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# Determinants of Business Cycle Synchronisation in the Common Monetary Area in Southern Africa

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# Determinants of Business Cycle Synchronisation in the Common Monetary Area in Southern Africa


## Abstract

This paper examines the key factors that determine business cycle synchronisation in the Common Monetary Area in Southern Africa by applying the extreme bounds analysis. I investigate traditional structural indicators and policy indicators of output correlation with annual data from 1980 to 2018. A positive effect of sector homogeneity and trade intensity on business cycle synchronisation is identified. However, whereas sector homogeneity is a growing trend correlating with an increasing trend of cycle correlation, trade intensity is not. Instead, trade intensity increases significantly in periods of stagnant growth when cycle correlation is higher, but no long-term trend can be seen.



## Keywords

business cycle synchronisation, extreme bounds analysis, Common Monetary Area, monetary union

## Cover Page Footnote

I thank Professor of Economics, Natalie Chen for insightful discussions and helpful suggestions. Most of this research was conducted when I was URSS Researcher at the University of Warwick, Dept. of Economics, whose hospitality I gratefully acknowledge. All potential errors are mine. Until June 2021, correspondence to g.dillner@warwick.ac.uk

# 1 Introduction

Formally established in 1974, replacing the Rand Monetary Area, the Common Monetary Area (CMA) links together South Africa, Namibia, Eswatini (formerly Swaziland) and Lesotho into a monetary agreement. All four member states issue their own national currency, but only the South African rand is tender throughout the union. All national currencies are also exchanged at par with the rand. The CMA is not a full monetary union as it lacks regional surveillance of domestic fiscal and structural policies, a de jure common central bank, a common pool of reserves and a mechanism for fiscal transfers to counter asymmetric shocks. However, it is the only de facto monetary union in Africa that is located in a free trade area (SACU)[1], has no external exchange rate anchor, has a high level of capital mobility and whose main currency is governed by a flexible exchange rate regime (Wang et al, 2007). Understanding the nature of CMA is therefore crucial for policy makers trying to expand monetary cooperation across the African continent. Despite this, limited research on the endogeneity of its business cycle has been conducted.

To decrease the costs arising from the loss of national monetary policy tools, optimal currency area (OCA) -theory finds business cycle comovement or synchronisation (BCS) to be a necessary criterion for a monetary union (Mundell, 1961). Studying the determinants of this comovement is crucial for policymakers and for the application of structural policies. In the context of the CMA, a desynchronisation by the smaller nations from the South African business cycle typically inflicts recessionary damage to the national economy.

Existing literature can roughly be divided into three strands. Studies with a focus on whether the CMA may constitute an OCA (Matsaseng, 2008; Nielsen, Uanguta & Ikhide, 2005; Metzger 2004; Van der Merwe, 1996; Cobham & Robson, 1994), studies on the potential expansion of the union (Debrun, Masson & Patillo (2019; Nchake, Edwards & Rankin, 2018 ; Debrun & Masson, 2013; Mbonigaba & Holden, 2009) and studies with a focus on individual member states (Dwight, 2006; Gons, 2006; Lledo et al, 2005; Tjirongo, 1995). However, Nzimande & Ngalawa, 2017, despite examining the Southern African Development Community (SADC)[2] and not the CMA, offer an insightful analysis into the endogeneity of output correlation more broadly in Southern Africa. Employing a GMM methodology,

[1] The Southern African Customs Union (SACU) includes the CMA member states and Botswana.
[2] The SADC is an inter-governmental organisation with 16 southern member states including the CMA members.

they find trade intensity, fiscal policy convergence and monetary policy similarity to be robust determinants of BCS in the SADC.

The determinants of output correlation have been studied extensively for the United States, the eurozone and other currency areas. Numerous papers by Imbs (1998, 1999, 2004) stress the importance of similarity in industrial structure as a determinant of BCS among OECD countries. Rose and Engel (2002) argue that currency unions may also induce higher levels of output correlation. However, these variables appear fragile in studies such as Baxter and Kouparitsas (2005) and Young Ji and Sunghyun (2020). The former studies over 100 countries and find that virtually only bilateral trade and a binary variable of development (developed vs developing) seems to be robust determinants of BCS. Similarly, Young Ji and Sunghyun (2020) find that for 17 Latin American countries trade integration with the US is the only main variable behind BCS within Latin America.

