0122***	-0.0124***	-0.0114***	-0.0107***
	(0.00199)	(0.00170)	(0.00173)	(0.00162)
Diversity	0.00723	0.00612	0.00333	0.00398
	(0.0101)	(0.00994)	(0.00977)	(0.00980)
Openness	6.26e-05***	5.91e-05***	4.93e-05***	5.29e-05***
	(1.06e-05)	(1.10e-05)	(1.50e-05)	(1.41e-05)
Reserves	0.00191***	0.00183***	0.00175**	0.00162**
	(0.000685)	(0.000694)	(0.000707)	(0.000711)
Investment	0.00102***	0.00103***	0.00106***	0.00102***
	(0.000222)	(0.000226)	(0.000232)	(0.000241)
REER		-0.00723***	-0.00713***	
		(0.00209)	(0.00231)	
$REER_{170}$	-0.0116**			-0.0112*
	(0.00534)			(0.00576)
Corruption	-0.0112		-0.0189	
	(0.0190)		(0.0186)	
$Corruption_{New}$		-0.152		-0.203
		(0.195)		(0.197)
Schooling	0.000271***	0.000259***		
	(8.15e-05)	(8.25e-05)		
Tertiary Education			0.000222***	0.000221***
			(6.09e-05)	(6.12e-05)
Constant	0.0873***	0.0740***	0.0813***	0.0968***
	(0.0319)	(0.0229)	(0.0260)	(0.0330)
Observations	139	137	136	136
Adj. R-squared	0.535	0.557	0.493	0.500
Robust standard errors in parentheses				
*** p < 0.01, ** p < 0.05, * p < 0.1				

Table 7
Relative importance of direct effect and transmission channels with alternative variables

Transmission channels	(1)	(2)	(3)	(4)
Direct	11%	9%	6%	7%
Openness	-2%	-2%	-2%	-2%
Reserves	35%	33%	36%	35%
Investment	-11%	-11%	-15%	-16%
REER		11%	11%	
$REER_{170}$	6%			7%
Corruption	9%		16%	
$Corruption_{New}$		10%		17%
Schooling	52%	50%		
Tertiary Education			48%	52%
Total	100%	100%	100%	100%
Total absolute effect	0.066	0.066	0.060	0.055

3.5. Income group asymmetries

Sarin et al. (2022) mention that a sharp contrast exists in the influence of export diversification on growth between developing and developed countries. Al-Marhubi (2000) argues that the main difference lies in the fact that while some direct effects of export diversification on growth are found in developing countries, this is not the case in advanced economies. Potential discrepancies between income groups are assessed here by applying the analyses to subsamples of developing countries and advanced economies. The first group is composed of low- and lower middle-income countries, while the group of advanced economies consists of high-income countries based on the World Bank classification. The descriptive statistics for the two groups are presented in appendix C.

Tables 8 and 9 show the results of the 2SLS estimation of Eq. (1) for developing countries and developed countries, respectively. Each column of the tables corresponds to an alternative choice of variables for the real effective exchange rate, corruption, and education. In line with Al-Marhubi (2000), the models detect no significant direct effects of economic diversity on growth in advanced economies. However, in contradiction with that study, Table 8 shows some significant negative direct effects of diversity in developing countries.

Table 8
2SLS estimation of growth regressions for developing countries

Dependent variable: *Growth*	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Ln Y 1998	-0.0152***	-0.0156***	-0.0146***	-0.0135***	-0.0130***
	(0.00336)	(0.00338)	(0.00306)	(0.00335)	(0.00329)
Diversity	-0.0302*	-0.0334*	-0.0339**	-0.0179	-0.0490*
	(0.0155)	(0.0195)	(0.0143)	(0.0197)	(0.0274)
Openness	7.42e-05	8.08e-05	7.12e-05	8.89e-05	6.90e-05
	(9.61e-05)	(9.56e-05)	(9.39e-05)	(9.69e-05)	(9.87e-05)
Reserves	0.00343***	0.00357***	0.00326***	0.00353***	0.00330***
	(0.00103)	(0.00116)	(0.000935)	(0.00110)	(0.00108)
Investment	0.000716***	0.000718***	0.000739***	0.000705***	0.000680***
	(0.000234)	(0.000251)	(0.000213)	(0.000230)	(0.000229)
REER	-0.00373***		-0.00327**	-0.00323**	
	(0.00136)		(0.00127)	(0.00157)	
$REER_{170}$		-0.00614			-0.00499
		(0.0182)			(0.0166)
Corruption	-0.0374	-0.0320		-0.0567**	
	(0.0276)	(0.0269)		(0.0244)	
$Corruption_{New}$			-0.329		-0.554***
			(0.233)		(0.207)
Schooling	0.000344***	0.000363***	0.000348***		
	(8.47e-05)	(8.52e-05)	(8.01e-05)		
Tertiary Education				0.000318**	0.000517***
				(0.000132)	(0.000158)
Constant	0.0630*	0.0708	0.0578**	0.0631*	0.0767
	(0.0328)	(0.0908)	(0.0280)	(0.0326)	(0.0833)
Observations	52	53	52	52	51
Adj. R-squared	0.485	0.531	0.561	0.424	0.522
Robust standard errors in parentheses					
*** p < 0.01, ** p < 0.05, * p < 0.1					

