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INCLUSIVE FINANCE, GROWTH AND SOCIO-ECONOMIC DEVELOPMENT IN SAUDI ARABIA: A THRESHOLD COINTEGRATION APPROACH*

SALEM HATHROUBI

Al-Imam Muhammad Ibn Saud Islamic University, Kingdom of Saudi Arabia

Empirical literature argues that financial inclusion has positive impact on growth, reduce inequality and poverty. This paper has twofold. First, it aims to provide a measurement of financial inclusion in the Kingdom of Saudi Arabia (KSA) as an oil-rich economy during the period 1980-2016 by the construction of a comprehensive index. Second, we study the incidence of financial inclusion on growth and human development through a set of socioeconomic leading variables. Using GMM methodology, our results suggest that financial inclusion is highly and positively correlated to human development index, and to employed share of adult population. Conversely, financial inclusion is insignificantly negatively correlated to per capita real GDP and highly negatively correlated to the share of rural population and to the share of women in adult population. In this study we take in consideration the non-linearity between inclusive finance, economic growth and human development by performing threshold cointegration and Granger-causality tests. Our findings show that there is non-linear causal relationship between financial inclusion, human development and economic growth in the long-run while in the short-run neither financial inclusion nor economic growth Granger-causes each other. This result is in concordance with previous empirical studies in the case of oil-based economies. Our findings could help policy-makers and regulators in KSA to design an inclusive financial sector taking into account the specificities of the Saudi economy.

Keywords: Inclusive Finance, Economic Growth, Human Development, Threshold-cointegration, TVECM, TGC
JEL Classification: G21, O16, O50

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1. INTRODUCTION

The relationship between financial development and economic growth has been examined extensively in the literature, but the effects of financial development and economic growth on socio-economic development is relatively scant. Since the start of the 20th century economists have highlighted the importance of financial development in the process of economic growth. Schumpeter (1911) supports that financial development leads economic growth, while Robinson (1952) argues that finance does not cause growth, but rather, it responds to demands from the real sector. Currently, there are several exiting views. According to the first view financial development is a "sine qua non" condition to economic growth and to a global socio-economic development (the supply-leading response). Cameron (1967), Goldsmith (1969), McKinnon and Chaw (1973) were the first to highlight the importance of liberalized financial system. They postulated that government intervention in the financial system of a country, which they termed "financial repression", inhibits growth by depressing real interest rates. Later, many studies argue that financial deepening is vital to economic growth since it increases savings and facilitates capital accumulation leading to greater investment. Recent empirical works find positive causal relationship between economic growth financial development and identify two distinct channels, the accumulative channel which emphasizes the finance-induced positive effects of physical and human capital accumulation (Pagano, 1993; De Gregorio and Kim, 2000) and the allocative channel which focuses on the rising efficiency of resource allocation which is caused by financial deepening and which subsequently enhances growth (King and Levine, 1993; Chistopoulos and Tsionas, 2004).

The second view maintains that it is economic growth that drives the development of the financial sector (Rajan and Zingales, 1998; Ang and Mckibbin, 2007) (the demand-following response). As economy grows, it generates demand for financial services, so the lack of financial institutions in developing countries is due to the lack of the demand to their services. Growth creates opportunities and increases the return on investment, stimulating demand for credit. Concurrently, growth increases wealth and the pool of savings that could be available for credit supply, provided that a sophisticated financial system is in place to intermediate between savers and borrowers (Ben Naceur et al., 2014).

The third view contends that both financial development and economic growth Granger-cause each other, i.e. that there is a bi-directional causality between financial development and economic growth. Patrick (1966) was the first to posit that financial deepening as an outcome of economic growth, which in turn feeds back as a factor of real growth. Works by Greenwood and Jovanovic (1990), Greenwood and Bruce (1997) and Berthelemy and Varoudakis (1997) among others support this view. In this line, Abu-Bader and Abu-Qarn (2008), using data from Egypt, concluded that there exist a bi-directional causality between financial development and economic growth and that financial development causes economic growth through increasing resources for

investment and enhancing efficiency.[1]

In recent years, the paradigm of financial inclusion emerged and economists try to understand the microeconomic relations between financial development, economic growth and other socio-economic variables like poverty, unemployment and exclusion. Inclusive finance; safe savings, appropriately designed loans for poor and low-income households and for micro, small and medium-sized enterprises, and appropriate insurance and payments services; can help people help themselves to increase incomes, acquire capital, manage risk and work their way out of poverty. The central question asked in this field is how to bring access to these fundamental services to all people in developing countries and thus accelerate their economic development and that of their countries.

The concept, financial inclusion, was initially referred to the delivery of financial services to low-income segments of society at affordable cost. Recently, the concept has evolved into four dimensions. Mirakhor and Zamir (2012) formulated them as follows: 1- easy access to finance for all households and enterprises, 2- Sound institutions guided by prudential regulation and supervision, 3- Financial and institutional sustainability of financial institutions and 4- Competition between service providers to bring alternatives to customers.

According to Kelkar (2010), Financial Inclusion is perceived as a quasi-public good in most of the developing countries in the sense that it's non-rival in consumption and non-excludable. The degree of 'publicness' in financial inclusion may be different from a typical public good like 'defense'. But being as important as access to water, energy, health services, or basic education, it does qualify to be termed as 'quasi-public good' (Gupte et al., 2012). This recognition has made financial inclusion a policy objective for policy makers and others engaged in developmental activities. As a quasi-public good the government should provide it with other agencies.[2]

World Bank Global Findex Report (2014) indicates that in 2008 there are about 2.7 billion people in the world which are excluded from financial services and they are about 2 billion in 2014. Saudi Arabia as an oil-based economy is one of the wealthiest countries in the world. It's classified among the high income economy with a high Human Development Index (HDI) but still with a non-generalized financial system and a low financial inclusion index (World Bank Report, 2014). The purpose of this research

[1]A forth view, usually scant in the literature, was put forward by Lucas (1988) and supported by Stern (1989), states that financial development and economic growth are not causally related. Other empirical studies highlight the potential negative effects of financial development on economic growth (see De Gregorio and Guidotti (1995), Loayza and Ranciere (2005)).

[2]In this field one should distinguish between conventional inclusive finance and Islamic inclusive finance. Islamic finance addresses the issue of inclusive finance from two directions, one through promoting risk-sharing contracts which provide an alternative to conventional debt-based financing and the other through specific instruments of redistribution of the wealth among the society. This discussion is beyond the scope of this paper. For more details see Ben Naceur et al. (2015).

is to measure the proportion of financially excluded in Saudi Arabia, as an oil-rich resource economy, and its consequences on growth and socioeconomic development. Most of the papers in the finance led growth literature drop natural-resource-based economies, arguing that economic development is driven by different factors and that the financial sector has different role and structure compared to non-based-natural-resource economies. The context of a natural-resource-dominated economy is worth to study in that resource-based countries can be subject to the natural resource curse in financial development (Beck, 2011). In this kind of economy, financial repression leads banks to offer less credit to the private sector especially small and medium enterprises leading to less financial inclusion.

This paper attempts to study the causality relationships between financial inclusion and standard measures of economic development and economic well-being in the context of an oil-based economy, the Kingdom of Saudi Arabia (KSA). To this end, we first measure the extent of financial inclusion in the KSA over time according the availability of the data. Then, using the computed index, we study, in a first step, the relationships between financial inclusion and socioeconomic variables (GDP, HDI, share of rural population, share of women in the adult population, immigrants) using the Generalized Method of Moments (GMM). In a second step we focus our analysis on the causal interactions between economic growth, inclusive finance and human development taking into account threshold effects. Our analysis will be assessed on non-linear Granger-causality and Threshold Vector Error Correction Model (TVECM). To the best of our knowledge no previous study, has calculated over time the inclusive financial index (IFI) for Saudi Arabia and use it to study the interaction between financial inclusion, economic growth and other socio-economic variables. The remainder of the paper is organized as follows: Section 2 contains a survey of prior literature. Section 3 briefly exposes the methodology to construct and compute a financial inclusion index for Saudi Arabia (more details are presented in Appendix 1). Section 4 studies the interactions between financial inclusion and socioeconomic variables with particular attention to the Saudi Arabian Paradox. Section 5 presents data and the model specification. In Section 6 we analyze the empirical findings of the GMM methodology and the causal relationships from a trivariate threshold vector error correction model integrating IFI, HDI and economic growth. Section 7 concludes the paper and proposes some political recommendations.