Despite this quite rich literature, determinants of BCS have not yet been studied for the CMA. My research tries to fill the gap in the literature by explicitly asking the question: *what causes business cycles to synchronise in the CMA?*

I employ an Extreme Bounds Analysis-approach (EBA) following the paper by Böwer and Guillemineau (2006) to examine the determinants of BCS in the region between 1980 and 2018. This paper is the first to examine the variables affecting output correlation in the region. It is also the first paper to use EBA to study BCS in Africa. My findings are similar to those of Nzimande & Ngalawa (2017) that study the SADC but differ in two mains ways. Firstly, fiscal policy does not come out as a robust determinant of BCS for the CMA. Secondly, Nzimande & Ngalawa (2017) does not study the role of sector heterogeneity, a variable that appears robust in my results. These results have wide implications for policy makers in Southern Africa.

# 2 Methodology and data

## 2.1 The business cycle

There are numerous ways to generate a business cycle from a time series trend. A growing number of papers on business cycle analysis, however, use one or multiple filtering techniques to separate the cyclical component of a time series from raw GDP data, thus generating a business cycle. Despite having been criticized on various points, I use the Hodrick-Prescott (HP) filter to detrend my data. The HP filter is a high-pass filter, meaning it only removes the high frequency noise, in contrast to the Baxter-King and Christiano-Fitzgerald band pass filters which specify a range of frequencies for the stochastic cycle to pass through. In theory, the HP-filter should thus produce a less "representative" business cycle. However, this is mostly true for high-frequency data and hence different business cycles produced with the different filters come out as very similar for my annual data. Regressing bilateral correlation coefficients produced with these different filtering techniques against each other produces $R^2$-values between 0.94 and 0.98 (see Appendix I). The main advantage of the HP-filter, however, is that a higher number of observations is kept and not dismissed simply as noise. As my data is very limited, I stick with the HP-filter. To reduce the measurement errors, I follow the Ravn & Uhlig (2002) recommendations for scaled smooth parameters.[3]

To produce a measure of synchronisation, I use a process of moving-window correlations with a window of 8 years for the n(n-1)/2 number of country pairs. As correlations are bounded between -1 and 1, it is desirable to transform the measure to generate normally distributed residuals. To resolve this issue, I use the Fischer-transformation shown below:

$$TSYNCH_{ij} = \frac{1}{2}\ln\left(\frac{1 + synch_{ij}}{1 - synch_{ij}}\right)$$

where $synch_{ij}$ is the bilateral correlation coefficient between country $i$ and $j$.

## 2.2 Determinants relevant in the context of the CMA

Subject to data constraints, this paper looks at four main potential indicators of business cycle synchronisation. These are sector heterogeneity, trade intensity (proxied by import intensity), real interest rate differentials, and government expenditure differentials. The first two are traditional determinants in the sense that economic literature recognises their causal impact on business cycle synchronisation. The other two, real interest rate differentials and government expenditure differentials can be considered policy indicators and their effect on output correlation is more ambiguous. Below follow descriptions of all four indicators.

[3] Ravn-Uhlig suggest a scaled smoothing parameter of 6.25 for time-series with annual data. Using the smoothing parameter equation developed by Pollock (2000): $\psi(\omega) = \frac{4\lambda\{1 - \cos(\omega)\}^2}{1+4\lambda\{1 - \cos(\omega)\}^2}$ where $\psi(\omega)$ is the cut-off frequency, ω the number of periods and λ the smoothing parameter, is a solid alternative but the differences in final results are negligible in my case.

### 2.2.3 Traditional determinants

*Sector Heterogeneity*

The intuition behind sector **homo**geneity as a potential determinant is straightforward. External sector-specific shocks inflict similar effects on economies with similar sectorial structures (Stockmann, 1988). However, the empirical evidence in favour of a causal relationship between sector homogeneity and business cycle synchronisation is less evident. Examining a large set of developing and developed countries, Kray & Ventura (2001) report a significant positive relationship between 'specialization' and bilateral differences in business cycles whereas Baxter & Kouparitsas (2004) report no such relationship in the eurozone.

For simplicity, I calculate sector heterogeneity instead of sector homogeneity. The determinant is constructed as following:

$$SH_{i,j,t} = \sum_{n}^{N} \left| \frac{s_{n,i,t}}{s_{i,t}} - \frac{s_{n,j,t}}{s_{j,t}} \right|$$

where N represents the different economic sectors and $s_{n,i,t}$ is gross value added in sector $n$ of country i in period t and $s_{n,t}$ is the total gross value added of country i in period t.

