Is Natural Resource Abundance a Stimulus for Financial Development in the USA?

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Abstract: This paper investigates the stimulating role of natural resource abundance in financial development for the case of the USA over the period of 1960-2016. We included education, economic growth and capitalization as additional determinants of financial development in finance demand function. Thus, we applied traditional and recent unit root tests, accommodating unknown structural breaks in the series for examining the unit root properties of the variables. To examine cointegration between the variables, we apply the Bayer-Hanck cointegration approach. The robustness of cointegration relationship is tested by applying the bounds testing approach to cointegration. The empirical results show the presence of cointegration between financial development and its determinants. In the long run, we observe that natural resource abundance contributes to financial development. Education has a positive impact on financial development. A positive relationship exists between economic growth and financial development. Capitalization is inversely linked with financial development. The causality analysis reveals a feedback effect between natural resource abundance and financial development i.e. natural resource abundance causes financial development; in turn, financial development Granger causes natural resource abundance. This empirical evidence provides new insights for policy makers to use natural resource abundance as an economic tool to improve the performance of financial sector by considering the role of economic growth and education.
Keywords: Natural Resources, Financial Development, USA

I. Introduction

Most of the empirical evidence has shown that the majority of resource-dependent countries have a low level of financial development (Gelb 1988, 2010, Sachs and Warner, 2001, Cordon and Neary 1982, Mehlum et al. 2006, Elbadawi and Soto 2012, Frenkel 2012). There is an evidence in the existing literature regarding the negative relation between natural resource abundance and financial development; however, to date, this relation has not been determined conclusively (see e.g., Sachs and Warner 1995, 2001, Auty 2001, Gylfason 2001). Wealth from natural resources is not a negative factor. Various components lead to the ability for reaping benefits from resources that countries such as Norway and Botswana have succeeded in acquiring to twist the "curse" into a blessing. The issues of possible negative effect and appropriate rental gains can be achieved through better economic and political institutions (Boschini et al. 2007). Hence, developed financial institutions are one of the solutions to stimulate economic growth and escape the curse driven by resource rents. A well-organized financial market determines investment opportunities, transfers public funds to the non-public sector (stimulate savings), encourages innovations, facilitates corporate control, and facilitates risk management and therefore leads to poverty reduction strategies (Rajan, 2003)[1]. Therefore, it will be interesting to know the relationship of financial development and natural resource abundance for reliable and conclusive empirical findings. The United States is one of the developed country with developed financial sector and natural resource rich country. Therefore, exploring linkage of financial development with natural resource abundance is important because financial development constitutes an important mechanism for long-run economic growth, any impact of natural resource abundance on financial development can inevitably influence the pace of economic growth. Further, empirical investigation of relationship between natural resource abundance and financial development provides new insights for policy makers to utilize natural resources as a blessing rather than a curse.

The United States of America (USA) is blessed with an unusual abundance of natural resources, including a large land mass, large coastlines, fertile land, fresh water and energy (oil, gas and coal). The USA has 95,471 miles of shoreline, which contributed $222.7 billion and $257.7 billion to gross domestic product (GDP), creating 2.6 and 2.8 million jobs in 2009 and 2010 respectively. Nearly three-quarters of these jobs are related to tourism and ocean recreation. However, the highest paying sector is oil drilling, which pays $125,700 per worker. The US economy has the world's largest reserves of coal, with 491 billion short tons or 27 percent of the total. In 2005, 60 percent of oil used in the United States was imported, which decreased to 24% by 2015 (Kimberly, 2017). The United States has an approximately 502,000-square-mile area between the Rocky Mountains and the Mississippi River, which have ideal conditions for cultivation. Approximately 80% of water used in the US is obtained through rivers, lakes and streams; the remaining 20% of water is pumped out of the ground. This water is primarily used in the electric power industry and agriculture sector. The US has also attracted approximately 43 million skilled immigrants who played a great role in making the US as hub of innovation industry. The US economy is among the top 10 producers of crude oil. The US natural gas exports continued to increase, as exports in 2016 were more than 3 times greater than the exports 10 years ago, and

[1] Detailed existing literature on finance-growth can be seen (Beck and Levine 2004, Benhabib and Spiegel 2000, Levine et al. 2000, Nili and Rastad 2007).

the USA is expected to become net exporter of natural gas by 2018 (Victoria and Katie, 2017). According to Daniel (2017), United States is the fourth largest exporter of coal.

According to U.S. Geological Survey in 2017, the United States produced 13 mineral commodities in 2016 that were valued at more than $1 billion each; the estimated value of total U.S. industrial minerals production in 2016 was $51.6 billion, 5% more than that of 2015. In 2012, 33% of the total land of the United States consists of forest, of which 10% is reserved. In addition to the additional benefits of controlling pollution, the value of these trees is more than 2.4 trillion. According to the American Forest and Paper Association, the U.S. forest products industry employs approximately 1 million workers and represents approximately 6 percent of the total U.S. manufacturing gross domestic product, or GDP, placing it approximately equivalent with the automotive and plastics industry. The forest products industry generates more than $200 billion a year, placing it among the top 10 manufacturing sector with employers in 48 states and approximately $54 billion in annual payroll. In 2011, the industry recycled 66.8% of paper consumed and is the leading generator and user of renewable energy. Business managers and entrepreneurs require financial resources to begin a new business or expand an existing business. There are various entities associated with business development, including money institution (banks), business partners, and capital market. Hence, financial system is a key driver of business environment. The development of new firms is affected by cost of capital and characteristics of financing for new firms (Cuervo, 2005). Schumpeter (1934) and Keynes (1971) argued the importance of an efficient banking sector in the development of innovation technology and economic growth. The crowding out effect and financial repression theories explain the relationship between oil revenues and financial system.

According to the previous theory, if money markets and commodity revenues are both in equilibrium, any increase in public spending that is not related with an increase in money supply will increase interest rates, and private sector investment will thus be decreased. Similarly, Beck (2011) argued that the relationship between resource abundance and financial development can be explained in term of supply and demand side. Furthermore, regarding the supply-side, a resource abundant economy can crowd-out investment and skills in financial sector. Moreover, regarding the demand-side, Dutch disease can lead to the expansion of consumer credit as a result of more demand for financial services. Public expenditures may increase due to public sector expansion, particularly during the period of oil booms. Conversely, with oil prices decreasing, government must continue to spend money on ongoing projects. In this situation, government uses its power and borrows money from the central bank, thereby weakening the financial system. This weakened financial system does not favor businesses. Gylfason et al. (1999) explain that an adverse relationship prevails between natural resource dependence and school enrolment for all school levels across countries. This relationship is observed because real exchange rate variations induced by natural resources impedes investment in the high-skill-intensive secondary sector. Furthermore, Alexeev and Conrad (2011) found the negative relationship between oil wealth and primary school enrollment for economies in transition. Furthermore, Gylfason (2001) argued that an increase in resource income shrinks the manufacturing sector for which human capital is a key production factor. Therefore, returns on education and the need for higher education decrease through reductions in the manufacturing sector. Moreover, Papyrakis and Gerlagh (2004, 2007) also reported the negative relationship between natural resource extractions and investments in human capital. It is evident from the existing literature that the wealth from natural resources has a sustainable and positive effect on economic growth if saved or invested properly (Auty 2007, Humphreys et al. 2007, Mehlum et al. 2007). The action is justified as it leads to capital accumulation. The goal of generating positive economic growth through accumulated capital can be achieved by well-functioning financial system. An important connection between financial development and natural resources is that resource revenues or rents can act as an alternative for private saving. Therefore, if a financial system is poor in resource rich countries, different forms of fluctuations could arise in the economy as a consequence of supplement the negative effects of natural resources, such as ineffectiveness of investments. Furthermore, a well-organized financial structure is likely to behave as a hedge to distortions in prices to which resource rich countries are sensitive and are thus likely to absorb disturbance better (Denizer et al. 2000).

