FINANCIAL INCLUSION AND FINANCIAL STABILITY IN SUB-SAHARAN AFRICA (SSA)

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Abstract
Recently, financial inclusion has become a key strategy for developing to enhance economic and financial development. However, a recommendation that banks should contain systemic risk and maintain their stability as important lesson from recent global financial crisis, puzzles the concordance between financial inclusion and financial stability. Few empirical studies investigated both negative and relationships suggested by recent literatures between stability and inclusion. This study used Generalized Method of Moments for dynamic panel data to explore such a relationship in 35 Sub-Saharan African countries for the period 2004-2011. The variables utilized are bank-z score for financial stability; outstanding deposits with and outstanding loan from commercial banks commercial banks for financial inclusion; and GDP per capita, inflation domestic credit provided to private sector by banks, and financial crisis are used as control variables. The findings show that outstanding deposits with commercial banks negatively affect financial stability. This implies that deposit accounts held with the banks are less diversified in SSA. Outstanding loans from commercial banks have a positive role on financial stability. In terms of controlling variables greater GDP per capita helps financial stability while inflation, financial crisis, and credit to private sector have adverse effect of financial stability.

Key words: financial stability; financial inclusion; banking sector; Generalized Methods of Moments; Sub-Saharan Africa.

1. Introduction
Since last decade, financial inclusion has become a core objective of many developing nations as a strategy to further develop their economies and financial systems. Furthermore, a number of scholars have found that the prevailing poverty in the less developed economies is directly linked to financial exclusion. For any financial system to be inclusive (providing basic financial services to all segments of the society), the stability is required. However, few studies carried out on financial inclusion and financial stability suggested both positive and negative effects of financial inclusion on financial stability, although very few empirical studies have confirmed this relationship.

The World Bank defines financial inclusion or a broad access to financial services as absence of price or non price barriers in the financial services. That is to ensure equal opportunities to access and use of basic financial services (i.e. savings, payments, transfer to credit and insurance) among the population. Khan (2011) explains financial inclusion as the process of ensuring access to financial services and timely and adequate credit where needed by vulnerable groups such as weaker section and low income groups at an affordable cost. Financial inclusion primarily represents access to bank account backed by deposit insurance, access to affordable credit and payments system.

European Central Bank defines financial stability as a condition in which the financial system – intermediaries, markets and market infrastructures – can withstand shocks without major disruption in financial intermediation and in the effective allocation of savings to productive investment (ECB, 2012). In other words financial system is stable when it is capable of facilitating the performance of economy, and dissipating both endogenous and exogenous financial imbalances (Schinasi, 2004).
While as it follows from the key lessons of the recent financial crisis that financial institutions could contain systemic risks and maintain financial stability, at the same time developing economies seek to promote financial inclusion towards economic and financial development. These two strategies may be subject to conflict because when the banks attempt to contain systemic risk, it can lead to reducing facilitation of financial services to the vulnerable and low income groups. Thereby the question whether the two can concord to serve the same goal is raised. Given the scarcity of the literatures on this relationship and the absence of this kind of study particularly in SSA, this motivates the selection of the present topic in order to shed light on the conditions of financial stability and financial inclusion in SSA as the least developed in term of financial system.

Households and firms especially in low-income countries face difficulties accessing financial services due to several reasons including: limited branches of banks and other financial institutions, limited availability of automated teller machines, relatively high costs of servicing small deposits and loans, limitation of satisfactory personal identification, lack of collateralizable assets and credit information and limited financial literacy.

This study seeks to empirically explore the link between stability and inclusion aspects of financial system in SSA whose financial system is dominated by banking sector and still undeveloped compared to the rest of the world (Moyo, J et al., 2014). Only 24% of adults possess a bank account at formal financial institutions (a common measure used to capture the financial inclusion) in the Sub-Saharan Africa (SSA) although Africa’s formal financial sector has shown sustained strong growth in recent years (M. Shahul Hameedu, 2014). Having identified the nature of this association between financial inclusion and financial stability, appropriate policies to improve both financial inclusion and stability for the welfare of the whole economy would be devised.