2. LITERATURE REVIEW

Since the contribution of King and Levine (1993), economists have shown renewed interest in the finance-growth nexus. Many works have shown that considerable part of the differences in long-run economic growth across countries can be elucidated by disparity in their financial development (King and Levine, 1993; Levine and Zervos, 1998; Demirguc-Kunt and Maksimovic, 1998; Rajan and Zingales, 1998; Beck et

al.,2006). Recent literature emphasizes the importance of financial inclusion as a broader concept than financial depth. Financial inclusion has proven to be linked to desirable outcomes above and beyond those associated with financial depth (Ben Naceur et al., 2015). Financial inclusion aims at addressing systemic change and institutional strengthening to attain both social targets and operational and financial sustainability. Understanding the specific constraints generating lack of financial inclusion in an economy is critical for tailoring policy recommendations. The survey of the literature reveals that there are three main constraints that stand out for financial inclusion namely, geography or physical access, lack of proper documentation and high prices and minimum account requirements and fees (Demirgüç-Kunt, 2010). Relaxing these kinds of constraints could lead to more access to credit, an increase in entrepreneurship and poverty reduction. Beck et al. (2007) show that financial development can alleviate poverty as the poor benefit enormously from basic payments and insurance services that can help smooth shocks. Using a panel of 26 countries, Pradhan et al. (2017a) examine the cointegrating and causal relationships between insurance market development (IMD) and economic growth and investigate the dynamic interrelationships amongst a number of important macroeconomic variables on IMD-growth nexus. The study uses two traditional measures of insurance market development, insurance density and insurance penetration. Their findings affirm a long-run equilibrium relationship between insurance market development, economic growth, and six other macroeconomic variables. The study recommends that future studies on economic growth must include the development of the insurance market as a key variable.

Pradhan et al. (2017) examines the relationships between economic growth and four different types of financial development in Asean Regional Forum (ARF) countries. Using principal component analysis (PCA) to construct development indices, and a panel vector auto-regressive model to test for Granger causalities, the study demonstrates unidirectional and bidirectional causality between the variables. The paper recommends making banking more accessible to residents without bank accounts in ARF countries and promoting stock market development to facilitate access to investment capital in order to enhance economic growth.

In explaining the differences in financial depth across countries, the empirical literature distinguishes between structural factors and policy factors. Structural factors are country-specific characteristics that cannot be altered by policy factors in the short-run. Structural factors, such as, income per capita, population size and population densities, urban versus rural, natural nonrenewable-resources GDP ratio, can promote financial inclusion (Demetriades and Fielding, 2012). For example, larger population and higher density can have deeper financial penetration and lower cost of financial intermediation from economies of scale. Policy sensitive factors, such as, inflation, fiscal balance, contract enforcement and property rights, credit infrastructure, market liberalization, are also found to be relevant in creating an enabling environment for financial inclusion (Demetriades and Fielding, 2012; Ahokpossi, 2013; Ben Naceur et al., 2015). For example, Demetriades and fielding (2012) investigate the determinants of

individual banks' loans in African countries and find that banks are reluctant to lend despite liquidity and low inflation, because infrastructure to screen and monitor borrowers is not developed. Thus, banking infrastructure is expected to reduce information asymmetries between lenders and borrowers and boost financial development. It's also ascertained that governance and institutional variables, such as, government effectiveness, control of corruption and rule of law, and political stability, play a role in financial inclusion/exclusion. According to Alter and Yontcheva (2015), improved financial supervision and financial sector governance contribute to promoting financial development.

Although financial deepening has accelerated in emerging market and low-income countries over the past two decades, firms continue to face barriers in accessing financial services. According to the World Bank (2014), 51% of firms in advanced economies use a bank loan or line of credit as compared with 34%in developing countries. Given that financial inclusion is multi-dimensional, policy implications to foster financial inclusion are likely to vary across countries. For example, Dabla Norris et al. (2015) find that as financial inclusion increases, income inequality first increases and then decreases in low-income countries consistent with Kuznets' hypothesis. By contrast, in emerging market economies the Kuznets' pattern is not observed. Their findings suggest that country-specific characteristics play a central role in determining the impacts, interactions, and trade-offs between macroeconomic variables and policies.

Although there is a growing literature on inclusive finance and its effect on sustainable and inclusive growth and poverty reduction in less-developed and emerging countries, it's worth noting that the context of natural-resource-based economy has been relatively scant in the literature. Exceptions are papers by Badeeb et al. (2016), Samargandi et al. (2014), Nili and Rastad (2007) and Beck (2007). Badeeb et al. (2016) empirically examine the existence of an oil curse in the finance-growth nexus for Malaysia. They study the direct and indirect effects of financial development and oil dependence on investment and then on economic growth. Their results reveal that symptoms of an oil curse exist and that the interactive relationship between financial development and oil dependence affects the level of investment in Malaysia.

Beck (2007) finds no significant difference in the impact of financial development on economic growth between both oil-based economies and non-oil-based countries. His findings are in opposition to those of Nili and Rastad (2007) who find that financial development has weaker effect in oil-exporting countries than in oil-importing countries. They argue that this result is not only due to the high dependence on oil in the former but also because of the general inefficiency of financial institutions in oil-dependent countries. In the specific case of Saudi Arabia, Samargandi et al. (2014), using ARDL approach, find that financial development has a positive impact on the growth of non-oil sector. In contrast, they find no evidence of an impact on oil-sector and a negative but insignificant impact on total GDP growth.[3] Their results are in line with Al-Malkawi

[3]Studies focusing on a single country case are numerous. See among others, Bader et al. (2008) for Egypt,

and Abdullah (2011) who argue that the financial sector in Saudi Arabia is still in the transition stage and it needs to pass the threshold point of development before it could instrumental in promoting economic growth. These results highlight the specific nature of oil and resource-based economies which do not necessarily follow the same pattern as manufacturing economies. Our purpose is to contribute to this debate and fill the gap of the literature by studying the case of one of the most important oil-based economy, Saudi Arabia.

3. INDEX OF FINANCIAL INCLUSION (IFI): CONSTRUCTION AND COMPUTATION FOR SAUDI ARABIA

The construction of a comprehensive financial index follows the methodology employed by international institutions such as United Nations Development Program (UNDP) for Human Development Index (HDI) and Human Poverty Index (HPI) and refers to works by Sarma (2008, 2012), Gupte et al. (2012) and Arora (2010). In the appendix we present the employed methodology and its implementation for Saudi Arabia. From the results we can depict that KSA has a low financial inclusion till 2004 (IFI<0.3), becomes medium financial inclusion during the period 2005-2008 (0.3<IFI<0.6) and it could be considered, according to our calculation, as a high financial inclusion economy in the last decade. This growth can be attributed mainly to the development of the bank sector which accounts in 1995, 1192 bank-branches and 1937 in 2015 and then a mean growth rate of about 37 new branches each year. Indeed, since the beginning of the 21 century the Saudi authorities have launched a number of reforms of the financial system. These include the introduction of new laws, for small-medium-sized enterprises loan guarantee scheme and the liberalization of insurance of banking licenses to non-Saudi banks. These reforms allowed the expansion and diversification of financial services beyond commercial banks with wider reach and access. They aimed at developing a more diversified intermediation framework, with a larger role for the private sector to meet the financing needs of the population. One of the purposes of this paper is to test in which extend the improvement of financial sector has participated to economic growth and to the inclusion of number of socioeconomic categories like women, rural and immigrants.

4. INCLUSIVE FINANCE, INCLUSIVE GROWTH AND SOCIO-ECONOMIC DEVELOPMENT

Policies for inclusive growth are an important component of most government strategies for sustainable development and poverty reduction. Financial inclusion is one

Muhsin and Pentecost (2000) for Turkey and Al-Malikawi et al. (2012) for UAE.

of the main instruments that could help governments to achieve these goals. Empirical evidence suggests that improved access to finance is not only pro-growth but also pro-poor, reducing income inequality and poverty (Beck et al., 2008).

Financial inclusion encompasses improving the range, quality and availability of financial services to the underserved and the financially excluded. Expanding the reach of financial access holds significant promise to enhance the livelihood and well-being of the poor and the growth of small and medium enterprises. It's argued in the literature that there exist two channels through which financial inclusion could impact human well-being of the population. One works indirectly through growth. The other works directly through the poor benefiting from accessing financial services. Concerning the indirect channel, although the earlier researches (Kuznets, 1955; 1963) suggested that economic growth may increase income inequality at the early stage of development, but reduces it at the mature stage of industrialization, a consensus has emerged recently among big number of economists that economic growth overall leads to poverty reduction through job creation and the reduction of wage differential between skilled and unskilled labor (Galor and Tsiddon, 1996). Higher growth could also lead to high tax revenues, enabling the government to allocate more fiscal resources on social spending such as health, education, and social protection, and hence benefiting the poor (Perroti, 1993). Aghion and Bolton (1997) argue that capital accumulation increases with high economic growth and more funds will be available to the poor for investment purposes, thus increasing their income and reduce poverty. Other empirical researches (Datt and Ravallion, 1992; Kakwani, 2000; Fields, 2001) attempted to explain changes in poverty in terms of a "growth effect", stemming from a change in average income, and a "distribution effect", caused by shifts in the Lorenz curve holding average income constant. They find the growth effect to explain the largest part of observed changes in poverty. Fields (2001) qualifies that the extent of the impact of growth on poverty alleviation depends on the growth rate itself and the initial level of inequality. Ravallion and Chen (1997) show that a 10% increase in the mean standard of living leads to an average reduction of 31% in the proportion of the population below the poverty line, indicating that growth leads to a reduction in poverty incidence.

