Sources of unemployment in Namibia: an application of the structural VAR approach

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Abstract

The main purpose of the research was to establish the sources of unemployment in Namibia for the period 1980 to 2013 using the SVAR methodology. Empirical results show that persistently high unemployment is the result of a combination of various shocks as well as the hysteresis mechanism. The impulse response functions and variance decomposition functions agree that labour supply, aggregate demand, and real wages seem to be the critical factors affecting unemployment. Moreover, the price shocks affect unemployment in the long run and productivity shocks explain only a small fraction of the forecast error variance of unemployment in both the short and long run. This finding is consistent with the controversy of uncertain effects of productivity shocks on the unemployment rate. Aggregate demand policies, deregulation policies and structural labour market reforms can be useful policy instruments to tackle unemployment in Namibia.

Keywords: Unemployment, Structural VAR, Impulse response, Variance decomposition, Namibia

JEL Classification: C50, J23, J30, J31, J64, and E52

1. Introduction

The Namibian unemployment performance has deteriorated since the 1980s. Before independence, unemployment can be attributed to the war of independence, which destroyed infrastructure and caused despondence in the economy. Although there were mild declines in unemployment in the 1990s, the evolution of the Namibian unemployment rate over the last three decades is characterised by a persistent upward trend. At independence in 1990, Namibia inherited an unemployment rate that was already high, which stood at around 19 percent. After independence, unemployment in Namibia continued to increase to reach a maximum of 37.6 percent in 2008, after which it started to decline. The decline is mainly attributed to a combination of both expansionary monetary and fiscal policies adopted from 2008 onwards. It should be noted that high unemployment is common in most countries in Southern Africa, and it has not received much attention from economic researchers, mainly due to the unavailability of relevant statistical data on key variables such as wage rates and unemployment. The persistent high unemployment rate in Namibia is undoubtedly one of the major macroeconomic evils that worry economists and policy makers currently.

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Stimulated by the need to investigate the sources of unemployment more closely, economists have carried out a large number of researches, particularly in the developed countries, attempting to explain what is responsible for the evolution of unemployment. However, a consistent and generally accepted framework of the development of unemployment has not been developed yet due to the intrinsic complexity and significance of this issue. Although a diversity of factors has been pointed out as possible culprits of high unemployment, two strands of explanations can be identified which emphasise institutions and shocks respectively (Linzert, 2001; Su, 2006). The dominant view attributes high unemployment to labour market rigidities. These include strict labour market regulations, high unemployment benefits, high labour taxes, strong employment protection, trade union strengths, etc. To eliminate these institutional rigidities, one possible remedy is to conduct labour market reforms. The other view focusses on adverse macroeconomic shocks. From this perspective, it could be possible that the various shocks that have hit the Namibian economy are responsible for the sustained increase in unemployment. To this effect, oil price shocks, productivity deceleration, and inadequate aggregate demand due to restrictive monetary and fiscal policies are quite often cited shocks. In addition, appropriate macroeconomic policies to stimulate aggregate demand are thought to be necessary in the fight against unemployment.

Considered individually, these views have not provided answers on some European economies like Spain and Germany, and they fail to provide plausible explanations that can account for the persistence of unemployment (Linzert, 2001; Maidorn, 2003; Su, 2006). These two positions should be regarded as complementary. The effects of adverse shocks and labour market institutions which prevent the proper working of self-equilibrating mechanisms should be considered. In fact, the apparent increasing proportion of long term unemployment has promoted the opinion that the interaction between negative shocks hitting the economy and structural elements in the labour market hindering a self-equilibrating process have possibly resulted in the persistently high unemployment rate in Namibia. Due to the existence of labour market rigidities, the hysteresis mechanism can be blamed for the long-lasting effects of adverse shocks influencing the unemployment rate. In a developing country like Namibia, poor business environment and poor infrastructure are also critical factors that affect unemployment even though they are not part of the current analysis.

Based on such a theoretical framework, the study provides a thorough analysis concerning the sources of persistently high unemployment rates in Namibia by investigating macroeconomic shocks and their persistent effects because of structural rigidities. Since the study focusses on macroeconomic shocks, the structural vector autoregressive (SVAR) method is appropriate. SVARs were promoted by the inability of economists to agree on the true underlying structure of the economy in the 1970s. VAR models, first discovered by Sims (1980), have become popular in empirical macroeconomics. To avoid incredible identification restrictions in traditional macroeconometric models, particularly the determination of exogenous variables, the VAR approach regards all variables as endogenous. Concentrating on shocks, VAR models are well suited to ascertain the relative contribution and propagation mechanisms of certain shocks hitting the economy.

However, this traditional VAR method, which is of a reduced-form, has been criticised as being a-theoretic and having no sensible economic interpretation. Such criticisms inspired the structural approaches to VAR modelling to recover the underlying structural shocks. The SVAR analysis is an extension of the traditional unstructured VAR analysis, which imposes a certain structure derived from economic theory.

Section 2 below briefly reviews literature on sources of unemployment. Section 3 discusses the specification of the SVAR unemployment model for Namibia, while Section 4 discusses the data and results. Finally, Section 5 concludes and gives policy recommendations to the study.

