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Artwork on the cover: “Pulling into Tomorrow” by Mitchell M. Gatsi

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FRIEDRICH EBERT STIFTUNG
Namibia Office

Acronyms and Initialisms

AMCU	Association of Mineworkers and Construction Union
BEPS	base-erosion profit shifting
BIEN	Basic Income Earth Network
BIG	basic income grant
CCN	Council of Churches in Namibia
CEDAW	UN Convention on the Elimination of All Forms of Discrimination Against Women
CSOs	civil society organisations
DSD	Differences of Sexual Development
ELCN	Evangelical Lutheran Church in Namibia
ELCRN	Evangelical Lutheran Church in the Republic of Namibia
ESOP	Employee Share Ownership Plan
FMS	Finnish Missionary Society
GBV	gender-based violence
GDP	gross domestic product
GEWE	gender equality and women's empowerment
GRB	gender-responsive budgeting
GRN	Government of the Republic of Namibia
HDI	Human Development Index
HTA	Hai||om Traditional Authority
ICCPR	International Covenant on Civil and Political Rights
ICESCR	International Covenant on Economic, Social and Cultural Rights
ICT	information and communication technology
IFFs	illicit financial flows
ILO	International Labour Organisation
IMF	International Monitory Fund
IMR	International Mineral Resources
IOC	International Olympic Committee

LMS	London Missionary Society
MAWLR	Ministry of Agriculture, Water and Land Reform
MGEPESW	Ministry of Gender Equality, Poverty Eradication and Social Welfare
MGEPESW	Ministry of Gender Equality, Poverty Eradication and Social Welfare
MPI	Multidimensional Poverty Index
MPUCT	Madhya Pradesh Unconditional Cash Transfer
MTEF	Medium-Term Expenditure Framework
NLF	Namibia Labour Force
NNSCH	Namibian Senior Secondary Certificate Higher-level
NPC	National Planning Commission
NSA	Namibia Statistics Agency
NSSCH	Namibian Senior Secondary Certificate Higher
OECD	Organisation for Economic Cooperation and Development
PDS	Public Distribution System
PIT	personal income tax
RMS	Rhenish Missionary Society
SADC	Southern African Development Community
SEM	structural equation modelling
SEWA	Self-Employed Women's Association
TAA	Traditional Authorities Act (No. 25 of 2000)
TVUCT	Tribal Village Unconditional Cash Transfer
UCT	unconditional cash transfer
VAT	value added tax
WHO	World Health Organization
WMMS	Wesleyan Methodist Missionary Society
WSWB	willing-seller-willing-buyer

Intersectionalities: The Effect of Educational Reform on Inequity Eradication and the Regional Economy in Namibia

H. J. Sartorius von Bach and E. A. Nuppenau

Abstract:

Graduation statistics of annual Namibian Grade 12 secondary education were used to link the school graduates' achievements to the political regions' economic development. It is hypothesised that the various pre-independence educational systems caused inequity between political regions' secondary education, bringing about diverse economic prospects. Educational reform was expected to improve academic outcomes, especially within the disadvantaged regions. Two decades of panel data allowed the researchers to simultaneously address complex relationships between regional development, educational levels at high school, and the underlying causalities. Latent variables were used to determine linkages and impacts between these levels and socioeconomic relationships. It transpired that educational reform contributed towards economic development at the national level, while regionally, impacts were sensed only after the new enrolment of primary learners reached the secondary level. Levelling of education systems, especially in the historically disadvantaged regions, positively impacted on the country's economic development.

Key terms: canonical correlation; Namibia; economic development; disadvantaged regions; educational inequality; secondary education

Introduction

In the early years of 1907, access to colonial services (including education) was bound to the inside of the existing German colonial police zone. The defined area outside of a territorial boundary demarcated by a blue line on maps defined exclusions for indigenous people, as the colonial regime deemed education to be unimportant for indigenous people (Miescher, 2012). After World War II, these restricted basic rights for citizens residing outside the police zone were redefined by a second colonial rule to fit the new regime's criteria for developmental efforts. Only after the implementation of the Odendaal Plan was school enrolment allowed for indigenous people

(Mbamba, 1981). However, schools were administered differently on the basis of ethnic groupings, applying different infrastructure provision, which resulted in different outcome levels. Mbamba (1981) determined that this system limited possible educational progress prior to the 1970s. It is therefore not surprising that after independence in 1990, the Government of Namibia set about correcting the past by embarking on several reforms, including an "education for all" system. This was deemed to be necessary because, prior to reforms, "the schools and curriculum were organized and run on a racial basis, that curriculum content and assessment procedures were foreign, and the curriculum materials were mainly examination syllabuses prepared in and by the ruling country" (Njabili, 2004 p. 31).

Namibia decided to take control of its educational destiny when in 1996, school education was reformed with the adoption of the Cambridge Examinations Syndicate system, in order to address injustices (Katjavivi, 2016). Education, as a human right, was regarded as the engine for developing learners and providing multiplier benefits such as poverty reduction, life fulfilment and improved employment prospects, earnings and health care. Such gains called for investing heavily in education, to change the direction and destiny of communities in Namibia.

Following Njabili's (2004) critical analysis of the Namibian education reforms in post-independence Namibia, and the finding that secondary school acts as the "academic backbone" for life by McManus et al. (2013), this paper took the Grade 12 final Namibian Senior Secondary Certificate Higher-level (NSSCH) results as determinant of secondary higher education performance levels over time (see Mayston, 2013). We hypothesise that investment in education has a direct and lasting positive impact on people's lives (see Agbor, 2015), and further that policy matters. The NSSCH system was selected as an important yardstick, because most of its components are required for further training and job entry.

The literature supports the view that education levels can strongly and positively contribute towards the human capital of the youth and multiply into economic development, as already discussed as early as in the 1960s by Schultz (1961) and many others. Santín and Sicilia (2015) recently showed that education contributes towards economic status; he showed particularly that a high percentage of public spending reflects a better educated population regarding life opportunities. Research shows that the return on educational investment took the form of economic growth through improved productivity and

increased revenue (see Werner et al., 2019; Aristovnik & Obadić, 2014; Hanushek & Woessmann, 2012; and Gyimah-Brempong et al., 2006). However, disaggregating data from higher educational levels does not always reveal this mono-causality. This opens a debate on how to achieve a more efficient education system and questions the contributing factors and implications of policy (Pearl & Mackenzie, 2018).