The direct channel is assessed on the belief that inclusive financial development can directly contribute to poverty reduction by providing or broadening the poor's access to financial services (Aghion and Bolton, 1997). In a panel of 67 low-and-middle income countries, Boukhatem (2016) showed that financial development has an important contribution to the reduction of poverty. It's argued that under a perfect financial market people with entrepreneurial abilities can become entrepreneurs whether they are rich or poor because everybody has equal access to the required funding. Contrarily, imperfect financial market affects the level of education or the level of human capital of the poor, thereby promoting persistent poverty. Poor people are usually credit constraint because of the lack of collateral. These credit constraints restrict the poor from exploiting investment opportunities, thus slowing aggregate growth by keeping capital from flowing to its highest-value use. A poorly functioning financial system will produce

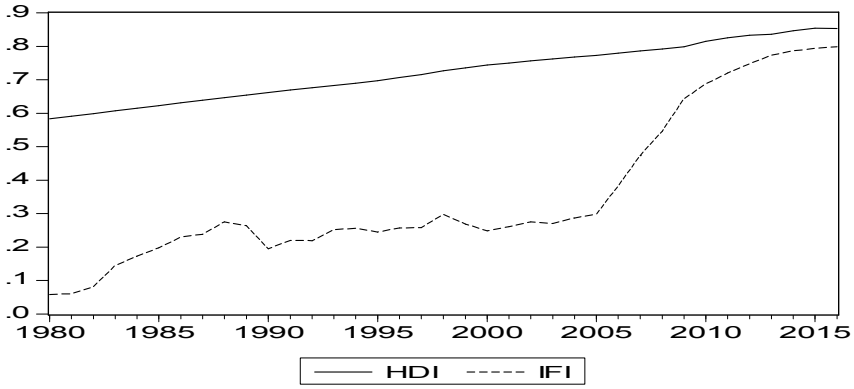
higher income inequality by disproportionately keeping capital from flowing to "wealth-deficient" entrepreneurs. Inclusive financial sector development reduces information and transaction costs and, therefore exerts a positive impact on the poor. Fields (2001) argued that through better access to credit, the poor are given the opportunity to participate in more productive endeavors, in turn increasing their incomes. Access to financial services also enables the poor to better respond to economic or health-related shocks, reducing the likelihood of falling into poverty when such shocks occur.

In some, financial inclusion can act as a fundamental source of poverty reduction. This implies that poverty causes low demand for organized financial system and financial exclusion causes poverty. Therefore, there could exist a bidirectional cause and effect relationship between poverty and financial inclusion.

4.1. IFI, HDI and the Saudi Arabian Paradox

Sarma (2008, 2010, 2012) and Sarma and Pais (2011) have shown that countries with low income have low IFI. A comparison of IFI with human development index (HDI) shows that all countries with high and medium IFI values belong to the group classified by the United Nations Development Program (UNDP) as countries with high human development (HDI>0.7). In the study of Sarma, the case of Saudi Arabia was treated as an exception in the sense that it is a high income country with high level of HDI but with a low level of IFI (according to her calculation). In the specific case of Saudi Arabia the low level of IFI could be explained, among other reasons, by the way the author has calculated the geographic penetration dimension. Saudi Arabia has an area of about 2149690 km^2 but a huge zone (Rub' Al-Khali which signifies the empty quarter) covering 650000 km2 is inhabitant. In this study we revise the calculation of IFI for Saudi Arabia by reconsidering these geographic characteristics. If we compare our results (Table A1 in the Appendix) to those of Sarma (2012) we can see significant differences. For example for the years 2005 and 2009, Sarma has found an IFI of 0.202 and 0.318 respectively while our calculation gives 0.277 and 0.669.[4] This shows that the Saudi Arabian economy is financially dynamic and moves from low to high financial inclusive economy in the space of one decade. This shift is due crucially to the reforms of the Saudi financial system as explained below. Figure 1 and Table 1 show that the IFI and HDI have similar dynamics and highly correlated with a more pronounced accelerated rhythm for the IFI during the last decade.

[4] The geographic dimension could also explain the relatively low IFI in the case of Norway (0.595 in 2004). In 2015 Norway has one of the lowest population densities (14h/km2) but a well-developed financial system.



Source: Author calculation for IFI and UNDP for HDI.

Figure 1. Inclusive Financial Index (IFI) and Human Development Index (HDI)

4.2. Inclusive Financial Index and Socio-economic Variables

As mentioned by Sarma and Pais (2011), literature has identified financial exclusion as reflection of a broader problem of "social exclusion". The degree of inclusion/exclusion depends on the level of the development of the country and that of its financial system. In high income countries, studies by, Connoly and Hajaj (2001) and Barr (2004) have shown that the exclusion from the financial system occurs to persons who belong to low-income groups, the ethnic minorities, immigrants, aged and so on. In the particular case of Italy, De Matteis (2015) noted that migrants face many obstacles and cited linguistic barriers as one of the most important one. She notified that there are at maximum 40% of migrants that have a bank account. Kempson (2006) have stressed the role of geographic factors. Rural population is likely to be more financially excluded. Buckland et al. (2005) emphasize the relation between financial inclusion and income distribution. They ascertain that countries with low levels of income inequality tend to have relatively high level of financial inclusion.

In developing countries the reality of financial inclusion is disparate and varies widely from country to another. In many countries, with similar income levels and in the same region, there can be significant differences in account penetration and then in financial inclusion. Among other examples, in 2008 World Bank report indicates that Ghana and Benin have similar GDP per capita of about $560. But while 29% of adults in Ghana report having a formal account, only 10% in Benin do. This suggests that the variation across economies is not determined solely by national income measured by GDP per capita.

As an oil-based economy, the KSA is one of the wealthiest economies in the world. According to the World Bank report, in 2016 the GDP per capita at purchasing power parity is about 54430.9 USD and is ranked 14 in the World classification. Saudi Arabia

has a high HDI of 0.847 in 2016 and ranked 38 among 188 countries, but has a low financial index of about 0.185 in 2004 and is ranked 34 among 49 countries (Sarma, 2010) and a value of 0.318 in 2009 and ranked 52 among 94 countries (Sarma, 2012). The Saudi financial system has evolved considerably during the last two decades. Between 1994 and 2016, the number of ATM has been multiplied by 34 and the number of bank branches has increased of about 16.5% during the same period accounting 9.75 branches for 100000 adults. One of the objectives of this paper is to verify whether this specific characteristic to the Saudi economy has been messes during the last decades.

5. DATA AND EMPIRICAL METHODOLOGY

5.1. Data Source and Statistical Proprieties of the Variables

In order to study the effect of financial inclusion on growth and socio-economic development we use annual time series data for the period 1980-2016. To measure Financial Inclusion we use the Transformed Index of Financial Inclusion (TIFI). Unlike the IFI which lies between 0 and 1, the transformed variable (TIFI) lies between $-\infty$ and ∞. This allows carrying out classical econometric regression. The transformed variable (TIFI) is a monotonically increasing function of IFI, and hence it preserves the same ordering as IFI.

$$TIFI_t = ln\left(\frac{IFI_t}{1-IFI_t}\right), \quad (1)$$

As it has been assessed, this index takes into account the three dimensions of financial inclusion, availability, usage, and penetration. Economic growth is measured by the logarithm of real per capita GDP. The logarithm transformation is usually used to achieve stationarity in variance. In Saudi Arabia, like the majority of developing countries, data on poverty, inequality, unemployment, and income distribution are scarce and in most cases inexistent.[5] For this reason, the current study uses the Human Development Index and other socio-economic variables, like the share of rural population, the share of women in the adult population, the share of active population and the share of active immigrants in active population in order to evaluate the interactions between financial inclusive and socio-economic development.

Results of Table 2 show a high and positive correlation between inclusive financial index and human development index. This is in line with major previous works (Sarma, 2008; Yorulmaz, 2012) and suggests that countries with high standing of living usually have a well-developed financial sector allowing a high fraction of the population to benefit from its services. The positive relationship between inclusive financial index and

[5]Most of the developing countries started recording poverty data only in the late 1990s.

the share of active population indicates that more safety and regular jobs in the formal sector are likely to encourage people to engage in the financial sector. Inclusive financial index is very weakly correlated to the logarithm of per capita real GDP. This result is specific to the KSA, as an oil-based economy, and in opposition to the findings of the major previous works, which assess a high and positive correlation between financial inclusion and economic growth (see among others Yorulmaz(2012) in the case of Turkey and European Union Countries and Odhiambo (2009) in the case of South Africa). Results of Table 2 indicate also that being a women and/or living in rural areas is a source of financial exclusion. The positive relationship between inclusive financial index and immigrants should be taken with caution. It could be explained in the case of Saudi Arabia by the use of financial services when immigrants transfer their earnings to their home countries. The correlation becomes negative when taking bank loans as an indicator of financial inclusion.[6] These intuitive findings will be analyzed in more details in Section 6 and 7.