There is a vast body of existing literature on the effect of institutional quality on natural resource curse. However, previous studies have focused minimally on the effect of natural resource abundance on financial development with additional determinants, such as education, economic growth and capital. In doing so, this study contributes to the existing literature by five means: (i), This study investigates the stimulating role of natural resource abundance on financial development for the case of the USA over the period of 1960-2016. (ii), Education, economic growth and capitalization are added as additional determinants of financial development in finance demand function. (iii), The traditional and structural break unit root tests are applied for examining unit root properties of the variables. (iv), We apply Bayer-Hanck combined cointegration approach and the robustness of cointegration relationship is tested by applying the bounds testing approach to cointegration. (v), The VECM Granger causality is applied to examine causal relationship between financial development and its determinants in the presence of structural break stemming in the series. Our empirical evidence reveals the presence of cointegration between the variables. Moreover, natural resource abundance adds in financial development. Education is positively linked with financial development. Economic growth contributes to financial development. A negative relationship exists between capitalization and financial development. The causality analysis reveals the feedback effect between natural resources abundance and financial development.

The rest of paper is organized as following: Section-II details review of studies in existing literature and model construction with data collection is explained in Section-III. Section-IV deals with methodological framework and results are interpreted in Section-V. The concluding remarks with policy implication are drawn in Section-VI.

II. Literature Review

Existing literature of the late 1980s shows natural resources as blessing; however, these resources may increase the chances of unfavorable political and economic scenarios, and the term “resource curse” appears. Weak political and financial institutions, neglected education, Dutch disease, failures of economic policy and rent seeking are the main causes of negative economic growth in resource rich countries (Sachs and Warner 1995, Rosser 2006, Caselli and Cunningham 2009, van der Ploeg and Venables 2009). It can also be observed that not all countries have similar situation. Countries with better interaction between institutions and natural resources may lead to prosperity. Countries with strong institutions that encourage accountability protect property rights, control corruption, and state competence will lead to benefits from resource booms, since these institutions determine policy outcomes, as for Norway (Mehlum et al. 2006). Leite and Weidman (1999) reported that natural resource abundance leads to intensified corruption, particularly in developing economies where the rule of law and institutions in general are inactive because of rent seeking activities. Furthermore, existing studies, such as that by Davis (1995), Herb (2005), Boyce and Emery (2005), Brunnschweiler and Bulte, (2008) and Esfahani et al. (2009) argued that resource curse does not exist and that resource abundance is directly proportional to economic growth. By adjusting regional dummies and initial conditions, Alexeev and Conrad (2009) found that a large amount of wealth from oil or other minerals does not hamper long-run economic growth for mineral-rich countries. Stijns (2005) argued that economic growth does not depend upon the nature of natural resources but on the kind of knowledge accumulation process and how it is produced. Moreover, he discovered that when natural resources are calculated in terms of the levels of production or reserves, rather than exports, there is no statistically meaningful effect on economic growth.

Beck (2011) illustrated the demand and supply-side perspective of dependence between natural resource abundance and financial development. Another approach that links natural resource abundance with financial development is by Gylfason and Zoega (2001). They used a sample of 85 countries covering the 1965-1998 period by applying an apparently unrelated regression (SUR) method and found that higher dependence on natural resources is correlated with lower degree of financial development. In the case of China, Yuxiang and Chen (2011) used provincial panel data covering the 1996-2006 period by applying a system GMM estimator to show the importance of natural resource abundance on development of financial system. They noted that slower development in financial system of resource-rich regions than resource-poor ones. Moreover, financial development is a significant determinant for long-run economic growth after controlling for the effect of investment. Kurronen (2012) used the fixed effect estimator on 133 countries after controlling for important determinants of financial development using pooled data. His empirical results indicated that a banking department tends to be smaller in resource-based countries, squeezing the financial sector. Barajas et al. (2012) examined the heterogeneity in growth performance using a GMM dynamic panel methodology that could be related to a finance-related resource curse through three dimensions: on regional and income levels, as well as for oil exports for 146 countries over the period of 1975-2005. Their results indicate that financial development is helping in reducing the natural resources curse effect on economic growth. Hoshmand et al. (2013) investigated the relationship between oil rents (measure of natural resources), institutions and financial development in oil exporting countries by applying Generalized Method of Moments (GMM) over the 2002-2010 period. They found that natural resources weaken financial development, which causes economic growth to decline.

Quixina and Almeida (2014) examined the finance-growth nexus by including natural resources as additional determinants of financial development and economic growth. Their empirical analysis indicated that natural resources cause economic growth; however, a neutral effect is also noted between natural resources and financial development in Angola. For Venezuela, Satti et al. (2014) investigated the relationship between financial development and economic growth by including natural resources in production function. Their empirical analysis reveals that financial development Granger causes natural resources; however, the opposite is not true. Recently, Law and Moradbeigi (2017) examined the resources-finance-growth nexus for 63 oil-producing countries for the 1980-2010 period by applying the common correlated effect mean group (CCEMG) estimator. Their empirical results indicate that financial development offsets the negative effect of natural resources on economic growth by channelizing oil revenues into productive investment ventures. Moradbeigi and Law (2017) used oil production as measure of natural resources to examine the impact of financial development on oil-growth nexus for 63 oil-producing countries. They found that financial development is helpful in nullifying the negative effect of natural resources on economic growth.

We may conclude that existing studies in literature provides ambiguous empirical results which could help policy makers in designing comprehensive policy to use natural resources as economic tool for improving financial development and hence economic growth. Investigating the impact of natural resources on financial development still remains a question which is main motivation for researchers. This paper fills the prevailing research gap by investigating natural resource abundance-financial development nexus by adding economic growth, capitalization and education as additional determinants in finance demand function for the US economy.

