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Article

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The endogeneity of business cycle synchronisation in SADC: A GMM approach

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Abstract: Studies often conclude that the proposed Southern African Development Community monetary union would be disastrous and not optimal for all member countries. This is because of the observed low, and sometimes negative business cycle correlation amongst member countries. However, it has been demonstrated that the degree of synchronisation is not irrevocably fixed and is endogenous to certain economic factors. This study, therefore, sets out to investigate factors influencing business cycle synchronisation in the SADC region. More precisely, the study employs a generalised method of moments to investigate the influence of trade integration, financial integration, fiscal policy convergence, monetary policy similarity and oil prices (a proxy for global common shocks) on the degree of business cycle synchronisation. To conduct our analysis, we use data covering the period 1994–2014. In addition, we employ bilateral data as a way of getting around the problem of unavailability of aggregated regional data. The study finds trade, fiscal policy convergence and monetary policy similarity to have a sanguine impact on the degree of business cycle synchronisation. In addition, owing to their procyclical behaviour, it is observed that financial flows lead to diverging business cycles. Furthermore, the study finds that oil prices exert a negative impact on business cycle comovement in the SADC region. The study results have far-reaching policy implications for the proposed SADC monetary union. It is implied in the study findings that by stimulating trade and ensuring coherence in macroeconomic policies, SADC can move closer to being an optimal currency area.

ABOUT THE AUTHORS

Ntokozo Nzimande graduated with MCOM economics at the University of KwaZulu-Natal, and later in 2015 he joined the University as an economics lecturer. At present, he is busy with his PhD in economics at the University of KwaZulu-Natal.

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PUBLIC INTEREST STATEMENT

Southern African Development Community intends to establish a monetary union, and had planned to complete the process by 2016, followed by the introduction of a single currency in 2018. However, empirical evidence suggests that conditions under which it is optimal to establish a monetary union are not satisfied in the region and therefore, establishing a monetary union at this stage would be disastrous and would lead to macroeconomic instabilities. However, other scholars postulate that monetary union is self-validating, i.e. establishment of a monetary union would alter the conditions to its favour. Thus, in this study we assess if the latter hypothesis would hold in Southern Africa, and if so what factors would need to be targeted in order to produce a conducive environment for a monetary union.

Subjects: Economics; Macroeconomics; Econometrics; International Economics

Keywords: business cycles; synchronisation; trade integration; financial integration; monetary union

JEL Classifications: E32; F15; J50

1. Introduction

Region-wide fixed exchange rates, or a monetary union, entail a loss of monetary policy to deal with economic disturbances at a country level. Therefore, for countries whose business cycles are significantly driven by idiosyncratic factors, using a common monetary policy or establishing a monetary union may be costly and not optimal for all member countries. Accordingly, to alleviate the costs associated with the loss of monetary policy tools, the theory of optimal currency areas (OCA), amongst other things, makes business cycle synchronicity a necessary requirement. As a consequence, in a monetary union, environment business cycle synchronisation has been extensively studied. In addition, business cycle synchronicity has been applied as an instrument to gauge the suitability of a monetary union in the Euro Area, East Asia, East Africa and West Africa, and most importantly, in Southern Africa.

Relying on historical data, an enormous number of studies suggest that the adoption of a common monetary policy in the Southern African Development Community (SADC)[1] would be disastrous, and would lead to macroeconomic instabilities across the region (see Kabundi & Loots, 2007; Tipoy, 2015; Zerihun, Breitenbach, & Kemegue, 2014, amongst others). This view is because historical data uncover insufficient degrees of business cycle comovements in SADC, and alternative adjustment mechanisms suggested by an OCA, such as labour mobility and nominal flexibilities, are absent.

Drawing from the famous Lucas critique, Frankel and Rose (1998) critique the view that business cycle synchronisation is a precondition for adopting a common monetary policy. They argue that historical data may be misleading and business cycle synchronicity is not irrevocably fixed, and is not exogenous. If this thesis holds, business cycle synchronisation could be an *ex post* rather than an *ex ante* phenomenon. This notion is owing to the view that introducing a single currency reduces transaction costs and exchange rate uncertainty, and therefore, stimulates trade, which in turn reinforces business cycle comovements (Gouveia & Correia, 2013). Consistent with this view, Rose and Engel (2000) demonstrate that countries sharing a single currency tend to trade more with each other, and are more synchronised vis-à-vis countries not sharing the same currency. Likewise, Barro and Tenreyro (2007) reveal that adopting a single currency tends to fuel trade. Moreover, Rose and van Wincoop (2001) argue that, indeed, using a single currency tends to boost trade. Therefore, multiple national currencies appear to be a significant impediment to trade, and hence business cycle synchronicity.