Table 1. Descriptive Statistics of TIFI and Socio-economic Variables

	TIFI	gdp	Hdi	Ap	Rural	Female	Immigrants
Mean	-1.066	10.820	-0.346	0.320	0.223	0.445	0.2529
Maximum	1.228	11.400	-0.179	0.389	0.340	0.462	0.3626
Minimum	-9.179	10.384	-0.539	0.256	0.170	0.434	0.1445
S.D.	1.693	0.332	0.108	0.027	0.045	0.007	0.0580
Observations	37	37	37	37	37	37	37

Notes: S.D. refers to standards deviations.

Table 2. Correlation of Socio-economic Variables with TIFI

	TIFI	gdp	hdi	Ap	Rural	Female	Immigrants
TIFI	1.000						
gdp	0.097	1.000					
hdi	0.701	0.463	1.000				
Ap	0.768	0.362	0.666	1.000			
Rural	-0.760	-0.185	-0.945	-0.651	1.000		
Female	-0.714	-0.181	-0.764	-0.792	0.852	1.000	
Immigrants	0.822	0.2718	0.927	0.635	-0.943	-0.853	1.000
Observations	37	37	37	37	37	37	37

5.2. Model Specification and Econometric Techniques

In order to investigate the relationships between financial inclusion, economic growth and socioeconomic development we regress the transformed inclusive financial

[6] This result is not reported and is available upon request.

index (TIFI) on a set of socioeconomic variables relative to the KSA, such as real per capita GDP, rural population rate, and human development index and immigrants. Given the woman status in Saudi Arabia we should consider the proportion of women in adult population. Education level and the literacy rate for the population 15 years and above also help explaining the large variation in the use of formal accounts. In developing economies adults with a tertiary or higher education are on average more than twice as likely to have an account as those with a primary education or less (World Bank, 2014). As HDI integrated these two components and in order to avoid co-linearity we don't introduce these two variables.[7] According to Demirguc and Klapper (2012), having a job is one of the major factors of social inclusion. Therefore, employment relative to the number of individuals that are active in the formal sector is a key indicator for the extent of the financial inclusion.[8]

Our model can then be written as follows:

$$TIFI_t = \alpha_0 + \alpha_1 TIFI_{t-1} + \alpha_2 gdp_t + \alpha_3 hdi_t + \alpha_4 ap_t + \alpha_5 rural_t + \alpha_6 female_t + \alpha_7 Immigrants_t + \varepsilon_t, \quad (2)$$

where $TIFI$ is the transformed financial inclusion index, hdi is the logarithme of the Human Development Index, gdp is the logarithm of real per capita GDP, ap is the share of active population in the adult population, $rural$ is the share of rural population, $female$ is the share of women in the adult population, $Immigrants$ is the share of active immigrants in total active population, and ε_t is iid random variable.

In order to study the interactions between financial inclusion and its determinants we adopt a strategy in two steps. First we estimate equation (5) using the Generalized Method of Moments (GMM), because many empirical works argue that the relationship between financial development and economic growth and between growth and its determinants is not linear. Berthelemy and Varoudakis (1997), Abdelkarim and Rahmani (2009) among others attach this non-linearity to the presence of a threshold effect. This method is also used to correct for bias caused by endogenous explanatory variables. In a second step we focus on non-linear cointegration and causality relationships between financial inclusion, economic growth and human development using a Threshold Vector Error Correction Model (TVECM). TVECM has the advantage to take into account the non-linearity in the cointegration relationship and to detect short and long term causality.

[7]Human Development Index (HDI) is a summary measure for assessing long-term progress in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living (UNDP). Long and healthy life is measured by life expectancy. Access to knowledge is measured by the mean years of education among the adult population and the expected years of schooling for children of school-entry age. Standard of living is measured by real Gross National Product (GNI) per capita.

[8]It would be more informative to study the interaction between unemployment and financial exclusion, unfortunately, in Saudi Arabia, unemployment rate is available only since 1999.

6. EMPIRICAL RESULTS

6.1. Unit Roots Tests

In order to test the stationarity of the variables and avoid spurs regression we use NP test of Ng-Perron (2001) and the DF-GLS test of Elliot-Rothenberg-Stock (1996) unit root tests because the ADF and PP (Phillips-Perron) tests are known to suffer potentially severe finite sample power and size problem. Results of table 3 on differenced variables show that all variables are stationary in difference. The exception is the series of women share in adult population for which the test of NP and DF-GLS don't give clear results. To this series we apply the Phillips-Perron test which proposes a non-parametric method of controlling for serial correlation. The test gives a value of (-3.03), compared to the critical value at 5% of (-2.95), we can conclude that the series is stationary in difference with constant and trend. In sum, we can conclude that all the variables used in the study are integrated of order one and this will allow performing cointegration relationships.

Table 3. Unit Root Tests on Differences

		Ng-Perron test statistics*				DF-GLS test**	Results variables
Variables		MZα	MZt	MSB	MPT		In level
Δ(TIFI)		-12.29	-2.47	0.201	2.008	-3.76	I(1)
Δ(gdp)		-17.12	-2.92	0.170	1.453	-3.90	I(1)
Δ(hdi)		-11.91	-2.11	0.178	3.224	-2.81	I(1)
Δ(ap)		-12.03	-2.26	0.188	2.738	-4.45	I(1)
Δ(rural)		-19.07	-3.05	0.160	1.404	-5.78	I(1)
Δ(female)		-2.05	-0.96	0.471	11.483	-1.99	ND
Δ(Immigrants)		-12.13	-4.82	0.163	2.503	-3.06	I(1)
Asymptotic	1%	-13.8	-2.58	0.174	1.78	-2.63	
critical values	5%	-8.1	-1.98	0.233	3.17	-1.95	
	10%	-5.7	-1.62	0.275	4.45	-1.61	

Note: *Perron (2001). **Elliot et al. (1996)

6.2. GMM Estimation

Table 4 presents the results of GMM estimation developed by Arenello and Bond (1991). We regress the transformed index of financial inclusion (TIFI) in difference on the difference of the logarithm of real per capita GDP, the difference of the logarithm of HDI and the difference of the logarithm of the other socioeconomic variables. In our context the GMM, as a generalization of the Instrumental Variables estimator is straightforward if the error distribution cannot be considered independent of the regressors' distribution. In this vein researchers usually use instruments lagged two times and more to obtain the orthogonality conditions. The number of optimal lags is determined by an information criterion (Akaike Information Criterion (AIC) and Schwarz Criterion). Another strong reason to use GMM is when data face

heteroskedasticity of unknown form. The validity of the instruments is tested using the overidentification J-statistic of Hansen (1982) which is distributed as chi-two with degrees of freedom equal to the number of overidentifying restrictions. Results of Table 4 indicate a positive and significant relationship between TIFI and hdi. This result is in line with previous findings. Sarma (2010), Demirguc-Kunt and Klapper (2012) in the case of country comparison have shown that countries with high HDI have a high financial inclusion. Gupta et al. (2014) in the case of India and Yorulmaz (2012) in the case of Turkey conclude that regions or states with high HDI have also a high IFI. During the three last decades Saudi Arabia has invested considerable efforts in the major human development dimensions like education, health and infrastructure. The impressive education track record has led to a more financial literacy allowing more financial inclusion. This suggests that Saudi government should incorporate financial inclusion as one of its objectives in the process of economic and social development.

Table 4. TIFI and Its Determinants (GMM)
Dependent Variable: Δ(TIFI)

Variables	Coefficient	Std. Error	t-Statistic	Prob.
Δ(TIFI)-1	0.353	0.172	2.054	0.051
Δ(gdp)	-0.933	0.330	-2.824	0.009
Δ(hdi)	9.721	2.383	4.080	0.000
Δ(ap)	2.629	0.569	4.620	0.000
Δ(female)	-16.427	5.491	-2.992	0.006
Δ(rural)	-0.949	18.017	-0.053	0.958
$\Delta(\text{rural})^2$	36.179	40.634	0.890	0.381
Δ(Immigrants)	0.548	0.175	3.128	0.033
Constant	-0.004	0.002	-0.462	0.170
R^2	0.937			
$\bar{R}^2$	0.925			
S.E.	0.137			
J-statistic	0.010			
RESET	4.563			
AR(1)(p-value)	0.034			
AR(2)(p-value)	0.045			

Note: Instruments list: Δ(TIFI)(-2), Δ(gdp)(-2), Δ(hdi)(-2), Δ(ap)(-2), Δ(female)(-2), Δ(rural)(-2). J-statistic is Hansen statistic for over-identification of instruments. RESET is the regression equation specification error test of Ramsey.

The consistency of the system GMM is tested using the tests proposed by Arellano and Bond (1997). The first is a Hansen test of over-identifying restrictions, which tests the validity of the instruments. The second test examines whether the differenced error term is second-order serially correlated. Failure to reject both tests lends support to our estimator.