The remainder of this study is organized as follows: the second section will highlight conditions of financial stability in SSA, banking system in SSA, and previous literatures on the relationship between financial inclusion and stability; the third section will contain the methodology used to analyze the above relationship; the forth section reports the results and their discussion; and finally, the fifth section concludes.

2. Literature Review

In addition the previous literatures on the relationship between financial inclusion and stability, the present section also briefly presents conditions of financial inclusion, and banking system in SSA.

Banking systems in SSA

Compared to other developing regions of rest of the world, financial sectors in SSA are underdeveloped. The banking systems accounts for the preponderance of financial sector assets and activities. Over the past decade the depth and coverage of financial systems underwent gradual increase. However the scale of financial intermediation and access to financial services are still lower as a result of low levels of income, small absolute size, and infrastructure weakness. Most of banking systems in SSA are characterized by: absolutely and relatively small size; low loan-deposit ratios; short-term maturity for lending, where about 60 percent of loans have to be redeemed with a period of less than one year; oligopolistic structures of market, i.e a big proportion of total assets accounts for by few largest banks; typical high cost operations; limited provision of financial services to the population, where the number of unbanked population is huge with small and medium enterprises (SMEs) are facing troubles to access any form of loan (Mlachila, M., et al, 2013). There are new forces at work in the SSA which are potential to improve financial sector. Such include: (i) evolution of information and communication technologies (ICT) that has shown its capability to expand access to financial services in SSA, especially for rural populations. Recent M-PESA that is a mobile phone-based payments system and M-KESHO (a phone-based deposit accounts, where customers without physical access to a bank can access financial savings services at a low cost) experience of Kenya illustrates how ICT can produce a hitting financial innovation. (ii) Pan-African Banking Groups. The initiative of pan African banking groups namely Bank of Africa, Ecobank, Stanbic and United Bank for Africa operating in numerous countries of SSA reinforced competition in national banking system and aided to propagate new technologies. (iii) Regional financial integration. Having noticed that small economic size of national markets continues to slow down the SSA financial systems development, countries choose to integrate their markets and it has been found out that this promotes financial depth.
Snapshot of financial inclusion in SSA

The table below is a snapshot of financial inclusion in SSA, where the reported figures are for 2014 unless otherwise noted and adult denotes anyone whose age is 15 years and above.

