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ESEPARC WORKING PAPER 001/SZL

Assessing the Relationship between Brain Drain and the Economy of Eswatini

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2019

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Abstract. Eswatini has been experiencing the brain drain phenomenon since the early 90s. Previous studies on the phenomenon attribute the brain drain to high unemployment and the labour market's inability to absorb emaSwati. With that said, there are still no studies have been conducted to quantify the impacts of brain drain on the economy of the country given its upward trajectory. It is on this premise, that this paper quantifies and assess the relationship between brain drain and economic growth in the short-run. To this end, the study employs secondary annual time series data from the World Bank Indicators for the period 1991 to 2017. The study employs the Bounds approach for co-integration and the short-run Autoregressive Distributed Lag (ARDL) model as estimation techniques. The bounds test found that there is no long-run equilibrium relationship between the variables. According to the ARDL short-run model the study found that all other things being equal, when brain drain increases by 1 percent at a given time period, Gross Domestic Product increase by E171 million the following year in the short-run. Furthermore, the Granger causality test reveals a unidirectional relationship running from Gross Domestic Product to brain drain at the 1% significance level, that is, past economic growth trends is an important predictor of future brain drain trends.

Keywords: Brain Drain; Bounds Test; Autoregressive Distributed Lag Model; Eswatini.

1. Introduction

Many countries, especially developing countries across the globe, have seen their native human capital reservoir decline due to migration. The International Labour Organisation (ILO) (2018) estimated that there were 164 million migrant workers living abroad worldwide that were accounted for in 2017. However, for decades in most developing countries, the proportion of unskilled and semi-skilled emigrants outweighed that of skilled emigrants. Since the 1900s, labour migration in Eswatini, for instance, has played an important part of the country's history, where emaSwati were recruited to work in the mines, farms, and households of white South African's (Crush *et. al.,* 2005). It was only from the mid-1990s that the composition or skills profile of these emigrants changed. The new form of migration was then characterised by an exodus of highly skilled or qualified people (brain drain) hence marking the beginning of the phenomenon of brain drain for Eswatini and the majority of the Southern African region.

Brain drain, especially among the youth in Eswatini, speaks to one of the most serious socio-economic push factor faced by a majority of countries all over the world, which is youth unemployment. A study conducted by Crush and Simelane (2004) identified some of the underlying unfavourable socio-economic push factors that justify brain drain as being a survival mechanism for emaSwati. The study found that the major reason for emaSwati migrating to South Africa was to find employment opportunities. This is no surprise as the country's unemployment rate and youth unemployment rates increase yearly and as of 2016 sit at a depressing 23% and 47.4%, respectively (Labour Force Survey, 2016). That coupled with the low absorption rate in some industries projected by the Swaziland's Labour Market Profile and

the 206,650 discouraged workers in the country (Labour Force Survey, 2016) are some of the factors that speak to the possible causes of brain drain in Eswatini.

Generally, if not managed brain drain creates negative production and fiscal externalities as this phenomenon disseminates the human capital of the sending country, further causing losses in tax revenue that could have otherwise accrued to that country's government (Gibson and McKenzie, 2012). Within the African context, Ghana which is one of the sub-Saharan countries known to be grappling with high brain drain, estimates a net fiscal cost of between US$5,450 and US$6,300 per highly-skilled emigrant annually (Gibson and McKenzie, 2012). Other countries such as Zimbabwe, Nigeria, and South Africa are part of nine African countries that have collectively lost more than $2 billion since 2010 in the health sector alone as a result of brain drain (Kweitsu, 2018).

For Eswatini this phenomenon should be made an area of policy concern because the emigrants leaving the country are mostly people who have tertiary education. This means that the investments the government makes in higher education are not seeing their full returns. This year alone there was a 7.5% increment for the budget allocated to education in the country, yet people are still leaving the country in throngs. This brain drain and the inability for Eswatini to provide opportunities for young people within the borders will continue to be felt in the future, having implications and ripple effects across different sectors that require a skilled labour force. For instance, the return on the investments the country is making now in developing Science, Technology, Engineering, and Mathematics (STEM) skills to add value for the country's industrialisation, innovation and value chain development will not be realised in the future should Eswatini's brain drain persist unabated.