As pointed out earlier, the literature on the degree of business cycle synchronisation in SADC often concludes that based on weaker business cycle alignment, a common monetary policy in SADC would not be optimal (see Kabundi & Loots, 2007; Nzimande & Ngalawa, 2016; Tipoy, 2015; Zerihun et al., 2014). However, these studies neither attempt to uncover factors, which could explain the underlying levels of synchronisation, nor suggest solutions to the observed low levels of synchronisation. This study, therefore, sets out to investigate factors influencing business cycle comovement in SADC.

Identification of factors explaining business cycle comovements in SADC is essential for a number of reasons. Firstly, it equips policy-makers with crucial knowledge to develop structural policies that will improve efficiency, and allow the application of a common monetary policy. Secondly, if business cycles are driven by peripheral factors such as trade, internal policies intended to stabilise the economy would have a negligible impact on output growth, thus necessitating economic policy coordination. Therefore, deeper knowledge about factors through which business cycles are

transmitted is warranted, and will have far-reaching policy implications. Moreover, knowledge of the factors influencing business cycle comovements would assist SADC monetary union aspirants in determining the best timing to adopt a single currency, and whether such a move would fast-track their convergence process (Vieira & Vieira, 2012).

The rest of this paper is organised in four sections. The next section reviews the literature on factors explaining business cycle comovements. Section 3 describes data and the empirical framework applied to conduct the analysis. Results and a discussion of the study findings are presented in Section 4. Section 5 concludes the paper and identifies areas for further research.

2. Literature review

Why are some countries' business cycles synchronised, and others are not? What could possibly explain the observed low levels of business cycle synchronisation in SADC? Answers to these questions will contribute towards the formulation of policies that may mitigate the adverse impact associated with the use of a single monetary policy in the SADC region. This section reviews literature on the determinants of business cycle comovement.

A number of potential determinants of business cycle synchronisation, such as trade, currency union membership and industrial similarity, amongst others, have been identified (see Artis & Zhang, 1997). However, industrial similarity and currency union membership are generally found to be weak estimators of synchronisation, and hence they are excluded from our analysis (see Baxter & Kouparitsas, 2005; Cerqueira & Martins, 2009; Clark & van Wincoop, 2001; de Haan, Inklaar, & Jong-A-Pin, 2008; Furceri & Karras, 2008, amongst others). In addition, required data to compute industrial similarity is hardly available in SADC, therefore, providing one extra reason to exclude it from our analysis.

It is argued that trade plays an integral role in explaining business cycle synchronicity, specifically by increasing the speed of propagation of shocks across countries (Barro & Tenreyro, 2007; Faia, 2007; Frankel & Rose, 1998; Gouveia & Correia, 2013, amongst others). However, both theoretical models and empirical evidence suggest an ambiguous link between trade and business cycle synchronicity.

There is a belief that trade intensification could result in asynchronous business cycles. Classical models of trade demonstrate that intensification of trade would result in product specialisation as countries attempt to exploit their comparative advantages (Kenen, 1969; Krugman & Venables, 1993). Countries that have specialised in certain products will be hit by sector-specific shocks, which in turn will translate into country-specific shocks, thus resulting in diverging business cycles. Consistent with this prediction, Crosby (2003) finds that trade has adverse effects on business cycle synchronicity in Asia-Pacific countries.

On the one hand, Backus and Kehoe (1992) argue that trade results in strengthened business cycle comovements. A shock hitting a particular economy will be transmitted through demand linkages to its trading partners. Accordingly, countries that trade more with each other tend to be more synchronised than countries that trade less with each other (Di Giovanni & Levchenko, 2010). In line with this view, Frankel and Rose (1998) find that trade has a sanguine impact on business cycle synchronisation. In addition, they conclude that the theory of OCA is not exogenous, and lack of business cycle synchronisation should not deter countries from establishing a monetary union. This is because establishing a monetary union would result in a reduction in transaction costs, thus stimulating trade, which in turn synchronises business cycles. Rose and Engel (2000) demonstrate that countries in a currency union tend to trade more with each other, than countries that are not in a currency union. There is a large strand of the literature showing a positive relationship between trade and business cycle comovements (Clark & van Wincoop, 2001; Furceri & Karras, 2008, amongst others).