The estimated coefficient of the share of active population is positive and significant at 1% level meaning that more population engaged in the formal sector is one condition

to accelerate the process of financial inclusion. Nevertheless, Saudi economy faces a relatively high rate of unemployment among citizens (11.5% in 2016 and 12.7% in 2017) and this rate is about 22% among young with university diploma. This high fraction of adult population will remain financially excluded unless future governments will be able to propose new employment policy. The coefficient of the share of adult female population is negative and highly significant. This result is the reflection of multiple socioeconomic constraints women face in the KSA. Among others, the rate of female unemployment among Saudi women citizens is about 31% in 2017 and only 61% of adult women have an account in a formal financial institution (SCDSI) which is very below the average of 94% in OECD countries.

The negative relation between inclusive financial index and economic growth, measured by the real per capita GDP, could infirm the demand following-response hypothesis which states that economic growth leads to financial development. This result is in line with previous works (Mahran, 2012) and could indicate that the process of development in the Saudi economy is still heavily dependent on government spending and the dominant role of the public sector. As an oil-based economy the government has a strong control over the major economic activity. Even though during the last decade several key services were privatized, the share of private sector in the real GDP is still low and represents about 38% in 2013 but has considerably increased last years to reach 48% in 2017. Inclusive finance benefits essentially to poor households through microfinance and microcredit which should be afforded by the banks, nevertheless, lending to small and medium sized enterprises still very low in the KSA and represents only 1.7% as a share of total lending in 2014. One possible explanation of this is the limited bank risk appetite and the inability of banks to adjust their operating models to the small and medium enterprises. This situation is in line with GCC countries but below benchmarks elsewhere in MENA region and internationally.

6.3. Non-linearity between Financial Inclusion and Macroeconomic Variables: AThreshold Cointegration Approach

In this section we focus our analysis on the nature of the relationship between financial inclusion index, economic growth rate and human development index. As mentioned before, the non-linearity between financial development and economic growth has been stressed by number of authors (see Berthelemy and Varoudakis, 1997; Abdelkarim and Rahmani, 2009). In order to take into account this characteristic we intend to introduce threshold type effects to model the possibility that the relationship linking the nonstationary variables undergoes regime switches. In this vein we perform threshold cointegration test as developed by Balke and Fomby (1997), Hansen and Seo (2002), and Goazalo and Pitarakis (2006). The non-linear cointegration relationship together with Granger representation theorem, ensuring the existence of threshold error correction representation (TVECM) which describes how variables respond to deviation from equilibrium. In subsection 6.3.4, following Li (2006) Threshold Granger-Causality

tests (TGC) between inclusive finance, economic growth and human development in the case of Saudi Arabia will be performed.

6.3.1. Testing Threshold Effects in Cointegration Regression

Standard cointegration tests suppose linear relationship between variables and assume that the adjustment toward the long run equilibrium occurs instantaneously at each time period. In economic theory we find many arguments that invalidate this assumption of linearity. Among them, the presence of transaction costs is may be noteworthy, as it implies that adjustment will occur only once deviations are higher than the transactions costs, and hence adjustment should not happen instantaneously and at each time. The combination of nonlinearity and known cointegration vector was first introduced by Balke and Fomby (1997). Hansen and Seo (2002) extended to the case of unknown cointegration vector. They propose a two-regime threshold vector error correction model (TVECM) with one cointegrating vector and a threshold effect based on the error-correction term, and develop a Lagrange multiplier (LM) test for the presence of a threshold effect. The two regime threshold model with order$l+1$of Hansen and Seo (2002) can be formulated as follows:

$$\Delta Y_t = \begin{cases} A_1' X_{t-1}(\beta) + \varepsilon_t \; if \; \eta_{t-1}(\beta) \leq \gamma \\ A_2' X_{t-1}(\beta) + \varepsilon_t \; if \; \eta_{t-1}(\beta) \geq \gamma \end{cases}, \tag{3}$$

with

$$X_{t-1}(\beta) = (1, \eta_{t-1}(\beta), \Delta x_{t-1}, \dots, \Delta x_{t-l})',$$

where $Y$is a p-dimensional $I(1)$ time series which is cointegrated with one $p \times 1$ cointegrating vector β, $\eta_t(\beta) = \beta' Y_t$ is the $I(0)$ error-correction term,ε_t is an iid error term, $A_1$and $A_2$are coefficient matrices that describe the dynamics in each of the regimes, and γ is the threshold parameter.

In this model, when the error correction term is lower or equal than the threshold, variables Y_t would not be cointegrated and there is no tendency to equilibrium. On the contrary, if deviations from the equilibrium are greater than the threshold, there is a tendency for the variables $Y$to move towards some equilibrium (i.e., the variables would be cointegrated).

The TVECM can alternatively be written as

$$\Delta Y_t = A_1' X_{t-1}(\beta) d_{1t}(\beta, \gamma) + A_2' X_{t-1}(\beta) d_{2t}(\beta, \gamma) + \varepsilon_t, \tag{4}$$

where

$$d_{1t}(\beta, \gamma) = I(\eta_{t-1}(\beta) \leq \gamma) \text{and} d_{2t}(\beta, \gamma) = I(\eta_{t-1}(\beta) > \gamma).$$

$I(\cdot)$ is an indicator function defining the behavior of the error correction term. Balke and Fomby (1997) proposed a two-step approach, using first linear tests of cointegration. If linear cointegration is not rejected, tests for threshold cointegration with linear under H_0should be used. Failure of cointegration in the first step should lead to the use of tests with no cointegration under $H_0$and threshold cointegration under the alternative. The second case is particularly interesting, as it illustrates how threshold cointegration is a broader concept that involves linear cointegration as a specific case.

Hansen and Seo (2002) proposed a heteroskedastic consistent Lagrange Multiplier (LM) test for the null hypothesis of linear cointegration [i.e. there is no threshold effect], against the alternative of threshold cointegration when the true cointegrating vector is unknown, and is denoted by:

$$SupLM = SupLM(\hat{\beta}, \gamma), \gamma_L \leq \gamma \leq \gamma_U, \quad (5)$$

where $\hat{\beta}$ is the estimate of β. $[\gamma_L, \gamma_U]$ is the search region set so that $\gamma_L$is the π_0 percentile of $\hat{\eta}_{t-1}$, and $\gamma_U$is the $[1-\pi_0]$percentile. According to Hansen and Seo (2002), the threshold effect only has content if $\pi_0 \leq P(\eta_{t-1}(\beta)) \leq \gamma \leq 1-\pi_0$ otherwise the model simplifies to linear cointegration. Andrews (1993) suggests setting $\pi_0$between 0.05 and 0.15. The test follows a complicated empirical distribution process and hence critical values for a general case can't be tabulated. To calculate the asymptotic critical values and p-values of the sup LM test, Hansen and Seo (2002) developed two bootstrap methods, a fixed regressor bootstrap[9] and a parametric residual bootsrap.

The rest of the paper aims to test if the relationship between inclusive finance, economic growth and human development in Saudi Arabia is conditioned by a threshold effect. Then we look to depict Threshold Granger Causality (TGC) between the three variables using TVECM following Li (2010).

6.4. Threshold Cointegration between Inclusive Finance, Economic Growth and Human Development

Many empirical works argue that financial inclusion and human development move closely. On the micro level, an inclusive financial system allows households to organize their income and to plan future consumption. On a macro level, it builds entrepreneurial spirit and job creation. It also allows governments' greater visibility of the fiscal system. As such it can be argued that financial inclusion is linked to development. Recognizing its importance to development, financial inclusion was included in the UN's Millenium Goals (Sen, 2010; UN, 2015).

[9] The label "fixed regressor bootstrap" is intended to convey the feature that the regressors $X_{t-1}(\beta)d_{1t}(\beta,\gamma)$ and $X_{t-1}(\beta)d_{2t}(\beta,\gamma)$ are held fixed at their sample values.

Nevertheless, as mentioned before, many empirical works recognize the non-linearity relationship between financial development (financial inclusion) and economic growth and between financial development and development indicators in general. The non-linearity is usually explained by the presence of threshold effect due to the existence of economics of scale and decreasing returns in the financial sector. This section focuses on the threshold cointegration and non-linear Granger causal relationships between financial inclusion, economic growth and human development in the KSA during the period 1980-2016.

First we test for the existence of linear cointegration relationship between TIFI and the logarithm of real per capita GDP growth rate (gdp) and the logarithm of HDI (hdi) using standard Johansen test. Second we test for the presence of threshold effect in the cointegration equation using SupLM test of Hansen and Seo (2002). If the threshold cointegration hypothesis is accepted we then can formulate and estimate a threshold vector error correction model and test short and long run threshold Granger causality between the three variables.