Table 9
2SLS estimation of growth regressions for advanced economies

Dependent variable: *Growth*	(1)	(2)	(3)	(4)	(5)
Ln Y 1998	-0.0182***	-0.0170***	-0.0183***	-0.0175***	-0.0171***
	(0.00270)	(0.00318)	(0.00218)	(0.00244)	(0.00224)
Diversity	0.00773	0.00843	0.00568	0.00753	0.00509
	(0.0124)	(0.0106)	(0.0125)	(0.0111)	(0.0100)
Openness	5.26e-05***	6.12e-05***	4.87e-05***	5.04e-05***	5.40e-05***
	(1.12e-05)	(1.08e-05)	(1.18e-05)	(1.07e-05)	(1.04e-05)
Reserves	0.00155**	0.00161***	0.00147*	0.000724	0.000899
	(0.000768)	(0.000582)	(0.000777)	(0.000701)	(0.000597)
Investment	0.00114***	0.00103***	0.00109***	0.00109***	0.000984***
	(0.000273)	(0.000240)	(0.000324)	(0.000241)	(0.000268)
REER	-0.0132*		-0.0110	-0.0107	
	(0.00796)		(0.00735)	(0.00725)	
$REER_{170}$		-0.0304**			-0.0234**
		(0.0131)			(0.0109)
Corruption	-0.0670***	-0.0568**		-0.0732***	
	(0.0206)	(0.0285)		(0.0190)	
$Corruption_{New}$			-1.229***		-1.173***
			(0.285)		(0.298)
Schooling	0.000124	0.000104	8.24e-05		
	(9.23e-05)	(9.31e-05)	(9.17e-05)		
Tertiary Education				0.000180***	0.000139**
				(6.40e-05)	(5.72e-05)
Constant	0.186***	0.254***	0.194***	0.191***	0.254***
	(0.0489)	(0.0593)	(0.0470)	(0.0410)	(0.0519)
Observations	49	49	49	48	48
Adj. R-squared	0.638	0.662	0.675	0.681	0.733
Robust standard errors in parentheses					
*** p < 0.01, ** p < 0.05, * p < 0.1					

It emerges from the estimation of Eq. (1) for the two subsamples that while openness to trade appears to be a significant confounder of growth in developed countries, it seems to play no significant role in developing countries. Growth in developing countries tends to be more influenced by the accumulation of foreign exchange reserves and human capital than it is in advanced economies. The detrimental effects of exchange rate appreciation and corruption on growth, as well as the positive impact of physical capital accumulation, appear to be stronger in advanced economies than in countries at early stage of development.

Tables 10 and 11 display the effect of diversity on the vector of transmission channel variables (including the alternative measures) for developing and developed countries, respectively. In the first group, the level of economic diversity is found to influence significantly and with the expected signs the accumulation of reserves, the broad version of the real effective exchange rate measure, as well as education measures and the alternative indicator of corruption. The trade openness and investment channels, however, do not appear to be

significantly linked with diversity in developing countries. Note that unlike with the estimations based on the entire sample, the coefficient of diversity in the investment channel regression carries a positive, yet nonsignificant, sign for countries at early stages of development.