In contrast to both views about the impact of trade on business cycle synchronisation, Otto, Voss, and Willard (2001) question the importance of trade in explaining business cycle comovements. They argue that Australia trades more with Japan than with the United States, yet, its business cycle is strongly correlated with that of the United States vis-à-vis the Japanese business cycle. This is consistent with Dellas (1986) who demonstrates that trade linkages play a negligible role in explaining business cycle comovements. He further argues that business cycle interdependencies are best explained by common shocks.

The other channel that is argued to have a positive impact on business cycle comovement is monetary policy (see Frankel & Rose, 1998, for discussion). Although a plethora of studies found monetary policy similarity to have a positive impact on business cycle synchronicity; its impact on business cycles remains an unsettled matter. Otto et al. (2001) find that great volatility in the interest rate differential has a negative impact on business cycle synchronicity. Whereas, Clark and van Wincoop (2001) find that monetary policy similarity has no significant impact on business cycle comovement. Schiavo (2008) finds that monetary policy similarity has an indirect impact on business cycle comovement. Thus, the endogeneity of business cycle synchronisation does not suggest that by joining a monetary union countries will automatically become more synchronised, but rather, the prospective increase in trade and financial linkages induced by the use of a common currency will have a positive influence on business cycle comovement.

Following the establishment of the European Union, the impact of financial integration received enormous interest from both scholars and policy-makers around the globe. However, regarding financial integration, Southern Africa has been neglected as an area of study. Financial integration is expected to promptly increase in Southern Africa due to the envisaged economic integration, and the proposed introduction of a Southern African single currency in 2018. Hence, understanding the economic consequences of deeper financial integration is warranted.

Given the lack of an independent monetary policy response in a monetary union, asymmetric disturbances may induce welfare losses, and threaten the stability of the union, unless, risk sharing mechanisms are in place. One of the mechanisms through which risks are shared is financial integration.

Financial integration is central in the functioning of a monetary union because it allows agents to exploit 'risk sharing' mechanisms, thus resulting in synchronisation of business cycles (Cerqueira & Martins, 2009). For example, monetary policy in a monetary union may fail to deal with asymmetric disturbances. So financial integration permits consumers to borrow from countries experiencing booms, and therefore synchronise business cycles. Kose, Prasad, and Terrones (2003) also argue that stronger financial linkages could reinforce business cycle synchronisation through demand linkages. Similar conclusions are reached by Imbs (2006). Consistent with these studies, Jansen and Stokman (2004) demonstrate that financial integration results in stronger business cycle comovement across countries. Moreover, Kose, Otrok, and Whiteman (2008) show that financial linkages stimulate business cycle synchronisation.

On the other hand, risk sharing encourages industrial specialisation, thus resulting in asymmetric shocks, which in turn result in an asynchronous business cycle. This has been demonstrated, amongst others, by Kalemli-Ozcan, Sørensen, and Yosha (2003) and Obstfeld (1994). Furthermore, Backus and Kehoe (1992) argue that the behaviour of financial flows is procyclical. For example, if there are two countries in the world, *X* and *Y*; and country *X* experiences a positive technological shock, agents will pull their capital from country *Y* to country *X* where the marginal product of capital and labour have increased. Therefore, the procyclicality behaviour of financial flows will result in diverging business cycles. In line with these studies, Garcia-Herrero and Ruiz (2008) show that intensified financial integration leads to asymmetric business cycles. Heathcote and Perri (2004) reach similar conclusions that financial integration leads to diverging business cycles.

Fiscal policy discipline or convergence is identified as another important channel through which business cycles are synchronised. However, a plethora of economists treat fiscal policy convergence with cynicism, because it has little or nothing to do with the traditional theory of OCA. In addition, there is no existing theory linking fiscal policy convergence with business cycle comovements (Darvas, Rose, & Szapáry, 2005). Despite the lack of a theoretical connection between business cycle comovements and fiscal policy convergence, it is relatively easy to build an instinctive link between the two. Countries that are ill-disciplined in their fiscal policy conduct, that is countries that run high budget deficits, generate individual fiscal policy shocks that lead to diverging business cycles. Thus, in envisaged and/or already established unions, fiscal policy should be countercyclical as opposed to procyclical (Brender & Drazen, 2005; Gavin & Perotti, 1997). Simply put, in the absence of idiosyncratic shocks, which would otherwise lead to divergent business cycles, the use of fiscal policy would be irresponsible.