III. Model Construction and Data Collection

This study examines the relationship between natural resource abundance and financial development by incorporating economic growth, education and capital in finance demand function. A developed financial system enables an economy to stimulate economic growth by offsetting the negative effect of natural resource abundance on economic growth. Sound financial sector allocates resources generated from natural resources into productive investment ventures, which stimulates economic growth. This behavior increases the demand for financial services due to enhanced economic activity, and financial development is increased (Rajan 2003, Yuxiang and Chen 2011, Hoshmand et al. 2013). In contrast, natural resources exploitation may shift production factors from trade-able sectors to nontrade-able sectors, which reduces trade. Trade plays a vital role in determining financial development. The firm's demand for external finances is increased due to expansion of trade-able sectors. In such circumstances, the weakening effect of natural resources on trade-able sectors may affect financial development negatively and vice versa. Economic growth leads financial development by raising the demand for financial services due to enhanced economic activity, such as investment activities, is termed as demand-side hypothesis (Shahbaz, 2012). Education may play important role in stimulating financial development via human capital development channels. Education enables individuals to reduce information gap and increases the demand for various financial services, i.e. instruments which affect financial development positively. Furthermore, educated investor and skilled entrepreneur may use financial resources efficiently compared to uneducated and unskilled individuals (Barro et al. 1995, Barro and Lee 2013, Ho 2013, Hatemi-J and Shamsuddin 2016). Capital may affect financial development positively or negatively. On the basis of discussed theoretical background, the general form of finance demand function is modeled as the following:

$$F_t = f(R_t, Y_t, E_t, K_t) \qquad (1)$$

All the variables have been transformed into natural-log after converting into per capita units by following Ahmed et al (2016). The data transformation into per capita units normalizes the data distribution and log-linear specification provides reliable empirical results in elasticities between independent and dependent variables respectively. The empirical equation of finance demand function is modeled as the following:

$$\ln F_t = \alpha_0 + \alpha_1 \ln R_t, + \alpha_2 \ln Y_t + \alpha_3 \ln E_t + \alpha_4 \ln K_t + \mu_i \quad (2)$$

where $\ln$, F_t, R_t, Y_t, E_t, K_t and μ_i indicate natural-log, financial development is measured by real domestic credit to private sector per capita, natural resources is proxied by real natural resource abundance per capita, economic growth is measured by real GDP per capita, education is proxied by colleges and high school attainment is the total number of high school graduates divided by the total population, capitalization is measured by real capital per capita and residual term is assumed to be normally distributed.

This study utilizes annual data for the period of 1960-2016. The data on real GDP (constant 2010 LCU)[2], domestic credit to private sector (constant 2010 LCU), natural resources (which is composite of coal rents, natural gas rents, oil rents, forest rents and mineral rents) (constant 2010 LCU) and gross fixed capital formation (constant 2010 LCU) from World Development Indicators (CD-ROM, 2017)[3]. The data on colleges and high school attainments is borrowed from Frank (2009). The total population collected from World Development Indicators (CD-ROM, 2017) to transform all of the variables into the per capita unit, except education.

IV. Methodological Strategy

IV.I Bayer-Hanck Combined Cointegration Approach

Existing applied economics literature provides many cointegration approaches to examine long-run relationship between macroeconomic variables. Before proceeding to cointegration approach, it is necessary to examine unit root properties of the variables, which helps in choosing suitable cointegration test for empirical model for reliable empirical results. Existing cointegration approaches include Engle and Granger (1987) (EG), Johansen (1991) (JOH), Phillips and Ouliaris (1990), Peter Boswijk (1994) (BO) and Banerjee et al. (1998) (BDM). These cointegration approaches may provide ambiguous empirical results due to their explanatory power properties. Later, to increase the power of the cointegration analysis, Bayer and Hanck (2009) developed a new cointegration approach known as the combined cointegration approach. This test combines the results of previous cointegration approaches (Johansen, Phillips and Ouliaris, Boswijk, and Banerjee) and provides Fisher F-statistics for more conclusive and reliable empirical findings. To apply the Bayer and Hanck combined cointegration approach, the order of integration must be unique, i.e. I(1). If the calculated F-statistic exceeds the critical value[4], we may reject the null of no cointegration; the reverse applies for the acceptance of the null hypothesis. The Fisher's formulas of computing Bayer and Hanck cointegration are as follows:

$$EG - JOH = -2\ [\ln(P_{EG}) + \ln(P_{JOH})] \quad (3)$$

$$EG - JOH - BO - BDM = -2ln[(P_{EG}) + (P_{JOH}) + (P_{BO}) + (P_{BDM})] \quad (4)$$

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[2] LCU stands for local currency unit.

[3] Natural resource abundance consists of fossil fuels and certain minerals. These fossil fuels and certain minerals are coal rents, natural gas rents, oil rents, forest rents and mineral rents etc. This definition of natural resource abundance is used by numerous researchers such as Gylfason (2001), Papyrakis and Gerlagh (2007), Satti et al. (2014), Ahmed et al. (2016) etc.

[4]Critical values are presented in Bayer and Hanck (2009).

where P_{EG}, P_{JOH}, P_{BO} and P_{BDM} are the p-values of various individual cointegration tests such as Engle and Granger (1987), Johansen (1991), Peter Boswijk (1994) and Banerjee et al. (1998), respectively. The Fisher statistic is used to examine whether cointegration exists or not between the variables. We may reject the null hypothesis in favor of cointegration between the variables if the Fisher statistic exceeds the Bayer and Hanck critical bounds and vice versa.

IV.II ARDL Bound Testing Approach to Cointegration

The autoregressive distributed lag (ARDL) bounds testing approach to cointegration developed by Pesaran et al. (2001) is applied to examine a long-run relationship between financial development, natural resource abundance, economic growth, education and capital. This cointegration test by Pesaran et al. (2001) has several advantages over traditional cointegration approaches, such as Ganger causality of Engle and Granger (1987) and cointegration test of Johansen (1988, 1991) concerning the order of integration[5]. This method is applicable if the variables are observed to be stationary at I(1) or I(0) or I(1)/I(0). The ARDL bounds testing empirical model utilizes a sufficient number of lags for capturing the data generating process using a general-to-specific modeling framework (Laurenceson and Chai 2003). The dynamic unrestricted error correction model can be derived from the ARDL bounds testing through a simple linear transformation. This approach provides reliable empirical results including for small samples. The UECM (unrestricted error correction model) combines the short-run dynamics with the long-run equilibrium without losing any long-run information. This approach identifies the cointegrating vectors that are due to multiple cointegrating vectors occurring in the empirical model. Under the ARDL framework, we may use a different optimal number of lags for different variables to compute the ARDL F-statistic for examining whether cointegration exists between the variables. This cointegration test allows us to capture the structural break information in the series by accommodating a dummy variable in empirical model. The estimated models for the ARDL bounds testing approach to cointegration are the following:

$$\begin{aligned}\Delta\ln F_t &= \alpha_1 + \alpha_T T + \alpha_F \ln F_{t-1} + \alpha_R \ln R_{t-1} + \alpha_Y \ln Y_{t-1} + \alpha_E \ln E_{t-1} + \alpha_K \ln K_{t-1} \\ &+ \sum_{j=1}^{q} \alpha_j \Delta R_{t-j} + \sum_{k=0}^{r} \alpha_k \Delta Y_{t-k} + \sum_{l=0}^{s} \alpha_l \Delta E_{t-l} + \sum_{m=0}^{t} \alpha_m \Delta R_{t-m} + \alpha_D D_1 + \mu_i\end{aligned} \quad (5)$$