*Import intensity*

Trade may be considered one of the strongest candidate variables to affect business cycle synchronisation. However, the direction of the effect is less obvious. The Krugman hypothesis states that as nations trade more, they exploit comparative advantages resulting in higher specialisation (Krugman, 1992). The specialisation in turn, results in a negative relationship between business cycle synchronisation and trade. On the other hand, spill-over effects due to technology and monetary innovations are often described in models of international trade as driving forces of business cycle synchronisation (Imbs, 2004).

In the case of the CMA, the region is highly open and there are virtually no trade barriers including transaction costs for currency conversion. Whereas the imports from South Africa has remained at very high levels for the smaller CMA countries the inverse is not true. The majority of Namibia's and Lesotho's exports are not destined for South African markets. There is thus room for increased trade linkages in the CMA.

Due to data constraints in terms of the availability of FOB export data, I am forced to use *import intensity* as a proxy for trade intensity. The determinant is constructed as following:

$$II_{i,j,t} = \frac{m_{ijt} + m_{jit}}{m_{it} + m_{jt}}$$

where $m_{ijt}$ is the value of imports that country i receives from country j in period t. $m_{it}$ is the total value of imports that country i receives.

### 2.2.4 Policy indicators

*Real interest rate differentials*

Since the introduction of national currencies in Namibia, Eswatini and Lesotho, these countries have, to a small extent, been in charge of their own monetary policy. The exchange rate arrangements in the CMA can roughly be seen as currency board arrangements but with the option for these institutions to buy domestic assets. This gives the smaller CMA countries some room to engage in discretionary monetary policy, for example by buying home-government debt obligations (Humpage & McIntire, 1995). However, it should be noted that bank deposit rates and real interest rates of the smaller nations move closely to that of South Africa. Any short-terms distortions from the comovement triggers an adjustment process (Wang et al, 2007). This relationship reflects the high level of financial integration in the region. Data from 1980 to 2018 confirm a strong comovement of real interest rates and virtually a linear relationship between bank deposit rates reflecting the high level of financial integration in the region (see Appendix II).

From a theoretical point of view, the effect of real interest rate differentials on cycle correlation is ambiguous. A change in the real interest rate typically inflicts a change to domestic output and thus we would expect small real interest rate differentials to correlate higher levels of cycle correlation. On the other hand, if governments' hands are tied in terms of monetary policy and an asymmetric external shock hits the region, we expect small real interest rate differentials to correlate with lower levels of cycle correlation. A third yet unlikely scenario for the CMA would be when central banks use discretionary monetary policy to counter business cycle desynchronisation with effects on the terms of trade.

The determinant is simply computed by taking the absolute difference in real interest rates as reported by the central bank of country $i$ and $j$ respectively in period $t$.

*Government expenditure differentials*

In the CMA, no formal arrangements of fiscal transfers to counter asymmetric shocks exist. Nor is there any rule-based framework for fiscal discipline as exists in the eurozone. However, revenues from SACU which amount to a substantial proportion of the government revenues for the smaller countries have been distributed relatively counter cyclical (Wang et al, 2007). As monetary and exchange rate policies are generally dictated by the CMA framework, fiscal policy seems to be the main tool for stabilization.

Theoretically, fiscal policy measures should behave similarly to the above-mentioned monetary policy determinant and the effect thus remains very much empirical.

The determinant is constructed in the following way:

$$GCED_{i,j,t} = \left| \frac{g_{i,t}}{GDP_{i,t}} - \frac{g_{j,t}}{GDP_{j,t}} \right|$$

where $g_{i,t}$ is the general government final consumption expenditure by country $i$ in period $t$ and $GDP_{i,t}$ is the GDP at constant 2010 US dollars in country $i$ in period $t$.

## 2.3 Extreme Bounds Analysis

To identify key determinants of output correlation in the CMA, I use the Extreme Bounds Analysis as developed by Leamer (1983). This approach is less data intensive than GMM and three-stage estimation (typically three-stage least squares or seemingly unrelated regression estimation) which are commonly used in studies of business cycle synchronisation. The latter usually requires the use of gravity variables which makes little sense in my case as these would exhibit little variation across a very small sample.

