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DETERMINANTY VEĽKOSTI SPRACOVATEĽSKÉHO PRIEMYSLU V SUBSAHARSKEJ AFRIKE

DETERMINANTS OF MANUFACTURING SECTOR SIZE IN SUB-SAHARAN AFRICA

Jiří Sejkora[1]

Subsaharské ekonomiky potřebují strukturální změny, které přinesou nárůst produktivity práce. V tomto ohledu hraje klíčovou úlohu industrializace. Cílem práce je s využitím regresní analýzy pomocí metody nejmenších čtverců otestovat, zdali obecné determinanty industrializace nalezené ve starších publikacích vysvětlují variabilitu velikosti zpracovatelského průmyslu v subsaharských ekonomikách. Výsledky ukazují, že zpracovatelský sektor je větší v zemích, které jsou otevřenější mezinárodnímu obchodu, jsou relativně méně závislé na rentách z těžby nerostného bohatství a mají větší domácí trh. Otevřenost mezinárodnímu obchodu však ztrácí statistickou významnost při kontrole robustnosti. [2]
Klíčová slova: industrializace, zpracovatelský průmysl, subsaharská Afrika.

Sub-Saharan economies need structural changes that would enhance their productivity. In this regard, industrialization plays a key role. Using ordinary least squares regression analysis, the aim of this study is to test whether the general determinants of industrialization identified in previous studies explain variation in manufacturing share in GDP in sub-Saharan economies. The results indicate that manufacturing sector is larger in countries that pursue trade openness policies, are relatively less dependent on natural resources rents and have larger domestic markets. However, trade openness loses its statistical significance in a robustness check.
Key words: industrialization, manufacturing, sub-Saharan Africa.
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[1] Ing. Jiří Sejkora. Department of World Economy, Faculty of International Relations, University of Economics in Prague, Winston Churchill Sq. 4, 130 67 Prague 3, Czech Republic, e-mail: jiri.sejkora@vse.cz.
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1 INTRODUCTION

Sub-Saharan Africa (SSA) remains the poorest region in the world. Although some local economies have experienced relatively high GDP growth rates in the beginning of the 21st century, there are concerns about sustainability of this trend and possible impacts on poverty reduction, for the growth rates have been driven mostly by mining industry. Indeed, mining industry is a capital-intensive one, it employs relatively small number of people, its profitability largely depends upon volatile prices of natural resources and it does not create backward and forward linkages between different sectors. This is especially true in case of sub-Saharan economies which export unprocessed natural resources.

Therefore, development economists emphasize the importance and necessity of productivity-enhancing structural changes in SSA (Page 2012). These changes should lead to development and growth of such sectors/branches that are able to absorb a large portion of low-skilled workforce, generate as much value-added as possible and create the aforementioned linkages between different sectors. In this regard, industrialization (i.e. expansion of manufacturing sector), which was identified as an engine of growth in developing countries (Szirmai 2012), plays a key role.

However, according to the data sourced from UN (2014) National Accounts Main Aggregates Database, many sub-Saharan economies have experienced a process of deindustrialization in the 21st century. In other words, manufacturing share in GDP has declined. On the other hand, some scholars argue that SSA faces an opportunity to develop its manufacturing base by attracting Chinese footloose labor-intensive manufacturing industries which are being relocated because of growing wages (Chandra, Lin and Wang 2012). For these reasons, it is necessary to analyze which factors contribute to industrialization in sub-Saharan economies so that governmental policies can be adjusted. Moreover, these factors change over time (Guadagno 2012). Hence, it is important to constantly update our knowledge on the actual determinants of industrialization and manufacturing sector size in SSA. Unfortunately, empirical studies regarding this topic are scarce.

Therefore, using a cross-sectional ordinary least squares (OLS) regression analysis, the aim of this study is to test whether the determinants of industrialization identified in previous theoretical and empirical studies explain variation in manufacturing share in GDP in sub-Saharan economies.

The rest of the paper is organized as follows. Section 2 briefly reviews literature on the determinants of industrialization, outlines variables, theoretical expectations, data sources and possible limitations of this study. Section 3 presents OLS regression analysis and its underlying assumptions. Furthermore, it discusses results of the analysis. The final section concludes.