Consistent with the view that fiscal policy should countercyclical, Fatas and Mihov (2003) argue that aggressive use of fiscal policy is associated with macroeconomic instabilities, and impedes economic growth. Similarly, Badinger (2009) shows that discretional use of fiscal policy results in significant and ample output volatility. Rodden and Wibbels (2010) agree with the view that fiscal policy should rather be countercyclical. In addition, fiscal policy in a monetary union ought to be centralised; and centralised fiscal policy provides insurance (in terms of fiscal transfers) against adverse shocks hitting a particular economy in a union (see Spahn, 1997). Furthermore, Fatas and Mihov (2003) argue that fiscal policy restrictions would lower macroeconomic volatilities. However, fiscal policy restrictions are said to limit fiscal policy action when it is needed the most (i.e. in the presence of shocks that would otherwise lead to diverging business cycles). In addition, fiscal policy restrictions may exacerbate economic fluctuations since they disregard cyclical conditions (Levinson, 1998). For example, in the case of Europe, it is argued that rules will worsen recessions, since countries will be tempted to apply procyclical fiscal policy when cyclical downturns increase deficits towards the Stability and Growth Pact (SGP) cap (Alt & Lowry, 1994; Lane, 2003).

3. Methodology and data

3.1. Econometric framework

Longitudinal data methods have become increasingly popular in recent years and are now the most used tools in contemporary econometrics, both in microeconomics and macroeconomics (Hsiao, 2005). The increasing popularity of panel data techniques is owing to a number of factors, predominantly because they allow practitioners to exploit two dimensions of the data: a cross-sectional dimension and a time series dimension (Hsiao, 2005).

Consider the following simple linear dynamic panel model:

$$y_{it} = y_{it-1} + X_{it}\beta + \epsilon_{it} \tag{1}$$

$$\epsilon_{it} = \mu_i + \varepsilon_{it} \tag{2}$$

where $i = 1, 2, \ldots, N, t = 1, 2, \ldots, T$, X' is a $(1 \times K)$ vector of regressors, β is a $(K \times 1)$ vector of coefficients to be estimated, μ_i represents individual fixed effects, capturing individual differences and ε_{it} denotes individual error terms. We assume μ_i and ε_{it} are i.i.d. with $(0, \sigma^2)$. Moreover, we assume they are exogenous to each other. Therefore,

$$E[\mu_{it}] = [\varepsilon_{it}] = [\mu_{it}, \varepsilon_{it}] = 0 \tag{3}$$

The introduction of the lagged endogenous variable introduces a *dynamic panel bias* because μ_i and y_{it-1} are correlated. Since y_{it} is a function of μ_i, which is time-invariant, it must also be true that y_{it-1} is a function of μ_i. Therefore, one of the regressors is correlated with one component of the error term, thus giving rise to the problem of endogeneity.

Accordingly, application of the ordinary least squares (OLS) approach to Equation (1) will yield inconsistent and upward biased estimates; and since $E[y_{it-1}, \epsilon_{it}] > 0$, then β_1 will be overestimated (Blundell & Bond, 2000). To tackle endogeneity bias, the literature suggests two remedies, which could be applied simultaneously or successively. First, one can eliminate time-invariant effects through data transformation such as first differencing. Secondly, the endogeneity problem can also be tackled by employing valid instruments of the lagged endogenous variable (Mairesse & Hall, 1996).

For simplicity we reduce Equation (1) to include only one explanatory variable,

$$y_{it} = \beta_1 y_{it-1} + \epsilon_{it} \tag{4}$$

To remove the time-invariant component of the error term, which is correlated with the explanatory variable, Equation (5) is subtracted from Equation (4);

$$y_{it-1} = \beta_1 y_{it-2} + \epsilon_{it-1} \tag{5}$$

resulting in Equation (6)

$$\Delta y_{it} = \beta_1 \Delta y_{it-1} + \Delta \epsilon_{it} \tag{6}$$

where $\Delta = (1 - L)$ is a first difference operator. In other words, we get the transformation by multiplying Equation (2) by $I_N \otimes D$, where I_N is an identity matrix of dimension N and D is a $(T - 1) \times T$ matrix[2]:

$$\begin{pmatrix} -1 & 1 & 0 & \dots & 0 & 0 \\ 0 & -1 & 1 & \dots & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & 0 & -1 & 0 \end{pmatrix} \tag{7}$$

Although first differencing $(T - 1)$ takes care of the individual time-invariant effect, it results in the loss of the degrees of freedom, since its drops T initial observations, which could have severe ramifications for an unbalanced panel. Following the transformation, the first difference estimator is the OLS estimator of Equation (6). That is

$$\hat{\beta} = \left\{ \sum_{i=1}^{N} (DX_i)' DX_i \right\}^{-1} \sum_{i=1}^{N} (DX_i)' Dy_i \tag{8}$$