The EBA-estimation framework is characterized by two criteria for which the examined independent variables is subject to. Firstly, the coefficient on the variable of interest should remain statistically significant when the information set changes. Examining the eurozone, Böwer & Guillemineau (2006) use a 95% significance level, however due to my limited data and few country pairs I apply a 90 % significance level to the criterion. Secondly, the extreme upper bound (EUB) and the extreme lower bound (ELB) should not be different in sign. The EUB and ELB are defined as following:

$$EUB = \alpha_X^{max} + 2\sigma(\alpha_X^{max})$$

$$ELB = \alpha_X^{min} - 2\sigma(\alpha_X^{min})$$

where $\alpha_X$ is the coefficient on the variable X and σ its standard error. My regression framework to test the EBA on the variables is a high dimensional linear fixed effects regression. I apply pair fixed effects to account for the pairwise nature of my data. The moving-window correlations should partly account for lagged causality. The regression can be written as:

$$Y = \alpha X + \beta Z + u$$

where $Y$ is a vector of coefficients of bilateral output correlations. The $X$-variable is the variable of interest which is tested with the EBA-framework. These include the traditional determinants. The $Z$-variable represents a varying set of control variables.[4] These include the policy indicators. The sensitivity of $\alpha$ is tested subject to alterations in $Z$.[5]

## 2.4 Dataset and countries of interest

My dataset covers the four countries making up the CMA between 1980 and 2018 i.e., South Africa, Namibia, Eswatini and Lesotho. This timeframe is determined fully by data constraints. However, the starting point for this timeframe seems exogenous to my variables of interest as varying the start and end date of the dataset does not result in significantly different results. The main shock to the region is the fall of the Apartheid regime in 1994 when the countries' business cycles synchronise as initially output falls for South Africa which has consequences for the smaller member states. Out of the four countries, South Africa is by far the largest economy with about 95 % of total GDP in 2019. To a large extent, the South African business cycle determines the regional economic performance and any divergence from it by smaller member states may cause complications for policy makers in these countries as the monetary policy is de facto determined by South Africa. My data confirm this as well as shown in Appendix II.

The data used in this paper is collected from various databases at UN agencies and institutions. To construct a measure of business cycle synchronisation and a government expenditure variable, data on government expenditure and GDP is taken from the World Bank databank, World Development Indicators. For the former, the general final consumption expenditure includes all goods and services purchased by the government and

[4] To avoid multicollinearity, Levine & Renelt (1992) suggest a maximum of eight variables in the information set. Thus, in my case, multicollinearity is unlikely.

[5] The command *reghdfe* is used in STATA. Statistics are robust to heteroskedasticity in all regressions

most expenditures on national defence except military expenditure that are part of government capital formation.

The gross value added data underlying the sector heterogeneity variable is from the UN Statistics Division. The seven sectors included are agriculture, hunting, forestry, fishing; mining, manufacturing, utilities; manufacturing; construction; wholesale, retail trade, restaurants, and hotels; transport, storage and communication; other activities.

Finally, to construct a measure of import intensity, trade data are taken from the UN Comtrade database (reported in 2010 US dollars).

A brief overview of the performance of these variables across pairs is provided in Appendix III.

# 3 Results and implications

## 3.1 Traditional determinants

*Sector heterogeneity*

Sector heterogeneity (SH) comes out as a negative significant determinant of bilateral cycle correlation across the whole time series sample. Across large parts of the sample, as cycle correlation increases sector heterogeneity decreases. For the multivariate regression with the complete information set and for the bivariate regression without the information set the coefficient is significant at the 90 % level.

The variable passes the EBA-test as the ELB and EUB never change sign and every multivariate regression is significant at least at the 90 % level (see Appendix V.A) The $\alpha_{X}$-coefficient is negative in all regressions indicating that there is a positive relationship between sector **homo**geneity and cycle correlation. This reflects the trend of increased sector homogeneity and more cycle correlation across large parts of the sample. For example, sector **hetero**geneity between South Africa and Lesotho drops from 0.82 in 1980 to 0.16 in 2017, and between Namibia and Swaziland from 0.65 to 0.10 over the same period. This is most likely driven by the convergence reported by Dlamini, 2011.

*Import intensity*

Import intensity comes out as clearly robust and positive. In particular, the determinant increases during periods of stagnant growth such as during the Great Recession (see Appendix IV). During these periods in the sample, cycle correlation is very high hitting numbers above 1 for numerous country pairs. This relationship translates to high p-values both for the bivariate and multivariate regressions. For the bivariate regression without the information set, the coefficient is significant at the 99 % significance level with an $R^2$ of 0.1412.

The variable passes the EBA-test by a margin with a 95 % significance level in all regressions (see Appendix V. B). The $\alpha_{X}$-coefficient is consistently positive and the ELB and EUB never change signs. However, what is interesting to note is that trade intensity does not follow an increasing trend like cycle correlation. Instead, the variable correlates with specific short-term fluctuations in the cycle correlation trend but otherwise stays relatively stable.