2 LITERATURE REVIEW

Even though this study focuses on determinants of industrialization in SSA, the dependent variable is not industrialization. Instead, I use manufacturing share in GDP in 2012. There are two reasons for using this dependent variable. First, data for many sub-Saharan countries is not very accurate and is therefore unsuitable to calculate year-on-year changes. Second, on average, SSA has been deindustrializing in the 21st century. Therefore, it makes better sense to use manufacturing share in GDP in 2012 as the dependent variable because if general determinants of industrialization identified in previous studies are relevant also for SSA, then, theoretically, economies with more developed determinants (i.e. explanatory variables) should have larger manufacturing share in GDP. Data on manufacturing (ISIC D) share in GDP in 2012 comes from UN (2014) National Accounts Main Aggregates Database.

There are eight independent variables used in this study: trade openness; infrastructure; institutions; human capital; physical capital; natural resources rents; size of the economy and latitude. Because data availability is poor, the independent variables (apart from latitude) are averaged by country over the 2000 – 2011 period.[3] This also helps to reduce data volatility that might undermine the analysis.

Relations between trade openness and industrialization (and also economic growth) used to be a controversial topic. However, the currently prevailing paradigm holds that greater trade openness leads to faster industrialization (and higher growth) because it allows developing countries to import know-how and exploit global demand (Lin 2012). This is confirmed by empirical studies (Guadagno 2012) and, furthermore, there are also examples of successful export-led industrialization in East Asia (e.g. China, South Korea). Nevertheless, dissenting opinion exists. Prebisch (1950) and his dependency school successors argue that in order to industrialize, developing countries need to adopt import-substitution (i.e. protectionism). Many sub-Saharan countries followed this strategy after independence and, indeed, manufacturing share in GDP increased notably. *"But, the industries they created were frequently uncompetitive and unsustainable and efforts to spur industrial development in Africa largely vanished with the economic collapses and adjustment programmes of the 1980 and 1990s. Since the middle of the 1980s Africa has deindustrialised…"* (Page 2012, p. 95). Therefore, given these facts, the relation between trade openness and manufacturing share in GDP in this study is expected to be positive. Trade openness is measured as the sum of exports and imports of goods and services as a percentage of GDP. Data is sourced from the World Development Indicators (WDI) database produced by the World Bank Group (WBG 2014).

Infrastructure has always been considered as a key determinant of industrialization (Rostow 1959, Page 2012). Infrastructure is necessary *"…to permit an*

[3] However, data on infrastructure and institutions is missing for the year 2011 and 2001, respectively.

economical national market to be created and to allow natural resources to be productively exploited…" (Rostow 1959, p. 5). However, in SSA there is a huge infrastructure gap (Foster and Briceno-Garmendia 2010). Considering the magnitude of this problem African Development Bank (AfDB) has created African Infrastructure Development Index (AIDI) to monitor status and progress in this field. Such composite index is ideal for this study because it takes into account various types of infrastructure (transport, electricity, information and communication technologies, water and sanitation).[4] Even though positive relation between infrastructure (measured by the AIDI) and manufacturing share in GDP is expected, results might be possibly biased by the existence of special economic zones (SEZ) in SSA. Theoretically, these geographically limited areas should have (among other things) perfect infrastructure in order to attract investors. Therefore, large-scale manufacturing activities might concentrate in SEZ while ignoring the infrastructure in the rest of the country (especially if products are destined for export). However, recently conducted research concludes that *"… economic zone programs in Africa have, by and large, failed to deliver significant benefits to date."* (Farole 2011, p. 239). It seems, therefore, plausible for this study to ignore the effects of SEZ in SSA.[5]