2. Brief overview of literature

The sources of unemployment have been analysed using variance decompositions by several researchers who include Jacobson *et al.* (1997), Dolado and Jimeno (1997), Carstensen and Hansen (2000) among others. Dolado and Jimeno (1997) studied the Spanish unemployment situation and established that the main sources of unemployment variability in Spain are productivity shocks followed by labour supply and demand shocks, respectively. In addition, Maidorn (2003) established that demand shocks explain the greater part of fluctuations in Australian unemployment, while Gambetti and Pistoresi (2004) found long lasting effects of demand shocks on the Italian economy. Christoffel and Linzert (2005) as well as Karannassou and Sala (2012) among others, found long lasting effects on European unemployment rates using other approaches instead of VAR models. Additionally, Carstensen and Hansen (2000) and Fabiani *et al*. (2001) found that technology and labour supply shocks account for the greater portion of long-run fluctuations in German and Italian unemployment, respectively, and also that the goods market shocks are significant in the short run. Algan *et al*. (2002) found that the standard model works well for the United States of America but performs poorly in capturing the rise of unemployment in France. In addition, Amisano and Serati (2003) also found that unemployment rates in several European countries are affected permanently by demand shocks. Furthermore, Jacobson *et al* (1997) found that transitory labour demand shocks negligibly affected unemployment in Scandinavian nations. Jacobson *et al*. (1997) also established that monetary policy has permanent effects on Swedish unemployment. They obtained this result because they modelled the rate of unemployment as an I(1) process, which implies that all shocks would automatically have long lasting effects. The current study analyses the sources of unemployment for a small developing economy that was ranked a middle-income country in 2009, despite its persistently high unemployment rate.

The only study on determinants of unemployment in Namibia was carried out by Eita and Ashipala (2010) for the period 1970 to 2007, using the Engle-Granger two-step econometric procedure. The study found that unemployment in Namibia is affected by actual output, inflation, investment and aggregate demand. Their findings support the original Phillips curve relationship between unemployment and inflation, which suggests that there is a negative relationship between these variables.

3. The unemployment model for Namibia

The study analyses the sources of unemployment in the Namibian labour market for the period 1980 to 2013. The primary aim is to disentangle structural shocks as main causes behind the rise in the Namibian unemployment rate and their propagation mechanism. A small macroeconomic model serves as the theoretical basis, which is in line with the approach of Dolado and Jimeno (1997)[3]. The model contains an aggregate demand function, a production function, a price setting relation, a wage setting relation, a labour supply function

[3] The theoretical model is not shown here for brevity's sake. However, the model can be made available if needed.

and a definition equation of unemployment. In accordance with the insider-outsider model, the wage setting rule states that nominal wages are chosen one period in advance and are set to make expected employment to be a weighted combination of lagged labour supply and employment. Full hysteresis corresponds to the extreme case where exclusively lagged employment (insiders) is considered in the wage bargaining process. These relations are influenced by exogenous variables, capturing the effects of various structural shocks. Institutional rigidities strengthen the power of insiders and thus exacerbate the inertia in the wage bargaining framework. Such labour market institutions have set the conditions to make the effects of adverse shocks persistent and produce a long-lasting rise in the unemployment rate.

The SVAR analysis with long run restrictions, which originated from Blanchard and Quah (1989), is employed. As compared with previous SVAR analyses of labour markets, novelties of this empirical work are the assumption of full-hysteresis in the unemployment rate, which is supported by the presence of a unit root in the unemployment series according to ADF and Perron tests, and the identification of price shocks as one further structural shock.

Using long-run identifying restrictions achieved from the theoretical model, five structural shocks (price, real wages, productivity, aggregate demand and labour supply shocks) are recovered. With the help of the impulse response analysis and forecast error variance decompositions, the contributions of various shocks to unemployment evolution in Namibia are evaluated and the part of institutional rigidities is captured by a hysteresis mechanism.

3.1 Data and VAR estimation for the unemployment model

All data are drawn from the Namibia Statistical Agency (NSA) and the Bank of Namibia; and where there are gaps; interpolation and extrapolation methods are used to generate the data. Given the fact that the unemployment (UEM) data for the period 1990 to 2013 is available, the study used backward extrapolation to generate data for the period 1980 to 1989 (see Smith and Sincich, 1988; Gil, 2012; Chow and Lin, 1971; Smith, 1987; Chang *et al*., 2007 and Tsonis and Austin, 1981). The use of extrapolated unemployment variable does not appear to cause bias problems in the analysis since the SVAR diagnostic tests appear to suggest that the data does not have any problems and all the results obtained make economic sense. The other variables used in the VAR include employment (EMP), GDP deflator (PCE), productivity (real GDP/EMP) (PRD) whose base year is 2005 (see Dolado and Jimeno, 1997 and Møller, 2013) and real wage (RWG). To calculate the real wage for Namibia, the study employed the method used by Akanbi and Du Toit (2011) for the Nigerian economy[4]. To get the optimal lag length of two, the AIC and the BIC criteria were used. The VAR estimations were carried out in level as explained in section 3.4 below. The estimated VAR and SVAR coefficients are not reported here for the sake of brevity, but there were no signs of misspecification in any of the equations.

3.2 Identification of structural shocks

The study follows the econometrics procedure developed by Maidorn in 2003. In order to identify structural shocks, the study uses the reduced form VAR as stated below:

$$A(L)\Delta X_t = \eta_t \qquad [1]$$

[4] See Appendix A3 for the detailed explanations of the sources and derivations of the variables used in the study.