When the causality between human capital and economic growth were examined, most studies provided mixed results (see Pegkas, 2014), indicating that emerging evidence in education is also associated with a wide range of non-economic benefits (Pouris & Inglesi-Lotz, 2014), and should be measured as growth, rather than as a direct measure of well-being. Gavurová et al. (2017) found that countries investing in education developed their human capital by reducing social inequalities; they concluded that human parity indirectly allows for economic growth and productivity. However, the literature is limited regarding the simultaneous assessment of contributing factors to both human capital and economic growth. For example, research on Nigeria showed that the poverty rate, unemployment and low income per capita, as well as low education levels, could be attributed to low productivity growth, but significant educational or health variables explaining growth were not found (see Popoola et al., 2019; Asaleye et al., 2017 & 2018).

This paper attempts to address some of the more complex relationships between economic development and secondary education outlined above. By determining the underlying causalities, we identify significant explanatory variables within the economic system of Namibia. We used regional panel data over the past two decades (see Baharom et al., 2013), applying the canonical correlation method (Pearl & Mackenzie, 2018) to determine causalities between schools' educational achievements as a proxy for human capital formation and the resulting economic status. Based on literature findings, we built a model to determine causalities, which were hypothesised and empirically evaluated.

Background

Human capital

Although the human capital issue is widely researched, the claim that it originates from education to develop skills and improve knowledge for economic growth frequently remains unproven. Certainly, inputs from secondary schools have a role to play in providing literacy and numeracy, which will enable learners to survive in complex technological societies. Already in 1776, Adam Smith recog-

nised the principle that educational and professional achievements in life often depend on (secondary) educational and professional attainments earlier in life. McManus et al. (2013) defined it as longitudinal achievements obtained during high school to continue via higher education up to the ultimate level of specialisation. By way of proof, a study by Hassan and Ahmed (2008) used cross-section panel data[1] regressions, and found positive correlations between economic growth and variables reflecting human capital, such as the literacy rate, average years of schooling, and primary and secondary school enrolment. However, their methodological approach is regarded as narrow, as it rarely sufficiently addresses causalities. Wagner et al. (2010) proposed using latent variable models for such purposes.

Investment in high school education is often found to be a signal to differentiate the most productive individuals from the poorly productive (see Popoola et al., 2019). It can serve to advance increased productivity (Escosura & Roses, 2010; Lee & Lee, 2016) by boosting capabilities. However, the syllogism of what drives and what remains is unanswered. Li et al. (2016) argue that a low rate of investment in human capital can be attributed to the inability to select the right channel of human capital and public investment to embark on. Literature that indicates that high public expenditure on school education may result in increased educational equality is evenly balanced with literature that indicates the opposite. This may imply that higher investment in public education supports parity. While it might contribute to growth, it may not be dependent on historic characteristics (Schlicht et al., 2010; Stadelmann-Steffen, 2012).

Baharom et al. (2013), which used a dynamic panel system focusing on high school data as a proxy for human capital, showed linkages between human capital and economic growth. Their aggregated country results showed that the pass rate of high school graduates affects national growth, while individual performance is deemed to be insignificant. Findings often depended on the method and approach applied. For example, research on Indonesian secondary school education[2] showed an adverse impact on economic growth (Mendy & Widodo, 2018), while Kasri (2011) showed that secondary school education had a positive effect. The above examples show that model specifications cause different findings, often leading to contradictory understandings of the development effect on economic growth (Wößmann, 2003).

1 Relating to sub-Saharan African countries.

2 Spending on education in Indonesia is low relative to other countries.

Namibian Secondary Education

At Independence in 1990, Namibian educational reform, based on the Constitution, aimed for regional parity and encouraged higher enrolment of learners. A strategic plan was drafted that aimed for improved quality, equity and efficiency in the education sector countrywide, and the attainment of the educational goals of access, equity, quality and democracy. Significant achievements followed following independence in 1990. Today, over 95 percent of school-age children are attending school, the number of teachers has increased by 30 percent, and over 4 000 new classrooms have been built (Research on Socio-Economic Policy (ReSEP) & UNICEF, 2017). However, because of the inherited regional differences, regional outcomes still differ. Table 1 summaries the regional learner enrolment numbers over the past two decades.

The NSSCH learner enrolment numbers increased nationally from 866 in 1996 to 16 621 in 2018, of which the northern regions' enrolment showed the biggest increase, from 44 in 1996 to 13 124 in 2018. The growing enrolment numbers clearly required additional classrooms, teachers and infrastructure, and these had the effect of supporting improved education levels 17 years after the reform started. The annual number of NSSCH learners, as a percentage of the regional population, shows that the demography of the regions' residents differs. In 2018, for example, 0.84% of Ohangwena Region residents were Grade 12 NSSCH learners; the percentage in Kunene Region was only 0.07%, but conversely, in Oshana Region, it was 1.23%.

Table 1 *NSSCH Learner Enrolment*

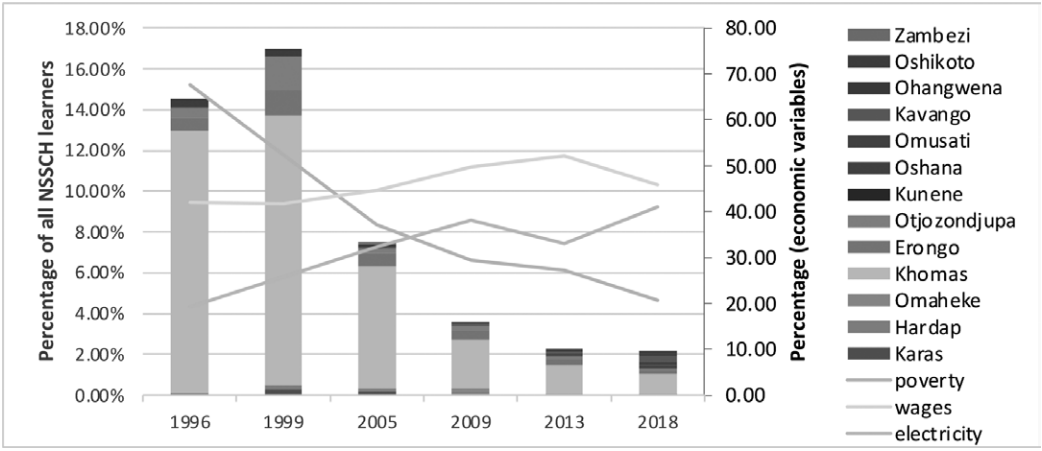
Region	1996	1999	2005	2009	2013	2017	2018	Learners as % of population in 2018
ǁKaras	49	62	86	143	235	265	339	0.30%
Hardap	46	29	67	90	83	152	178	0.17%
Omaheke	14	15	41	54	58	62	85	0.08%
Khomas	591	640	990	1 250	1 569	1 959	2 040	0.45%
Erongo	63	120	192	203	422	478	624	0.25%
Otjozondjupa	78	115	68	116	137	166	185	0.11%
Kunene	0	0	11	57	55	67	46	0.07%
Oshana	0	0	287	1192	2013	1395	2287	1.23%