Owing to the assumption that $\epsilon_{it} \sim$ i.i.d. $(0, \sigma_\tau^2)$, the first difference estimator is inconsistent since the transformation (i.e. first differencing) prompts a MA(1) process for the $\Delta \epsilon_{it}$. This calls for a generalised least squares (GLS) approach (see Arellano, 2003). Moreover, as shown in Arellano (2003), the optimal GLS estimator is the within-group estimator, which takes the following form:

$$\hat{\beta}_{WG} = \left(\sum_{i=1}^{N} X_i' D' (DD')^{-1} DX_i \right)^{-1} \left(\sum_{i=1}^{N} X_i' D' (DD')^{-1} Dy_i \right) \tag{9}$$

In line with Arellano (2003), the Q matrix is defined as the "deviations-from-time-means" because it alters y_{it} series into deviations from time averages $\bar{y}_i = Qy_i$, whose elements are $\bar{y}_{it} = y_{it} - \bar{y}_i$. The Q matrix is shown to be:

$$Q \equiv D' (DD')^{-1} D \tag{10}$$

Again, the within-group estimator successfully gets rid of the individual fixed effect. However, it fails to fix the dynamic panel bias. Therefore, it yields inconsistent estimates (Nickell, 1981).

Given the failure of pooled OLS, the first difference estimator and within-group estimator to resolve the issue of dynamic panel bias, an alternative tool to deal with the challenge is warranted.

Instrumental variable estimators are amongst alternative models used to deal with the issue of dynamic panel bias (Anderson & Hsiao, 1981, 1982, amongst others). The instrumental variable approach is usually preferred over the maximum likelihood method of Hsiao (2003), on the grounds that maximum likelihood (ML) requires that assumptions about initial conditions be made, and that they must be correctly specified, otherwise the ML estimator would be inconsistent. Although the estimators of Anderson and Hsiao (1981) successfully identify the model, they are not necessarily efficient because they do not exploit all instruments available.

The panel data generalised method of moments[3] (GMM) circumvent most, if not all issues faced by other estimators. Through exploitation of a set of meaningful instruments, for each instrument, GMM permits the use of all available instruments. Arellano and Bond (1991) suggest the use of all available lags for each period in time as instruments for the first-differenced lagged endogenous variable in Equation (5).[4] The Arellano and Bond (1991) estimator is known as the difference GMM estimator. The Arellano and Bond (1991) first difference estimator is given by:

$$\hat{\beta}_{\text{GMM diff}} = \left((\Delta y'_{-1} Z_{\text{d}}) W_N (Z'_d \Delta y_{-1})^{-1} (\Delta y_{-1} Z_{\text{d}}) W_N (Z'_{\text{d}} \Delta y \right) \tag{11}$$

where $\Delta y_i = (\Delta y_{i3}, \Delta y_{i4}, \ldots, \Delta y_{iT})'$, Δy_{-1} is the vector that includes the first lag of Δy_i, $Z'\Delta y = \sum_{i=1}^{N} Z_{di}, y_i$, W_N is an optimal weighting matrix and Z_{d} is an instrument matrix for ith individual, which has $T-2$ rows with non-negative elements and $(T-2)(T-1)/2$ columns. The difference GMM estimator of Arellano and Bond (1991) is consistent for $T \to \infty, N \to \infty$ and also for fixed T.

Although, the first difference GMM estimator performs better than other panel techniques (see Blundell & Bond, 1998), it is not without hitches. More precisely, when the lags of the dependent variable are weakly correlated with the first difference of the dependent variable in the following period, first difference GMM (FDGMM) is argued to suffer from finite sample bias (Blundell & Bond, 1998).

The drawbacks of the Arellano and Bond (1991) estimator gave birth to the systems GMM of Blundell and Bond (1998). The systems GMM formulates supplementary orthogonality conditions that make more valid instruments accessible and achieve efficiency gains. In addition to the use of lagged levels of y_{it} as instruments for the first differences equations, the system GMM estimator (SGMM) uses the lagged first-difference Δy_{it-1} of y_{it} as instruments for Equation (1) in levels. Therefore, the resulting SGMM estimator is given by:

$$\hat{\beta}_{i\text{GMM s}} = \left(q'_{-1} Z_{s W_N Z'_s q_{-1}} \right)^{-1} (q'_{-1} Z_s W_N Z_s q_i) \tag{12}$$

where $q_i = (\Delta y'_i, y'_i)$ and Z_s is the full instrument matrix. The SGMM is proven to be more efficient relative to the FDGMM estimator, especially as $\beta \to 1$.