The revised National Development Strategy (NDS) (1997), which is the Strategy for Sustainable Development and Inclusive Growth (SSDIG) (2017) still laments the loss of skilled people to neighbouring countries (especially South Africa), yet in spite of the evident knowledge and increasing prevalence of the brain drain in Eswatini, there is no empirical evidence that shows the extent of the brain drain including its effect on the economy. Although the Ministry of Labour and Social Security with the assistance of the International Labour Organisation (ILO) recently launched a Labour Market Information System (LMIS), there is limited information on migration in Eswatini apart from the odd sociological and demographic commentary. Conceivably, this has compromised the ability of the country to develop a human capital retention strategy including prioritising policies that will provide more opportunities to emaSwati, especially for young people within the borders.

It is on this premise that this study is conducted. Questions relating to how the country can best manage the brain drain, the costs associated with brain drain and the appropriate responses by Eswatini to counter these patterns of mobility have still not been addressed. These questions and their answers have become very important as Eswatini enters the last three years of the SSDIG. Therefore, the study aims to: establish the nature of the relationship between Eswatini's economy and brain drain, empirically derive the lilangeni value of the impact of brain drain on the economy of Eswatini, as well as seeks to ascertain the directional causality between Eswatini's economy and the brain drain phenomenon.

The subsequent sections of this paper are organised as follows: section two reviews literature while section three presents the methodology employed to achieve the objectives of the study. A

summary of the results and discussions are presented in section four and section five concludes and makes policy recommendations.

2. Literature Review

According to Docquire and Rapoport (2012) the first wave of economic papers on brain drain dates back to the late 1960s and consists mainly of welfare analyses (see Grubel and Scott, 1966; Johnson, 1967; Berry and Soliqo, 1969; Bhagwati and Hamada, 1974). Literature on labour migration in the beginning proposed an imbalanced view and papers generally concluded that the impact of skilled labour migration on source countries was essentially neutral and emphasized the benefits of free migration to the world economy (Docquire and Rapoport, 2012).

Skilled labour migration has since become a critical policy issue and subsequent studies on the phenomenon, especially in developing sending countries, lament the negative effects of it and as a result recasting the assumptions of the first analysts. This may be due to the fact that previously labour migration consisted of unskilled and semi-skilled workers and did not necessarily constitute a brain drain (skilled labour migration). This paper also highlights the possible negative effects of brain drain in Eswatini, in the absence of any programmes to counter the undesirable consequences it may come with.

It is important, however, to mention that with the new wave of research on brain drain, studies show that the effects of brain drain on sending countries and have shown that the possibility of brain drain could create some positive effects or a brain gain effect (see Mountford, 1997; Beine et al., 2001 and 2003; Stark, 2005; Easterly and Nyarko, 2008; Gibson and McKenzie, 2012). One of these positive effects that researchers believe are spawned through brain drain are remittance receipts. Mwangi and Mwenda (2015) determine the effect of international remittances on the economic growth in Kenya for the period 1993 – 2013. Using the granger causality tests, the results from the study conclude that a US$1 increase in remittances leads to a 0.24% increase in Kenya's Gross Domestic Product (GDP). It is often argued that the negative impact of the brain drain may be mitigated through these remittances (Faini, 2007) (see Docquier and Rapoport, 2012; Gibson and McKenzie, 2012). However, on the contrary, a study done in Nicaragua found that remittances have a negative effect on labour force participation (Funkhouser, 1992). These capital flows discourage the participation in the labour market without necessarily decreasing the unemployment rate. Bredtmann (2019) also supports this by stating that the effects of brain drain on sending countries are so dire and cannot be mitigated through remittances (see Faini, 2007; Adams, 2009; Niimi *et al.,* 2010).

The debate on the effects of brain drain has stimulated the development of this field and the optimistic view proposed by the previously mentioned studies in support of brain drain has been heavily criticized. This criticism may be because it is known that the majority of the brain drain occurs from developing countries to developed countries causing a wider developmental gap. A lot of these developing countries have not taken advantage of the brain drain like developed countries have through brain circulation and through tapping into their diaspora networks to offset the negative effects of brain drain. Much like Eswatini, most of these developing countries had not seen brain drain as a cause for concern in the past, thus, they do not have sufficient data available on their emigration preventing them from properly informing their human development framework or having strategies around this phenomenon.