$$\begin{aligned}\Delta\ln R_t &= \alpha_1 + \alpha_T T + \alpha_R \ln R_{t-1} + \alpha_F \ln F_{t-1} + \alpha_Y \ln Y_{t-1} + \alpha_E \ln E_{t-1} + \alpha_K \ln K_{t-1} \\ &+ \sum_{j=1}^{q} \alpha_j \Delta R_{t-j} + \sum_{k=0}^{r} \alpha_k \Delta Y_{t-k} + \sum_{l=0}^{s} \alpha_l \Delta E_{t-l} + \sum_{m=0}^{t} \alpha_m \Delta R_{t-m} + \alpha_D D_2 + \mu_i\end{aligned} \quad (6)$$

$$\begin{aligned}\Delta\ln Y_t &= \alpha_1 + \alpha_T T + \alpha_Y \ln Y_{t-1} + \alpha_R \ln R_{t-1} + \alpha_F \ln F_{t-1} + \alpha_E \ln E_{t-1} + \alpha_K \ln K_{t-1} \\ &+ \sum_{j=1}^{q} \alpha_j \Delta R_{t-j} + \sum_{k=0}^{r} \alpha_k \Delta Y_{t-k} + \sum_{l=0}^{s} \alpha_l \Delta E_{t-l} + \sum_{m=0}^{t} \alpha_m \Delta R_{t-m} + \alpha_D D_3 + \mu_i\end{aligned} \quad (7)$$

[5]All these approaches require that the variables should be integrated at a unique order of integration.

$$\Delta \ln E_t = \alpha_1 + \alpha_T T + \alpha_E \ln E_{t-1} + \alpha_R \ln R_{t-1} + \alpha_F \ln F_{t-1} + \alpha_Y \ln Y_{t-1} + \alpha_K \ln K_{t-1} + \sum_{j=1}^{q} \alpha_j \Delta R_{t-j} + \sum_{k=0}^{r} \alpha_k \Delta Y_{t-k} + \sum_{l=0}^{s} \alpha_l \Delta E_{t-l} + \sum_{m=0}^{t} \alpha_m \Delta R_{t-m} + \alpha_D D_4 + \mu_i \tag{8}$$

$$\Delta \ln K_t = \alpha_1 + \alpha_T T + \alpha_K \ln K_{t-1} + \alpha_R \ln R_{t-1} + \alpha_F \ln F_{t-1} + \alpha_Y \ln Y_{t-1} + \alpha_Y \ln Y_{t-1} + \sum_{j=1}^{q} \alpha_j \Delta R_{t-j} + \sum_{k=0}^{r} \alpha_k \Delta Y_{t-k} + \sum_{l=0}^{s} \alpha_l \Delta E_{t-l} + \sum_{m=0}^{t} \alpha_m \Delta R_{t-m} + \alpha_D D_5 + \mu_i \tag{9}$$

where Δ is a first difference operator, and D is a dummy variable for structural breaks identified by the Kim and Perron (2009) structural break unit root test. The appropriate lag length of the variables is chosen based on the Akiake Information Criterion (AIC). The ARDL F-test provides different F-statistics at different lag orders. To compute the ARDL F-statistic, we act in accordance with the null hypothesis of no cointegration for all models, such as $H_0 : \alpha_F = \alpha_R = \alpha_Y = \alpha_E = \alpha_K = 0$. The alternate hypothesis of existence of cointegration is $H_0 : \alpha_F \neq \alpha_R \neq \alpha_Y \neq \alpha_E \neq \alpha_K \neq 0$. We are in favor of the existence of cointegration between the variables if the ARDL F-statistic exceeds the upper critical bound (UCB). There is no cointegration between the variables if the lower critical bound (LCB) is more than the ARDL F-statistic. The empirical results will be inconclusive when the ARDL F-statistic is between UCB and LCB. The CUSUM and CUSUMsq tests are applied to check the reliability of the ARDL estimates for the long-run and short-run[6]. The diagnostic analysis is also conducted to examine the presence of serial correlation, white heteroscedasticity, and ARCH for the specification of the empirical model.

IV.III The VECM Granger Causality

The existence of a long-run relationship suggests that we need to identify a causal relationship between financial development, natural resource abundance, economic growth, education and capital. Engle and Granger (1969) argued that there should be causality between the variables on at-least from one side if variables are cointegrated with a unique order of integration. Thus, we apply the VECM Granger causality, which provides a causal relationship between the variables in the long-run and in the short-run, as well. The empirical investigation of causal association between the variables in the long-run and short-run is helpful in designing comprehensive policy implications. The empirical equations of VECM Granger causality are modeled as follows:

[6] The CUSUM are CUSUM tests are used to examine the consistency of estimates. The CUSUM test detects the structural changes occurs in intercept. The CUSUMsq test identifies structural change stems in slope coefficient. The CUSUM and CUSUMsq tests have high power properties if structural changes are involved in intercept and slope coefficients respectively (Turner, 2010).

$$(1-L)\begin{bmatrix}\ln F_t\\ \ln R_t\\ \ln Y_t\\ \ln E_t\\ \ln K_t\end{bmatrix}=\begin{bmatrix}\alpha_1\\ \alpha_2\\ \alpha_3\\ \alpha_4\\ \alpha_5\end{bmatrix}+\begin{bmatrix}b_{11i}\,b_{12i}\,b_{13i}\,b_{14i}\,b_{15i}\\ b_{21i}\,b_{22i}\,b_{23i}\,b_{24i}\,b_{25i}\\ b_{31i}\,b_{32i}\,b_{33i}\,b_{34i}\,b_{35i}\\ b_{41i}\,b_{42i}\,b_{43i}\,b_{44i}\,b_{45i}\\ b_{51i}\,b_{52i}\,b_{53i}\,b_{54i}\,b_{55i}\end{bmatrix}\times\begin{bmatrix}\ln F_{t-1}\\ \ln R_{t-1}\\ \ln Y_{t-1}\\ \ln E_{t-1}\\ \ln K_{t-1}\end{bmatrix}+\ldots+\begin{bmatrix}b_{11i}\,b_{12i}\,b_{13i}\,b_{14i}\,b_{15i}\\ b_{21i}\,b_{22i}\,b_{23i}\,b_{24i}\,b_{25i}\\ b_{31i}\,b_{32i}\,b_{33i}\,b_{34i}\,b_{35i}\\ b_{41i}\,b_{42i}\,b_{43i}\,b_{44i}\,b_{45i}\\ b_{51i}\,b_{52i}\,b_{53i}\,b_{54i}\,b_{55i}\end{bmatrix}$$