There is a strong consensus among economists that quality of institutions has a significant impact on economic growth and development (Fagerberg and Srholec 2008, Acemoglu and Robinson 2012). Moreover, it also has an impact on industrialization (Lin 2012; Harrison and Rodríguez-Clare 2010). *"The Industrial Revolution has still not spread to Africa because that continent has experienced a long vicious circle of the persistence and re-creation of extractive political and economic institutions."* (Acemoglu and Robinson 2012, p. 116). Manufacturers in countries with weak institutions have to undergo considerable risks and higher costs of running a business. Therefore, weak institutions present a constraint to expansion and development of manufacturing sector. In this study, following Siba (2007), Rule of Law (RoL) index from the World Governance Indicators (WGI) database produced by Kaufmann, Kraay and Mastruzzi (2010) is used as a measure of institutional quality. The RoL index captures *"perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence."* (Ibid., p. 4).[6] Even though the perception-based nature of the index is disadvantageous, I believe it is a good proxy for institutional quality in this study because it covers business environment factors (e.g. contract enforcement, property rights) that are

[4] The AIDI takes values between 0 to 100; higher score indicates better infrastructure. For more details about AIDI, see AfDB (2013).

[5] It should be noted, however, that recent Chinese efforts to set up several new SEZs in SSA might substantially change the situation in the near future (Bräutigam 2011).

[6] The RoL index takes values between -2.5 to 2.5; higher score indicates better rule of law. For more details about the index, see Kaufmann, Kraay and Mastruzzi (2010).

exceptionally important for entrepreneurial activities in manufacturing industry. The relation between the RoL index and manufacturing share in GDP is expected to be positive.

Development economists also agree about the importance of capital (both human and physical) for the process of industrialization and economic growth (Oketch 2006). Industrialization is faster in economies with higher levels of skill and knowledge in the population (Guadagno 2012, Ramachandran and Shah 2007). Temple and Voth (1998, p. 1360) conclude that *"higher levels of human capital lower the cost of adopting advanced techniques, increase their diffusion, and so the growth of the manufacturing sector is naturally accompanied by equipment investment."* Unfortunately, quality of human capital is another area in which SSA lags behind (Page 2012). To measure the quality of human capital in sub-Saharan countries, Education index produced by Mo Ibrahim Foundation is used (Mo Ibrahim Foundation 2013). The index reflects multiple factors (both quantitative and qualitative), so it seems suitable for this study.[7]

Regarding physical capital, insufficient rate of capital accumulation has been considered as the main obstacle to industrialization and economic growth since the beginning of development economics (Nurkse 1953). For example, in a two-sector surplus labor model of Lewis (1954), additional capital increases labor productivity in industrial sector (i.e. manufacturing). Subsequently, manufacturers earn greater profits through higher labor productivity. They reinvest the profits (i.e. accumulate capital) and the manufacturing sector expands. Ideally, capital formation rate would be used as a measure of the capital accumulation. However, reliable and comparable data is not available. Therefore, considering the fact that domestic investment capacity of poor countries is relatively low, net inflows of foreign direct investment (FDI) as a percentage of GDP is used as a proxy. FDI presents a great potential for rapid capital accumulation in the globalized world economy. In addition, FDI is characterized by several positive side effects (e.g. transfers of technology and know-how). Developing countries are thus liberalizing restrictions on FDI inflows in order to attract as much FDI as possible (Noorbakhsh, Paloni and Youssef 2001). Data on the FDI net inflows as a percentage of GDP is sourced from the WBG's WDI database. The effects of both human capital (measured by the Education index) and physical capital accumulation (measured by the FDI net inflows) on the dependent variable are expected to be positive.

SSA is richly endowed with an array of natural resources. This fact cannot be ignored because mining industries are of great importance in many sub-Saharan

[7] The Education index takes values between 0 to 100; higher score indicates better system of education. The index comprises seven factors: Education Provision and Quality; Educational System Quality; Ratio of Teachers to Pupils in Primary School; Primary School Completion; Progression to Secondary School; Tertiary Enrolment; Literacy. For more details about the index, see Mo Ibrahim Foundation (2013).

economies. Theoretically, this might have a negative impact on the dependent variable in this study through effects of Dutch disease (Corden and Neary 1982). *"Dutch disease is a market failure that affects almost all developing countries and may permanently obstruct their industrialization, since the market converges on a long term equilibrium exchange rate that is caused by this disease."* (Bresser-Pereira 2008, p. 51). So, the main effect of the Dutch disease is a long-term appreciation of domestic currency. International competitiveness of manufacturing industries drops and, therefore, manufacturers cannot take full advantage of the global demand. However, the condition for the Dutch disease to occur is a large and successful export-oriented mining sector that plays a vital role in domestic economy. Therefore, as a measure of mining sector importance, total natural resources rents as a percentage of GDP (sourced from the WBG's WDI database) are used. This indicator is calculated as the difference between the price of a commodity and the average cost of producing it, multiplied by the quantities extracted. The assumption is made that all mining industries in SSA are export-oriented because even the most developed sub-Saharan countries with significant mining sector (e.g. Botswana or South Africa) export the extracted natural resources.