Within the Southern African context, brain drain is an on-going and persistent problem. Although we mostly witness migration from African countries to other continents, there is some migration between other countries in the Southern African Development Community (SADC) region. Zimbabwe is the country with the largest number of emigrants in Southern Africa and for most Zimbabweans, South Africa is the destination of choice with 649, 385 documented Zimbabweans living in South Africa (United Nations, 2017). Although South Africa is the primary destination country for intra-SADC migrants (Dodson and Crush, 2015), the republic is also experiencing a detrimental loss in skills through emigration as more people are leaving than ever. Staff Writer (2019) states that for every one professional going to South Africa, eight are leaving. Bohlman (2010) uses a Computable General Equilibrium (CGE) model to measure the impact of skilled emigration and the subsequent loss in primary factor production on the South African economy. The study found that real GDP would be around three per cent lower over an eight-year period as a result of skilled emigration. The resulting loss in competitiveness severely curtails export-oriented industries, with declining rates of return hurting the investment sector. The study also found that skilled emigration in the absence of any programmes to counter this flow of workers has a generally negative effect on the economy.

In Eswatini, the effects of brain drain have not been subject to serious quantification. The minute number of papers that have been written only focus on the dimensions and characteristics of labour migration, not necessarily brain drain. Simelane and Crush (2004) use a survey method to provide unique and unprecedented insights into the Eswatini migration phenomenon. They find that the respondents come from all walks of life and they go to South Africa for a bucket of reasons. A majority of the 600 respondents had received some formal education and go to South Africa mostly for jobs (32.1%) and for healthcare reasons (12.1%).

The impact of brain drain on the sending country is an extremely important topic to explore. Other areas that are known to be affected by this phenomenon and are worth further empirical investigation include its impact on wages; the national investment in training (see Cervantes and Guellec, 2002); the number of highly skilled workers available to domestic production, which in turn affects GDP; and the sending economy's capacity to be innovative or adopt modern technologies. This latter consequence is particularly important in globalization, where capital investments are made in countries with high production efficiencies (Marchiori *et al.,* 2013).

2.1 How Brain Drain affects Economic Growth

Countries that are affected by the large movement of their highly skilled workers often raise questions as to how these valued workers impact the countries they leave and their economic growth. Studies on brain drain support the prospects of reductions in the average level of human capital which creates sluggish economic development. Contemporary economic theory, such as the endogenous growth theory, that extensively explain the nexus between education, migration, and growth, predicts that the loss of human capital due to skilled labour migration further reduces economic growth rates.

Naicker and Ashuntantang (2017) state that since education is a major contributing factor of long-term growth, brain drain is, therefore, detrimental to the country of emigration. Due to the imperfect substitution between skilled and unskilled labour, the brain drain can be seen as a negative externality on the people left in the source country. It undermines a developing country's productive capacity, slowing economic (GDP) growth, and consequently increasing poverty and inequality (Lowell and Findlay, 2001).

According to Raji and Attah (2018) most studies emphasise the positive effects of migration on human capital (Barguellil *et al.*, 2013; Belot & Hatton, 2012; Larsen & Fondahl, 2015; Wahba, 2015). However, when turning to how it actually affects and the sending country's economy, conclude that there is a detrimental growth effect.

2.2 The Relationship between Labour Migration and Eswatini's Economic Growth

Since the influence of western civilization, the economic trajectory of Eswatini has been characterised by peaks and troughs. In the early 1900s the unavailability of capital inflows that were urgently required for the Eswatini's development due to the world wars caused the country's GDP to plummet. The unemployment rates during this time also increased which explains why emaSwati migrated into other countries in search of all kinds of opportunities. Several studies using survey data (e.g. Saben, 1964; Lansing and Mueller, 1967) confirm that unemployment can be a major push factor with regards to labour migration (Da Vanzo, 1978).

The earliest dated information about emaSwati's cross border migration was in 1901 when emaSwati were recruited and introduced as migrant labourers in Natal, recruited to mine coal in St. Georges Colliery. This was done by Swati men to pay for taxes and to pay lobola (Crush and Simelane, 2004). Labour migration during this time was not a cause for concern or an immediate problem for government and therefore could not be characterized as a brain drain as the majority of the migrants constituted of mine workers. TEBA, a company involved in the recruitment in the mining industry, records a total number of 6, 623 emaSwati mine workers that were recruited by 1960.