$$\times\begin{bmatrix}\ln F_{t-1}\\ \ln R_{t-1}\\ \ln Y_{t-1}\\ \ln E_{t-1}\\ \ln K_{t-1}\end{bmatrix}+\begin{bmatrix}\alpha\\ \beta\\ \gamma\\ \delta\\ \phi\end{bmatrix}ECT_{t-1}+\begin{bmatrix}\varepsilon_{1t}\\ \varepsilon_{2t}\\ \varepsilon_{3t}\\ \varepsilon_{4t}\\ \varepsilon_{5t}\end{bmatrix} \qquad (10)$$

where (1-L) is the difference operator, and ECT_{t-1} is a lagged correction term obtained from the long-run equation. The statistical significance of the ECT_{t-1} t-statistic confirms the presence of long-run causality[7]. The direction of short-run causality is provided by the significant relationship in first differences of the variables. Thus, the joint χ^2 statistic for the first differenced lagged independent variables is used to test the direction of short-run causality between the variables under the framework of the Wald test. For instance, $b_{12,i} \neq 0 \forall_i$ shows that natural resource abundance Granger causes financial development, and financial development Granger causes natural resource abundance if $b_{21,i} \neq 0 \forall_i$.

V. Empirical Results and Their Interpretation

Table-1 provides the descriptive statistics and the correlation matrix. The empirical findings report that mean and median value of all variables are approximately the same. The standard deviation analysis reveals that volatility in financial development and natural resource abundance is high compared to education, economic growth and capital. The Jarque-Bera test statistic reveals that all of the variables have normal distribution, which means that further empirical analysis is needed. The pairwise correlation analysis shows that natural resource abundance is positively correlated with financial development. The positive correlation also exists for capitalization, education and economic growth with financial development. Natural resource abundance is inversely correlated with capital, education and economic growth. Education and economic growth are positively correlated with capital. However, we observe a positive association between economic growth and education.

Table-1: Descriptive Statistics and Correlation Matrix

Variables	$\ln F_t$	$\ln R_t$	$\ln K_t$	$\ln E_t$	$\ln Y_t$
Mean	1.7441	1.5564	2.2566	1.2239	2.6416
Median	1.7523	1.5387	2.2538	1.2309	2.6436

[7]A dummy variable is also included for structural breaks identified by the Kim and Perron (2009) structural break unit root test.

Maximum	1.9395	1.8582	2.3341	1.2757	2.7160
Minimum	1.5171	1.2000	2.1345	1.1473	2.5295
Std. Dev.	0.1351	0.1321	0.0488	0.0354	0.0554
Skewness	-0.2035	-0.0887	-0.3505	-0.5252	-0.3288
Kurtosis	1.6914	3.4409	2.3635	2.2958	1.7588
Jarque-Bera	1.1040	1.5817	1.2767	1.1104	1.0802
Prob.	0.5089	0.4534	0.4670	0.4808	0.5109
$\ln F_t$	1.0000				
$\ln R_t$	0.5496	1.0000			
$\ln K_t$	0.4108	-0.2075	1.0000		
$\ln E_t$	0.4701	-0.3115	0.3505	1.0000	
$\ln Y_t$	0.3089	-0.4035	0.4567	0.6070	1.0000

To estimate the demand function of finance, the first step is to check the order of integration of the variables, such as financial development, natural resource abundance, capital, education and economic growth. Thus, we have applied the ADF (Dickey and Fuller, 1981) and PP (Phillips and Perron, 1988) unit root tests; the empirical results are reported in Table-2. We find that financial development, natural resource abundance, capital, education and economic growth contain the unit root process at the level with the intercept and the trend. After first difference, all of the variables are determined to be stationary. This finding confirms that all of the variables have a unique order of integration, i.e., I(1). The results of the PP unit root test also confirm the empirical findings provided by the ADF unit root test. This finding indicates the reliability and robustness of the unit root analysis.

Table-2: Unit Root Analysis without Break

Variables	ADF Unit Root Test		Phillips-Perron Unit Root Test	
	T-statistics	Prob. Value	T-statistics	Prob. Value
$\ln F_t$	-2.5315	0.3127	-1.4922	0.8287
$\ln R_t$	-1.8529	0.6739	-1.4889	0.8298
$\ln E_t$	-1.7708	0.7708	-2.1694	0.5030
$\ln Y_t$	-1.4838	0.8313	-1.5772	0.7980
$\ln K_t$	-3.1049	0.1086	-2.6109	0.2761
$\Delta \ln F_t$	-2.6865***	0.0787	-6.2009*	0.0000
$\Delta \ln R_t$	-3.2865***	0.0724	-6.0884*	0.0000
$\Delta \ln E_t$	-5.0933*	0.0002	-6.3829*	0.0000
$\Delta \ln Y_t$	-3.5267**	0.0400	-5.6728*	0.0000
$\Delta \ln K_t$	-3.4805**	0.0449	-4.8244*	0.0006
Note: *, ** and *** show the significance at 1%, 5% and 10% level of significance.				

The main disadvantage of ADF and PP unit root tests is that these tests do not accommodate the information of unknown structural breaks occurring in the series. However, the existing literature provides numerous unit root tests accommodating a structural break in the series, such as the Perron (1997) and Zivot-Andrews (1996), and Clemente-Montanes-Reyes (1992) unit root tests. These tests are suitable for accommodating single and double unknown structural breaks occurring in the series. The empirical results provided by these unit root tests are not free from criticism due to their low explanatory power. To solve this problem, we apply the Kim and Perron (2009) unit root test, covering all deficiencies and limitations of the previous structural break unit root test. The Kim and Perron (2009) unit root test accommodates the information of a single unknown structural break occurring in the series. The results of the Kim and Perron (2009) test are reported in Table-3. The empirical results indicate that financial development, natural resource abundance, education, economic growth and capital are found non-stationary in the presence of structural breaks. The structural break periods for financial development, natural resource abundance, education, economic growth and capital are 1994Q_I, 1985Q_I, 1996Q_{IV}, 1982Q_I and 1991Q_I, respectively. The US government implemented numerous economic, financial and education reforms for long-run sustainable economic development. All of the variables are stationary after 1st difference in the presence of structural breaks occurring in the series. The empirical results provided by the Kim and Perron (2009) unit root test are also consistent with the findings of the ADF and PP unit root tests. The researchers conclude that all of the variables are integrated at I(1).

Table-3: Unit Root Analysis with Breaks

Variable	Kim and Perron at Level			Kim and Perron at 1st Difference		
	T-statistics	Prob.	Time Break	T-statistics	Prob.	Time Break
$\ln F_t$	-2.3149	0.9439	1994Q_I	-4.2360***	0.0887	2007Q1
$\ln R_t$	-2.9096	0.7343	1985Q_I	-4.2138***	0.0946	2008Q1
$\ln E_t$	-1.8771	0.9885	1996Q_{IV}	-6.8945*	0.0000	1983Q1
$\ln Y_t$	-3.8089	0.2320	1982Q_I	-4.5301**	0.0397	1984Q1
$\ln K_t$	-3.8236	0.2255	1991Q_I	-4.6340**	0.0297	2009Q1
Note: *, ** and *** show the significance at the 1%, 5% and 10% level.						