**Table 1: Financial inclusion in SSA**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account (% age 15+)</td>
<td></td>
</tr>
<tr>
<td>All adults</td>
<td>34.2</td>
</tr>
<tr>
<td>Women</td>
<td>29.9</td>
</tr>
<tr>
<td>Adults belonging to the poorest 40%</td>
<td>24.6</td>
</tr>
<tr>
<td>Young adults (% ages 15–24)</td>
<td>25.9</td>
</tr>
<tr>
<td>Adults living in rural areas</td>
<td>29.2</td>
</tr>
<tr>
<td>Financial Institution Account (% age 15+)</td>
<td></td>
</tr>
<tr>
<td>All adults</td>
<td>28.9</td>
</tr>
<tr>
<td>All adults, 2011</td>
<td>23.9</td>
</tr>
<tr>
<td>Mobile Account (% age 15+)</td>
<td></td>
</tr>
<tr>
<td>All adults</td>
<td>11.5</td>
</tr>
<tr>
<td>Access to Financial Institution Account (% age 15+)</td>
<td></td>
</tr>
<tr>
<td>Has debit card</td>
<td>17.9</td>
</tr>
<tr>
<td>Has debit card, 2011</td>
<td>15.0</td>
</tr>
<tr>
<td>ATM is the main mode of withdrawal (% with an account)</td>
<td>53.8</td>
</tr>
<tr>
<td>ATM is the main mode of withdrawal (% with an account), 2011</td>
<td>51.7</td>
</tr>
<tr>
<td>Use of Account in the Past Year (% age 15+)</td>
<td></td>
</tr>
<tr>
<td>Used an account to receive wages</td>
<td>7.3</td>
</tr>
<tr>
<td>Used an account to receive government transfers</td>
<td>3.8</td>
</tr>
<tr>
<td>Used a financial institution account to pay utility bills</td>
<td>2.8</td>
</tr>
<tr>
<td>Other Digital Payments in the Past Year (% age 15+)</td>
<td></td>
</tr>
<tr>
<td>Used a debit card to make payments</td>
<td>8.7</td>
</tr>
<tr>
<td>Used a credit card to make payments</td>
<td>1.9</td>
</tr>
<tr>
<td>Used the Internet to pay bills or make purchases</td>
<td>2.4</td>
</tr>
<tr>
<td>Domestic Remittances in the Past Year (% age 15+)</td>
<td></td>
</tr>
<tr>
<td>Sent remittances</td>
<td>28.7</td>
</tr>
<tr>
<td>Sent remittances via a financial institution (% senders)</td>
<td>31.0</td>
</tr>
<tr>
<td>Sent remittances via a mobile phone (% senders)</td>
<td>30.8</td>
</tr>
<tr>
<td>Sent remittances via a money transfer operator (% senders)</td>
<td>21.0</td>
</tr>
<tr>
<td>Received remittances</td>
<td>37.2</td>
</tr>
<tr>
<td>Received remittances via a financial institution (% recipients)</td>
<td>26.6</td>
</tr>
<tr>
<td>Received remittances via a mobile phone (% recipients)</td>
<td>27.6</td>
</tr>
<tr>
<td>Received remittances via a money transfer operator (% recipients)</td>
<td>22.1</td>
</tr>
<tr>
<td>Savings in the Past Year (% age 15+)</td>
<td></td>
</tr>
<tr>
<td>Saved at a financial institution</td>
<td>15.9</td>
</tr>
<tr>
<td>Saved at a financial institution, 2011</td>
<td>14.3</td>
</tr>
<tr>
<td>Saved using a savings club or person outside the family</td>
<td>23.9</td>
</tr>
<tr>
<td>Saved any money</td>
<td>59.6</td>
</tr>
<tr>
<td>Saved for old age</td>
<td>9.8</td>
</tr>
<tr>
<td>Saved for a farm or business</td>
<td>22.7</td>
</tr>
<tr>
<td>Saved for education or school fees</td>
<td>22.9</td>
</tr>
<tr>
<td>Credit in the Past Year (% age 15+)</td>
<td></td>
</tr>
<tr>
<td>Borrowed from a financial institution</td>
<td>6.3</td>
</tr>
<tr>
<td>Borrowed from a financial institution, 2011</td>
<td>4.8</td>
</tr>
<tr>
<td>Borrowed from family or friends</td>
<td>41.9</td>
</tr>
<tr>
<td>Borrowed from a private informal lender</td>
<td>4.7</td>
</tr>
<tr>
<td>Borrowed any money</td>
<td>54.5</td>
</tr>
</tbody>
</table>
Borrowed for a farm or business & 12.8 \\
Borrowed for education or school fees & 12.3 \\
Outstanding mortgage at a financial institution & 5.2 \\

Source: Global Financial Inclusion Database; “the little data book on financial inclusion, 2015”

The most striking challenges to access formal financial services include the lack of revenue, high costs, distance to formal financial institutions, and documentation for opening and maintaining an account at formal financial institution. In this regard some people prefer to use informal ways of banking such as savings clubs based in their communities. Furthermore, lack of efficient ways to transfer money, access to credit and insurance, a place to save money securely are cited to make the public obstructed from investment (Triki, T., & Faye, I., 2013).

Relationship between financial inclusion and financial stability

Previous scholars have suggested both negative and positive effect that financial inclusion could have on financial stability.

According to Khan (2011) three ways through which financial inclusion promotion can enhance financial stability are: (i) diversification of bank assets resulting from lending to small firms is likely to reduce the overall riskiness of financial institution’s loan portfolio. In this case since the relative size of any single borrower in the overall portfolio will be reduced, the portfolio volatility tends to be reduced as well; (ii) increasing the number of small savers can also increase the size and stability of deposit base. This will reduce bank’s dependence on non-core financing that tends to be more volatile during a crisis; (iii) a better transmission of monetary policy may also result from greater financial inclusion; this also contributes to financial stability.