Table 10
2SLS estimation of indirect transmission channels for developing countries.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variables	*Openness*	*Reserves*	*Investment*	*REER*	$REER_{170}$	*Corruption*	*Corruption New*	*Schooling*	*Tertiary Education*
Diversity	-21.92	14.10***	5.319	-0.371	-0.411**	-0.177	-0.0341**	146.9***	106.1***
	(55.03)	(3.683)	(11.67)	(0.479)	(0.171)	(0.133)	(0.0145)	(30.69)	(37.23)
Constant	81.19***	15.60***	23.22***	5.056***	4.786***	0.434***	0.0437***	11.57	-14.77
	(16.13)	(1.072)	(3.799)	(0.148)	(0.0531)	(0.0428)	(0.00493)	(8.749)	(9.844)
Observations	53	53	53	53	53	53	53	53	51
Adj. R-squared	0.003	0.298	0.002	0.001	0.055	0.057	0.105	0.285	0.293
Robust standard errors in parentheses									
*** p < 0.01, ** p < 0.05, * p < 0.1									

Table 11
2SLS estimation of indirect transmission channels for advanced economies.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variables	*Openness*	*Reserves*	*Investment*	*REER*	$REER_{170}$	*Corruption*	*Corruption New*	*Schooling*	*Tertiary Education*
Diversity	-156.8**	6.310***	-7.866**	-0.604***	-0.255***	-0.0416	-0.00553	28.31*	41.48**
	(65.50)	(1.499)	(3.471)	(0.168)	(0.0885)	(0.0502)	(0.00418)	(15.13)	(17.02)
Constant	175.1***	20.05***	27.18***	4.876***	4.716***	0.185***	0.0185***	92.16***	43.78***
	(35.81)	(0.816)	(1.847)	(0.0885)	(0.0486)	(0.0242)	(0.00203)	(6.660)	(9.110)
Observations	49	49	49	49	49	49	49	49	48
Adj. R-squared	0.079	0.214	0.059	0.223	0.103	0.012	0.043	0.082	0.142
Robust standard errors in parentheses									
*** p < 0.01, ** p < 0.05, * p < 0.1									

In contrast with developing countries, the indirect effect of diversity through the investment channel is found to be significantly negative in advanced economies. The negative sign observed for the investment channel in the full-sample estimation thus tends to be driven by this latter group. Economic diversity thus appears to become detrimental to the accumulation of physical capital after reaching a certain level of development. A potential explanation for that quite odd outcome could be the increasing tertiarization in advanced economies.

Another striking difference between the two subgroups is the significance of the negative sign of the trade openness channel in advanced economies. This outcome is in line with the works of Dornbusch et al. (1977), Imbs (2004) and Di Giovani & Levchenko (2009), who associate openness to trade with sectoral specialization. Their view is that specialization leads to a more intensive use of resources in fewer sectors, which in turn results in a greater necessity to recur to foreign markets to satisfy the demand for goods that can be obtained at lower cost through trade than via local production. This tends to show that the import-reducing leg of economic diversity outpaces the export-enhancing leg, especially in advanced economies.

None of the corruption measures appears to be influenced by the level of diversity in developed countries. Moreover, higher levels of economic diversity tend to have a lower influence on education in advanced economies than in developing countries. Note that the alternative measures of education allow us to observe that while tertiary education tends to be more stimulated by economic diversity than secondary school enrollments in developed countries, the opposite applies to low-income countries. This is consistent with the empirical studies of Psacharopoulos (1994), Petrakis & Stamatakis (2002) and Self & Grabowski (2004), suggesting that the contribution of higher educational levels increases as the level of development increases. Petrakis & Stamatakis (2002) show that secondary schooling plays a more important role in countries at early stages of development, while growth in advanced economies appears to be more driven by the level of tertiary education. Moreover, following the principle of relatedness developed by Hidalgo (2021), the path to greater levels of economic diversity is inclined to be closely linked to the nature of the existing activity sectors. Developing countries thus tend to diversify first through the activation of basic manufacturing industries (e.g., textile, apparel, food, etc.) which require relatively low-skilled labor with lower education levels. Advanced economies, on the other hand, will likely embrace higher end sectors associated with skillful and more educated workers (Hummels & Klenow, 2005).