Table-4: Lag Length Criteria

VAR Lag Order Selection Criteria						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	1924.74	NA	4.68	-23.4114	-23.3169	-23.3731
1	3702.39	3425.23	2.44	-44.7853	-44.2182	-44.5551
2	3936.79	436.094*	1.92*	-47.3307*	-46.2911*	-46.9086*
3	3949.79	24.6855	2.21	-47.1926	-45.6805	-46.5787
4	3956.07	10.9410	2.78	-46.9642	-44.9795	-46.1585
* indicates lag order selected by the criterion LR: sequential modified LR test statistic (each test at the 5% level) FPE: Final prediction error AIC: Akaike information criterion SC: Schwarz information criterion HQ: Hannan-Quinn information criterion						

The unique order of integration of the variables means that we should apply the cointegration approach to examine the long-run relationship between financial development and its determinants. Thus, it is necessary to choose the appropriate lag length of the variables by applying the VAR model. The appropriate choice of lag length is helpful in estimating the F-statistic, as the F-statistic is sensitive to the lag length selection. We act in accordance with the Akaike Information Criterion (AIC) for optimal lag selection because AIC has superior properties for a large sample set. Furthermore, Akaike Information Criterion (AIC) provides more efficient and consistent results than do other criteria. The results are shown in Table-4; we find that lag length 2 is optimal for investigating the cointegration between the variables. To confirm the long-run relationship among financial development, natural resource abundance, education, economic growth and capital, we apply the recently developed combined cointegration approach by Bayer and Hanck (2013). The results of the combined cointegration are reported in Table-5. The empirical findings show that the null hypothesis of no cointegration is rejected as we used financial development, natural resource abundance, capital and economic growth as dependent variables. This finding confirms the presence of four cointegrating vectors showing the existence of cointegration between financial development and its determinants. The disadvantage of the combined cointegration approach is that it fails to incorporate the information on structural breaks occurring in the series. To solve this problem, we utilize the ARDL bounds testing approach to investigate the cointegration between financial development and its determinants in the presence of structural breaks in the series. The dummy variable capturing the structural break based on the Kim and Perron (2009) unit root test empirical findings is included while investigating the ARDL F-statistic proposed by Pesaran et al. (2001). The results of the ARDL bounds testing approach to cointegration are reported in Table-6. We find that the ARDL F-statistic exceeds the upper critical bound, as we treated financial development, natural resource abundance, education, economic growth and capital as dependent variables. This finding shows the presence of four cointegrating vectors in the finance demand function. This finding indicates the corroboration of cointegration between financial development and its determinants over the 1960-2016 period in the presence of structural breaks in the series for the USA. This result confirms the robustness of cointegration analysis, which indicates the reliability and consistency of the empirical results.

Table-5: Bayer and Hanck Combine Cointegration

Estimated models	EG-JOH	EG-JOH-BO-BDM	Lags	Cointegration
$F_F = f(R_t, E_t, Y_t, K_t)$	16.2556*	20.9479**	2	Yes
$R_F = f(F_t, E_t, Y_t, K_t)$	11.0770**	26.8685**	2	Yes
$E_F = f(F_t, R_t, Y_t, K_t)$	6.5878	7.0035	2	No
$Y_F = f(F_t, R_t, E_t, K_t)$	11.2087**	27.0731**	2	Yes
$K_F = f(F_t, R_t, E_t, Y_t)$	17.0901*	35.1005*	2	Yes
Significance Level				
1%	15.845	30.774		
5%	10.576	20.143		
10%	8.301	15.938		
Note: * and ** show the significance at the 1% and 5% level.				

Table-6: ARDL Bound Testing Approach

Bound testing to cointegration				Diagnostic tests		
Estimated Models	Optimal Lag Length	Break Years	F-statistics	χ^2_{ARCH}	χ^2_{RESET}	χ^2_{SERIAL}
$F_F = f(R_t, E_t, Y_t, K_t)$	(2, 0, 2, 0, 0)	1994QI	4.0549**	0.1546	0.6046	0.1340
$R_F = f(F_t, E_t, Y_t, K_t)$	(3, 2, 1, 1, 2)	1985QI	5.2394*	0.9892	0.2990	0.2392
$E_F = f(F_t, R_t, Y_t, K_t)$	(2, 1, 1, 1, 1)	1996QIV	2.8598	0.1153	0.8825	0.3157
$Y_F = f(F_t, R_t, E_t, K_t)$	(2, 2, 2, 2, 1)	1982QI	5.3943*	0.9261	0.0504	0.0047
$K_F = f(F_t, R_t, E_t, Y_t)$	(3, 0, 3, 2, 2)	1991QI	6.0495*	0.2210	0.0740	0.1808
Critical values						
Significance level.		Lower bounds $I(0)$		Upper Bounds $I(1)$		
1%		3.74		5.06		
5%		2.86		4.01		
10%		2.45		3.52		
Note: * and ** show the significance at the 1% and 5% level.						

After confirming the long-run relationship, we move to estimate the long-run and the short-run parameters. The results of the long-run analysis are reported in Table-7 (upper segment). The empirical results reveal a positive relationship between natural resource abundance and financial development. Natural resource abundance has a positive and statistically significant effect on financial development. It opines that effecting economic policies to explore the unusual abundance of natural resources play important role in heating US economy which in resulting, stimulates economic activity. This economic activity not only creates jobs for unskilled labor but also absorbs skilled human capital and raises their income levels. This increases aggregate demand that leads investment activities and in resulting, increases financial development due to increase in the demand for financial services. Keeping other things constant, a 1% increase in natural resources leads financial development by 0.2820%. This empirical evidence is contradictory to Yuxiang and Chen (2011), who noted that natural resource abundance decreases financial development in resource-rich regions and vice versa in China. Similarly, Hooshmand et al. (2013) also reported a negative relationship between natural resource abundance and financial development in 16 oil exporting countries. Law and Moradbeigi (2017) noted that natural resources decrease economic growth, which thus retards financial development.

The association between education and financial development is positive and statistically significant. This finding implies that education is a stimulant of financial development. We may infer that education leads financial development by organizing, managing and governing the firms well for enhancing their productive efficiency. This also increases the scope and superiority of financial sector to make economic growth conducive. Education also contributes to financial development via research activities to increase the efficiency of financial system that affects total factor productivity directly and indirectly. Education enables financial system to diffuse financial knowledge for measuring, assessing and managing financial stability by increasing the flexibility of financial system to absorb shocks linked with the intermediation process. A 1% increase in education increases financial development by 0.4893% by maintaining other things constant. This empirical finding is consistent with Hatemi-J and Shamsuddin (2016) who noted that education leads to financial development by improving the skills of the human capital. Similarly, Outreville (1999) reports that education adds to financial development for 57 developing countries.