In Equation [1], X_t is a 5×1 vector encompassing $(PRD_t,\ EMP_t, RWG_t, PCE_t, UEM_t)$; $A(L)$ is a k order polynomials matrix, with lag operator L, $A_0 = I$ with all roots outside the unit circle, and η_t is a vector of zero mean *i.i.d* innovations with covariance matrix Σ (Maidorn 2003). Equation [2] summarises the corresponding structural form of the model:

$$S(L)\Delta X_t = \varepsilon_t, \qquad [2]$$

In Equation [2], ε_t is assumed to be a vector of uncorrelated *i.i.d* shocks having unit variance, and implying that $E[\varepsilon_t \varepsilon_t'] = I$. The moving average representations of the reduced and structural forms are respectively used to derive restrictions used in the study:

$$\Delta X_t = D(L)\eta_t$$

and,

$$\Delta X_t = C(L)\varepsilon_t, \qquad [3]$$

where $D(L) = A^{-1}(L),\ D(0) = I$ and $C(L) = S^{-1}(L)$.

Thus, we have:

$$D(L)\eta_t = C(L)\varepsilon_t \qquad [4]$$

and, $\eta_t = C(0)\varepsilon_t$.

Employing the relationship between η_t and ε_t, it can be noted that the covariance matrix Σ justifies $\Sigma = C(0)C(0)'$ which allows for an imposition of 15 nonlinear restrictions, leaving 10 elements of $C(0)$ free. To get additional restrictions required to fully identify the structural system, it is assumed that some structural shock ε_{it} does not permanently affect one of the x_{jt}'s. This is equivalent to setting equal to zero the structural moving average representation of the entry in i^{th} column and j^{th} row of the matrix of long run multipliers $C(1)$.

3.3 Non-stationarity and cointegration

The unit root test results, using the Augmented Dickey Fuller (ADF) and the Phillips Peron (PP) tests, in Tables 1 and 2, respectively, indicate that all series incorporated in the model are non-stationary in levels, but they become stationary after first differencing. This means that they are integrated of order one [$I(1)$] processes.

Table 1: ADF and the PP non-stationarity tests in levels 1990 - 2013

		ADF	**PP**
Variable	**Model**	$\tau_{tc}, \tau_c\ \tau_n$	$\phi_{tc}\ \phi_c\ \phi_n$
$LNRWG$	Trend Constant None	-1.718 0.507 2.670	-2.751 -1.187 5.590
$LNPCE$	Trend Constant None	-0.563 -1.647 0.735	-1.187 -6.146*** 4.316
$LNUEM$	Trend Constant None	-2.737 -2.383 -0.016	-3.143 -2.972** -0.584

$LNPRD$	Trend Constant None	-1.680 0.319 1.190	-0.923 0.764 2.045
$LNGDP$	Trend Constant None	-2.246 1.679 2.861	-0.695 0.216 7.512

*** (**) [*] represent significance at the 1% (5%) [10%] levels, respectively. $\tau_{tc}, \tau_c\ \tau_n$ and $\phi_{tc}\ \phi_c\ \phi_n$ represent ADF and PP results using trend and constant, constant and none, respectively

Source: Authors' calculation from Eviews 8

Table 2: ADF and the PP non-stationarity tests in first differences 1990 - 2013

		ADF	**PP**
Variable	**Model**	$\boldsymbol{\tau_{tc}, \tau_c, \tau_n}$	$\boldsymbol{\phi_{tc}\ \phi_c\ \phi_n}$
$\Delta LNRWG$	Trend Constant None	-3.435* -3.472** -2.250**	-4.162*** -4.307*** -3.096***
$\Delta LNPCE$	Trend Constant None	-3.354* -2.016 -1.674*	-4.992*** -3.044** -1.743*
$\Delta LNUEM$	Trend Constant None	-3.169* -3.149** -3.182***	-5.617*** -5.646*** -5.684***
$\Delta LNPRD$	Trend Constant None	-3.558** -3.029** -2.788***	-4.932*** -4.791*** -4.539***
$\Delta LNGDP$	Trend Constant None	-3.665** -3.486** -1.255	-5.066*** -5.081*** -2.957***

*** (**) [*] represent significance at the 1% (5%) [10%] levels, respectively. $\tau_{tc}, \tau_c\ \tau_n$ and $\phi_{tc}\ \phi_c\ \phi_n$ represent ADF and PP results using trend and constant, constant and none, respectively

Source: Authors' calculation from Eviews 8

This information leads to the issue of selecting the appropriate estimation methodology. The current study follows existing literature, which typically estimates VARs in levels even when variables are $I(1)$ processes. The unwillingness to impose possibly incorrect restrictions in the model leads to the preference of VARs that are partially explained by Sims *et al*. (1990), Berkelmans (2005) and Alom *et al*. (2013). They argue that even with $I(1)$ variables, residuals are stationary because of the inclusion of lagged levels of variables in the VAR. This means that, the likelihood of spurious influences between the $I(1)$ variables remains. Confirming that the relationships summarised by the SVAR are plausible on economic grounds is the only way to ensure that the relationships are not spurious. Sims *et al.* (1990) demonstrated that it is unnecessary to transform models to stationary forms by difference or cointegration operators when it appears likely that data are cointegrated. Sims *et al.* (1990) added that this is because statistics of interest frequently have distributions that are not affected by non-stationarity, and this implies that it is possible to test the hypothesis even without initially converting series to stationarity.

The above findings by Sims *et al.* (1990) have been widely accepted and embraced in literature (see Jacobs and Wallis, 2005; Sonedda, 2006; Dungey and Pagan, 2009; Bhuiyan, 2008; Berkelmans, 2005; Ngalawa and Viegi, 2011; Bernanke, 1986; Bernanke and Mihov, 1998). The preference of SVAR in levels according to Kim and Roubini (2000) and Becklemans (2005) is explained, in part, by an unwillingness to impose possibly incorrect restrictions on the model. Kim and Roubini (2000) emphasize the fact that the resulting inferences are incorrect if false restrictions are imposed. In addition, Bernanke and Mihov (1998) bolstered this argument by saying that levels specification lead to consistent estimates irrespective of whether cointegration exists or not, whereas a differences specification yields inconsistent estimates if some of the variables are cointegrated.