Between the years 1940 – 1960, which was an era where progress really began, development was stirred by the influx of European settlers that saw Eswatini becoming a product of large-scale capital investments for different development projects (Simelane, 2005). According to Daniel (2013), development was also attributed to the expansion and emergence of more stable markets for agricultural produce. In the primary industry other enterprises were established including a box mill and patulite factory in the Piggs Peak area, a pulp mill in Bhunya in the Usuthu Forests, sugar mills at Big Bend and Mhlume, a rice mill, a citrus packing plant and a cannery (Daniel, 2013). This type of economic activity revised the status of the country as a labour catchment area for South Africa gold and coal mines, as the country developed a strong labour market itself, able to compete with recruitment from the South African mines.

During Eswatini's golden age (1980 – 1989) economic growth grew exponentially and Eswatini was enlisted as one of the 20 fastest growing economies in the world, maintaining the fourth highest average rate of real growth in the Sub-Saharan region. This kind of growth made way for many opportunities including employment opportunities not only for locals but also attracting skills from as far as the United Kingdom, West Africa, and in the SADC region, presenting a positive migration or a brain gain for the country. Beginning from 1990, however, the structure and economic trajectory of the economy started to change. During the 1990 – 1997 period, GDP growth slowed down to an average of 3.9 percent annually, and by the early 2001 Eswatini saw very slow growth rates.

The Eswatini economy continued to underperform and experienced very slow growth rates. This was a reflection of many factors including the deteriorating investment climate especially in priority areas like the agricultural sector; the economic slowdown in South Africa; the global economic crisis between 2008 and 2010, and the country's 2011 fiscal crisis due to the 60%

decline in the Southern African Customs Union (SACU) receipts (Ayoki, 2011). This caused the economy to be unable to create the already much needed jobs for emaSwati and this economic turnaround lead to emaSwati reverting back to looking outside the borders for better opportunities. Although for decades, migrants were primarily unskilled and semi-skilled workers in the mines, farms and households of white South Africa, now, and particularly since the collapse of apartheid system, the skills profile of Eswatini's migrants had changed as skilled emigrants found it much easier to move, live, and work in South Africa as well as other parts of the world (Crush *et al.*, 2005).

3. Methodology

Studies that have analysed the impact of brain drain on economic growth employed a variety of methods including a recursive-dynamic CGE model and different co-integration techniques (see Asad *et al.*, 2015; Bohlman, 2010; Laila and Fiaz, 2018). The CGE models are a class of economic models that use actual economic data in order to simulate computationally the policy effects. These types of models are useful when we wish to estimate the effect of changes in one part of the economy upon the rest. This study employs the co-integration technique as well as the Autoregressive Distributed Lag Model (ARDL) as this tool allows you to analyse nonstationary time series or systems with unit root variables, allowing the estimation of their long-run parameters or equilibriums (Rao, 2007). Moreover, the co-integration and ARDL models reveal if there exists a long-term equilibrium relationship and directional causality among the variables, in accordance with the objectives of the study unlike the CGE model.

The study uses time series for the period of 1974 to 2017 sourced from the World Development Indicators (WDI), organised by the World Bank. Some variables take the percentage number format and one variable takes the currency format at Local Currency Units (LCU). According to Upton and Cook (2002) in statistics although a proxy is a variable that is not in itself directly relevant, it can be used in place of an unobservable variable or unavailable variable. In order for a proxy to be considered a good one, it must have a close correlation that can either be positive or negative but not necessarily linear with the variable of interest. To this effect and in the absence of any data on the country's brain drain, remittances are used as a proxy for brain drain. In the case of Eswatini, the remittance variable can be used to proxy brain drain as it is highly correlated with brain drain. Remittances better captures the relationship with brain drain or skilled labour migration over that of unskilled labour migration. This is due to the fact that the banking system, which is the system through which remittances under the WDI are recorded, only captured remittances remitted by skilled professionals in the diaspora. The majority of unskilled labour which worked in South Africa would not remit through the banking system. These labourers who were employed as truck drivers and housekeepers would use non-bank remittance channels such as physically carrying their wages or salaries with them when they would visit their families.