The last two explanatory variables used in this study are control variables. Regarding size of the economy, small domestic market might theoretically present an obstacle to economic growth and manufacturing sector expansion. For instance, Nurkse (1953, p. 7) argues: *"... small size of a country's market can discourage, or even prohibit, the profitable application of modern capital equipment by any individual entrepreneur in any particular industry."* Furthermore, Guadagno (2012) found a statistically significant positive relationship between size of the economy (measured by logarithm of population) and industrialization. Therefore, positive relationship is also expected in this study. Following the literature, size of the economy is captured by the logarithm of population (i.e. all residents regardless of their legal status or citizenship) and data is sourced from the WBG's WDI database.

Latitude is often used as a control variable in studies concerned with Africa. I include the latitude (in absolute value) so that geographical factors are also taken into account. Scholars argue that countries closer to the equator have difficult conditions (i.e. tropical climate, disease environment etc.) that impact economic development, quality of institutions etc. (La Porta et al. 1999, Siba 2007). Generally, these countries have also less productive agriculture (Sachs 2001). Therefore, it is possible (in Ricardian view) that countries closer to the equator might develop other sectors than agriculture. Paradoxically, it might be the manufacturing sector (especially in the case of resource-poor countries). Since the relationship between latitude and manufacturing share in GDP is theoretically unclear, I make no predictions about the coefficient sign of this variable. Values of the latitude indicator represent the center point of a country and are expressed in degrees. Data is sourced from CIA (2014).

Since industrialization is a complex process, there are even more determinants identified in previous studies. However, these cannot be included in this analysis because there is a lack of reliable data for too many sub-Saharan countries. Therefore, two important omitted variables in this study are exchange rate movements (Rodrik 2008) and labor productivity in agricultural sector (Rostow 1959).

The regression sample includes 44 sub-Saharan countries selected according to data availability for the relevant variables. Among the excluded countries are Sudan, South Sudan, Somalia, Djibouti and DR Congo.[8]

3 EMPIRICAL ANALYSIS

The model used in the present analysis takes the following form:

$$MSGDP = \beta_0 + \beta_1 TO + \beta_2 I + \beta_3 RL + \beta_4 E + \beta_5 NRR + \beta_6 FDI + \beta_7 L + \beta_8 SE + \varepsilon$$

- MSGDP = manufacturing share in GDP in 2012,
- TO = trade openness,
- I = infrastructure,
- RL = rule of law,
- E = education,
- NRR = natural resources rents,
- FDI = foreign direct investment,
- L = latitude,
- SE = size of the economy.

Table 1: Descriptive statistics of the variables

Variable	*Obs.*	*Mean*	*Std dev.*	*Min*	*Max*
Manufacturing share in GDP	44	9.368	6.532	0.190	41.450
Trade openness	44	80.092	38.972	35.956	227.301
Infrastructure	44	15.960	12.866	2.534	64.311
Rule of law	44	-0.665	0.600	-1.713	0.953
Education	44	47.316	15.891	22.299	94.198
Nat. resources rents	44	15.002	17.574	0.008	78.039
FDI	43	5.217	5.247	0.157	27.411
Latitude	44	11.949	7.606	1.000	29.500
Population (log of)	44	15.583	1.565	11.346	18.773

Source: WBG's WDI database, AfDB (2013), WBG's WGI database, Mo Ibrahim Foundation (2013), CIA (2014). Author's calculations.

[8] Gambia is excluded from regressions 1 and 2 because of missing data on FDI.

Descriptive statistics of the variables are in table 1.