3.4 Imposition of Restrictions

The study adopts a structural model expressed as Equation [3] above: $\Delta X_t = C(L)\varepsilon_t$, where $\Delta X_t = (\Delta PRD_t,\ \Delta EMP_t,\ \Delta RWG_t,\ \Delta PCE_t\ \Delta UEM_t)'$. To be consistent with literature, all variables used in the model are assumed to be stationary and not cointegrated in levels. In Equation 3, C(L) is defined as an infinite order matrix of lag polynomial defined as $C(L) = C_0 + C_1 L + C_1(L) + \cdots$ in the lag operator L, and C_0 is an identity matrix. Note that the observed fluctuations in the vector of five variables $X_t = (PRD_t,\ EMP_t,\ RWG_t,$ $PCE_t\ UEM_t)'$ are because of five uncorrelated structural shocks $\varepsilon_t = (\ \varepsilon_t^{PRD} \varepsilon_t^{EMP}, \varepsilon_t^{RWG},$ $\varepsilon_t^{PCE}, \varepsilon_t^{UEM})'$ with $E[\varepsilon_t \varepsilon_t'] = I$. The model identifies five structural shocks.

Consider long run effects of structural shocks by setting $L = 1$ in [3]:

$$C(1) = \begin{bmatrix} C_{11}(1) & C_{12}(1) & C_{13}(1) & C_{14}(1) & C_{15}(1) \\ C_{21}(1) & C_{22}(1) & C_{23}(1) & C_{24}(1) & C_{25}(1) \\ C_{31}(1) & C_{32}(1) & C_{33}(1) & C_{34}(1) & C_{35}(1) \\ C_{41}(1) & C_{42}(1) & C_{43}(1) & C_{44}(1) & C_{45}(1) \\ C_{51}(1) & C_{52}(1) & C_{53}(1) & C_{54}(1) & C_{55}(1) \end{bmatrix} \qquad [5]$$

The structural model in Equation 5 is just identified when 10 long run restrictions are imposed in the above matrix (see Blanchard and Quah, 1989). Additionally, to choose the set of just-identifying assumptions needed, the study follows a practical approach where the model is estimated under a given set of identifying assumptions to generate impulse response functions. If impulse response functions are not reasonable or fail the over-identifying restrictions test, a different set of identifying assumptions is utilised (see Blanchard and Quah, 1989). Using this procedure, it is possible to select identifying restrictions that can be easily derived from the theoretical model consistent with 11 long run restrictions. The long run restrictions employed in the current study are enumerated below. First, only productivity shocks have a long lasting effect on productivity. This implies that $C_{12}(1) = C_{13}(1) = C_{14}(1) = C_{15}(1) = 0$. Employment is affected by productivity shocks, implying that $C_{23}(1) = C_{24}(1) = C_{25}(1) = 0$. Real wages are affected by productivity and employment shocks, implying that $C_{34}(1) = C_{35}(1) = 0$. Price inflation is influenced by productivity, employment and real wage shocks, also implying that $C_{45}(1) = 0$. It should be noted that the most endogenous variable (unemployment) comes last in the model. Labour supply shocks only permanently affect unemployment according to the hysteresis hypothesis (Maidorn 2003). Incorporating the ten restrictions explained above on a 25×25 matrix $C(1)$, the long run effects of the five shocks on endogenous variables are given by:

$$\begin{bmatrix} PRD_t \\ EMP_t \\ RWG_t \\ PCE_t \\ UEM_t \end{bmatrix} = \begin{bmatrix} C_{11}(1) & 0 & 0 & 0 & 0 \\ C_{21}(1) & C_{22}(1) & 0 & 0 & 0 \\ C_{31}(1) & C_{32}(1) & C_{33}(1) & 0 & 0 \\ C_{41}(1) & C_{42}(1) & C_{43}(1) & C_{44}(1) & 0 \\ C_{51}(1) & C_{52}(1) & C_{53}(1) & C_{54}(1) & C_{55}(1) \end{bmatrix} \begin{bmatrix} \varepsilon_t^{PRD} \\ \varepsilon_t^{EMP} \\ \varepsilon_t^{RWG} \\ \varepsilon_t^{PCE} \\ \varepsilon_t^{UEM} \end{bmatrix} \quad [6]$$

To estimate the sources of unemployment in Namibia, the study uses Equation 6. According to Blanchard and Quah (1989) and also Dolado and Jimeno (1997), the requisite restrictions are formulated from the theoretical model. Maidorn (2003) argues that if a shock is absent in one of the above equations, it can be assumed that its structural form coefficients add to zero. The current study achieves over identification in the system by employing more than 10 restrictions. Maidorn (2003) adds that if over-identification exists, the structural form covariance matrix, Σ, varies from the covariance matrix of the reduced form $\hat{\Sigma}$. He argues that this permits the testing of the restricted model against the reduced form model by employing a likelihood ratio test which is based on $LR = 2lnL(\hat{\Sigma}) - 2lnL\ (\tilde{\Sigma})$, with $\chi^2_{(r)}$ distributed under the null hypothesis (H_0) (the full set of identifying restrictions are valid). In this case, r represents the total of the overidentifying restrictions and $lnL\hat{\Sigma}$ and $lnL\ (\tilde{\Sigma})$ are the concentrated log likelihood reduced and the structural forms of the functions respectively (see Amisano and Giannini, 1997 and Lütkepohl, 2012). The set of restrictions selected and utilised in this study give $\chi^2_{(1)}$ of 0.680045 (p-value = 0.4096)[5]. The Chi-square and its probability indicate that the set of restrictions imposed is undoubtedly accepted, and it consists of 11 long-term restrictions. These are the restrictions imposed on the estimated SVAR, whose results are discussed in the next section. The next section explains the impulse response (IR) functions and the forecast error variance (FEV) decompositions embedded within the SVAR.