To achieve the objective of deriving the lilangeni value of the impact of brain drain on the economy, the following augmented production function is developed:

$$GDP = f(BD, PCN, INV) \quad (1)$$

The function can also be represented in a multiple linear regression as:

$$GDP_t = \alpha + \beta_1 BD_t + \beta_2 PCN_t + \beta_3 INV_t + e_t \quad (2)$$

Where,

GDP or Gross Domestic Product represents the economy; BD stands for Brain Drain, which uses remittances as a percentage of GDP as a proxy; PCN stands for Private Consumption measured as a percentage of GDP; INV stands for Investment which uses gross capital formation as a percentage of GDP as a proxy; e_t is the stochastic term. Our *apriori* expectations are that BD, PCN, and INV will have either a positive or negative impact on GDP (i.e. $\beta_1, \beta_2, \beta_3, \beta_4 \neq 0$).

3.1 Econometrics Procedure

3.1.1 Unit Root Tests

Gujarati (2009) states that often time series data is not stationary, meaning that it's mean, variance, and covariance are time variant. The consequence of using non-stationary data is the possibility of a spurious regression results that would not have any explanatory power and policy strength (Gungor and Ringim, 2017). The time series are first tested for stationarity, which is the absence of unit root, in order to avoid the possibility of spurious results. The general practice is to first plot the series graphically to have a glimpse of how the variables behave (i.e. Eyeball test) from Figure 3.0.1. The solution to non-stationary data is the use of unit root tests. The Augmented Dickey-Fuller (ADF) by Dickey and Fuller (1981), and the Philips-Perron (PP) proposed by Phillips and Perron (1988) unit root tests are, therefore, employed to double check the assumptions of non-stationarity made from the eyeball test mentioned above. The general arrangement of the equation is given as:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{j=1}^{m} \alpha_j \Delta Y_{t-j} + \varepsilon_t \qquad (3)$$

Where the ε_t represents Gaussians white noise which is assumed to have a mean of zero, and possible auto-correlation represents series to be regressed on the time *t.* The unit root tests are then carried out under the null hypothesis of non-stationarity (unit root) against the alternative of stationarity (no unit root). The results of the ADF and PP tests for stationarity are presented in the following section in Table 4.1.

3.1.2 Bounds Test for Co-integration

It is common that most macroeconomic variables show a trend at their level form. To achieve the objective of determining the nature of the relationship between GDP and BD a bounds co-integration test is conducted. This test examines for a long-run equilibrium relationship among series under the null hypothesis of no co-integration (no long-run relationship). Prior to conducting the co-integration test the appropriate lag length (1) is selected using the Akaike Information Criterion (AIC). The results are presented in Table 4.2.

3.1.3 Estimation of Short-Run Coefficient

Since there are no equilibrium relationships established through the co-integration test, only the short-run dynamic effects can be estimated. The ARDL model which is an ordinary least square (OLS) based model is, therefore, employed (Shrestha, 2018). The ARDL is a common, straightforward time series model used for the analysis of time series data that has a mixed order of integration. According to Pesaran and Shin (1999) the ARDL specification is additionally suitable in providing robust and better results for finite and small sample sizes. ARDL models include lags of both the dependent variable and explanatory variables as regressors (Greene, 2008). In this study, the lagged value of the first difference of GDP, BD, PCN, and INV are the explanatory variable of GDP at time *t*, and the short-run estimated model is given in equation 4. The results provided through estimating this equation address the objective of deriving the lilangeni value of the impact of brain drain on the economy of Eswatini. The estimation results are presented in Table 4.3.

$$\Delta \text{GDP}_t = \beta_1 + \sum_{i=1}^{p} \beta_2 \Delta\,(\text{GDP})_{t-i} + \sum_{i=1}^{q} \beta_3 \Delta\,(\text{BD})_{t-i} + \sum_{i=1}^{q} \beta_4 \Delta\,(\text{PCN})_{t-i} + \sum_{i=1}^{p} \beta_5 \Delta\,(\text{INV})_{t-i} + e_{1t} \quad (4)$$

3.1.4 Granger Causality

A general econometric regression deals with the dependence of one variable on another variable and does not necessarily imply causation or direction of influence. Therefore, there is a need to conduct a test that will determine the direction of causality between variables. The pairwise granger causality test is employed and the results from this test answers the final objective of the paper which is to ascertain the directional causality between Eswatini's economy and the brain drain phenomenon.