Omusati	0	0	0	1664	2784	3094	3433	1.17%
Kavango / Kavango West & Kavango East	0	54	380	463	873	1 469	1 552	0.66%
Ohangwena	0	0	370	433	1 665	2 156	2 572	0.84%
Oshikoto	25	56	592	836	1 117	1 584	1 845	0.80%
Zambezi	15	13	66	157	376	1 289	1 435	1.46%
National NSSCH	866	1 104	3 150	6 658	11 387	14 136	16 621	Average 0.69%
Namibian population	1.706 mil	1.858 mil	2.032 mil	2.137 mil	2.113 mil	2.369 mil	2.448 mil	

Source: Adapted from National Media Holdings (1996 – 2019) and National Statistics Agency (NSA) (2020)

The educational budget was used not only to improve the facilities, but also to enhance academic achievements. Figure 1 summarises the NSSCH performers during the past two decades. The improved "academic backbone" can be regarded as an outcome of the reform, to allow for improved learner opportunities and regional parity. Some economic variables, such as poverty, wage dependency, and access to electricity were taken for trend comparison, but also to determine causalities between secondary education and regional development.

Figure 1 *NSSCH Top Performers Relative to Economic Development*



The figure shows that investment in the NSSCH resulted in differentiation. The trend showed that this measure did not yet correct the inequality within NSSCH performance (see Katjavivi, 2016; Shafuda & De, 2020). In 1999, about 17% of all NSSCH learners could be classified as top performers (those who obtained 40 or more points out of a maximum of 54 points), but this measure had declined to about 2% two decades later. Figure 1 reveals that the supremacy of Khomas Region remained untouched with its outstanding school performance. However, the capital region lost its status of producing the preponderance of top school performers. The question to be asked is how this relates to regional poverty or wage dependency, and how to identify its cause and effect. The paper attempts to address these questions in the following sections.

Methodology

Iipinge and Likando (2012, p. 8) assessed Namibia's educational reform, starting from the old Cape Education Department Matriculation education system and progressing to its replacement with the new Cambridge system, as having followed a "process of mental decolonization away from the images of an inferior and to separate people which permeated the old curriculum and pedagogy". We applied longitudinal data, comprising individual Grade 12 NSSCH results from 1996 until 2018, and correlated them with both data of the current education system and the regional Namibian economies. As there are statistical methods which deal with complex situations and go beyond easily observable variables, we rather made use of latent variables through structural equation modelling (SEM) (Bowen & Guo, 2012). With this methodology, we could detect the either weak or strong causalities as a measure for implementation success or failure. We decided to test for these causalities by presenting a case to understand hidden variables describing the progress in development (in our case through high school achievement). We wanted to find causalities between the political regions' economic performance and high school results, following Pearl and Mackenzie (2018). This paper therefore aims to test the most important socioeconomic components in society for example by looking at confounding variables, logics and stochastic *vs*. deterministic elements. It is an attempt to qualify variables of high school education within the Namibian economic context working with causalities as pathways given for analysis.

Data

We based the analysis on longitudinal panel data (Baltagi, 2008; Manca, 2011; Teixeiraa & Queiros, 2016) covering education on the one side and

economic status on the other, in our case specifically for education regions.

Note that a learner could score a maximum of 54 points for six subjects. By way of comparison, the basic entrance level to a Namibian university requires a minimum of 25 points. Individual learners' subject results were entered on annual excel sheets and averaged to regional NSSCH education levels over time for the years 1996, 1999, 2005, 2009, 2013 and 2018. As from 2019, the third phase of basic educational changes was implemented, resulting in the phasing out of the NSSCH and the introduction of the NSSCAS (Namibian Senior Secondary Certificate Advanced Subsidiary) level course. The data for 2019 onwards could therefore not be included in these panel data.

All individual and average learners' marks were indexed and also presented as a skewness index[3] to show the regional secondary education levels. Besides learner variables on regional averages, additional regional[4] variables, such as the number of teachers, learner per teacher ratio, number of schools, average teachers' salaries, and various educational budget lines, were collected to describe the secondary education situation in Namibia.

We obtained economically related data from the National Statistical Agency of Namibia (NSA, 2020). The following variables were collected: (1) regional population size, average regional household size, percentage of households having access to electricity; (2) young citizens (<34 years) unemployed; (3) regional urbanisation %; (4) poverty rate; (5) inequality measure; (6) average regional household consumption; (7) percentage of population formally employed; and (8) regional income tax contribution.[5]

Comparing the baseline at independence (1990) with the current previously advantaged and dis-advantaged regions, we hypothesised that the education reform would cause NSSCH level improvement for especially the disadvantaged northern regions, with accompanied improved parity in resources, skills and opportunities. It was a deliberate policy goal to improve the educationally disadvantaged regions, and it could be expected that the intention to correct the imbalances of the past might have a negative effect on the previously educationally advantaged southern regions.

In order to explain the variables, our longitudinal panel data were grouped in the three levels of the educational index

3 The Gini coefficient was used to show the equity between total marks obtained by students in regions

4 Because of data limitations, Kavango East and West were combined as one region

5 To keep monetary variables comparable, they were deflated in line with the consumer price index.

(low, average and high), respectively, as 1, 2, and 3; additionally, we elected to adopt regional disaggregation. A discriminant analysis was used to find underlying explanatory variables for both school achievement and the regional economic status.