4. Data and Estimation Results

4.1 Impulse-response functions and variance decomposition

The impulse response analysis shown here traces out the reaction of unemployment to particular shocks at time t. Furthermore, the impulse response functions of the unemployment rate shown in Figure 1 allow for sensible economic interpretation.

According to Panel (a) in Figure 1, positive productivity shocks decreased unemployment significantly in the first 5 years. This means that productivity shocks have a favourable effect of decreasing unemployment in Namibia in the short run and this is consistent with most empirical studies (see Lindbeck, 1993). The effects of technology shocks on economic fluctuations have been discussed a lot in recent VAR literature. For example, Dolado and Jimeno (1997) found that technology shocks increased unemployment for Spain. Carstensen and Hansen (2000)'s results compare favourably with the current study since they found that productivity shocks have a long run negative effect on unemployment in the West Germany economy. On the other hand, Linzert (2001) found that technology shocks decrease unemployment in the short run with no long run effect. Moreover, Brüggemann (2006) established that a technology shock decreases unemployment in the short run, whereas in the long run the effect is borderline significant.

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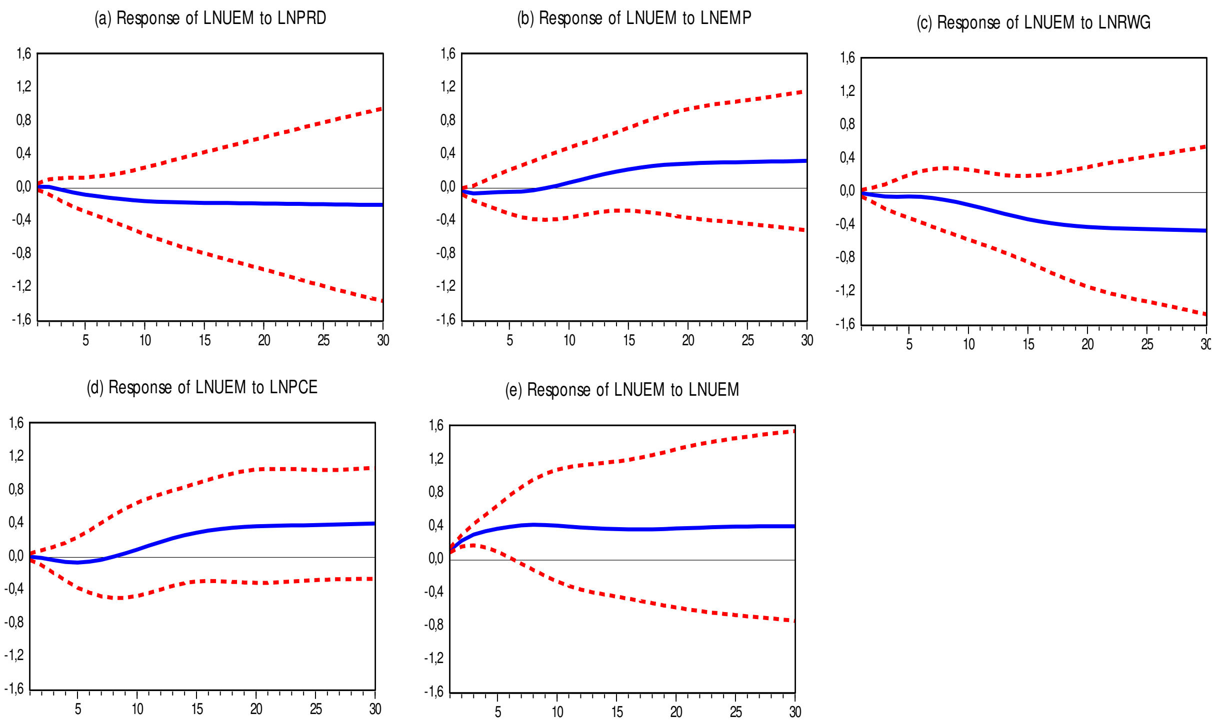
[5] The detailed SVAR results of the study cancan be made available on demand.

Panel (b) in Figure 1 shows that a demand shock significantly lowers unemployment in the short run, that is, up to the 8th year, which is consistent with the standard economic theory. Between the 8th and the 11th year, the unemployment response to a demand shock becomes insignificant. After the 11th year, the response of unemployment becomes positive and it reaches equilibrium, which is above the pre-shock level on the 17th year. Unemployment falls in the short run after a positive aggregate demand shock and this is at variance with Dolado and Jimeno (1997) as well as von Li Su (2006), who found that unemployment permanently decreases after an aggregate demand shock.

Figure 1: Response to Generalized One Standard Deviation Innovations



Source: Authors' calculation from Eviews 8

Panel (c) shows that a positive real wage shock leads to a negative unemployment response in Namibia. From a theoretical perspective, a positive shock to real wages leads to an increase in unemployment since it becomes costly for the employers to hire new employees or even maintain the existing number of employees. Linzert (2001) and also Casternsen and Hansen (2000) found that unemployment responds positively to a real wage shock in the short run and then responds negatively in the long run. Real wage shocks significantly affect unemployment in the short run and in the long run the effect becomes insignificant. This means that wage shocks are fully compensated by variations in productivity without an effect on employment in the long run. However, Dolado and Jimeno (1997) found that wage-push shocks permanently increased the Spanish unemployment rates.