In the first regression, significant relationships are found to exist between trade openness, natural resources rents and FDI (table 2). However, the coefficient for FDI has an opposite sign to what is predicted by the theory. The same applies for education and rule of law which are, however, not statistically significant. The inconsistency with the theory may be due to several reasons. First, a check for possible outliers is performed.

Table 2: Regressions for manufacturing share in GDP

Dependent variable: Manufacturing share in GDP (2012)				
Regression no.	***1***	***2***	***3***	***4***
Trade openness	0.140***	0.082***	0.043*	0.036
	(0.038)	(0.027)	(0.025)	(0.038)
Infrastructure	0.121	0.216**	0.059	0.146
	(0.122)	(0.081)	(0.059)	(0.101)
Rule of law	-0.489	0.674	-0.113	-0.398
	(1.753)	(1.159)	(1.231)	(1.289)
Education	-0.156	-0.196***	-	-
	(0.106)	(0.070)		
Nat. resources rents	-0.245***	-0.170***	-0.152***	-0.126*
	(0.076)	(0.051)	(0.054)	(0.064)
FDI	-0.397*	-0.185	-	-
	(0.200)	(0.135)		
Latitude	0.004	-0.063	0.053	0.040
	(0.145)	(0.096)	(0.095)	(0.116)
Population (log of)	0.676	0.918*	1.034**	1.165**
	(0.715)	(0.469)	(0.483)	(0.540)
Constant	-1.488	-1.580	-10.188	-13.323
	(12.952)	(8.467)	(8.601)	(9.778)
Observations	43	42	43	39
Adjusted R^2	0.38	0.42	0.29	0.19

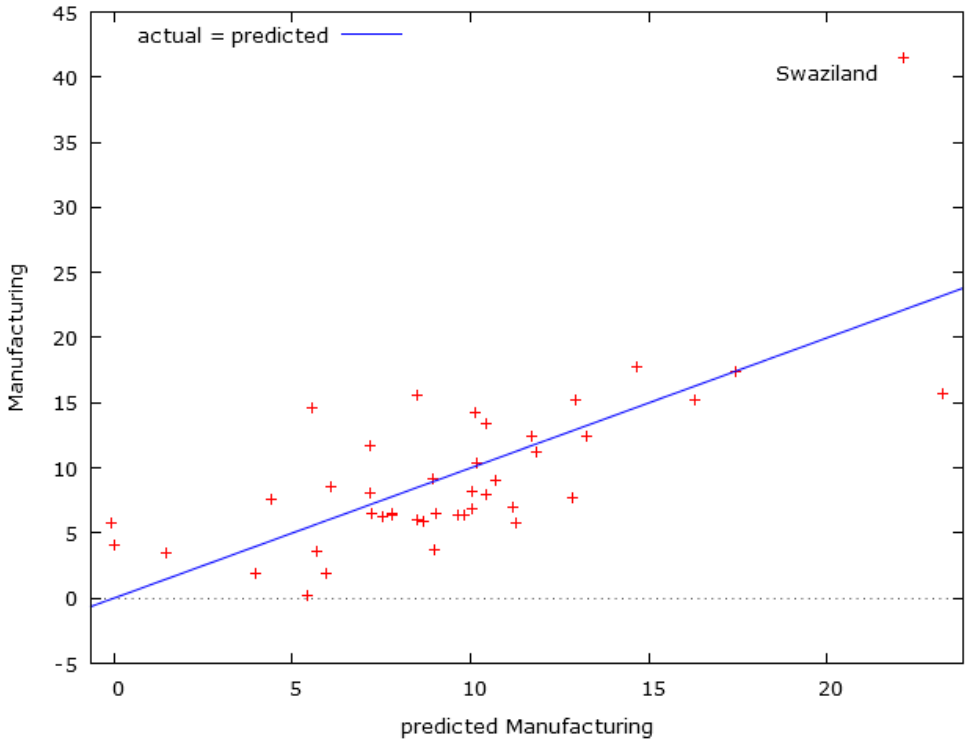
Note: *** significant at 1% level, ** significant at 5% level, * significant at 10% level; standard errors in parentheses.

Source: Author's calculations using Gretl 1.9.8.