In light of the issues associated with dynamic panel data and other dynamic panel data estimators such as FD and the within-group estimator, this study employs systems GMM to estimate factors influencing business cycle comovements in SADC. A plethora of studies have used similar equations to estimate factors influencing business cycle synchronisation and thus variables employed in the study are adopted from various studies (Cerqueira & Martins, 2009; Clark & van Wincoop, 2001; Darvas et al., 2005; Lee & Azali, 2010, amongst others).

$$Y_{ikt,t} = \alpha_0 + \alpha_1 Y_{ik,t-1} + \alpha_3 \mathrm{TI}_{ik,t} + \alpha_4 \mathrm{FI}_{ik,t} + \alpha_5 \mathrm{FP}_{ik,t} + \alpha_6 \mathrm{MPS}_{ik,t} + \alpha_7 \mathrm{OP}_{ik,t} + e_{ik,t} \tag{13}$$

where $Y_{it,t}$ is a business cycle correlation index between country *i* and *k*, $\mathrm{TI}_{ik,t}$ denotes trade intensity, $\mathrm{FI}_{ik,t}$ is the degree of financial integration, $\mathrm{FP}_{ik,t}$ represents fiscal policy convergence, $\mathrm{MPS}_{ik,t}$ is monetary policy similarity, $\mathrm{OP}_{ik,t}$ are oil prices, which represent exogenous common shocks, and $e_{ik,t}$ is the error term.

3.2. Data sources

We use panel data covering the period 1994–2014, which are collected from various sources. Nominal oil prices are collected from the International Monetary Fund (IMF) World Economic Indicators, and converted into real oil prices using the world GDP deflator collected from the IMF World Economic Indicators database. Data on financial flows, inflation rates and government deficit/surplus were collected from the World Development Indicators, and data on bilateral trade were collected from the CEPPII database. While we would have preferred high-frequency data, such data are hardly available in Southern Africa. Accordingly, we employ annual data. Thus, the scope of the data is dictated by its availability. Data were collected for all SADC member countries except for Namibia and Democratic Republic of Congo, where data were not available.

3.3. Construction of variables

3.3.1. Real oil Prices

In line with existing studies, we use real oil prices as a measure of global exogenous shocks (see Kutu & Ngalawa, 2016; Moneta & Rüffer, 2009, amongst others).

3.3.2. Business cycle synchronisation index

To construct a business cycle index, we follow Kalemli-Ozcan, Papaioannou, and Peydró (2009) who construct the index of business cycle comovement as negative absolute differences in real GDP between country *i* and *k*. Thus, we have a total of $N(N-1)/2$, bilateral correlations.

$$Y_{ikt} = -\left|\left(ln\mathrm{GDP}_{it} - ln\mathrm{GDP}_{it-1}\right) - \left(ln\mathrm{GDP}_{kt} - ln\mathrm{GDP}_{kt-1}\right)\right| \tag{14}$$

3.3.3. Fiscal policy convergence

$$\mathrm{FC}_{ijt} = \left|\frac{\mathrm{GbDef/Sur}_{it}}{\mathrm{GDP}_{it}} - \frac{\mathrm{GbDef/Sur}_{kt}}{\mathrm{GDP}_{kt}}\right| \tag{15}$$

To measure fiscal policy convergence, we follow Darvas et al. (2005). They measure fiscal convergence as absolute differences in government budget deficit/surplus between the two countries in question as a share of GDP.

3.3.4. Monetary policy similarity

$$\mathrm{MPS}_{ijt} = \left|\pi_{kt} - \pi_{kt}\right| \tag{16}$$

Monetary policy similarity is measured as absolute differences in inflation rate between country *i* and *k*.

3.3.5. Financial integration

- De facto financial integration:

$$\mathrm{FI}_{ikt} = \left[\left(\frac{\mathrm{CF}_{it}}{\mathrm{GDP}_{it}}\right) + \left(\frac{\mathrm{CF}_{kt}}{\mathrm{GDP}_{kt}}\right)\right] \tag{17}$$

De facto financial integration is measured as a sum of financial flows (outflows and inflows) between the countries of interest weighted by the sum of their GDPs.

3.3.6. Trade integration

$$\text{Trade}_{\text{Intense}} = \frac{2(X_{ikt} + M_{ikt})}{(Y_{it} + Y_{kt})} \tag{18}$$

Trade intensity is measured as a sum of exports and imports between the two countries under consideration weighted by the sum of their GDPs.