Panel (d) shows that unemployment decreases and then rises to reach its pre-shock level after 7 years. A positive price inflation shock may be caused by increased prices of imported inputs or higher mark-up. The response of unemployment becomes positive and reaches equilibrium at a level above its pre-shock level in the 17th year. It appears that price inflation shocks are a critical factor for increased and persistent unemployment as its effects on unemployment are important in the long run. This implies that increased prices translate into higher costs in the long run in Namibia; therefore, firms need to adjust demand. The results of price inflation shocks established here are similar to what Dolado and Jimeno (1997) found for the Spanish economy. Gambetti and Pistoresi (2004) also drew the conclusion that mark-up shocks increase unemployment in the long run.

Finally, as shown in Panel (e), the unemployment rate positively responds to a positive labour supply shock. Therefore, labour supply shocks have a permanent effect on the unemployment rate, which is in line with the findings by Dolado and Jimeno (1997) as well as Carstensen and Hansen (2000). Balmalseda *et al.* (2000), on the other hand found that labour supply shocks do not have a permanent effect on the unemployment rate.

In brief, impulse responses concerning the reaction of the unemployment rate are consistent with economic theory and allow a plausible economic interpretation. From the preceding analysis, shocks to productivity, aggregate demand, real wages and labour supply seem to be critical factors affecting unemployment, while price shocks correctly affect unemployment in the long run only.

Forecast error variance decompositions of the variables in the over-identified SVAR are given in Table 3. The forecast error variance decomposition of the unemployment rate is critical to the analysis due to the fact that they provide insight into the importance of different structural shocks in accounting for the unemployment rate.

Table 3 shows that aggregate demand shocks, real wage shocks and labour supply shocks appear to be the driving forces of unemployment. In the short run, labour supply shocks play an important role in explaining the forecast error variability of the unemployment variable. They explain the largest part of about 56 percent in the first year, which increases to about 71 percent in the second year of the forecast error variance of the unemployment rate. Their importance declines to about 60 percent in the 10^{th} year and they account for about 46 percent in the long run.

Shocks to aggregate demand are the other important factors for the forecast error variance of the unemployment rate. They account for about 22 percent of the forecast error variance of unemployment in the first year. Their importance decreases with an increase in the forecast horizon up to the fifth year, after which it increases with an increase in the forecast horizon. In the long run, shocks to aggregate demand are the second most important factor accounting for about 20 percent of the forecast error variability of the unemployment rate.

The importance of the real wage in accounting for the unemployment rate variability falls from about 21 percent in the first year to about 13 percent in the long run. It should also be noted that although price inflation appears insignificant in explaining the unemployment rate variability in the short run, it accounts for about 15 percent in the long run. Of all the factors used in the SVAR model, productivity is the least important in accounting for the unemployment rate variability, accounting for about 0.4 percent in the first year and only 6 percent in the long run.

Table 3: Variance decomposition of unemployment

Period	S.E.	Productivity shocks	Aggregate demand shocks	Real wage shocks	Price inflation shocks	Labour supply shocks
1	0.042214	0.391481	22.33826	20.72288	0.630631	55.91675
2	0.046635	0.211374	13.18890	14.77725	0.377605	71.44488

5	0.061861	7.027335	9.037238	10.54646	1.420842	71.96812
10	0.076351	7.913174	11.77213	9.885523	10.80736	59.62181
15	0.086437	6.546376	18.39169	11.50943	15.39748	48.15503
20	0.094690	6.294684	19.57118	12.43478	15.43980	46.25956
25	0.101308	6.293922	19.55062	12.52425	15.39313	46.23808
30	0.106733	6.295318	19.56599	12.53208	15.43432	46.17229

Cholesky Ordering: LNPRD LNEMP LNRWG LNPCE LNUEM

Source: Authors' calculation from Eviews 8

As demonstrated above, the forecast error variance of the unemployment rate in this model is determined by labour supply shocks, aggregate demand shocks, real wage shocks and price inflation shocks, respectively. Note that such strong permanent effects of aggregate demand are quite reasonable due to the non-neutrality features of the model. In contrast, productivity shocks explain only a small fraction of the forecast error variance of unemployment in both the short and long run, in spite of the moderate rise of their importance with increasing forecast horizons. This finding is consistent with the controversy of uncertain effects of productivity shocks on the unemployment rate. Labour supply shocks have the most important impact on the forecast error variance of unemployment at any time horizon.

4.2 Robustness of the results

In this section, the study reports the robustness checks of the sources of unemployment model. The summarised statistics of individual variables indicate that all variables are normally distributed individually and this is important in that it also helped ensure that the estimated model was also normally distributed (see Table 4). Additionally, the structural VAR results indicate that all the coefficients in the two models have standard errors with values less than the ones suggesting that they are efficient and hence they form a solid basis for measuring shocks. In addition, inverse roots of the characteristic AR polynomial for the determination of stability and stationarity show that all inverse roots of the characteristic AR polynomials have moduli less than one and lie inside the unit circle, implying that at the chosen lag length of order two, the estimated model is stable (see Appendix A1). Lastly, serial correlation test results reported indicate that there is no evidence of any serious serial correlation in the models (see Appendix A2)[6].