4. Results and Discussion

The decision criteria for the unit roots test is that if the order of integration of a variable is zero (I (0)), this implies stationarity. However, if the order of integration is I (1) or I (2), it means that the variable under observation is non-stationary and they can be stationary either after first or second differencing. From the results in table 4.1 we can conclude that both stationarity tests fail to reject the null (H_0) hypothesis of unit roots (non-stationarity) and confirm that the variables are stationary of order one (I (1)) for all the series except Private Consumption (PCN), which is stationary at levels I (0)). Variables that are stationary at I (1) can be differenced in order to get a stationary data generating process. Moreover, these results validate the suitability of the Bounds test for co-integration, as this type of co-integration test is advised for variables that have a mixed (both I (0) and I (1)) order of integration.

Table 4.1: ADF and PP unit root test

Statistics	Gross Domestic Product (GDP)	Brain Drain (BD)	Private Consumption (PCN)	Investment (INV)
Level (I(0))				
ADF (i)	1.726	-1.313	-4.866***	-1.774

ADF (t and i)	3.226*	-2.306	-4.499***	-3.002
ADF (n)	3.227	-0.569	0.431	-0.888
PP (i)	1.479	-1.605	-5.550***	-1.755
PP (t and i)	-2.481	-2.337	-4.685***	-2.932
PP (n)	6.251	-0.761	0.514	-0.935
First difference (I(1))				
ADF (i)	-4.528***	-6.160***	-8.184***	-4.922***
ADF (t and i)	-4.835***	-6.224***	-8.291***	-4.891***
ADF (n)	-1.009	-6.238***	-8.175***	-4.962***
PP (i)	-4.470***	-6.325***	-8.235***	-6.459***
PP (t and i)	-4.877***	-6.390***	-8.443***	-6.418***
PP (n)	-2.299**	-6.387***	-8.176***	-6.529***

Notes: *; **; *** denote significance level at 10%, 5% and 1% respectively. (t and i) represent the general model with trend and intercept, (t) represents the model with only a trend, (n) represents the most restricted model with no trend or intercept. The unit roots tests were conducted in E-views 9.0.

The decision criterion for the bounds test states that the null hypothesis of no co-integration is rejected if the F-statistic value is greater than the upper I (1) critical bound value at the 5% significance level or any other significance below. The null hypothesis is accepted if the F-statistic value is lower than the lower I (0) bound value. The test is inconclusive is the F-statistic lies between the lower I (0) and upper I (1) bound values. The results for Bounds co-integration in table 4.2 conclude that there are no co-integrating equations (no long run equilibrium relationships) between GDP and the independent variables. Rejecting the null hypothesis of no co-integration implies that the variables under observation are not related. According to Adeleye (2018) if series are not co-integrated it also implies that if there are shocks in the short run, which may affect movement in the individual variables, they will not converge in the long run. The failure of variables to converge with economics time series data does not bear any consequences when estimating the ARDL model or any other estimation model. The outcome of no co-integration, however, implies that only the short-run relationship between the variables under study can be estimated.

Table 4.2: Bounds test for co-integration

F-Statistics	2.986	
	Critical Value Bounds	
Significance	I(0) Bound	I(1) Bound
10%	2.72	3.77
5%	3.23	4.35
2.5%	3.69	4.89
1%	4.29	5.61

Source: Authors' representation using data from World Bank (2019)

The ARDL model results of the short-run estimates are presented in Table 4.3. The results show that the coefficients of the lagged differences of GDP, BD, and PCN are significant at the 1, 5, and 10 percent significance levels respectively. Thus, on average, increasing Gross Domestic Product (GDP) or output in Eswatini by E1 in a given year is associated with a E0.47 increase in

GDP one year later, *ceteris paribus.* This implies that Eswatini's GDP in the short-run influences itself.

The estimation results also show that Eswatini's Brain Drain (BD) influences its GDP positively contrary to prior expectations. The magnitude of the coefficient indicates that, on average, a 1 percent increase in BD in a given year, accounts for a E171 million increase in GDP one year later, *ceteris paribus*. Finally, the paper found that Investments (INV) are not a variable that helps explain the variation in GDP in Eswatini. Private Consumption (PCN) is also not statistically significant, and does not help explain the variations in GDP as the probability value for this variable is above the desirable significance level of 5 percent. As INV and PCN have high probability values this implies that there is a high risk or chance that the estimated coefficients are unreliable.