Low income groups are considered to be relatively immune to economic cycle. Including them in the financial sector tends to increase the stability of deposit and loan bases (Hannig and Jansen, 2010).

Khan (2011) also identifies ways through which greater financial inclusion could negatively affect financial stability. Examples are: (i) lending standards will be reduces as the financial institutions attempt to increase the number of borrowers; (ii) reputational risk of banks could be increased if they outsource various functions such as credit assessment in the process of reaching small borrowers; and (iii) if microfinance institutions are not properly regulated, an increase in lending by group could dilute the overall effectiveness of regulation in the economy and increase financial systemic risks.

Majnoni and Uribe (2006) in a study of Chilean banks found that systemic risk of the small firms is greater than that of large firms. This implies that small and medium-size enterprises should reduce the overall riskiness of banks’ lending portfolio, hence enhancing financial stability.

Morgan P. and V. Pontines (2014) empirically analyzed the causality between financial inclusion and financial stability. They found that financial stability is improved through increasing share of lending to small and medium-sized enterprises mainly by reducing non-performing loans and the probability of default by financial institutions. This confirms the positive relationship running from financial inclusion to financial stability through lending to medium-size enterprises.

Using the measures of financial inclusion to check its effect to the maximum drop in bank deposit growth, Han and Melecky (2013) concluded that 10% increase in the share of people that have access to bank deposits could reduce the deposit growth drops (or deposit withdrawal rates) by 3 to 8% points. This also supports a positive relationship between financial inclusion and financial stability.

3. Methodology

This section presents the data, model and method used to estimate the relationship between financial inclusion and financial stability in SSA.

Model

To analyze the link between financial inclusion and financial stability this study uses a dynamic regression model of the form:
The recent global financial crisis was assigned the crisis as a dummy variable are also considered. Since there is no consensus on how long it lasted, recent global financial crisis was assigned the values for the years 2007, 2008 and 2009. That is because it is likely to have had severe impact during that period as it is commonly believed to have started in the middle of 2007 and tremendously observed in the third quarter of 2008.

**Estimation technique**

In economics and other fields, panel data is commonly used with the need of empirical support. It provides the strong advantage of combining both times series and cross section aspects of the data. It is also called longitudinal or cross sectional time series data. This combination of data allows controlling individual specific observable and unobservable aspects that may be linked to independent variables.

For the reasons mentioned this study uses system-GMM dynamic panel estimator to estimate the equation (1). GMM estimation method is based on differencing in order to eliminate the entity-specific effects. The system-GMM developed by Blundell and Bond (1998), combines difference regression with level regression. The GMM estimator requires instruments to address the potential endogeneity that stays after differencing and newly constructed error term. The developers of this estimator suggested using lagged differences and levels of corresponding variables as suitable instruments.

Consistency of the GMM estimator depends on the validity of instruments. To confirm this assumption Sargan test suggested by Arrellano and Bond (1991), Arrellano and Bover (1995), and Blundell and Bond (1997) is considered. It is a test of over-identifying restrictions, which checks the overall validity of instruments by analyzing the sample analogue of the moment conditions used in the estimation process. Another important test examines the hypothesis that the error term $e_{it}$ is not serially correlated. In both the difference regression and the system difference-level regression it is tested whether the differenced error term is second-order serially correlated. Failure to reject the null hypotheses of both tests results in supporting the developed model. Appendix (B) gives a short detail on panel data estimators.

4. **Results and discussion**

Table 2 reports the autocorrelation of the variables used by this study to estimate the link between financial inclusion and financial stability in SSA.
As it can be seen from table 2, there is high positive correlation among few independent variables such as DCP and DEP, DCP and LOAN, and DEP and LOAN. Including the highly correlated variables in the same regression equation may cause multicollinearity issues that could lead to misleading results of estimation. In this regard, different alternatives will be made running the regression to account for the consistency of the findings.