Table 4: Normality Test Results

Component	Jarque-Bera	df	Prob.
1	0.688936	2	0.7086
2	1.629047	2	0.4429
3	7.355666	2	0.0253
4	0.785331	2	0.6753
5	3.582441	2	0.1668
Joint	14.04142	10	0.1711

Source: Authors' calculation from Eviews 8

5 Conclusion and policy recommendations

[6] The summary statistics and structural VAR results mentioned in section 4.2 are readily available from the authors if needed.

Empirical results show that no single factor has caused the rise in unemployment on its own. The persistently high unemployment is instead the result of a combination of various shocks as well as the hysteresis mechanism.

As regards the structural shocks under investigation, labour supply shocks are shown to be dominant in accounting for the unemployment evolution even in the long run, followed by aggregate demand shocks. Deficient labour supply and aggregate demand are no doubt important reasons for the miserable unemployment development in Namibia. Although price shocks do not influence unemployment in the short run, they lead to a rise in the unemployment rate in the medium to long term. Since the impact of price shocks is significant and long-lasting, they can explain to some degree the unemployment persistence in Namibia. Just like many theoretical and empirical literature about the effect of productivity shocks on the unemployment rate, this study does not provide a clear-cut picture concerning productivity shocks, either. However, productivity shocks seem to slightly influence unemployment in the long run. Finally, labour supply shocks are shown to have an important effect on the unemployment rate. It can be concluded from the empirical work that it might be too simplistic blaming solely insufficient effective demand or labour market rigidities for persistently high unemployment in Namibia.

The empirical results provide strong implications for economic policy. Since unemployment is the result of interactions of several structural shocks (impulse mechanism) and hysteresis effects (propagation mechanism), policy implications involve both aspects. As far as structural shocks are concerned, the role of aggregate demand shocks and price shocks in influencing the Namibian unemployment evolution provides a rather important insight for macroeconomic policy designs. Starting from the role of aggregate demand shocks, the findings offer new evidence on the strong long run relationship between demand policies and unemployment. If hysteresis is a relevant phenomenon, the analysis implies that demand-side policies matter for output and unemployment, not only in the short run, but also in the long run. This finding is in line with other recent empirical evidence stating that aggregate demand affects unemployment even in the long run (see Linzert, 2001; Dolado and Jimeno, 1997; and Maidorn, 2003).

Since price shocks play a role in explaining high unemployment rates in the long run, policies that lower mark-up contribute to reducing the unemployment rate. The deregulation policies operate primarily through the regulation of the product market with the aim of increasing the degree of competition among firms. In the context of the Southern African Customs Union, of which Namibia is a member, such policies may include, for example, the reduction of tariff barriers or standardization measures. Deregulation policies that are intended to reduce entry costs may consist of the elimination of state monopolies or the reduction of red tape associated with the creation of new firms. If the number of firms is not fixed in the long run, a reduction in entry costs leads to an entry of new firms, unemployment will hence be lowered, and a higher real wage may be realised.

In addition, this empirical analysis has also important policy implications concerning hysteresis effects as a propagation mechanism. Since hysteresis effects arising from the insider-outsider framework make adverse shocks to have quite long lasting influences, the insider-outsider theory plays a crucial role in eliminating unemployment persistence. Despite the diversity of political implications in this respect, the common emphasis is the creation of a more level playing field in the labour market. As long as insiders have favourable opportunities than outsiders, policies that guarantee a more level playing field between insiders and outsiders can improve efficiency and equity. Generally, two broad types of policies can be identified in this context: power-reducing policies that reduce insiders' market power and enfranchising policies that strengthen outsiders' voice in the wage bargaining process. Power-reducing policies range from restrictions on strikes to relaxing job security legislation. For example, laws simplifying firing procedures, reducing litigation costs and reducing severance pay. These policies tend to reduce insiders' welfare. Therefore, insiders may resist these policies, which will limit the effectiveness of power-reducing policies. The general form of enfranchising policies are vocational training programs and job counselling for the unemployed, schemes to convert wage claims into equity shares, policies to reduce the occupational, industrial, and geographic coverage of union wage agreements and again policies to reduce barriers to the entry of new firms.

Indeed, within a theoretical framework where the labour market is rigid and structural reforms can play a role, certain monetary and fiscal policies are powerful. The reason why such policies are important instruments for the reduction of unemployment, namely the rigidity in the labour market, exactly justifies structural reforms. Hysteresis in the unemployment rate makes economic policies effective, not only in the short run but also in the long run. Therefore, aggregate demand policies should be considered as useful instruments to tackle unemployment and they are complementary rather than contrasting with structural labour market reforms. This means that the expansion of demand will make labour market policies more effective.

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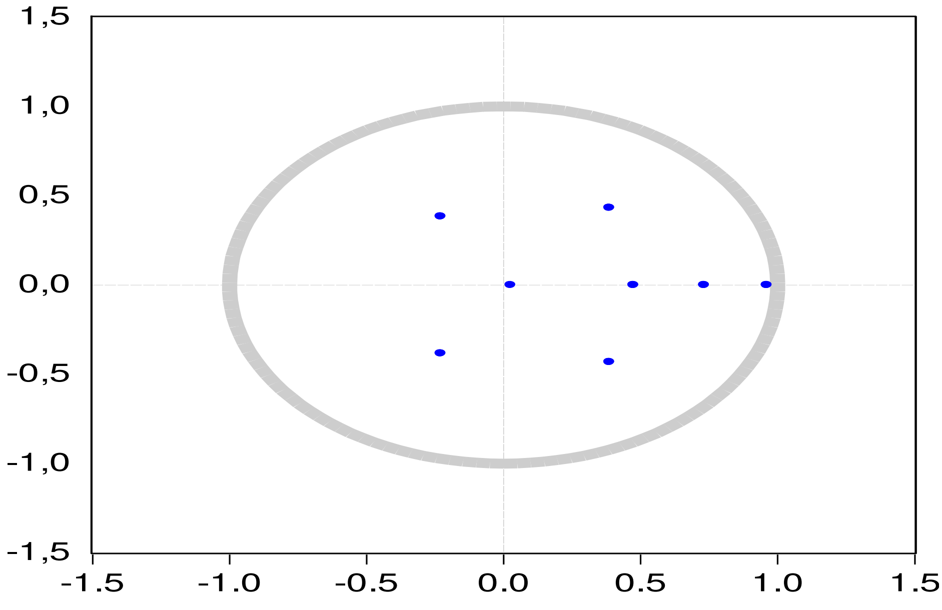
Appendix A1: Roots of characteristic polynomial of the unemployment model