Regional inequality

For conformity, Mbamba's (1981) educational classification was used to divide the country into the northern previously educationally disadvantaged regions (Zambezi, Kavango East, Kavango West, Ohangwena, Oshikoto, Oshana, Omusati and Kunene) and the rest of the country. This implies that the other regions can be regarded as more privileged despite containing pockets of disadvantage.[6] Today, many regional high schools only offer limited subject choices, which discriminates against bright learners, for example from Kunene Region, who wish to attend a prestige government school in one of the better-served regions, such as the capital region, Khomas. However, these learners would not be enrolled in these prestige high schools because learners are still today limited to high schools from the region of their residence.

Cognisance is taken of the fact that Mbamba's generalisation is not perfect, since educational inequity occurs within regions. Data availability limits the assessment to differences between political regions. The more educationally advantaged regions are taken to be Otjozondjupa, Omaheke, Erongo, Khomas, Hardap and ǁKaras regions.

Ranking learners' average NSSCH marks by region and by year, we could observe changes. Table 2 provides an overview of the changing outcomes, presented as the total average learners' points obtained for their six subjects.

6 Black communities living in historic poverty; black schools having less qualified teachers, smaller variety of subjects offered, etc.

Table 2 *NSSCH Learner Performance (Average Total Points Obtained)*

Region (Advantaged)	1996	1999	2005	2009	2013	2017	2018
ǁKaras	14.02	13.92	13.29	10.85	11.22	14.09	11.84
Hardap	15.41	17.83	14.66	16.32	11.96	10.95	9.24
Omaheke	14.71	20.40	13.98	16.96	12.46	12.40	10.82
Khomas	23.02	24.47	21.81	19.42	18.33	16.35	15.74
Erongo	20.94	18.98	18.87	20.54	15.19	15.36	12.81
Otjozondjupa	18.01	21.61	19.60	20.78	19.79	17.30	12.80

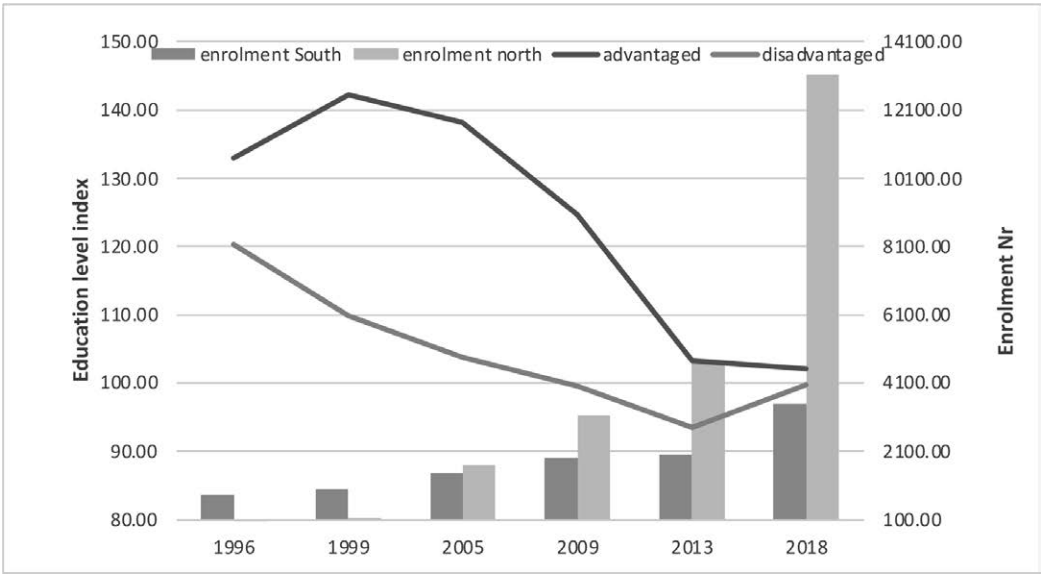
Region (Disadvantaged)							
Kunene	NA	NA	6.64	9.25	9.87	9.90	10.91
Oshana	NA	13.12	9.00	7.52	7.89	9.87	9.12
Omusati	NA	NA	NA	7.06	7.24	8.03	8.29
Kavango	NA	9.85	8.58	9.48	9.71	10.47	10.69
Ohangwena	NA	NA	6.86	6.22	6.96	7.07	7.55
Oshikoto	18.32	17.77	8.99	9.07	9.79	9.72	9.51
Zambezi	8.47	25.85	15.47	10.18	11.25	9.38	9.52

It shows, for example, that the 78 learners from the Otjozondjupa Region obtained an average total of 18.01 points per learner in 1996 (refer to Table 1 for NSSCH enrolment figures) to be ranked 3rd amongst educationally advantaged regions in NSSCH points obtained, and improved to being ranked in 1st place in NSSCH performance with total average of 20.78 points per learner in 2009, when it had 116 learners; conversely, Khomas, the capital region, ranked 1st in points obtained in 1996 by its 591 learners, but declined to rank 3rd in 2009, and back to 1st in 2018, when 2 040 learners were enrolled. Another previously advantaged southern region, Hardap, showed a general decline in points obtained. Although the northern, disadvantaged regions ranked lower throughout for the period under investigation, some of these regions presented significant performance changes over time. For example, the 13 learners of the Zambezi Region obtained a total average of 25.85 points per learner in 1999, ranked first amongst all regions, but declined to an average total points of 9.38, ranking 11th in 2017, when 1 289 learners were enrolled. Kavango and Omusati, regions with historically low NSSCH rankings, showed significant improvements after 17 years, but Ohangwena Region had not yet shown any response to the educational reforms.