It is important to understand that the level of trade intensity between the CMA countries have always been high, especially measured in African standards. The smaller nations, especially Lesotho and Eswatini have developed a strong dependence on South African imports and these account to 83 % and 74 % respectively of all imports to these countries in 2018 [6]. These very high levels of trade intensity may remain stable or decrease in the future but are unlikely to further increase.

## 3.2 Policy indicators

*Real interest rate differentials*

It is not a surprise that the monetary policy-variable does not come out as a robust determinant of cycle correlation. Regressing the real interest rate differentials against the dependent variable gives a very insignificant p-value (0.774). The variable does not pass the EBA-test.

As described, the CMA is a de facto monetary union and the room for discretionary monetary policy by the smaller CMA countries is small. However, these results do not necessarily confirm that view as there are numerous channels of transmission for monetary policy to influence cycle correlation.

*Government expenditure differentials*

Without much room for discretionary monetary policy, fiscal policy is naturally the best way to counter short term business cycle desynchronisation. Despite this, government expenditure differentials is not a robust variable in the EBA-framework. The bivariate regression with only the dependent variable gives a very insignificant p-value (0.596). However, in the regressions where it does come out as robust (all the regressions with import intensity included), it is clearly negative

[6] Author's calculations

suggesting that distortions in government expenditure is slightly linked to desynchronisation. Despite these results not being robust, policy makers in the smaller CMA states are advised to be careful in distorting from South African fiscal policy in the long run.

### 3.3 Implications

EBA cannot be considered a causal analysis, hence my approach relies on economic theory in the choice of $X$-variables as potential determinants (Levine & Renelt, 1992). In the economic literature, my traditional determinants, trade intensity and sector homogeneity, have been considered to have a causal impact on cycle correlation (Böwer & Guillemineau, 2006). For the variables denoted "policy indicators", on the other hand, the causal direction is less clear. My results are very much in line with this strand of business cycle literature. The policy indicators are not robust in my regression framework and distortions in government policies are expected to have limited impact on cycle correlation. It is unclear if active fiscal policy is used to (re)synchronise with the general business cycle trend in the region. The latter scenario would only be true for the smaller CMA countries. To conclude, policy makers in the smaller CMA countries are, to a certain degree, not restrained by desynchronisation when engaging in active fiscal policy making.

The traditional determinants of synchronisation, trade intensity and sector homogeneity, are clearly robust in the regression framework. This implies a strong correlation between these variables and cycle correlation. For trade intensity this is particularly true. The results are partly in line with the research of Frankel and Rose (2001). They conclude that trade effects cycle correlation and that membership in a monetary union increases trade, jointly *called endogeneity of the OCA-criteria*. Due to no data before the creation of the CMA, my research cannot confirm the latter part of the criteria. It is possible that the share of intra-union trade as a share of total trade has reached a ceiling for the CMA and may decline in the future as the smaller CMA economies turn into modern open economies. However, the observation that intra-union trade as share of total trade increases during periods of lower GDP growth is certainly interesting. This trend may act as a resynchronisation mechanism for smaller CMA countries if their GDP growth rates decline relative to the South African GDP growth rate. However, more research is needed on this topic and on trade in specific sectors. For instance, similarity in manufacturing sectors may contribute more to cycle correlation due to more extensive value chains.

In contrast to trade, sector homogeneity follows an increasing trend that correlates with business cycle synchronisation. This trend is mostly driven by sectorial modernisation of the smaller CMA economies. For example, between 1980 and 2017, the agricultural sector in Eswatini shrinks from 22,0 % of total gross value added to 9.8 %, from 21.9 % to 6.2 % in Lesotho and from 9.3 % to 6.5 % in Namibia. During the same period, the South African share drops from 3.0 % to 2.5 %.[7] Not only does this increase sector homogeneity with South Africa, it also increases similarity in the sectors that contribute the most to business cycle synchronisation. Similarity in the mining sector does not necessarily increase cycle correlation as shocks to the mining sector may be very dependent on certain goods. For instance, if the South African diamond industry is hit by an external shock, the Namibian copper industry will most likely not be affected or at least to a much smaller extent. This effect is typically less visible in the manufacturing and finance industries where customers and suppliers are much more intertwined (Böwer & Guillemineau, 2006).

My findings suggest that policy makers in the smaller CMA countries who wish to increase business cycle synchronisation with South Africa should aim to increase sector homogeneity by encouraging investment in certain key sectors such as telecom and transport.