4. Results and discussion

The systems GMM estimation results are reported in Table 1.[5] For robustness of the results, we estimate different specifications of the model. An additional regressor is added in each column. Regardless of the number of variables added on the regression, the findings are consistent with expected signs and statistically significant coefficients.

Prior to discussing the findings and their implications, we look at the specification tests put forward by Arellano and Bover (1995). The tests are used to validate the instruments in our GMM estimation, and are reported in the lower panel of Table 1. The Arellano–Bond test for serial correlation is utilised to test whether a second-order serial correlation exists in the first differenced residuals. The null hypothesis tested is that there is no serial correlation. If the null hypothesis is rejected, it

Table 1. Systems GMM: factors influencing business cycle synchronisation

	Model 1	Model 2	Model 3	Model 4	Model 5
Lagged dependent var.	0.367***	0.324***	0.381***	0.377***	0.341***
	(0.013)	(0.013)	(0.011)	(0.009)	(0.027)
Trade intensity	0.224***	0.219***	0.160***	0.102*	0.079**
	(0.032)	(0.348)	(0.056)	(0.053)	(0.0 63)
De facto financial integration		−0.383***	−0.291***	−0.668***	−0.753***
		(0.058)	(0.071)	(0.135)	(0.098)
Monetary policy similarity			0.016	0.049***	0.055**
			(0.023)	(0.016)	(0.023)
Fiscal policy convergence				0.624***	0.455**
				(0.145)	(0.185)
Oil prices					−0.506***
					(0.212)
Arellano–Bond test for AR(1)	−4.98	−4.38	−4.15	−4.32	−4.24
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Arellano–Bond test for AR(2)	1.26	1.38	1.56	1.88	1.60
	[0.206]	[0.168]	[0.118]	[0.601]	[0.109]
Hansen test	65.83	59.98	54.95	56.54	54.76
	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]

Notes: In round brackets are standard errors, and in square brackets are *p*-values for corresponding tests.
In each model, an additional regressor is added, all models are estimated using GMM.
*Represents 1% levels of significance.
**Represents 5% levels of significance.
***Represents 10% levels of significance.

provides evidence that there is second-order serial correlation and the GMM estimator is inconsistent. In addition to the Arellano–Bond test for AR(2), we use Hansen's *J*-test to examine the null hypothesis of validity of the instruments. Rejection of the null hypothesis indicates that the instruments are not valid. The results reported in Table 1 show that there is no second-order serial correlation and that our instruments are valid across different specifications. We fail to reject the null hypothesis of no serial correlation and of the validity of instruments.

In line with Frankel and Rose (1998), Clark and van Wincoop (2001), Imbs (2006) and Cerqueira and Martins (2009), the study results suggest that trading countries with greater bilateral trade relations tend to have greater synchronisation of their business cycles. This implies that removal of trade restrictions will result in a higher degree of synchronisation since increased levels of trade will permit easy transmission of demand shocks across countries. In contrast to Kose et al. (2003) who find that the positive link between trade and business cycle comovements is limited only to industrial countries, we demonstrate that the relationship holds even in developing countries (see also Calderón, Chong, & Stein, 2007).

Our study findings suggest that SADC must strive to strengthen trade ties amongst member countries. Indeed, initiatives to reinforce trade relations in SADC are in place. For example, a SADC free trade area (FTA) was established in 2000. However, countries such as the Democratic Republic of Congo and Seychelles are not part of the FTA. If countries that remain outside the free trade area could join, the scope of intra-SADC trade could be expanded thus reinforcing business cycle comovements.

In addition, the results have far-reaching implications for the proposed SADC monetary union. As argued by Frankel and Rose (1998), if trade exerts a positive influence on business cycle comovements, then even a country that is not suitable *ex ante* to join a monetary union, can be justified *ex post* due to the resulting business cycle coherence.

Contrary to Imbs (2004) and Kose et al. (2003) who find that financially integrated countries tend to be highly synchronised, our findings suggest that financial integration results in diverging business cycles in SADC. This is in line with the predictions of risk sharing theory, which suggests that financial integration results in higher production and specialisation, and, therefore, induces industry-specific shocks, which translate into country-specific shocks and thus asymmetric business cycles (see Cerqueira & Martins, 2009; Kalemli-Ozcan, Sørensen, & Yosha, 2001). In addition, we argue that the behaviour of financial flows is procyclical, such that agents tend to pull their investments from countries experiencing downturns, to countries experiencing booms. Simply put, better performing economies tend to attract more financial inflows, resulting in decoupling business cycles (Backus & Kehoe, 1992).