In section 6.1 we have established that the logarithm of IFI (TIFI), the logarithm of per capita GDP growth rate (gdp) and the logarithm of HDI (hdi) are I(1) variables. So they can be cointegrated. In Saudi Arabia on the period 1980-2016, using OLS we estimate the following equation

$$TIFI_t = \alpha + \beta_1 gdp_t + \beta_2 hdi_t + \eta_t. \quad (6)$$

From this regression, the recovered residuals are used to estimate a regression of the form

$$\Delta\hat{\eta}_t = \rho\hat{\eta}_{t-1} + \sum_{i=1}^{l} \vartheta_i \Delta\hat{\eta}_{t-i} + \nu_t. \quad (7)$$

The lag length l is chosen using information criterion such as AIC and BIC so that the model is well specified and results in ν_t being white noise. In our case, both criterion lead to $l = 2$. In order to depict the existence of a cointegration relationship between TIFI, gdp and hdi we test the null $H_0: \rho = 0$ of no-cointegration using the Johansen co-integration test. Results of Table 5 show that conventional cointegration tests that assume linear adjustments such as the trace test and max-eigen values can't reject H_0 at the 5% level, soη_t is not stationary and there exist no long run relationship between the three variables (i.e. TIFI, gdp and hdi are not cointegrated).

Nevertheless, the tests conducted above assume that the cointegrating vector is constant and linear during the study period. However, as mentioned before, many studies argue that financial development is non-linearly linked to its determinants and particularly to economic growth. Berthelemy and Varoudakis (1997) were among the first to emphasize threshold effects with respect to financial depth in the relationship between growth and financial depth. They develop a model with multiple equilibria hypothesis and show that a country starting with a small financial sector will experience

stagnation of its financial sector. Conversely a country which starts above the financial development threshold will be able to expand its financial sector. Similarly, Rioja and Valev (2004) identified three different regions of financial development and showed that the relationship between finance and growth changes depending on which region the country belongs to. Applying a threshold regression model, Deidda and Fattouh (2002) argue there is no significant relationship between financial development and growth in low-income countries, whereas the relationship is positive and strongly significant in high-income countries. Rioja and Valev (2004a) add that this relationship varies according to the level of financial development, finding a positive and significant effect of financial development on growth only with medium and high levels of financial development. Arcand et al. (2012) use credit to GDP ratio to establish that there is a threshold above which financial development no longer has a positive effect on economic growth.

Table 5. Johansen Cointegration Test between $TIFI$, Gdp and Hdi

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eingenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.7336	21.3689	29.7970	0.1351
At most 1	0.2457	9.0350	15.4947	0.3621
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eingenvalue	Max.Eigen.Stat	0.05 Critical Value	Prob.**
None	0.7336	19.3339	21.1316	0.1506
At most 1	0.2457	9.0264	14.2646	0.2840

Note: Trace Test indicates no cointegration equation at the 0.05 level. Max-Eigenvalue Test indicates no cointegration equation at the 0.05 level. **MacKinnon-Haug-Michelis (1999) p-value.

A useful test for such behavior is the threshold cointegration. Testing for threshold cointegration is particularly difficult as it involves two aspects: the presence of cointegration and that of non-linearity (Stigler 2013). Hence, one may have four different cases: cointegration and threshold effects, cointegration and no threshold effects, no cointegration and no threshold effects, and no cointegration and threshold effects. Consequently, a test with threshold cointegration may have as null hypothesis either cointegration or no cointegration.

We proceed to investigate the existence of non-linear cointegration as against linear cointegration between the variables based on the SupLM test of Hansen and Seo (2002). In this vein we estimate the threshold autoregressive (TAR model) initiated by Enders and Siklos (2001) where the cointegration vector β and the threshold parameter are

calculated endogenously[10] through the following equation.

$$\Delta\hat{\eta}_t = \rho_1\hat{\eta}_{t-1}I(\eta_{t-1}(\beta) \leq \gamma) + \rho_2\hat{\eta}_{t-1}I(\eta_{t-1}(\beta) > \gamma) + \sum_{i=1}^{l-1}\vartheta_i\Delta\hat{\eta}_{t-i} + \nu_t. \quad (8)$$

In equation (8) the regime switches are governed by the magnitude of the threshold variable $\eta_{t-1}(\beta)$crossing an unknown threshold value. In the non-augmented version of model (8) (i.e. without the term$\sum_{i=1}^{l}\vartheta_i\Delta\hat{\eta}_{t-i}$), Petrucelli and Woolford (1984) showed that the necessary and sufficient conditions for the stationarity of η_t is $\rho_1 < 0, \rho_2 < 0$ and$(1+\rho_1)(1+\rho_2) < 1$for any value of γ. In the higher-order process[11] (8), to ensure that there is no more than a single unit root, all the values of r satisfying the inverse characteristic equation $1 - r\vartheta_1 + r^2\vartheta_2 + \cdots + r^{l-1}\vartheta_{l-1} = 0$ must lie outside the unit circle (Enders and Siklos, 2001). The appropriate lag length is usually determined using model selection criteria such as the Akaike information criterion (AIC) or the Bayesian information criterion (BIC).

In model (8) when the value of $\eta_{t-1}$is below or equal to the threshold parameter γ, then the adjustment is$\rho_1\hat{\eta}_{t-1}$ and if the value of η_{t-1} is above γ, then the adjustment is $\rho_2\hat{\eta}_{t-1}$. The null hypothesis of $\rho_1 = \rho_2$ tests for the linear cointegration relationship, with the rejection of the null hypothesis indicating the existence of threshold cointegration between the variables.

Table 6. Tests for Threshold Cointegration

Cointegration vector β=(1, 0.96, -2.05), Threshold parameter γ=0.77		
	Fixed Regressor Bootstrap	Residual Bootstrap
SupLM test value	26.5638	26.5638
p-value	0.0232	0.0038
Critical values		
99%	29.2816	27.3457
95%	25.3561	23.9430
90%	21.7205	19.0386

Note: p-values are calculated by bootstrap with 1000 replications using the simulation procedure of Hansen (1996) and Hansen and Seo (2002) implemented in R.R packages are from DiNarzo et al. (2018): https://cran.r-project.org/web/packages/tsDyn.

Table 6 summarizes the results of the SupLM test. We observe that the SupLM test value is bigger than critical values obtained from the simulation procedure of Hansen

[10]In case of a known threshold parameter, a likelihood-ratio test for the null of no threshold effects can be formed and has the usual χ^2 distribution (Chan and Tong 1990). But when it is unknown, which is typically the case in practice, the distribution of the test is then non-standard as it entails a parameter that is not identified under the null, the so-called Davies problem (1977, 1987).

[11]This formulation is adopted when the adjustment process is serially correlated.

(1996), Hansen and Seo (2002). The evidence of bivariate threshold cointegration using both bootstrapping techniques clearly rejects the null hypothesis of linear cointegration at the 5% significance level. Consequently, the threshold cointegration model is more suitable for our data.

The estimated threshold cointegration relationship is $\eta_t = TIFI + 0.96gdp - 2.05hdi$ and the estimated threshold is $\hat{\gamma} = 0.77$. Thus the first regime (unusual regime) occurs when the deviation from the long run equilibrium is below the threshold (i.e $TIFI + 0.96gdp - 2.05hdi \leq 0.77$) with only 15% of the observations. The second regime (usual regime with 85% of the observations) is when $TIFI + 0.96gdp - 2.05hdi > 0.77$.

According to these results, the null hypothesis of linear cointegration between financial inclusion, economic growth and human development index is rejected in favor of two-regime threshold cointegration model, with the threshold parameter estimated at 0.77%. The next step is to estimate a TVECM using the maximum log-likelihood method and deduce the non-linear Granger causality relationships.

6.4.1. TVECM and Non-linear Granger Causality between TIFI, Gdp and Hdi

Li (2006) has combined threshold model and Granger causality and developed a Threshold Granger Causality (TGC) test based on the threshold autoregressive distributed lag (TADL) model for two-regimes. The TGC test takes the form of the heteroskedasticity-robust Wald test. Conditional on threshold effects, the TGC test asymptotically follows a standard $\chi^2(m)$ distribution, where m is the number of restrictions in the VAR. We follow the methodology of Li (2006) in order to test the existence of TGC between TIFI, gdp and hdi.

In this vein, a dynamic threshold Granger causality test is used. This technique is chosen because of its favorable response to both large and small samples. The trivariate threshold Granger causality model based on the Error-Correction Mechanism (ECM) can be expressed as follows:

$$\Delta Y_t = \begin{cases} \alpha_1 + \omega_1 \hat{\eta}_{t-1} + \sum_{i=1}^{l} \varphi_{1i} \Delta X_{t-i} + \varepsilon_{1t} if\ (\eta_{t-1}(\beta) \leq \gamma) \\ \alpha_2 + \omega_2 \hat{\eta}_{t-1} + \sum_{i=1}^{l} \varphi_{2i} \Delta X_{t-i} + \varepsilon_{2t} if\ (\eta_{t-1}(\beta) > \gamma) \end{cases}, \quad (9)$$

where $\Delta Y_t = (\Delta gdp_t \Delta TIFI_t \Delta hdi_t)'$ and ε_{1t} and ε_{2t} are iid errors. α_1 and α_2 are regime specific vector of intercepts.