**Dependent variable: Bank Z-score**

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>BZ(-1)</td>
<td>0.149185</td>
<td>(0.035496)</td>
<td>[0.0000]</td>
<td>0.125214</td>
<td>(0.014137)</td>
</tr>
<tr>
<td>DCP</td>
<td>-0.056264</td>
<td>(0.038396)</td>
<td>[0.1445]</td>
<td>-0.031886</td>
<td>(0.016478)</td>
</tr>
<tr>
<td>DEP</td>
<td>-0.102849</td>
<td>(0.016824)</td>
<td>[0.0000]</td>
<td>-0.143030</td>
<td>(0.014175)</td>
</tr>
<tr>
<td>FCRIS</td>
<td>-0.986278</td>
<td>(0.268600)</td>
<td>[0.0003]</td>
<td>-1.135126</td>
<td>(1.653908)</td>
</tr>
<tr>
<td>LGDP</td>
<td>36.44201</td>
<td>(7.373487)</td>
<td>[0.0000]</td>
<td>29.20504</td>
<td>(5.198893)</td>
</tr>
<tr>
<td>INF</td>
<td>-0.028975</td>
<td>(0.019726)</td>
<td>[0.1436]</td>
<td>-0.003867</td>
<td>(0.010694)</td>
</tr>
<tr>
<td>LOAN</td>
<td>0.147599</td>
<td>(0.044301)</td>
<td>[0.0000]</td>
<td>0.111454</td>
<td>(0.018256)</td>
</tr>
<tr>
<td>SARGAN TEST (p-value)</td>
<td>0.657099</td>
<td>0.210093</td>
<td>0.398730</td>
<td>0.307628</td>
<td>0.438879</td>
</tr>
</tbody>
</table>

Note: Values in () and [ ] indicate the standard error and p-values respectively

Due to high correlation observed among some variables (see table 2), five regressions were run as shown by each of the columns in the table for results in order to account for potential multicollinearity.
The estimated results (see table 3) report negative coefficients on domestic credit to private sector by banks, outstanding deposits with commercial banks, inflation, and financial crisis. This reflects a negative relationship between these variables and the bank $z$-score. Outstanding loan from commercial banks, and GDP per capita positively related to the bank $Z$-score. Generally, the coefficients from different regression equations are significant except for inflation and financial crisis. Both Sargan test for instrument validity and serial correlation test for autocorrelation among the residuals produce $p$-values that are greater than five percent.

**Discussion**

The positive sign on the coefficient of outstanding loan from commercial banks implies that greater lending leads to greater stability of the banking system. This is normal since one of the best avenues the banks can use to raise the funds needed to smoothly maintain their basic financial functions is the interest reaped from lending.

The outstanding deposits with the commercial banks show a negative sign. This relationship indicates that greater deposits cause high probability of bank default. Prior studies have shown that during the periods of financial stress, depositors tend to withdraw their deposits. Therefore, if the deposits are held among a restricted number the banks will find themselves unable to properly fulfill their role during periods of hardship. This finding predicts that in the SSA the number of depositors is still low and less diversified.

In terms of the control variables it has been found that the GDP per capita is positively related to the financial stability. The good performance of an economy tends to lower the default probability of the banks. So, countries with high income or increasing income will see their banks assuring their functions properly because as the increase in income incentivizes the users of bank services to increase their spending or simply extend the economic activities.

The negative coefficient on domestic credit to private sector by banks indicates that high borrowing made by the banking sector leads to high probability of default of banking systems. It can be understood from here that the private sector in the SSA is not yet strong enough to lead the growth of these economies. This is because if the lending to them can expose the debtors to default risk, it is sign that they are themselves easy to go bankrupt.

The adverse effect of inflation on the bank’s performance is as expected since it can easily worsen the asymmetric information between borrowers and lenders. Unstable prices create the likelihood for misperceptions about the future return possibilities such that investors restrict their borrowings and banks reschedule lending policies. Lastly, another interesting finding is a negative sign of financial crisis coefficient. This indicates that financial crisis has potential effect of reducing financial stability.