One should be very careful in applying these results to potential members of the CMA. Even for SACU-member, Botswana, results may differ significantly. Botswana is less dependent on South African trade and has quite a different business cycle with higher levels of growth.[8] However, what might be said is that countries with similar sectorial structure as South Africa are likely to be better candidate members.

# 4 Concluding Remarks

The story of business cycle synchronisation in the CMA has very much been a story of (1) periods of stagnant GDP growth and (2) sectorial modernisation. The former point is not unique for the CMA and most monetary unions initially increase their cycle correlation in periods of recession. The latter point offers great insight for policy makers in the CMA who wish to increase cycle correlation in the union. These are also important findings for policy makers of potential member states who strive to enhance their chances of membership. Trade intensity is at high levels in the region and will probably not further increase cycle

[7] Author's calculations.
[8] Despite this, Botswana as well as the existing CMA countries would most likely benefit from Botswanan membership. See Debrun, Masson & Pattillo (2019) for a detailed analysis of the benefits.

correlation in the future. It does, however, correlate strongly with business cycle synchronisation, especially during periods of low GDP growth, acting as a resynchronisation mechanism for the smaller CMA countries should they desynchronise from the South African business cycle. In addition, I find no evidence that distortions in fiscal policy across the region would decrease business cycle synchronisation in the short term.

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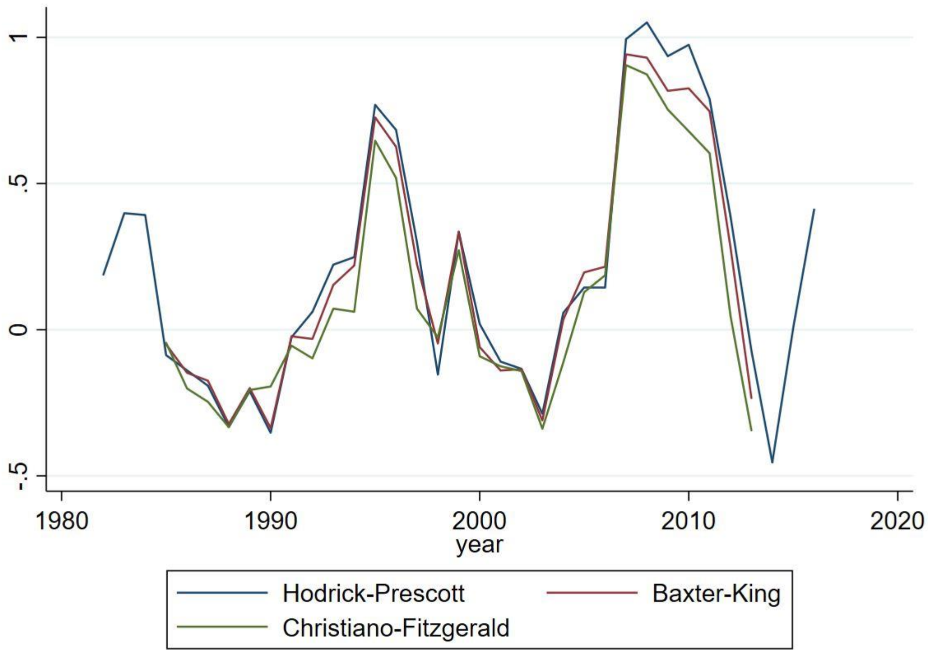
# 6 Appendix

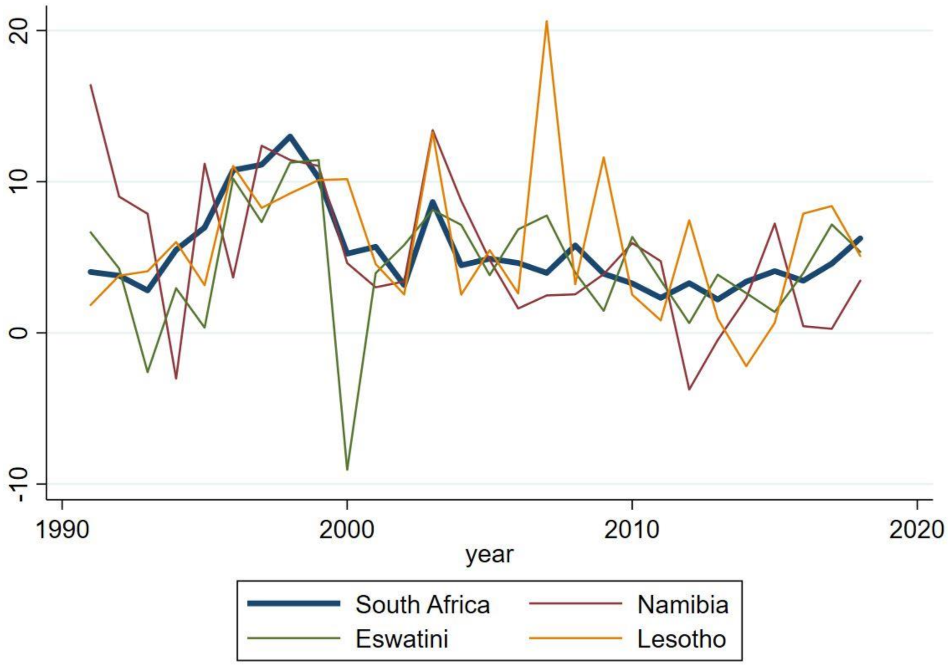
**APPENDIX I. Mean values of bilateral correlation coefficients produced with three different filtering techniques**