The relative contributions of each transmission channel to the total effect of diversity on growth, as well as the value of the total effect for the two subgroups, are displayed in Tables 12 and 13. The negative direct effect of diversity observed in the estimation of Eq. (1) for developing countries is found to be outpaced by the positive indirect effects, leading to a positive overall effect. Economic diversity appears to be more beneficial to developing countries than to advanced economies. Indeed, the results show that as diversity increases by one standard deviation in developing countries (+ 0.080), the average growth rate tends to increase by 0.60 to 0.64 percentage points. This is approximately three times higher than what is found for developed countries, where increases in diversification by one standard deviation (+ 0.134) lead to changes in the average growth rate of + 0.17 to + 0.20 percentage points depending on the variable choice. These findings are consistent with the idea of a U-shaped relationship between economic diversification and development level supported by the works of Imbs & Wacziarg (2003) and Mania & Rieber (2019), among others. The U-shaped hypothesis predicts decreasing incentives along the development path for countries to seek higher levels of economic diversity as re-specialization appears to become a better rewarding strategy after reaching a certain threshold[1] of development.

Table 12
Relative importance of direct effect and transmission channels for developing countries

Transmission channels	(1)	(2)	(3)	(4)	(5)
Direct	-38%	-41%	-43%	-23%	-65%
Openness	-2%	-2%	-2%	-2%	-2%
Reserves	61%	63%	59%	63%	62%
Investment	5%	5%	5%	5%	5%
REER	2%		2%	2%	
$REER_{170}$		3%			3%
Corruption	8%	7%		13%	
$Corruption_{New}$			14%		25%
Schooling	64%	66%	66%		
Tertiary Education				43%	73%
Total	100%	100%	100%	100%	100%
Total absolute effect	0.079	0.080	0.078	0.079	0.075

Table 13
Relative importance of direct effect and transmission channels for advanced economies

Transmission channels	(1)	(2)	(3)	(4)	(5)
Direct	53%	60%	39%	58%	40%
Openness	-57%	-69%	-53%	-65%	-71%
Reserves	67%	73%	64%	33%	42%
Investment	-62%	-58%	-59%	-62%	-57%
REER	55%		46%	50%	
$REER_{170}$		56%			46%
Corruption	19%	17%		27%	
$Corruption_{New}$			47%		55%
Schooling	24%	21%	16%		
Tertiary Education				58%	45%
Total	100%	100%	100%	100%	100%
Total absolute effect	0.015	0.014	0.015	0.013	0.013

The accumulation of reserves and human capital are identified as the main channels through which diversity influences growth in developing countries. The corruption channel then follows with a contribution up to 9.4 times lower than those of the two main straits. Next come the investment channel amounting to 5 percent of the total effect in developing countries and the REER channel with 2 to 3 percent of the effect depending on the version of the measure employed. As expected, the least important channel is that of trade openness, with a negative contribution of -2 percent of the total effect of diversity on growth in developing countries.

The task of ranking the transmission channels based on their relative contributions to the total effect tends to be less straightforward for advanced economies. Indeed, no clear-cut distinctions between channels can be observed in this sample. Trade openness, reserves, and investment appear to be the most important channels with broadly similar relative contributions depending on the choice of variables. They are closely followed by the channels of international competitiveness. Corruption and education appear to account for the smallest shares of the total effects when considering the initial measures for these channels. However, the contributions of these latter channels are revealed to be substantially more important and close to the figures of the leading channels when alternative variables are employed.
[1] IMF (2014) locates this threshold at levels of annual GDP per capita around $25,000-$30,000.

4. Conclusion

This paper aimed to evaluate the total effect of economic diversity on GDP per capita growth and to assess the sizes of the indirect transmission channels through which this effect is carried. The analyses have been performed on the entire dataset as well as on two subsamples of developing and developed countries separately envisage possible income-related discrepancies in the nexus between growth and diversity.

Human capital and foreign exchange reserve accumulations are found to be the most influential transmission channels overall, followed in terms of marginal contribution by corruption, physical capital accumulation and international competitiveness. The channel of trade openness appears to carry the lowest weight of contribution to the total effect of diversity on growth for the entire sample.

The income-level distinction allowed us to identify some important dissimilarities between countries at early stages of development and advanced economies. First, while the ranking of transmission channel sizes for developing was found to be similar to the entire sample scheme, no clear-cut distinction between channels has been observed for advanced economies. Second, the results have shown a dramatically heavier impact of the negative openness to trade channel in advanced economies compared to developing countries. The channel of physical capital investment also appeared to carry a greater share of the total effect of diversity on growth in developed countries. Moreover, although that channel was found to be positive for developing countries, the opposite was observed for advanced economies. The increasing tertiarization and the subsequent higher relative importance of human capital compared to physical capital

accumulation observed in advanced economies may explain this negative sign of the investment channel. The sizeable negative contributions of the trade openness and investment channels in developed countries may help explain the lower total effect of economic diversity on growth in that income group compared to developing countries. Indeed, the results show that one standard deviation increases in economic diversity generate surges in growth of magnitude up to three times more important in developing countries than in developed countries. This may contribute to the U-shaped pattern observed between specialization and GDP, as diversity tends to become less advantageous at higher levels of development. Finally, note that unlike previous studies, this paper observes a significant negative direct effect of diversity on growth in developing countries that is not detected for advanced economies. This tends to suggest that diversity per se may be detrimental for growth in countries at early stages of development if not associated with some positive externalities through the transmission channels.