The standard diagnostic tests for the efficiency of the used regression model show the absence of misspecification issues. From the reported $p$-values, the Sargan Hansen test fails to reject the null hypothesis that instruments are valid. In the same context the hypothesis of non existence of second order correlation among the residuals could not be rejected as follows from the $p$-values. This gives evidence that the regression model used in this study fits the data.

5. **Conclusion and Recommendations**

This study empirically explored the relationship between financial inclusion and financial stability in SSA using data spanning from 2004 to 2011 for 35 countries of SSA.

Of two variables used to represent financial inclusion, it was found that greater outstanding loan from commercial banks leads to financial stability. However outstanding deposits with commercial banks have adverse effect on financial stability. This reveals the lack of diversification among users of financial services in SSA.

Regarding controlling variables, economic growth helps financial stability, while inflation and domestic credit provided to private sector by banks cause financial instability. Due to its domination over other financial sectors in SSA, banking sector was the focus of this study as a representative of financial system.

To sum up, the properly improved financial inclusion can help to achieve greater stability of financial system in SSA.

Based on the findings of this study following recommendations can be drawn:

Diversification in deposits is needed. Formal financial institutions should relax the requirements for opening and holding an account with them in order to facilitate the low income group to access prior financial services. Also the governments could consider providing financial literacy among
the population for the welfare of both countries’ financial system and users. Where possible the government should be active advisors of private sector for its proper management since this sector is likely to be the key leader of countries’ macro-economy. The good performance of private sector is welcoming environment for jobs and hence improving the lives of especially low income groups.

Considering that a number of borrowers and savers use community-based banking methods due to some facts including high costs of financial services and distance to formal financial institutions, the governments should strive to identify these groups to upgrade them into microfinance institutions. Due to short period for availability of indicators of financial inclusion, this study was had to cover a number of countries for regression analysis. However countries in SSA might have their individuality even though they share some important features. In this regard, primary data based studies on individual countries should be undertaken to capture the potential differences and suggest more policies accordingly.

6. References


7. Appendix

A. List of sub-Saharan African countries
1. Angola*
2. Benin*
3. Botswana*
4. Burkina Faso
5. Burundi*
6. Cameroon*
7. Cabo Verde
8. Central African Republic*
9. Chad*
10. Comoros
11. Congo, Rep. (Brazaville)
13. Cote d'Ivoire*
14. Djibouti
15. Equatorial Guinea*
16. Eritrea
17. Ethiopia
18. Gabon*
19. The Gambia*
20. Ghana*
21. Guinea*
22. Guinea-Bissau
23. Kenya*
24. Lesotho*
25. Liberia
26. Madagascar*
27. Malawi*
28. Mali*
29. Mauritania*
30. Mauritius*
31. Mozambique*
32. Namibia*
33. Niger*
34. Nigeria*
35. Rwanda
36. Sao Tome and Principe
37. Senegal*
38. Seychelles*
39. Sierra Leone*
40. Somalia
41. South Africa*
42. South sudan
43. Sudan*
44. Swaziland *
45. Tanzania *
46. Togo *
47. Uganda *
48. Zambia *
49. Zimbabwe

Note: countries marked with * are the only sampled for regression analysis

**B. Panel data estimation methods**

The general econometric framework of a panel data as found in numerous econometrics books e.g. Wooldridge, J. M. (2010) and Baltagi, B. (2008) has the form:

\[ Y_{i,t} = \beta X_{i,t} + \gamma Z_i + \alpha_i + \epsilon_{i,t} ; \quad (i=1, \ldots, N ; \quad t=1, \ldots, T) \]  (2)

Where, Y is the dependent variable, and X and Z are independent variables. \( \beta \) and \( \gamma \) are respectively the coefficients linked to time variant and time invariant variables. \( \epsilon \) is the panel data error term and is supposed to be uncorrelated to X or Z at any point of the time. i and t denote entity and time respectively. The issue in panel data is the existence of a is the error term associated with the time invariant and this can change with time or entity. It is possible to be correlated with some X and Z. Once it is correlated with variables (X, Z) the estimate of \( \beta \) and \( \gamma \) are likely to be biased using ordinary least square (OLS) or generalized least square (GLS) method. The fixed effect method is commonly used to capture the individuality of entities as it creates intercept of each entity. Alternative to fixed effect is the random effect that creates intercept of each entity.