As can be seen from actual vs. fitted plot (figure 1), Swaziland might be considered as an obvious outlier. It is the only observation with a residual in excess of 2.5 standard errors and it has by far the highest DFFITS (difference in fit, standardized) value (4.5) suggesting that it should be removed from the sample. However, it cannot

be removed until its unusually high value of the dependent variable (given the values of explanatory variables) is explained.

Figure 1: Actual vs. fitted plot



Source: Author's calculations using Gretl 1.9.8.

Swaziland's manufacturing share in GDP was 41.45% in 2012. The sample countries' (Swaziland excluded) average value of manufacturing share in GDP was only 8.62% (median 7.54%) in the same year.[9] How can this anomaly be explained? According to the UN Statistics Division data, Swaziland's manufacturing sector was booming in the second half of the 1980s. Its share in GDP climbed to nearly 37% in 1989. This was, however, caused by political reasons. The apartheid regime of South Africa was affected by international sanctions and partial relocation of local manufacturing industries to Swaziland allowed the regime to circumvent the sanctions (WEN 2007). Because Swaziland is a small state (about 1 million inhabitants), partial relocation of South African manufacturing industries significantly increased Swaziland's manufacturing share in GDP. Despite the removal of the sanctions in the early 1990s, manufacturing industries have remained in Swaziland. Since the

[9] Even in China, the so-called "factory of the world", the manufacturing share in GDP was "only" 31.09%.

Swaziland's overgrown manufacturing sector arose for political reasons that had nothing to do with the determinants of industrialization, Swaziland can be removed from the sample.

In the second regression (without Swaziland) in table 2, significant relationships are found for trade openness, infrastructure, education, natural resources rents and size of the economy (measured by the log of population). The FDI coefficient, though insignificant, retains its negative sign. Moreover, education not only retains its negative sign, but it is statistically significant. Since there are no more obvious outliers, both variables deserve closer investigation in order to explain the unexpected coefficient signs.

Regarding FDI, the problem lies in SSA's rich natural resources endowment. According to UNCTAD (2005), FDI inflows to Africa are mostly concentrated in primary sectors. Moreover, Asiedu (2005) argues that countries in SSA that are endowed with natural resources attract relatively more FDI. Mining industry is extremely capital-intensive and, therefore, FDI inflows in manufacturing industries (and other non-primary sectors) of richly endowed sub-Saharan countries are relatively marginal compared to FDI inflows in primary sectors. The aggregated FDI net inflows data used in this study does not take this fact into account and causes the results to be deceptive. To overcome this problem, FDI net inflows data excluding primary (or mining) sector should be used. However, such disaggregated data is not available for the sample countries. Because there is no other suitable proxy variable measuring capital accumulation in non-primary sectors, the FDI variable will be completely dropped from further regressions.[10]