No root lies outside the unit circle. VAR satisfies the stability condition

Source: Authors' calculation from Eviews 8

Appendix A2: VAR residual serial correlation tests of unemployment

Lags	LM-Statistics	Probability
1	28.75634	0.2742
2	25.07673	0.4581
3	23.04405	0.5750
4	31.91679	0.1604
5	34.79634	0.0920
6	24.11304	0.5129
7	13.47445	0.9701
8	27.73205	0.3203
9	12.06638	0.9860
10	22.71222	0.5944
11	19.69098	0.7628
12	22.44651	0.6098

Probabilities from chi-square with 25 degrees of freedom

Source: Authors' calculation from Eviews 8

Appendix A3

ACRONYM	VARIABLE NAME	VARIABLE EXPLANATION	DATA SOURCE
LFC	Labour force	Due to lack of data on the labour force for the period 1980 to 1989, the main method used to generate the values of the labour force for the period 1980 to 1989 is the linear extrapolation method also used by Smith and Sincich (1988), Chow and Lin (1971), Smith (1987), Chang *et al.* (2007) and Tsonis and Austin (1981). Given the fact that the labour force data for the period 1990 to 2013 is available, the study did backward extrapolation to generate data for the period 1980 to 1980.	NSA, MLSW & author calculations
UEM	Unemployment rate	Due to lack of data on the labour force for the period 1980 to 1989, the main method used to generate the values of the labour force for the period 1980 to 1989 is the linear extrapolation method also used by Smith and Sincich (1988), Chow and Lin (1971), Smith (1987), Chang et al. (2007) and Tsonis and Austin (1981). Given the fact that the labour force data for the period 1990 to 2013 is available, the study did backward extrapolation to generate data for the period 1980 to 1980.	MLSW and NSA
EMP	Employment	Total employment is equivalent to labour force minus total unemployment. Labour force and unemployment are as described below. Once the figures for the labour force and unemployment are available, it is easy to calculate the figures for total employment.	MLSW and NSA
KST	Capital stock	This is gross fixed capital formation expressed in real terms and in millions of local currency with a base year of 2005 dollars. Akanbi and Du Toit (2011) apply a similar measure	NSA
RWG	Real wage	Note that capital stock and labour are the major inputs in the production process. To derive wages, the following identity is used: $\frac{KST_T}{GDP_T} + \frac{EMP_T}{GDP_T} = \frac{GDP_T}{GDP_T} = 1$ Thus, $\frac{KST_T * LER_T}{GDP_T} + \frac{EMP_T * RWG_T}{GDP_T} = \frac{GDP_T}{GDP_T} = 1$ where GDP_T is GDP, EMP_T is employed labour, LER_T is the interest rate (lending rate), and RWG_T is the real wage rate. $KST_T * LER_T$ represents the total value of capital in the	Calculated using, KST, GDP, EMP, and LER using the indicated formula

		economy and $EMP_T * RWG_T$ represents the total wage bill of the economy. This implies that: $RWG_T = \left[1 - \left(\frac{KST_T * LER_T}{GDP_T}\right)\right]\left(\frac{GDP_T}{EMP_T}\right)$ $= \frac{GDP_T - KST_T * LER_T}{EMP_T}$ This is the calculation Akanbi and Du Toit (2011) used in their study.	
PRD	Productivity	Productivity: is the ratio of real GDP over total employment $[(GDP/CPI)/EMP]$. In this case, GDP is the nominal Gross Domestic Product measure in millions of national currency. Real GDP (GDP) is calculated by deflating the nominal measure of GDP using the CPI measure and EMP is the measure of total employment (see Linzert, 2001).	Calculated using GDP and CPI
PCE	Price inflation	This is the consumer price index with base year 2005. Linzert (2001) used the same measure for the German economy.	NSA
GDP	Real gross domestic product	Real gross domestic product (GDP) is defined as nominal GDP in local currency units (LCU) adjusted for inflation, which is found as a ratio of GDP in local currency units and the CPI. This data is available in the NSA.	NSA
LER	Lending rates	The rate at which, commercial banks lend money to their clients. This is also referred to as the cost of money. Note that this rate is frequently influenced through the repo rate (rate at which the banks borrow money from the central bank) in Namibia. Interest rates data were obtained from the South African Reserve Bank and Bank of Namibia Quarterly Bulletins. Data for the period 1980 to 1990 was obtained from the South African Reserve Bank since Namibia was considered a province of SA then and that for the period 1990 to 2013 was obtained from the Bank of Namibia. Shiimi and Kadhikwa (1999) also used the same strategy in their study on Namibia.	RBSA and BoN