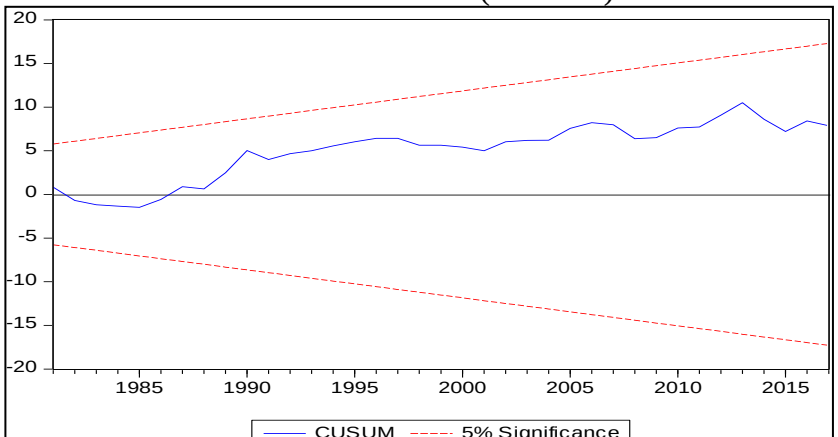
After estimating the model parameters, it is important to check if the fitted model is appropriate. The OLS estimation method (which the ARDL analysis also employs) is carried out under a number of assumptions, some of which are: no serial correlation, homoscedasticity, normality, and stability of the model (Allen, 1997). In the absence of a long-run relationship the only diagnostic tests required for a short-run ARDL model is the serial correlation test (Breusch-Godfrey) and the stability test of the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUM of SQUARES). The results in Table 4.3 further show that the probability value of the serial correlation is greater than the 5% significance level thus failing to reject the null hypotheses of no serial correlation. Figure 4.1 and 4.2 both graphically depict a correctly specified and stable model as the model lies within the 5 percent significance bound (ie. the blue line lies within the two red lines).

Table 4.3: ARDL results GDP=f(BD, PCN, INV)

Short-run coefficients				
Variables	**Coefficient**	**Std. Error**	**T-statistic**	**Probability**
Δ(GDP)				
L1. Δ(GDP)	0.486	0.161	3.013	0.005***
L1. Δ(BD)	1.71E+08	7.32E+07	2.334	0.025**
L1. Δ(PCN)	-2.61E+07	1.32E+07	-1.981	0.055*
L1. Δ(INV)	6.51E+05	2.13E+07	0.003	0.976
Constant	4.59E+08	1.63E+08	2.808	0.008***
Diagnostic Tests				
Serial Correlation Test				0.292

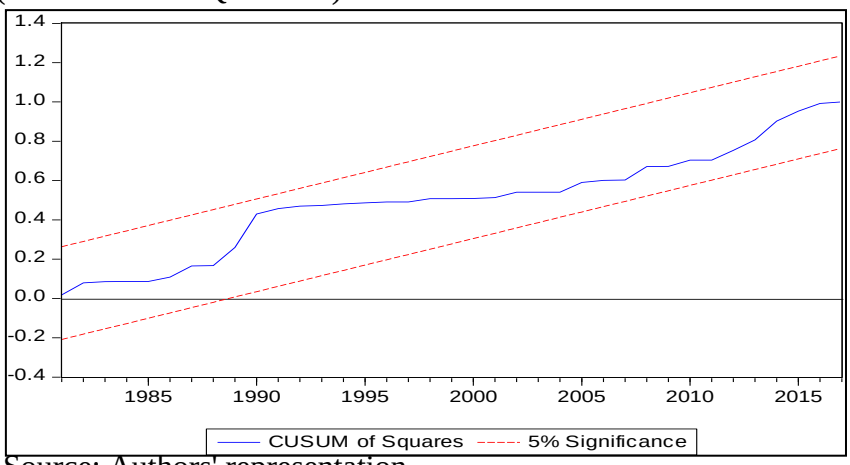
Notes: *; **; *** denotes the significance of the estimated coefficients at 10%, 5% and 1% respectively. Δ represents first difference. L1 shows that the lag lengths of the variables.