To further explain the above outcome (since reform implementation), we plotted the NSSCH level and equity compared to learner enrolment and number of teachers over years. Figure 2 shows the changes of weighted performance levels between the historically educationally advantaged southern and disadvantaged northern regions. The educational levels of both groups followed the declining trend; the national weighted average index declined from 132 in 1996 to 100 in 2018. Investigating this trend, we can observe that the southern (advantaged) regions have exhibited a bigger variation in average performance over the years in response to the reforms. However, contrary to the intended relationship,

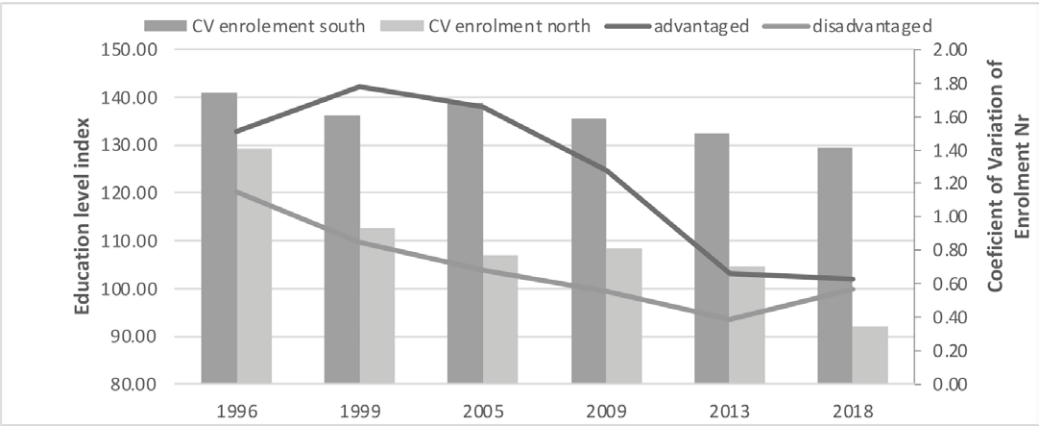
the recovery of the declining levels only started in 2013. Learner enrolment, especially in the northern regions (see Table 1), has shown a very substantial absolute increase over the past five years, which followed 12 years after learners entered primary school at the Grade 1 level. The educationally advantaged regions showed insignificant changes in learner enrolment (Figure 2).

Figure 2 *Higher Secondary Education Levels Relative to Learner Enrolment within Regions*



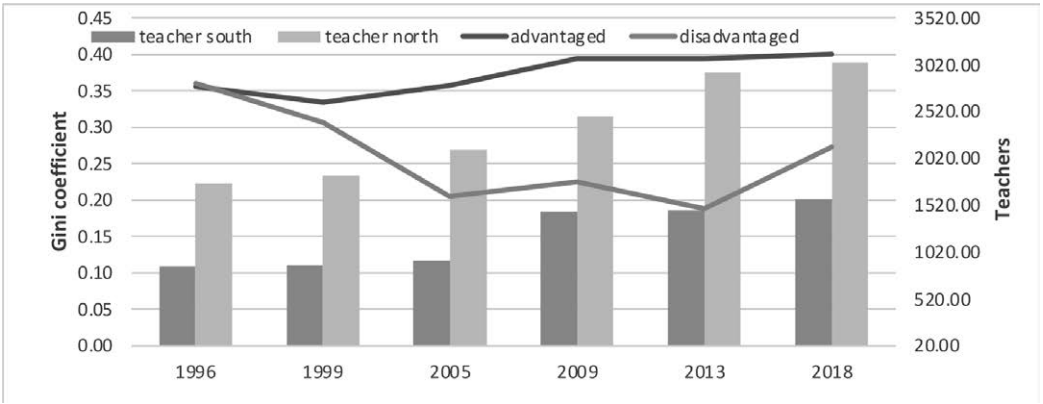
The above relationship can be explained if approached in relative terms. Figure 3 shows the same educational levels but relates them to the coefficient of variation (CV%) of enrolment numbers by regions. It can be observed that while implementing the education reforms over the years, both the northern (disadvantaged) and southern (advantaged) regions showed greater similarity in terms of learner enrolment by individual regions. Unfortunately, the regional implementation of enrolment numbers was treated differently, as observed from Figure 3, and these practices contributed towards declining NSSCH aggregate educational levels over the years – an unintended result of the reforms.

Figure 3 *Higher Secondary Education Levels Relative to Regional Learner Enrolment Practices*



With the implementation of the reforms, the variation of the learners' educational level by region showed a declining trend in the disadvantaged regions, while the historically advantaged regions showed a small increasing variation in educational levels. The Gini coefficient was used to put a number to the NSSCH inequity. Figure 4 shows that the increasing number of teachers in both historically advantaged and disadvantaged regions apparently contributed towards the differences in academic performance. For the first years until 1999, the calculated weighted Gini coefficient was decreasing, which implied that the variation in average performance was narrowing. We can observe that the equity of the educational levels in disadvantaged northern regions continued to decrease and moved sideways until 2013, when changes in numbers of primary school enrolment were felt at NSSCH level. When these learners reached Grade 12 in 2013, the variation of the average academic level increased again. The effect of improved access to education on academic levels in the southern regions moved sideways, with a minute widening of NSSCH levels. We can make a case that the decrease in the ratio of learners to teachers for the NSSCH, especially since 2009, has had a positive impact on the recovery and variation in the declining academic levels.

Figure 4 *Higher Secondary Education Equity in Performance Relative to the Number of Teachers in Regions*



From Figure 4 it becomes clearer that the economy was in a reconstruction phase after independence, and that the effects on educational outcomes only became apparent after 2013. The presented graphs reveal three distinct phases:

- We can describe the first phase with improving education levels from 1996 to 1999, possibly associated with teacher's quality promotion through improving wages and salaries since 1994.

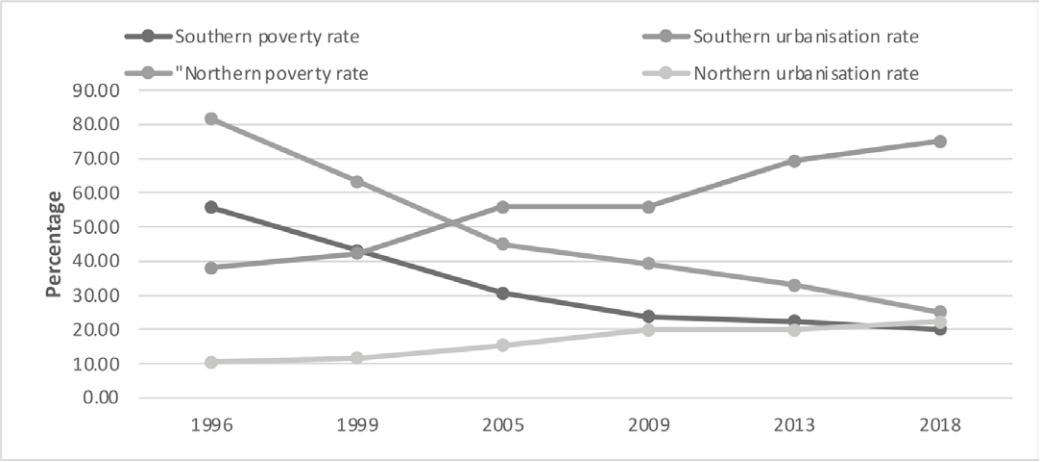
- The next phase showed a general decline in academic results and lasted until 2013. It corresponds to a period during which a decision was made to cut teachers' incentive payments for obtaining further qualifications, such as the Higher Education Diploma.