Economic growth is positively and significantly linked with financial development. This reveals that stimulation in economic activity leads to generate job opportunities which in resulting, increases income levels of all segments of population. In such circumstances, consumption and investment activities rise which in turn, increase the demand of financial services and hence, financial development in increased. Holding all other parameters the same, a 0.2456% increase in financial development is linked with 1% increase in economic growth. This empirical evidence is similar to Shahbaz (2009) who noted that economic growth leads investment activities, which increases the demand for financial services; consequently, financial development is increased. Capital has a negative and significant effect on financial development. This shows that development of capital infrastructure and financial development are not interconnected in USA. It indicates that capitalization is inefficient in promoting financial development due to weak financial policies. A 1% decline in capital will increase financial development by 0.3641% if all else is the same. The dummy variable captures the impact of the Riegle-Neal Interstate Banking and Branching Efficiency Act that were implemented in 1994. The results show that implementation of the Riegle-Neal Interstate Banking and Branching Efficiency Act has a positive effect on financial development, but the effect is insignificant.

Table-7: Long-Run and Short-Run Analysis

Dependent variable: $\ln F_t$			
Variables	Coefficient	Std. error	T-statistics
Long Run			
Constant	-4.5670*	0.0836	-54.586
$\ln R_t$	0.2820*	0.0995	2.8326
$\ln E_t$	0.4893*	0.1607	3.0436
$\ln Y_t$	0.2456*	0.0132	8.482
$\ln K_t$	-0.3641*	0.0677	-5.3783
D_t	0.0017	0.0234	0.7275
Short Run			
Constant	0.0011**	0.0005	2.3501
$\Delta \ln R_t$	0.0252**	0.0102	-2.4522
$\Delta \ln E_t$	1.2529*	0.4023	3.1144
$\Delta \ln Y_t$	0.3166	0.2764	1.1453
$\Delta \ln K_t$	-0.0169	0.1143	-0.1478
D_t	0.0016	0.0024	1.0175
ECM_{t-1}	-0.0441**	0.0240	-1.8393
R-squared	0.4589		
F-statistics	9.0129		
Prob.	0.0000		

Diagnostic Analysis			
Test	F-Statistic	P. Values	
$\chi^2 NORMAL$	0.1825	0.7845	
$\chi^2 SERIAL$	2.2245	0.1213	
$\chi^2 ARCH$	0.7568	0.3856	
$\chi^2 WHITE$	2.2373	0.1324	
$\chi^2 RESAY$	1.9891	0.1543	
Note: * shows the significance at the 1% level.			

The short-run results (Table-7, lower segment) show the positive and significant impact of natural resource abundance on financial development. The relationship between education and financial development is positive and significant at the 1% level. Economic growth affects financial development positively but insignificantly. Capital is negatively and insignificantly linked with financial development. The dummy variable has a positive but insignificant impact on financial development. The estimate of ECM_{t-1} is negative and statistically significant at the 5% level, which confirms the established long-run relationship between financial development and its determinants. The significant and negative estimate of ECM_{t-1} shows the speed of adjustment from short-run disequilibrium towards the long-run equilibrium path. This finding shows that short-run deviations are corrected by 4.41% in each quarter; thus, it will take approximately 5 years and 6 months to achieve its long-run equilibrium. The diagnostic analysis indicates the absence of serial correlation, in addition, the residual term has normal distribution. There is no empirical evidence for autoregressive conditional and white heteroscedasticity. The function form is well-formulated, as confirmed by the Ramsey reset test. The CUSUM and CUSUMsq test are also applied to examine the reliability of the ARDL long-run and short-run estimates. The empirical results are reported in Figure-1 and 2. We find that the CUSUM and CUSUMsq test are between the critical bounds at the 5% level. This finding confirms that ARDL estimates are reliable and consistent.

Figure-1: CUSUM Test

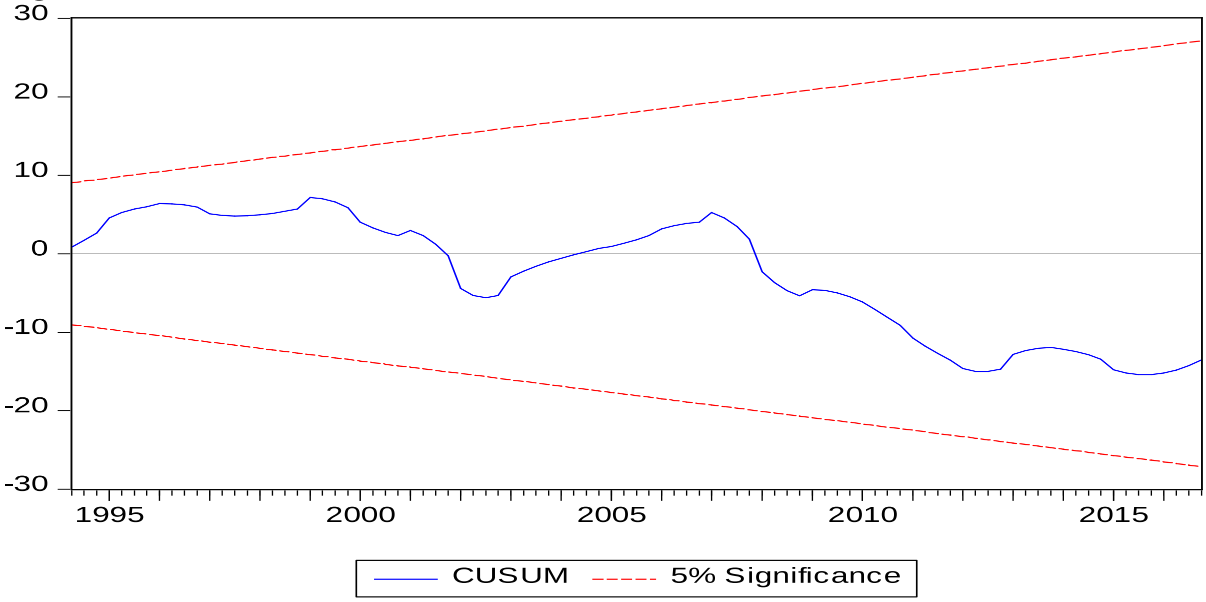
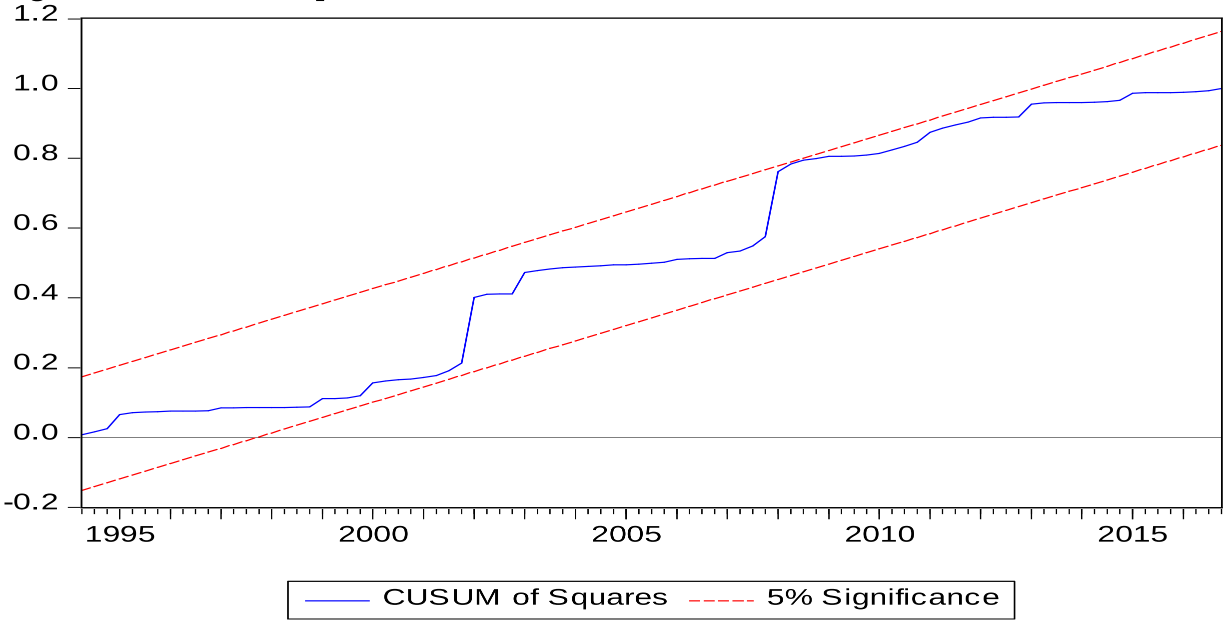