Figure 4.1 Cumulative Sum of Recursive Residuals (CUSUM)



Source: Authors' representation

Figure 4.2: Cumulative Sum of Squares of Recursive Residuals (CUSUM of SQUARES)



Source: Authors' representation

After conducting the pairwise granger causality test, the results in Table 4.4 show that there is unidirectional causality running from GDP to BD. This simply means that GDP causes brain drain and the past history of GDP trends can help predict the brain drain patterns in Eswatini in the short-run. Therefore, in order to change the brain drain trends, the country must first change the economic environment in the country. The results also show that there is bidirectional causality between brain drain and private consumption. Here the past history of brain drain trends helps in the prediction of private consumption trends in the short-run and vice versa.

Table 4.4: Pairwise Granger Causality Test

Null Hypothesis	Observations	F-Statistic	Probability
BD does not Granger Cause GDP	42	8.16936	0.0012
GDP does not Granger Cause BD		2.43726	0.1013
BD does not Granger Cause CONS	42	0.01288	0.9872
CONS does not Granger Cause BD		0.06983	0.9327

Source: Authors' representation

5. Conclusion

This study quantifies the impact of brain drain on the economy of Eswatini, as well as identifies the nature of the relationship and directional causality between gross domestic product, brain drain, investment, and private consumption. The study uses secondary data from the World Development Indicators. The study applies the ARDL short-run model in the absence of cointegration for the period 1974 – 2017 to describe the dynamic behaviour of the variables, especially between brain drain and gross domestic product. Gross domestic Product is used to

proxy the economy of eswatini. Remittances are used as a proxy of brain drain and gross capital formation is used to proxy investment. The study found that there lies no co-integration or long-run relationship between gross domestic product and the independent variables. This implies that the estimated ARDL short-run model only accounts for short-run fluctuations that are not due to deviations from the long-run equilibrium.

Additionally, the study found that investment and private consumption do not help in explaining the changes in gross domestic product in Eswatini in the short run. A possible explanation for the insignifance of investment in the country may be due to the fact that this type of investment by government to improve industrial capacity might be misplaced leading to inefficiencies and failure to increase productivity in the economy. The paper, however, finds that brain drain increases economic growth by E 171 million on average in the short-run. Although these results are contradictory to prior expectations, the chances of their understatement are high as different banks in the country have been struggling with the categorization and appropriate record taking of remittances due to the changing remittances definitions in the Balance of Payments (BPM) manuals. Granting that this kind of monetary impact may not be enough to offset the overall negative effects of brain drain, there is still an opportunity for Eswatini to benefit from this phenomenon if brain drain yields positive returns. In the short run, the positive impact from brain drain aids in easing the burden of unemployment, as well as alleviating poverty.

The findings from the study further conclude that GDP granger causes brain drain in Eswatini and this is a reality for Eswatini as the ailing economy and its inability to absorb people into the labour market causes emaSwati to look for opportunities across the border. If for instance there was a unidirectional causality running from brain drain to GDP, it would imply that emaSwati are still leaving but they are not leaving due to the economic conditions (push factor) in the country but they are maybe leaving due to other pull factors (i.e. higher incomes) from host countries unrelated to the conditions in Eswatini.

6.0 Recommendations

Based on the findings the study recommends the following:

- The Government of Eswatini should also consider creating a database that provides information and data on brain drain in the country within the Labour Market Information System (LMIS) that has recently been launched by the Ministry of Labour.

- There should be a diaspora engagement policy to enable emigrants in the diaspora to contribute to their home countries' development, through the transfer of not only remittances, but critical skills.

- The government of Eswatini can consider taking part in "brain exporting" where Eswatini, in addition to other countries like Vietnam, would produce highly skilled labour solely for the purpose of exporting to foreign countries. This would happen under any of the following forms of labour export: agreement signed between two governments, labour cooperation and experts, Eswatini enterprises receiving contracts, or joint ventures etc. This would be done in the short-run whilst the country continues to work towards attaining Sustainable Development Goal (SSDG) 8 of creating good jobs and economic growth within the borders. When this goal is achieved and the opportunities within the

borders of Eswatini are created, then the country can work on programmes that will entice emaSwati in the diaspora to come back to the country.

- The country needs to encourage private sector and foreign investment which may be much more effective in actually increasing productivity as private firms may have more knowledge about the most effective types of investment.

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