The following equation is the general form of time fixed effect panel data model:

\[ Y_{i,t} = \beta X_{i,t} + \alpha_i + \epsilon_{i,t} ; \quad (i=1, \ldots, N ; \quad t=1, \ldots, T) \]  (2*)

Observing both (2) and (2*) there is absence of time invariant variables.

The generalized method of moments (GMM) is primarily used in panel data econometrics to estimate dynamic models (Holtz-Eakin et al., 1990; Arellano and Bond, 1991; and Arellano and Bover, 1995). It addresses the issues induced by unobserved entity-specific effects and joint endogeneity of explanatory variables (Levine et al., 2000).

Following Greene (2001), consider the general heterogeneous panel data framework:

\[ Y_{i,t} = \alpha Y_{i,t-1} + \beta X_{i,t} + \gamma + \epsilon_{i,t} \]  (3)

GMM estimation method is based on differencing in order to eliminate the individual-specific effects. Applying this, the equation (3) looks like:

\[ \Delta Y_{i,t} = \alpha \Delta Y_{i,t-1} + \beta \Delta X_{i,t} + \Delta \epsilon_{i,t} \]  (4)

Having eliminated the specific effect through differencing, there would still be the presence of endogeneity of explanatory variables and newly constructed error term \( \Delta \epsilon_{i,t} \) related to \( \Delta Y_{i,t-1} \) that require instruments. With the assumptions that the error term should not be serially correlated, and that explanatory variables are weakly exogenous, the GMM for dynamic panel estimator uses the moment conditions below (Arellano and Bond, 1991):

\[ E[Y_{i,s,t}(\epsilon_{i,t} - \epsilon_{i,t-1})] = 0 ; \quad for \quad s \geq 2 ; \quad t=3, \ldots, T , \quad (5) \]

\[ E[X_{i,s,t}(\epsilon_{i,t} - \epsilon_{i,t-1})] = 0 ; \quad for \quad s \geq 2 ; \quad t=3, \ldots, T . \quad (6) \]

Based on these conditions, the GMM estimator is referred to as the difference estimator.

It has been statistically shown that when the explanatory variables are persistent over time, lagged levels of these variables are weak instruments for the regression equation in differences. The weakness of instruments influences the asymptotic and small sample performance of difference estimator. Asymptotically, the variance of the coefficients rises. In small samples, Monte Carlo experiments show that the weakness of instruments can produce biased coefficients.

To reduce the potential biases and imprecision associated with the usual difference estimator, Arellano and Bover (1995), and Blundell and Bond (1998) suggested using GMM system estimator that combines difference regression with level regression. The instruments for difference regression are same as above. The instruments for the regression in levels are lagged differences of the corresponding variables. These are suitable instruments under the additional assumptions below: even though there may be correlation between the levels of the explanatory variables and the individual-specific effects in the initial equation, there is no correlation between the differences of these variables and the individual- specific effects.
The additional moment conditions for the second part of the system are:

\[ E[(Y_{i,t-3} - Y_{i,t-1})(u_{i,t} - \varepsilon_{i,t})] = 0; \text{ for } s=1 \] (7)

\[ E[(X_{i,t-3} - X_{i,t-1})(u_{i,t} - \varepsilon_{i,t})] = 0; \text{ for } s=1 \] (8)

Hence the four conditions presented in previous equations and GMM procedures were used to generate consistent and efficient parameter estimates.

C. Descriptive statistics

The table below shows the summary statistics for the used variables

<table>
<thead>
<tr>
<th>TABLE 4 Summary Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>BZ</td>
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<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Median</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Std. Dev.</td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
</table>