- The third phase started in 2013, when the educational reforms reversed the decline in performance levels with a slight increase in the levels.

The NSSCH assessment was used to find the hidden causalities between improved household livelihoods and education (see Asaleye et al., 2017; Eigbiremolen & Anaduaka, 2014; Fashina et al., 2018; Popoola et al., 2019). These authors argued that even with high national budget allocation for education, the inability to direct the funds into the right channels for human capital formation can have serious consequences. School graduate outcomes were shown in relation to economic variables such as regional poverty rates, unemployment, and income levels for the historically differently treated regions. Figure 5 shows the poverty rate and the

urbanisation rate. It can clearly be observed that the trends in the regional classifications were similar, but that the response rate to changes was different. For example, the historically advantaged southern regions urbanised slower than the northern regions. It is interesting to note that the poverty rate reduced more quickly in the previously disadvantaged northern regions than in the southern regions, and that on average, the various regions had reached similar poverty levels after little more than two decades between 1996 and 2018.

Figure 5 *Higher Secondary Education Equity in Performance Relative to Numbers of Teachers in Regions*



Causality Analysis

Classical analyses showed that hard explanatory variables can significantly explain education and economic changes. But the question is: Is it only correlation, or is it causality? The standard assumptions of metric statistics characterised all variables, but the power of cause and effect needs scrutinising. These variables are the "easily obtainable" variables for empirical analysis, which in most cases do not depict the full theory to be qualified, i.e., most analysis could not reflect the full and complex theory. We therefore applied structural equation modelling (SEM).

We apply less stringent assumptions on data and statistical tools, such as "soft variables". They are variables which are not directly observed, often called "latent variables", and often used where socioeconomic characteristics are integrated in economic analysis. To explain this application, the least complex model illustrated by Dhrymes (1974) is used. Recently, Voelke et al. (2016) have shown the power of SEM

in time series and panel analysis. We follow that concept and offer a latent variable approach to the above problem of causalities. Equation 1 shows that the exogenous variable *z* determines an endogenous variable *w*, and that both variables are regarded as not directly observable.

Equation 1:

$z = \Sigma\alpha_i x_i$ with i = 1, ….. n and

$w = \Sigma\beta_m y_m$ with m = 1, ….. m

Individually, the indicator variables are indirectly correlated with each other, i.e., if the traditional statistical methods are applied, we could presume causality; but we have complex relationships. The equations seem purely exogenous and determined by *z* variables. However, for an in-depth quantitative approach, the magnitude of τ requires that it be measured, since ɾ is the driving relationship in the setting (see Equation 2). This concept can be extended to systems of dependent and independent latent variables, which are combined in structural interdependencies. Mathematically, this concept of interdependency and mutual causalities can be presented in Equations 2 and 3, yet it is the first offer of a pathway and reveals a recursive model, while the second equation includes one interactive component (ζ, unilateral mono-causality).

Equation 2:

$$w_1 = \tau_{11}\, z_1 + \tau_{12}\, z_1$$

Equation 3:

$$w_2 = \zeta_{21}\, w_1 + \tau_{21} + \tau_{22}\, z_1$$

Inserting the indicator variables, a structure of observable variables would be obtained.

Equation 4:

$$\Sigma\beta_{1i}\, y_{1i} = \tau_{11}\, (\Sigma\alpha_{1i}\, x_{1i}) + \tau_{12}\, (\Sigma\alpha_{2i}\, x_{2i})$$

Equation 5:

$$\Sigma\beta_{2i}\, y_{2i} = \zeta_{21}\, (\Sigma\beta_{1i}\, y_{1i}) + \tau_{21}\, (\Sigma\alpha_{1i}\, x_{1i}) + \tau_{22}\, (\Sigma\alpha_{2i}\, x_{2i})$$

The above equations would cause a large correlation matrix, but it would not allow for the identification of structural parameters. We follow Dhrymes (1974) who proposed for a simple model like w = Υ z, a constraint maximisation of Υ, extended to α and β simultaneously, which he called canonical correlation. Only in cases where the endogenous variable is limited to one (e.g. m = 1), the generalised function (w = Υ z) would be reduced to the standard multiple regression problem, but in the general form the canonical correlation (Υ) would exhibit the relationship

between latent variables, presented as:

Equation 6:

$$\gamma = \text{cov}\,[z'w]/\,(Var\,[z]\,Var\,[w])^{1/}$$

or

Equation 7:

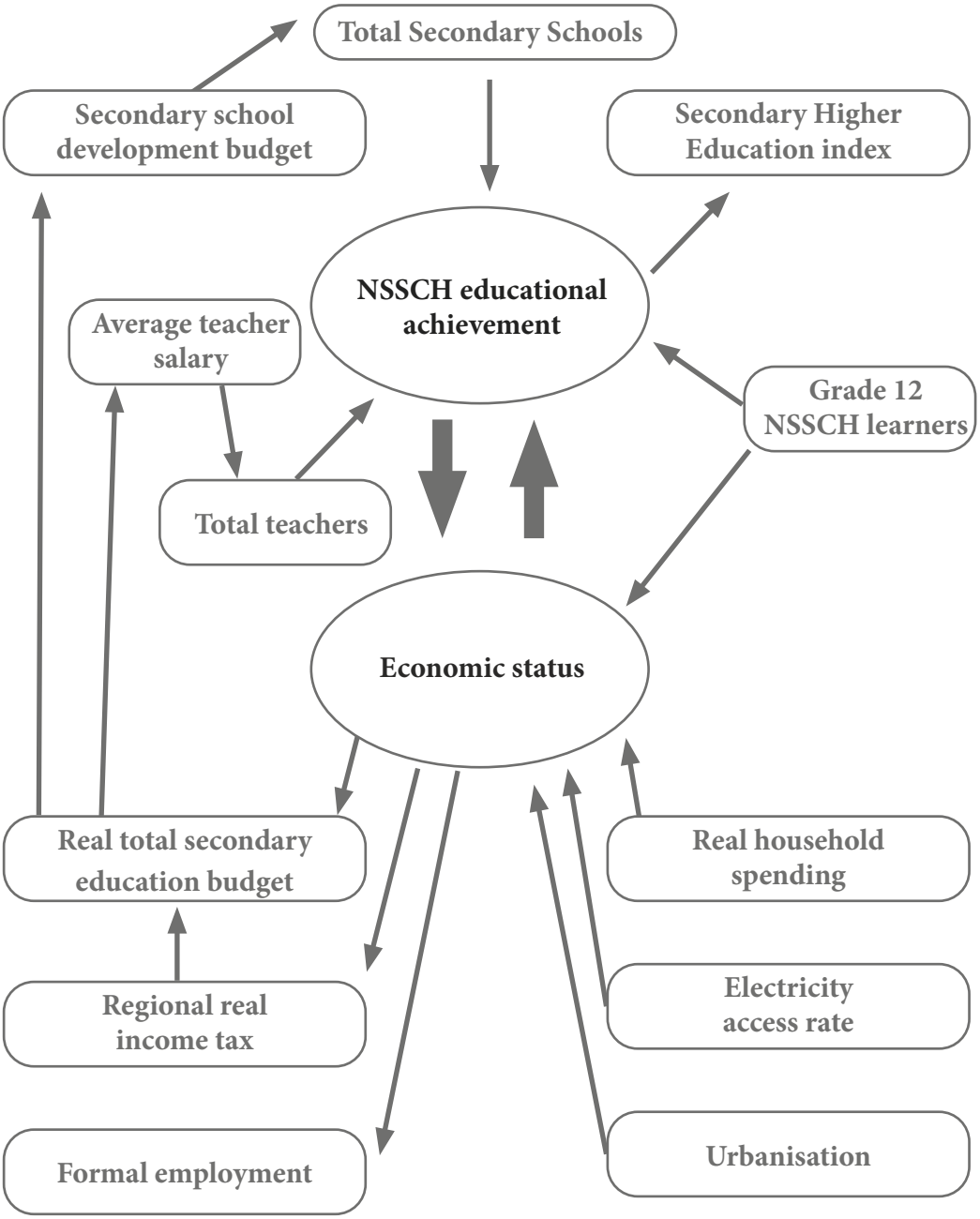
$$\gamma = \alpha'\Sigma_{12}\beta\ /\ ((\alpha'\Sigma_{11}\,\alpha)$$

$$(\beta'\Sigma_{22}\beta))^{1/2}$$

where Σ_{12} (variance-covariance matrix) represents Cov [x' y] of the observable indicator variables x and y, and Σ_{11} and Σ_{12} (corresponding internal variance-covariance matrix) represent the internal Cov [x' x] and Cov [y' y], respectively (Granger, 1988). Dhrymes (1974) proposed maximising the canonical correlation coefficient Υ in Equation 7 using constraints to result in a non-trivial solution. We apply this principle using the Stata software (Stata, 2011). Empirical findings from several studies on the implications of human capital on economic growth have been used to guide on building a causality diagram (Figure 6) between schools' educational achievements and the economic status in Namibia. We based the variable selection on the educations-development-logic, classical steps for econometric modelling, and a discriminant analysis to identify explanatory variables.

We start with a diagram as suggested by Pearl and Mackenzie (2018), where causalities are indicated by arrows.

Figure 6 *Proposed Causality Links between Schools' Educational Achievements and Economic Status in Namibia*



Findings of the best fitted model show that "schools' educational achievements"[7] play a significant role in economic status in Namibia, though resource availability is still unequal by region. Figure 6 presents the causalities of all significant variables selected for the model. From this figure, our latent variable "schools' educational achievements" is sufficiently characterised by (i) the average teacher's real salary attracting teachers; and the (ii) the development budget for more schools, while the education level resulted from "schools' educational achievements". The model showed a positive causality, such that the "economic status" is characterised by the soft latent variable "schools' educational achievements", plus some hard explanatory variables, such as access to electricity and average real household spending. The "economic status" which is characterised by the variables formal employment, the poverty rate, urbanisation, and household annual real income tax, gives significant output. The approach (see Equation 7) was first applied to all regions over the entire period, followed by separate applications on both the historically disadvantaged and advantaged regions.

7 The latent variable "schools' educational achievements" recognises the level of educational attainment in a population which is considered an important determinant of economic growth. The definition is equal to The World Bank (2020) measurement, except that it excludes a level of health. The educational attainment in this paper is limited to the results portrayed in the secondary higher education certificate.

Results and Discussion

The model (see Figure 6) provides coefficients between structural and latent variables, using the presented causal links. Statistically, each of the causal links received a significant coefficient, summarised in Table 3. By way of a guide for interpretation: the total number of teachers, the number of secondary schools, and the number of Grade 12 NSSCH learners all characterise the "NSSCH educational achievements" latent variable. This latent variable then characterises the derived secondary higher education index. These variables, however, were characterised by other independent variables. A two-way causality exists between the latent variables "NSSCH educational achievement" and "economic status". The latent variable "economic status" is also characterised by variables such as the level of real household spending, access to electricity, and urbanisation. The model shows that the latent variable then characterises formal employment levels, the poverty level and the regional amount of real income tax paid.

We found the model as presented in Figure 6 to describe the Namibian causalities between NSSCH achievements (as a proxy for human capital formation) and the resulting economic status. The confounding regional elements discussed above, like the number of teachers and its effect

on the implementation of reform could equally be included. To determine the effect of the inherited inequality in secondary education, the national educational NSSCH outcome was disaggregated into the historically advantaged and disadvantaged regions, following Mbamba's (1981) classification. Table 3 summarises the results, showing the causalities and the different effects in the three right hand columns.

The results show that the total secondary education budget characterised teachers' salaries more in the historic disadvantaged regions than in the southern regions, and that the opposite is the case for the use of the educational development budget. On aggregate, the development budget has a positive significant coefficient, while the teachers' salaries have a significant negative coefficient in relation to the total real secondary education budget. Both the development budget and the average teacher salary significantly characterise the number of secondary schools and the number of teachers, respectively. Both causalities show higher coefficients for the historically disadvantaged regions, which correspond with the intention to correct the inequities of the past. The relationship between household income tax, used as a proxy for the national budget for secondary education, showed similar coefficients for all models. This is a confirmation that the formula of allocating funds to the regions followed the same rule.