A mean value of bilateral correlation coefficient above 1 is possible due to the Fischer-transformation describe previously. Stronger periods of synchronisation include the years immediately after the fall of Apartheid in 1994 and the Great Recession, two periods with significant decline in GDP growth across the region.

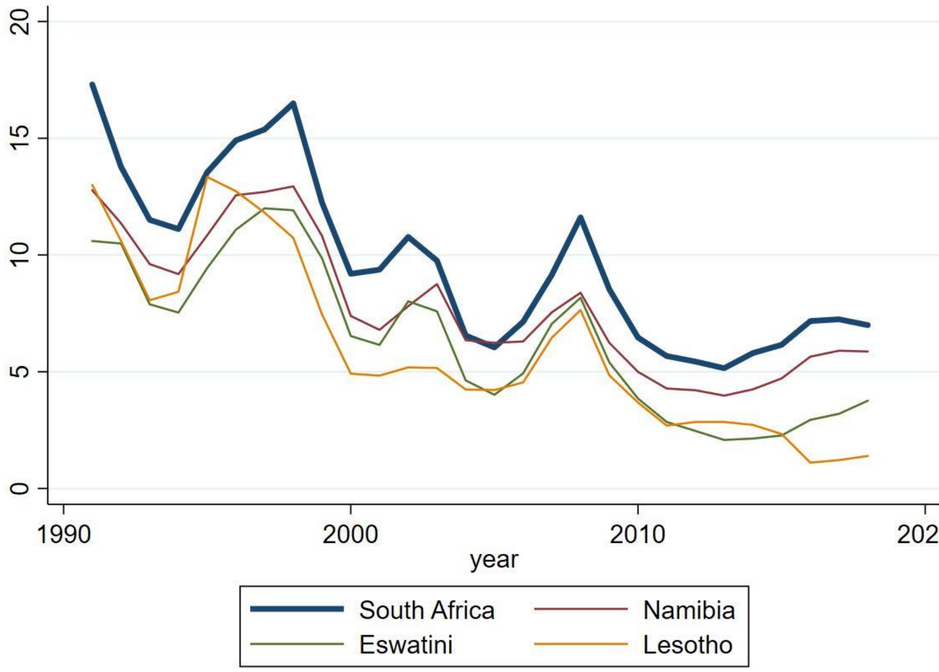
## APPENDIX II. Comovement of real interest rates and deposit interest rates

### Real interest rates between 1991 and 2018




Since the independence of Namibia, the real interest rates of the three smaller nations have generally moved closely around the South African real interest rate.