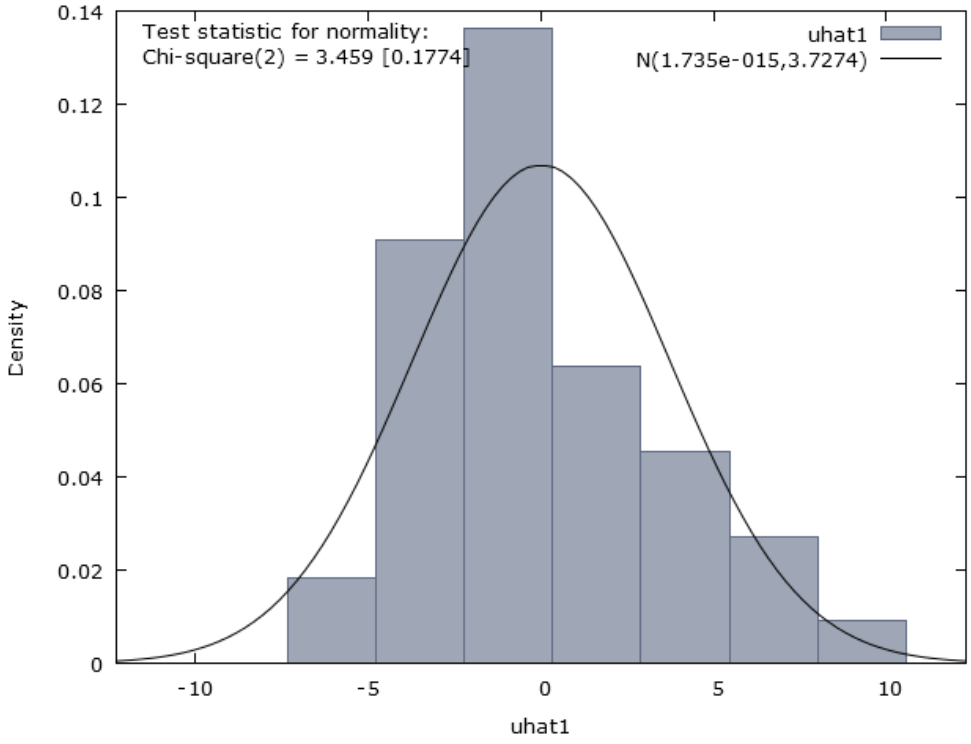
The negative coefficient sign for education is also inconsistent with the theory because, as was already mentioned, industrialization is faster in countries with higher levels of human capital. On the other hand, higher levels of human capital correspond with higher labor costs and that might pose a problem because the presented model does not control for average labor costs. Yet the labor costs are especially important for development of labor-intensive manufacturing that is so desirable considering the current stage of economic development in many sub-Saharan countries. Unfortunately, average labor costs (preferably in manufacturing) variable cannot be included in the model because the required data is not available (with the exception of a few countries). As in the case of FDI, education will be completely dropped from further regressions. Therefore, the equation for the third regression is:

$$MSGDP = \beta_0 + \beta_1 TO + \beta_2 I + \beta_3 RL + \beta_4 NRR + \beta_5 L + \beta_6 SE + \varepsilon$$

[10] Using a different aggregated FDI variable, specifically FDI stocks sourced from WBG, results in similar outcomes (not reported here), thus supporting the above claim. The variable is statistically significant and retains its negative sign.

There are three statistically significant variables in the third regression (table 2): trade openness (significant at 10%), natural resources rents (significant at 1%) and size of the economy (significant at 5%). All coefficients have correct signs except for the rule of law variable that remains insignificant in all specifications. T-statistics suggests that removing the rule of law variable from the equation might improve the model, but the results (not reported here) are, as a matter of fact, almost identical (except for slight improvement in adjusted R^2). The question is whether the institutional quality (measured by the RoL index) is actually not a determinant of industrialization in SSA or whether the RoL index is just a wrong proxy for the institutional quality. At this point it should be recalled that the index is perception-based in its nature and, therefore, it does not necessarily capture the objective reality. Unfortunately, it is the only relatively complex measure of institutional quality available for all the sample countries. In any case, further research in this regard is desirable.

Figure 2: Normality of residuals



Source: Author's calculations using Gretl 1.9.8.

Adjusted R^2 for the third regression is 0.29. The hypothesis of normally distributed residuals cannot be rejected (figure 2). Based on the results of White and Breusch-Pagan tests, the hypothesis of absence of heteroskedasticity also cannot be

rejected (table 3). Finally, variance inflation factors do not indicate problems of multicollinearity (table 4), so the Gauss-Markov assumptions are met.

In conclusion, it is confirmed from the third regression analysis that sub-Saharan countries have relatively larger manufacturing share in GDP if they:

a) are more involved in international trade,
b) are relatively less dependent on natural resources rents (i.e. mining sector is relatively smaller, less profitable or both),
c) have larger domestic market.

This paper thus provides further evidence in favor of the export-led industrialization. However, Lin (2012) argues that countries pursuing trade openness policies should reduce trade barriers specifically in those sectors in which they have comparative advantages. It is, therefore, necessary for any government to identify comparative advantages before pursuing trade openness policies.

Table 3: Tests for heteroskedasticity

White's test for heteroskedasticity
Null hypothesis: heteroskedasticity not present
Test statistic: LM = 27.3495
with p-value = P(Chi-square(27) > 27.3495 = 0.445063
Breusch-Pagan test for heteroskedasticity
Null hypothesis: heteroskedasticity not present
Test statistic: LM = 4.21238
with p-value = P(Chi-square(6) > 4.21238) = 0.64796

Source: Author's calculations using Gretl 1.9.8.