Figure-1: CUSUM of Squares Test



The cointegration analysis only confirms the existence of a long-run relationship between the variables. Similarly, the long-run and short-run analysis provides coefficients of the estimated parameters. To identify the causal relationship between the variables, Engle and Granger (1987) introduced the VECM version of the Granger causality approach, which provides the direction of causality. To provide a clear picture of the relationship, we also apply the VECM Granger causality approach. This approach has an advantage in that it detects the causal relationship for the short run and the long run. The results of the VECM Granger causality analysis are reported in Table-8. In the long run, we find a feedback effect between natural resource abundance and financial development. Natural resources Granger cause financial development; subsequently, financial development Granger causes natural resources. This empirical evidence supports the results reported by Hoshmand et al. (2013). The researchers noted the bidirectional relationship between oil rents, i.e. the measure of natural resources and financial development. The unidirectional causality exists, extending from education to financial development. Similarly, Hatemi-J and Shamsuddin (2016) noted that financial development Granger causes education via the human capital channel. In contrast, Hakeem and Oluitan (2012) reported the feedback effect between financial development and educated human capital. Education Granger causes natural resources. The bidirectional causality exists between economic growth and financial development. This finding shows that economic growth and financial development are interdependent. The feedback effect between financial development and economic growth is consistent with Shahbaz (2012). Natural resources Granger cause economic growth; consequently, economic growth Granger causes natural resources. This empirical evidence is consistent with Satti et al. (2014) and Ahmed et al. (2016) for Venezuelan and Iranian economies, respectively. The feedback effect, i.e., bidirectional causality, exists between capital and financial development (natural resources). The relationship between capital and economic growth is also bidirectional. Similarly, Shahbaz (2009) also noted that a feedback effect exists between capital and economic growth.

In the short run, bidirectional causality is observed between natural resources and financial development. Education Granger causes natural resources. A feedback effect exists between natural resources and economic growth. Capital Granger causes natural resources; in turn, natural resources Granger cause capital. The bidirectional causality is found between education and financial development. Financial development and economic growth Granger cause capital.

Table-8: VECM Granger Causality Analysis

Dependent Variable	Short run						Long Run
	$\Delta \ln F_t$	$\Delta \ln R_t$	$\Delta \ln Y_t$	$\Delta \ln E_t$	$\Delta \ln K_t$	*Break Year*	ECM_{t-1}
$\Delta \ln F_t$	---	2.6002*** (0.0775)	0.0814 (0.9218)	6.2866* (0.0024)	1.6509 (0.1952)	1994QI	-0.0542* (0.0066)
$\Delta \ln R_t$	2.8731*** (0.0595)	---	3.6745** (0.0276)	2.1732 (0.1173)	9.5067* (0.0001)	1985QI	-0.0787* (0.0002)
$\Delta \ln E_t$	7.1516* (0.0011)	1.333 (0.2667)	2.2020 (0.1140)	---	1.6306 (0.1992)	1996QIV	---
$\Delta \ln Y_t$	0.0940 (0.9103)	3.5572** (0.0309)	---	2.0749 (0.1290)	268.98* (0.0000)	1982QI	-0.0358* (0.0001)
$\Delta \ln K_t$	2.6591*** (0.0732)	12.038* (0.0000)	278.14* (0.0000)	1.8973 (0.3287)	---	1991QI	-0.0275* (0.0000)
Note:*, ** and *** show the significance at the 1%, 5% and 10% level.							

VI. Conclusions and Policy Implications

This paper explores the relationship between natural resources and financial development by considering the vital role of education, economic growth and capital in the finance demand function for the US economy. Thus, we have applied traditional and recent unit root tests to examine the integration properties of the variables. The cointegration between the variables is investigated by applying the Bayer and Hanck combined cointegration approach, while the robustness of cointegration analysis is confirmed by applying the bounds testing approach in the presence of structural breaks occurring in the series. The causal relationship between financial development and its determinants is examined by applying the VECM Granger causality.

The empirical results validate the existence of cointegration between the variables in the presence of structural breaks, as variables are integrated at I(1). Furthermore, natural resources add in financial development. The linkage between education and financial development is positive. Economic growth stimulates financial development; however, capitalization decreases it. The causality analysis reveals the feedback effect between natural resources and financial development.

The empirical findings suggest that making changes to improve government's abilities in terms of monitoring and evaluation, public investment management, and budget processes will also support the conversion of natural wealth into produced capital and intangible wealth. Alternatives should be emphasized instead of continuously extracting natural resources. Furthermore, to achieve the goal of sustainability, emphasis should be placed on the forecasting of the supply and demand of natural resources. There is also a need for the public sector to ensure that savings/earnings from natural resources are converted into more productive investments for the benefit of all. The government should reform its human capital through science and technology education and by investing in vocational training.

Capitalization is negatively linked with financial development. This suggest that a curse can be converted to a blessing by suitable policies. Thus, non-physical wealth, such as governance quality, is a basic factor to reap natural resource abundance as a curse or a blessing. Furthermore, a well-working financial system reduces uncertainty among stakeholders, increases the government's reputation, and thus intensifies the favorable effects of natural resources on economic growth by channeling their earnings into more fruitful activities; hence, financial development is improved.

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