Table 3 *Causalities in Namibian Secondary Education*

Variable	Causality	Variable	Coefficient Historically Advantaged	Coefficient Historically Disadvantaged	Coefficient All Regions
Real secondary total budget	→	• Average teacher salary • Development budget	354.02** 0.085**	1 167.70*** 0.069***	-177.11 0.769***
Development budget	→	• Total Secondary schools	60.11*	182.62**	126.08***
Average real salary	→	• Total teachers	1225.11*	2 210.88***	1769.75***
Real household income tax	→	• Real secondary total budget	1 14.57***	116.62***	115.67***
Total Secondary schools **Total NSSCH teachers** **Total NSSCH learners** **Economic status**	→	• NSCCH educational achievements	3.81e-08 3.97e-09 1.89e-10 -58.947	2.49e-08 1.22e-09 8.12e-11 734.58	3.25e-07 1.08e-08 5.41e-10 457.71
Secondary education level	←	• NSSCH educational achievements	105.34	98.79	101.82
NSSCH educational achievements **Electricity** **Household real spending** **Urbanisation**	→	• Economic status	1.09e-11 4.55e-10 6.01e-13 5.48e-10	-5.02e-12 2.33e-10 2.47e-13 2.85e-10	-1.44e-11 1.26e-09 1.58e-12 1.16e-09
Formal employment **Poverty level** **Regional real income tax**	←	• Economic status	69.37*** 30.63*** 369.60***	25.70 46.37*** 234.79***	45.85*** 39.11*** 297.01***
NSSCH learners	←	• Household real spending	0.885***	0.559	0.125
Model fit	Log likelihood Chi2 Probability		-3 128.56 1 185.42 0.000	-3 710.13 1 383.82 0.000	-7 085.15 2 333.95 0.000

Note: Chi2 = 403.11; Probability > Chi2 = 0.000; *, **, *** denote 10%, 5% and 1% significance, respectively

Source: Author's own calculations

From an historical perspective, the outcome of the NSSCH educational achievements, measured as a secondary education level index, showed that parity was not reached. At the same time, we can state that the historically disadvantaged regions still generate lower educational outputs. The model showed that the level of real household spending, representing the economic status, significantly contributed towards the improving NSSCH levels in the southern regions, while the coefficient was lower and insignificant for the northern regions. The economic status justifies higher levels of formal employment and household income tax for the southern regions than for the historically disadvantaged regions, while we found the opposite for the poverty levels. It is thus clear that the level of economic status between the regional classification is still unequal, but that the causalities between NSSCH achievements, as a proxy to human capital formation, and the resulting economic status, exist. Thus, we found that "schools' educational achievements" had a positive effect on the economic status of the citizens of Namibia.

To better understand these newly discovered causalities, the regional classifications were disaggregated into three educational performance levels, namely low, medium, and high. We observe in Table 4 that the high level of achievement of the historically advantaged regions could be correctly classified, and that it has shifted towards the low level since 2013.[8] This implies that although the reform showed results in general, the urbanisation rate and the formal employment rate showed noticeable simultaneous impacts (as confounding). It also points out that different regional response levels have to be recognised in the course of policy implementation.

8 See the shift from high NSSCH level to low level regional concentrations.

Table 4 *Correctly Predicted Average Regional NSSCH Achievements during the Reform Period*

Year	No. of Previously Advantaged Regions			No. of Previously Disadvantaged Regions		
	Low level	Medium level	High level	Low level	Medium level	High level
1996		2	4	1	1	1
1999	1	2	2		1	1
2003		1	1		2	1
2009	1		2	1	2	1
2013	2		1	4		
2018	4			2	3	

Source: Author's own calculations

Conclusions

The Namibian educational reform of secondary education was assessed, focusing on the NSSCH, to determine whether social justice has been reached. A method was chosen for analysing linkages between cause and effect through causality, providing benefits for policy analysis. The results confirm findings that human capital formation occurs through high schooling, which has a positive effect on the country's economic status; yet overall, for the analysis of the efficacy policy, we need more detailed regional information to account for the effects of discrimination, and the goal of attaining equity. Such a model could then improve the understanding of educational reform on the principles of social justice and the macroeconomic situation in the country.

The empirical results for Namibia's progress in secondary education show that education reform (aimed at righting the wrongs of the past) have resulted in increased learner enrolment numbers, but unfortunately also in declining academic high school achievement levels of the Grade 12 outcomes, which is most pronounced regionally. We combined this with the narrowing of learners' outputs. With these findings, we reject the hypothesis that the reform process improved NSSCH levels, especially in the historically educationally disadvantaged northern regions. The high school educational reform has not yet attained the results that were hoped for (Katjavivi, 2016). After only 17 years (from 1996 to 2013), a slow recovery of the historically skewed academic levels showed some positive effects.

The reform response was slower than expected in the northern regions but it matched the secondary education levels of the southern regions. However, by disaggregation of the longitudinal data, the findings support global literature in general, and in particular that high school education levels in Namibia contributed towards human capital formation to multiply into economic development. Specifically, since 2013, academic performance levels have shown some revised results that are associated with non-economic benefits by reducing social inequalities, and consequently promoting regional growth and productivity. Although slow, the implementation of education reform partially corrected the inequality of the past. The finding corresponds to other educational reforms, such as those embarked on in Zimbabwe (Kanyongo, 2005). As the change eventually turned to become positive, the paper opens up the question of whether the further revised curriculum in 2019 (Nghipondoka, 2020) will strengthen or counter the observed correction.

As a follow up on policy and for a debate on public spending, it can be tentatively stated that results support Shafuda and De (2020) in the view that that some educational funding was inefficiently directed. Namibia depends on increased educational expenditure to achieve faster economic growth. In particular, an expansionary budget is required for its high school education programmes so that funds are efficiently directed towards school development projects which support the causality between improved academic levels and increased generation of regional income tax. It cannot, however, be assumed *per se* that expanded investment is required in education. As was the case with case studies of other countries (see Chang et al., 2016; Glewwe, et al., 2014), Namibia's first years of implementing its education reform resulted in reduced academic levels. More targeted educational spending could have prevented academic performance from declining from an average index of 132 in 1996 to 100 in 2018. These reduced average academic levels may have contributed to the growth of the youth unemployment rate of 14.2% per annum (see Mwinga, 2012).

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