Since sub-Saharan economies with higher natural resources rents tend to have smaller manufacturing share in GDP, governments should consider how to protect manufacturers from the adverse effects of the Dutch disease. There are several options how to do this. Nevertheless, *"... the neutralization of the Dutch disease always involves managing the exchange rate."* (Bresser-Pereira 2008, p. 57). Any solution must be country-specific. Furthermore, it should also be taken into account that natural resources rents are often linked with other negative effects apart from the Dutch disease (rent seeking, corruption etc.).

The results also confirm the previous findings about a positive relationship between size of the economy and manufacturing sector size. Sub-Saharan countries are thus not an exception in this regard.

Table 4: Variance inflation factors

Variance Inflation Factors	
Minimum possible value = 1.0 Values > 10.0 may indicate a collinearity problem	
Trade_openness	2.667
Infrastructure	1.807
Rule_of_law	1.726
NResources_rent	2.803
Latitude	1.516
l_population	1.765

Source: Author's calculations using Gretl 1.9.8.

Surprisingly, infrastructure, though with a positive coefficient sign, does not have a significant relationship with the dependent variable in the third regression. The same applies for latitude. However, even though there are no obvious outliers (after the removal of Swaziland), influential observations analysis indicates four leverage points that have influence on the parameter estimates (Equatorial Guinea, Lesotho, Seychelles and South Africa). Therefore, in order to deal with these influential cases, fourth regression without the above mentioned observations is also included in the study.

As can be seen from table 2, natural resources rents and size of the economy remain statistically significant (at 10% and 5% respectively) in the fourth regression. However, trade openness loses its significance. Latitude, infrastructure and rule of law remain insignificant. This does not have to necessarily mean that there are no relations between these determinants and the manufacturing share in GDP in SSA. Since all the determinants are predicted by the theory, they should not be removed from the regression equation. As was already mentioned, economic data on Africa are less reliable and there are also some omitted variables. Therefore, all results of this paper should be seen as preliminary because of data and methodology limitations. We definitely require more empirical studies as well as qualitative research regarding determinants of industrialization in SSA.

4 CONCLUSIONS

The aim of this paper was to test the determinants of industrialization identified in previous studies on a sample of sub-Saharan countries (selected as per data availability). We used manufacturing share in GDP in 2012 as the dependent variable in the cross-sectional regressions. Independent variables included in this study are trade openness, infrastructure, institutions, human capital, physical capital, natural resources rents, size of the economy and latitude. These variables (apart from latitude) are averaged by country over the 2000-2011 period. Both size of the economy and latitude are the control variables of this analysis.

The results indicate that manufacturing share in GDP is larger in those sub-Saharan countries that pursue trade openness policies, are relatively less dependent on natural resources rents (as defined by WBG) and have larger domestic market. Pursuing trade openness policies that allow countries to import know-how and exploit global demand help manufacturing activities to expand. A high level of independence from natural resources rents provides a partial protection from the adverse effects of the Dutch disease and, therefore, it creates a favorable economic environment for manufacturers. Finally, larger domestic market presents more opportunities for manufacturing activities (especially on a large scale). All the above mentioned factors contribute to industrialization in general and this paper confirms those results also for SSA. Statistical significance of trade openness, however, vanishes in robust regressions.

The analysis does not show statistically significant relationships between the dependent variable and infrastructure, rule of law and latitude. Both physical capital accumulation (proxied by the net FDI inflows) and quality of human capital (measured by the education index) had to be dropped from the model. In order to include them, disaggregated FDI data and data on labor costs would be required.

It should be stressed that limited availability and poor quality of data regarding many sub-Saharan countries make any research in this field difficult. Even though much has been done in order to improve statistical database (e.g. the newly created infrastructure index by AfDB), there is still much room for improvements. Therefore, considering data and methodology limitations of this study, all results should be taken as preliminary. Further research on the actual determinants of industrialization in SSA is needed.

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