Through the system (9), the short-run Granger-Causality is examined by testing whether the coefficients φ_{1i} and φ_{2i} are statistically different from zero using the Wald test. The long-run Granger-Causality is established through the significance of the coefficients ω_1 and ω_2 of the error-correction term. The maximum likelihood estimation results of the TVECM are presented in Table 7. The VAR lag length 2 is obtained using both AIC and BIC criteria. Square errors (SE) are calculated from the heteroskedasticity robust covariance estimator.

From results of Table 7 we depict that in the gdp equations the adjustment coefficient is significant only in the usual regime $(\eta_{t-1}(\beta) > 0.77)$. The coefficient of the lagged error-correction term is negative and significant at 5%. These findings support the existence of a long-run causality from financial inclusion and human development to economic growth only when the deviation from long run-equilibrium is above threshold parameter. In the short-run we observe only a causal-flow from human development to economic growth for the two regimes $\varphi_{13} \neq 0$ and $\varphi_{23} \neq 0$. The absence of short-run Granger causality between financial inclusion and economic growth could support some earlier findings in the case of KSA. Marashdeh and Al-Malkawi (2014), using ADRL model and linear causality tests, find that in the short-run, neither the financial deepening nor the economic growth Granger-cause each other. In contrast, their findings suggest that there exist a positive and statistically significant long-run relationship between financial deepening and economic growth and conclude that financial deepening spurs growth and support the supply-leading hypothesis. Samargandi et al. (2014) have found that financial development has a positive impact on growth of the non-oil sector and, in contrast, its impact on the oil-sector growth and total GDP is either negative or insignificant.

Table 7. Threshold VECM Estimation and Granger-causality Results

Variables	Usual Regime $\eta_{t-1}(\beta) > 0.77$			Unusual Regime $\eta_{t-1}(\beta) \leq 0.77$		
	$\Delta(gdp)$	$\Delta(TIFI)$	$\Delta(hdi)$	$\Delta(gdp)$	$\Delta(TIFI)$	$\Delta(hdi)$
η_{t-1}	-0.1256*	-0.0320*	-0.3040*	0.1203	-0.0043*	-0.0286*
	(-0.0423)	(-0.0054)	(-0.1204)	(1.352)	(-0.0021)	(-0.0161)
$\Delta(gdp_{-1})$	0.1076*	-0.5410	0.0372*	-0.0731*	-0.0756	0.0085
	(0.0423)	(-2.0423)	(0.0061)	(-0.0192)	(-1.0603)	(0.2514)
$\Delta(gdp_{-2})$	-0.2107	0.0862	0.2201*	0.2561	0.0093	0.3810
	(-0.0423)	(0.1207)	(0.1026)	(0.6207)	(0.4701)	(1.0661)
$\Delta(TIFI_{-1})$	-0.2781	-0.0651*	-0.0825	-0.0105	-0.0691	0.2256
	(-0.7190)	(-0.0241)	(-2.023)	(-0.7413)	(-0.0804)	(0.9403)
$\Delta(TIFI_{-2})$	-0.0064	0.0075	0.0073	0.0286	0.3568*	0.0861
	(-0.2901)	(0.0703)	(0.0717)	(0.0816)	(0.1099)	(2.0510)
$\Delta(hdi_{-1})$	0.0134*	0.3920	0.0276	0.0538*	0.0087	0.0461
	(-0.0082)	(0.5206)	(0.0509)	(0.0190)	(0.0783)	(0.0823)
$\Delta(hdi_{-2})$	0.0063*	0.0691*	0.0601*	0.0286*	0.0591	0.7501*
	(0.0032)	(0.0373)	(0.0225)	(0.0083)	(0.0486)	(0.3483)
$Intercept$	0.0731*	-0.0081	0.0627*	0.0934	-0.0251*	0.7371*
	(0.0143)	(-0.0526)	(0.0108)	(0.3803)	(-0.0109)	(0.2506)
$Wald_{regime}$	42.64	28.52	58.27	14.62	9.53	12.37
$Wald_{all}$	gdp equation: 63.7, TIFI equation: 83.2, hdi equation: 72.6					

Note: Eicker-White Standard Errors are in parenthesis. Wald denotes the standard Wald statistic used to examine the existence of short-run Granger causality in the different equations. LL refers to the log likelihood value.* denotes significance at 5%.

In the TIFI equations, the coefficient of the lagged error-correction term is negative and statistically significant in the two regimes supporting a long-run equilibrium between inclusive finance; economic growth and human development index while in the short-run only human development index Granger-causes inclusive finance ($\varphi_{23} \neq 0$). The above findings establish that in the case of KSA as an oil-based economy, economic growth can induce financial inclusion only in the long-run. In the short-run, neither financial inclusion nor economic growth Granger-cause each other. Put it in another way, there are no short-run bidirectional causations between financial inclusion and economic growth. One possible explanation advanced by Marashdeh and Al-Malkawi (2014) is that policymakers in Saudi Arabia do not promote short-run economic policy.

In the equation of human development index both economic growth and inclusive finance Granger-cause human development in the long-run in the two regimes, while the causality in the short-run stems only from economic growth to human development in the usual regime. These findings corroborate the theoretical analysis according to which economic growth is a sine-qua-non condition to human development.

Table 8. Nature and Direction of Threshold Granger Causality

Causality Direction	Usual regime		Unusual regime	
	Short-run	Long-run	Short-run	Long-run
Inclusive finance(TIFI) → Economic Growth(gdp)	No	Yes	No	No
Inclusive finance(TIFI) → Human Development (hdi)	No	Yes	No	Yes
Economic Growth(gdp) → Inclusive finance(TIFI)	No	Yes	No	Yes
Economic Growth (gdp) → Human Development(hdi)	Yes	Yes	No	Yes
Human Development(hdi) → Economic Growth(gdp)	Yes	Yes	Yes	Yes
Human Development(hdi) → Inclusive Finance(TIFI)	Yes	Yes	No	Yes

The totality of the causal relationships for the two regimes is summarized in Table 8.Overall, the above results show that there exist long-run bidirectional causations between each pair of variables whatever the regime. In the long-run, the only exception is the unidirectional causality from economic growth to inclusive finance. In the short-run, neither economic growth nor inclusive finance Granger-causes each other while there exist bidirectional causation between economic growth and human development and unidirectional one from human development to financial inclusion only in the usual regime.

7. CONCLUSION AND POLICY RECOMMENDATIONS

This research was an attempt to construct an inclusive financial index for Saudi Arabia as an oil-rich economy and to study the causality interactions between financial inclusion and its determinants. Using UNDP approach and Sarma (2008) methodology our transformed financial inclusion index (TIFI) takes into account three dimensions,

availability, penetration and usage of the bank system. The computation of the TIFI during the period 1980-2016, taking into account geographic specificities, shows that the Saudi Arabian economy is a financial dynamic one and evolved from a low inclusive financial economy at the beginning of the century to a high inclusive one during the last decade. This result allows resolving the Saudi-paradox stressed by Sarma, according to whom KSA has a high human development index and high per capita GDP but a low financial inclusion. Our statistical analysis shows that financial inclusion and human development are highly correlated in KSA.

The second step of this research was devoted to study the interactions between inclusive finance and its determinants using macroeconomic leading variables. Our results, from GMM methodology, show that financial inclusion is negatively correlated to per capita GDP and the share of women in adult population and to rural while it's positively related to the human development index and the active population and to immigrants.

These findings are corroborated by the lead/lag causality interactions based on the TVECM estimation taking into account the non-linearity between inclusive finance and its determinants. We depict that HDI causes financial inclusion and economic growth both in short-run and in the long-run while neither inclusive finance nor economic growth Granger-causes each other in the short-run. In Saudi Arabia, the causality between financial inclusion and economic growth runs only in the long-run. This result is in line with the general consensus that in natural resource-based economies, financial systems deepen at a slower rate than in other countries (Beck, 2011). In Saudi Arabia the high dependence of the economy on oil and the dominant role of public sector leave little room for the private sector to play a significant role in the economy. In this kind of economy, banks are interested in big projects leaving aside small and medium enterprises enhancing financial exclusion of a part of the population especially women and young without collaterals. In order to avoid the emergence of pockets of poverty and reduce certain inequalities specifically due to the relatively high unemployment rate among women, young and high graduate, policymakers in Saudi Arabia should accelerate reforms in bank system. The latter should allocate more resources to the private sector especially to the small and medium enterprises allowing more financial inclusion. Although the KSA has made continuous efforts towards greater financial inclusion, supplement measures are needed for a coordinated endeavor between government, banks and microfinance institutions to facilitate access to financial services amongst young, women and low-income groups. Government has an important role to play in building inclusive financial system by increasing the outreach to un-served and underserved households and enterprises. Transposing the formula of Matin et al. (2002) for microfinance, we can say that inclusive finance is not a magic sky-hook that reaches down to pluck the poor out of poverty. It can, however, be a strategically vital platform that the poor can use to raise their own prospects for an escape from poverty.

Finally, the current study may suffer from potential shortages related to the variable used to measure financial inclusion. The inclusive financial index we have constructed is

a better proxy than those usually used by previous works; it brings interesting information but suffers from many problems due to the lacking of data. Nevertheless, the IFI developed here can be used to monitor the progress of policy initiatives for financial inclusion over a period of time. It can be also of interest to the research community in order to investigate empirical questions between development and financial inclusion.