**Deposit interest rates between 1991-2018**



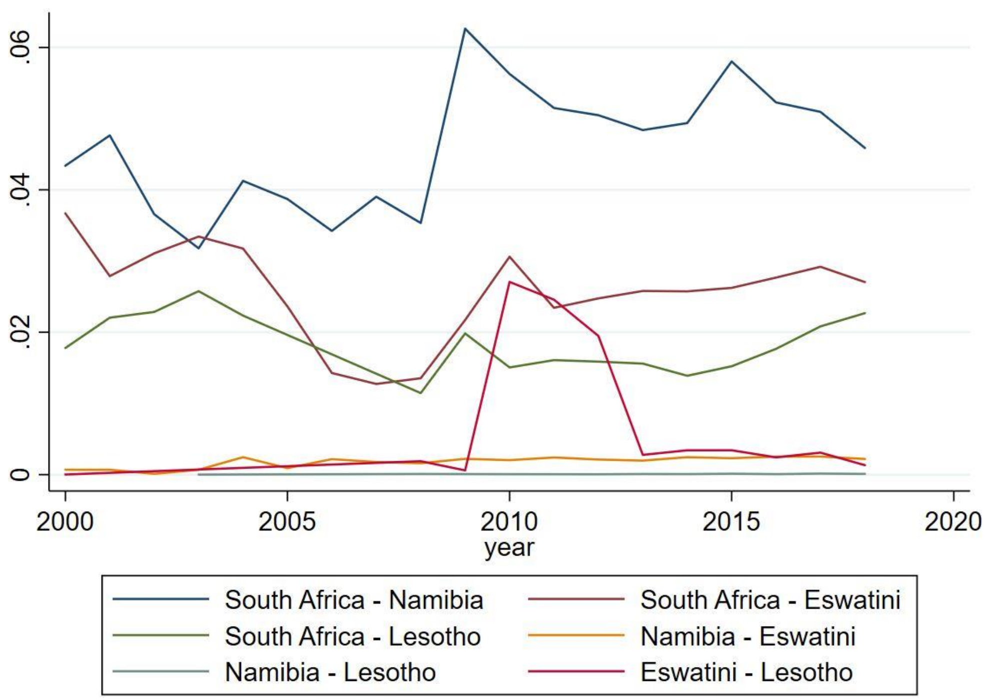

Deposit interest rates i.e. the rates paid by commercial banks for savings deposits generally move in a linear relationship between the smaller CMA countries and the rate of South Africa. Data are taken from the World Bank World Development Indicators. These data confirm the level of financial integration in the region driven by the South African banks First National Bank, Nedbank and Standard Bank that have a majority of the market share in the smaller CMA countries (Wang et al, 2007).

**APPENDIX III. Overview of bilateral dataset**

| | ZA - NA | ZA - ES | ZA - LS | NA - ES | NA - LS | ES - LS |
|---|---|---|---|---|---|---|
| Import intensity | 0.046 | 0.0266 | 0.0184 | 0.00178 | 8.57E-05 | 0.0075 |
| Sector heterogeneity | 0.261 | 0.537 | 0.435 | 0.562 | 0.309 | 0.651 |
| Government expenditure differentials | 0.0644 | 0.0361 | 0.129 | 0.0963 | 0.143 | 0.109 |
| Real interest rate differentials | 3.416 | 4.278 | 3.349 | 5.507 | 4.948 | 5.845 |
| Business cycle synchronisation | 0.112 | 0.537 | 0.203 | 0.0571 | 0.599 | -0.235 |

The variables are expressed as bilateral averages across the sample (1980 - 2018). ZA, NA, ES and LS stand for South Africa, Namibia, Eswatini and Lesotho respectively. Note that the three pairs that include South Africa have on average higher values for import intensity and business cycle synchronisation reflecting the dominance of South Africa in the union.

**APPENDIX IV. Import intensity during the Great Recession**




Note that import intensity increases rapidly during the Great Recession but otherwise stays surprisingly unchanged over the long term.

## APPENDIX V. A. Extreme-bounds analysis results for sector heterogeneity

| | (1) | (2) | (3) | ELB | EUB |
|---|---|---|---|---|---|
| Sector Heterogeneity | -0.590* | -0.587* | -0.609* | -1.141 | -0.028 |
| | (0.283) | (0.280) | (0.266) | | |
| Real Interest Rate Differentials | | -0.000869 | 0.00248 | -0.036 | 0.0289 |
| | | (0.0158) | (0.0130) | | |
| Government Expenditure Differentials | | | -1.030 | -4.354 | 2.140 |
| | | | (1.662) | | |
| Constant | 0.469** | 0.471** | 0.566** | | |
| | (0.144) | (0.156) | (0.202) | | |
| Fixed effects | Yes | Yes | Yes | | |

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

## APPENDIX V. B Extreme-bounds analysis results for trade intensity

| | (1) | (2) | (3) | ELB | EUB |
|---|---|---|---|---|---|
| Trade Intensity | 16.09*** | 14.57*** | 11.67** | 4.133 | 21.494 |
| | (2.704) | (2.790) | (3.771) | | |
| Real Interest Differentials | | -0.0413** | -0.0346* | -4.182 | 0.026 |
| | | (0.0137) | (0.0135) | | |
| Government Expenditure Differentials | | | -2.687** | -4.751 | 2.140 |
| | | | (0.748) | | |
| Constant | -0.0466 | 0.124 | 0.390* | | |
| | (0.119) | (0.147) | (0.183) | | |
| Fixed effects | Yes | Yes | Yes | | |

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$