Contrary to Moneta and Rüffer (2009) we find that real oil prices have a decoupling effect on business cycles across the region. In other words, our findings suggest that oil price shocks lead to asynchronous business cycles. We argue that the desynchronising effect of oil prices can be attributed to the fact that some countries in the SADC region are net oil exporters, and others are net oil importers. Real oil price shocks have a different impact on business cycles across countries, depending on whether a country is a net oil exporter, or net oil importer. Indeed, studies examining the relationship between oil prices and economic activity suggest that the response differs depending on whether a country imports or exports oil (see Cunado & Perez de Gracia, 2005; Hamilton, 1983; Jiménez-Rodríguez & Sánchez, 2005; Lardic & Mignon, 2008; Nzimande & Msomi, 2016). In addition, based on this finding, we argue that the view that global common shocks result in symmetric business cycles may not necessarily be correct. Common shocks will have a coupling impact, if and only if, economies share a common economic structure.

The study findings suggest that monetary policy similarity has a positive and statistically significant impact on business cycle comovements. The results are consistent with the existing literature (see Frankel & Rose, 1998; Otto et al., 2001, amongst others). These findings have far-reaching policy implications for the SADC region. They suggest that monetary policies should be coordinated in order to strengthen synchronisation of business cycles. Monetary policy coordination will also ensure that countries without monetary policy credibility import credibility from countries with credible central banks, such as South Africa.

Although there are no established theoretical linkages between business cycle comovements and fiscal convergence, empirical studies have suggested a positive link between the two variables (Artis, Fidrmuc, & Scharler, 2008). Indeed, our results suggest that there is a positive association between fiscal policy convergence and business cycle synchronisation in SADC. These findings are consistent with those of Darvas et al. (2005) and Artis et al. (2008). This finding is in line with the view that in a monetary union, fiscal policy must be countercyclical, rather than being 'procyclical' (see Fatas & Mihov, 2003). In addition, Carmignani and Laurenceson (2013) argue that coordination of fiscal policies could result in synchronised business cycles. Therefore, we suggest that fiscal policy restrictions be imposed across SADC member countries, and that policies be coordinated. Overall, our findings show that the SADC convergence criteria should give rise to further coupling effects because of convergent fiscal policies.

5. Concluding remarks

The study investigates the relationship between trade intensity, financial integration, fiscal policy convergence, monetary policy similarity, oil prices and business cycle synchronisation in SADC member countries, over the period of 1994–2014. In line with Frankel and Rose (1998), we confirm that business cycle comovement is endogenous, and thus the observed lower levels of synchronisation in SADC are not irrevocably fixed. In contrast to Krugman and Venables (1993), we find that intensifying trade results in more synchronous business cycles. In addition, all other variables, with the exception of oil prices and financial integration, have a positive impact on business cycle synchronisation. The adverse effect of financial integration on business cycles is in line with the predictions of 'risk sharing' theory. The risk sharing theory suggests that financial integration will induce industrial specialisation across the regions or countries leading to asymmetric shocks—thus decoupling business cycles. Furthermore, the negative influence of financial integration on business cycle synchronisation could be explained by the procyclical behaviour of financial movements. With regard to oil prices, we argue that their decoupling effect could be explained by the fact that some countries in the region are net oil exporters while others are net oil importers. Thus, oil price shocks have different impacts—depending on whether a country is a net importer or exporter of oil. Furthermore, we show that fiscal policy convergence and monetary policy similarity have a positive impact on business cycle comovements. Thus, the SADC convergence criteria should give rise to increased synchronisation due to convergent fiscal policies and similar monetary policies.

Overall, we conclude that indeed business cycle synchronisation is not irrevocably fixed, and is endogenous (Frankel & Rose, 1997). Thus, consistent with Flandreau and Maurel (2005), we recommend a rapid establishment of a SADC monetary union that is relatively independent of the attained degree of business cycle synchronicity. In addition, a number of studies have shown that a monetary union could be established even if countries are not synchronised *ex ante* because they can become more synchronised *ex post* (see Artis & Zhang, 1997; Fatás, 1997; Frankel & Rose, 1997, amongst others).

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Notes

1. SADC consists of 15 sovereign member countries, Angola, Botswana, Congo Democratic Republic, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.
2. See Arellano (2003) for more discussion.
3. Initially developed by Hansen (1982), Hansen and Singleton (1982).
4. Holtz-Eakin, Newey, and Rosen (1988) also suggest the same thing.
5. We also estimated fixed effects model and Generalised Least Squares estimators. The results are available upon request.

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