APPENDIX

A1. Inclusive Financial Index: Construction and Computation for KSA

A1.1. A Methodological Review

In the literature, we can find different methods to compute the IFI. The differences are due to the number of dimensions, the number of variables in a dimension and the way dimensions are combined. For example, Gupte et al. (2012) have considered four dimensions namely, outreach (penetration and accessibility), usage, ease of transactions and cost of transactions whereas Arora (2010) didn't include usage dimension and Sarma (2008, 2010, 2011, 2012) didn't include ease and cost dimension. Some authors have used arithmetic average of the different dimensions, while others have used geometric mean to take into account the imperfect substitution across all the dimensions (Gupte et al. 2012). Following the literature, the approach employed in this paper to construct IFI is similar to United Nations Development Program (UNDP)'s computation (2010) for well-known development indices such as the HDI (Human Development Index), the GDI (Gender-Related Development Index), and the HPI (Human Poverty Index). The computation for IFI starts by first calculating an index for each aspect of financial inclusion. The index of the i^{th}variable in a dimension, δi, is computed by formula (1) (Sarma, 2010, Gupte et al. 2012, Gupta 2014).

$$\delta_{it} = \frac{A_{it} - m_i}{M_i - m_i}, \tag{10}$$

where$A_{it}$is actual value of variable i,$M_i$ismaximum value of variable i,m_i is minimum value of variable i.

This ensures that δ_{it}lies between 0 and 1 and the higher the value of δ_{it}higher the country's achievement in dimension i. Each dimension is a simple average of all theδ_{it}. Finally, the index of financial inclusion, IFI_t, can be measured either by the formula (12) (Sarma, 2008) or by formula (13) (Gupte et al. 2012). In Formula (12), the IFI is "the normalized inverse Euclidean distance" of the point $\Delta_i = (\delta_{1t}, \delta_{2t}, \ldots . \delta_{nt})$from the

ideal point $I = (1,1,1,\dots,1)$ (Sarma, 2010)[12] while in formula (13) it's a geometric mean of the different dimensions δ_{it} (Gupte et al., 2012).

$$IFI_t^{Sarma} = 1 - \frac{\sqrt{(1-\delta_{1t})^2+(1-\delta_{2t})^2+\cdots\dots+(1-\delta_{nt})^2}}{\sqrt{n}}, \quad (12)$$

$$IFI_t^{Gupte} = \prod_{i=1}^{n} \delta_{it}^{1/n}. \quad (13)$$

A high IFI value represents higher financial inclusion. In this research, we consider three basic dimensions: banking penetration (accessibility), availability of the banking services and usage of the banking system. The size of the banked population is a measure of the banking penetration of the system. However, there is no available data for the numbers of people that have bank accounts;[13] therefore in the absence of such data for KSA, following Sarma and Pais (2010) and Arora (2010), accessibility is measured by the penetration of the banking system proxied by the number of bank accounts per 1000 population. We suppose that the availability dimension has two components, demographic and geographical.[14] We use data on the number of bank branches and the number of ATM per 100000 of persons to measure the population-availability dimension and we use the number of bank branches and the number of ATM per 1000 km^2 as an indicator of the geographical-availability dimension. We suppose that the two components have the same weight in the availability dimension. Having a bank account by itself is not enough for a financial system to be inclusive; in addition, the banking services must be adequately utilized. Thus, the volume of credits and deposits as the proportion of GDP is used to measure usage dimension. In this vein, one should distinguish between use and access to financial services. While use indicates consumption of financial services and hence is related to the demand side, access comprises both the demand and supply sides of financial services.[15]

Being given these three dimensions (penetration (π_{it}), availability (α_{it}) and usage (μ_{it})), we can identify a country or a region i by a point(π_{it}, α_{it},μ_{it}) in the three dimensional Cartesian space where π_i, α_i and μ_i are the dimension indices computed using formula (1). In the three dimension case, formula (2) and (3) become:

[12] Sarma (2012) calculated IFI as a simple average of the distances from both the worst point and ideal point: $IFI_t = \frac{1}{2}\left[\frac{\sqrt{{\delta_{1t}}^2+{\delta_{2t}}^2+\cdots\dots+{\delta_{nt}}^2}}{\sqrt{n}} + \left(1 - \frac{\sqrt{(1-\delta_{1t})^2+(1-\delta_{2t})^2+\cdots\dots+(1-\delta_{nt})^2}}{\sqrt{n}}\right)\right]$.

[13] World Bank (Global Findex Report (2014)) began publishing this kind of data only since 2011.

[14] World Bank Global Findex Survey (2014) finds that 20 percent of adults in developing countries cite distance as a reason behind not having an account.

[15] One of the debates on the use and access to financial services is the voluntary and involuntary exclusion. The first is due to cultural and religious reasons; the second is mainly due to the unaffordability of financial services.

$$IFI_{KSAt}^{Sarma} = 1 - \frac{\sqrt{(1-\pi_t)^2+(1-\alpha_t)^2+\left(1-\mu_t\right)^2}}{\sqrt{3}}, \quad (12A)$$

$$IFI_{KSAt}^{Gupte} = \pi_t^{1/3}\alpha_t^{1/3}\mu_t^{1/3}. \quad (13A)$$

Our contribution differs from previous works because it is concerned by a long period and focuses only on the case of Saudi Arabia. A potential contribution of this paper is the time series measure of financial inclusion. The time dimension allows a look at how financial inclusion has changed over time and how it has impacted or been impacted by other events. Generating time series for an inclusive financial index is also useful for econometric estimations in relation with macroeconomic variables.

Table A1. Financial Inclusion Index in the Kingdom of Saudi Arabia 1980-2016

Year	IFI-Gupte	IFI-Sarma
1980	0.0586	0.0586
1981	0.0603	0.0603
1982	0.0820	0.0820
1983	0.1442	0.1442
1984	0.1732	0.1732
1985	0.1980	0.1980
1986	0.2302	0.2302
1987	0.2385	0.2385
1988	0.2752	0.2752
1989	0.2639	0.2639
1990	0.1951	0.1951
1991	0.2205	0.2205
1992	0.2192	0.2192
1993	0.2523	0.2523
1994	0.1860	0.2560
1995	0.1666	0.2453
1996	0.1989	0.2568
1997	0.2028	0.2585
1998	0.2544	0.2973
1999	0.2201	0.2689
2000	0.2054	0.2484
2001	0.2301	0.2614
2002	0.2497	0.2752
2003	0.2528	0.2704
2004	0.2675	0.2872
2005	0.2779	0.2981
2006	0.3753	0.3824
2007	0.4763	0.4736
2008	0.5555	0.5460
2009	0.6691	0.6429
2010	0.7041	0.6879
2011	0.7370	0.7200
2012	0.7829	0.7478
2013	0.8134	0.7736
2014	0.8237	0.7864
2015	0.8405	0.7932
2016	0.8532	0.7985

Source: Author calculation.

A1.2. Computing IFI for the KSA

The main problem that encounters this computation is the unavailability of adequate data. In this paper we combined several sources of data to construct the IFI for the KSA. The World Banks' "World Development Indicators" (WDI), the International Monetary Funds' "International Financial Statistics" (IFS), the Saudi Central Department of Statistics and Information (SCDSI) Annual Report and the Saudi Arabian Monetary Agency (SAMA) Yearly Book were our main sources. The computation of the IFI is set on two distinct periods 1980-1994 and 1994-2016. On the first period our indicator is composed only of the usage dimension because the only available data are on credit and deposits. Beginning 1994, data on account number and on ATMs and bank branches are available, and then we can calculate the three dimensions. The computed index is reported in table 1 in the appendix. We can see that both methods (Sarma, 2010 and Gupte et al., 2012) give almost the same IFI. We can use either one or the other for the rest of the analysis. Results show also that the IFI has grown considerably especially during the last two decades. The KSA has a low financial inclusion till 2004 (IFI<0.3), becomes medium financial inclusion during the period 2005-2008 (0.3<IFI<0.6) and it could be considered, according to our calculation, as a high financial inclusion economy in the last decade. This growth can be attributed mainly to the development of the bank sector which accounts in 1995, 1192 bank-branches and 1937 in 2015 and then a mean growth rate of about 37 new branches each year. Indeed, since the beginning of the 21 century the Saudi authorities have launched a number of reforms of the financial system. These include the introduction of new laws, for small-medium-sized enterprises loan guarantee scheme and the liberalization of insurance of banking licenses to non-Saudi banks. These reforms allowed the expansion and diversification of financial services beyond commercial banks with wider reach and access. They aimed at developing a more diversified intermediation framework, with a larger role for the private sector to meet the financing needs of the population.

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Mailing Address: SALEM HATHROUBI, College of Economics and Administrative Sciences. Department of Economics. Al-Imam Muhammad Ibn Saud Islamic University, Saudi Arabia. Email: shathroubi@yahoo.fr.

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