This empirical work provides some additional evidence on the mechanisms through which economic diversity may influence growth both positively and negatively. Additionally, it sheds some light on potential discrepancies that may exist between countries at different stages of development in the manifestation of the total effect of economic diversity on growth. A better understanding of these elements is crucial for the design of sound diversity-based development policies. Further research could include some additional potential channels and investigate more thoroughly the ins and outs of each channel. Moreover, some domestic market-based measures of diversity could be used, as solely focusing on export diversification may not provide the whole picture.

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Figures

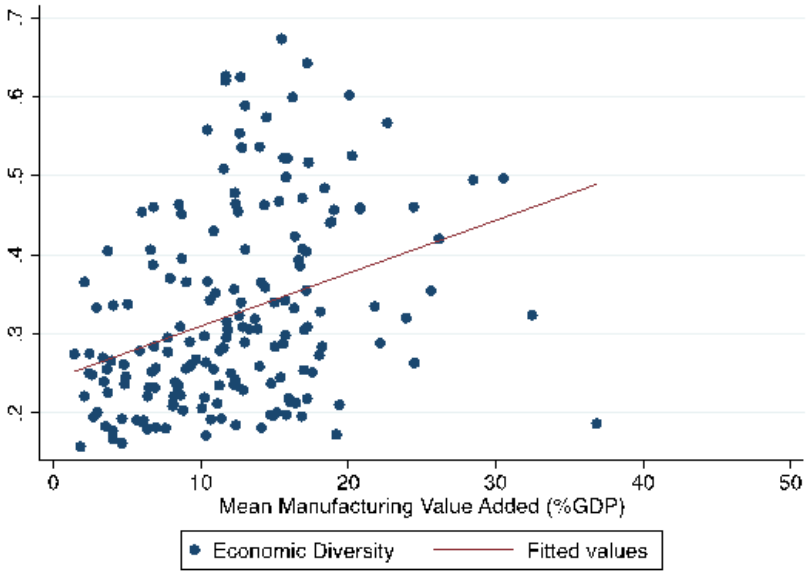

Figure 1

Mean manufacturing value added (% GDP) and mean export diversity.

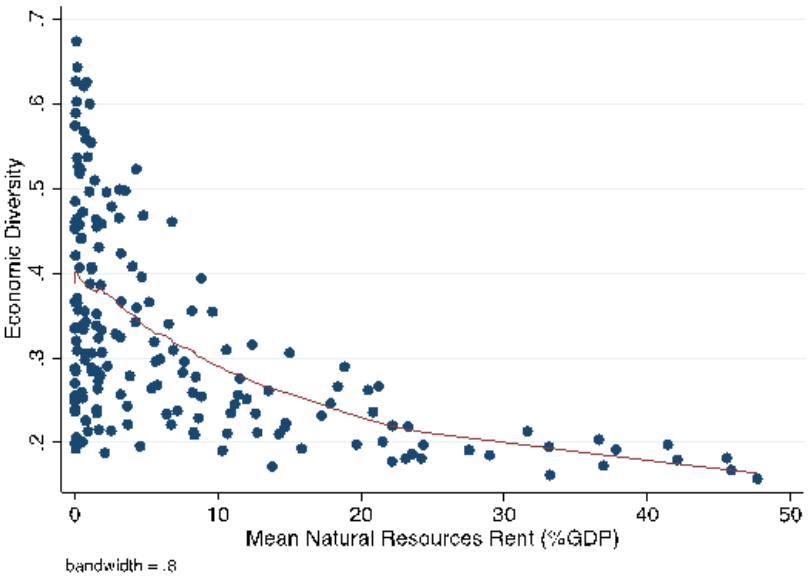

Figure 2

Mean natural resource rent (%GDP) and mean export diversity with fitted loess smooth curve.

Supplementary Files

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- Appendices.docx