



BANK PERFORMANCE, RISK AND ECONOMIC GROWTH: ROLE OF FINANCIAL INNOVATION

Muhammad Usman

School of Finance

Zhongnan University of Economics and Law

Wuhan P.R. China

E-mail: usmanzuel@yahoo.com

Abstract: The purpose of study is to examine the impact of financial innovation on bank performance, risk and economic growth in Pakistan. To test study hypotheses, bank level and country level variables are used. Time period of study is 14 years from 2000 to 2013. Data are collected from World Bank, Global Economy, State Bank of Pakistan, Bank Scope databases and Economic Survey of Pakistan. We use correlation matrix and ordinary least square techniques for evaluation. According to hypotheses, we also develop three econometric models to test relationship between depend and independent and control variables. By controlling different variable in model 1, we found positive and statistically significant impact of financial innovation on bank performance. Moreover in model 2 after controlling various bank level indicators we found that financial innovation minimize the risk of bankruptcy. Farther we utilize model 3 to evaluate the relationship between financial innovation and economic growth. Results indicate positive and statistically significant relationship between financial innovation and economic growth.

Key words: Financial Innovation, Bank Performance, Bank Risk, Economic Growth

Recebido em: 29-10-2016

Aceito em: 17-11-2016

INTRODUCTION

Banks are the backbone for financial system in any country around the world. The non-stop alteration of competitive atmosphere, globalization, rule of law, privatization and economics variations, needs financial institution to remain efficient and effective by continuous innovation. Financial innovation like electronic payment, ATM, wire transfer, cards etc. discourage robbing and other crime related to cash, because while using these means customers require less physical cash (Armey et al., 2014). As like customer, financial innovation is also beneficial for vendor as it reduce operation cost, increase efficiency and increase revenue.

Discussion related to economic innovation was start from Schumpeter 1934, who defines economic innovation as; an introduction of new good, production methodology, market, supply chain of raw material/work in process, industrial organization and in macro prospective new economic system. Tufano (2003), define financial innovation as act of creating and introducing financial instruments, technology, institutions and markets. General innovation can be define as product and process innovation but in term of financial sector product innovation means creating new financial instruments and process innovation means the distributing mechanism of these financial instruments. According to Afuah (2003) the new product or services shout be less costly or have more attributes then previously so that the innovative institution enjoy excess profit than before.

Modern banking institutions frequently developed innovative products to attract both the money savers and money users. Financial innovation like new financial markets and institutions, new criteria and decisions, new managerial and organizational practice, also play an important role in countries financial system. These innovations are also helpful to reduce and transfer risk (Hao & Hunter, 1997). In current era, financial innovations are the hot topic need to discuss that how to structure future financial system. Prior to the financial crisis 2007-09, financial innovation was considered as important tool for the growth of financial system. But after the experience of crisis, said view about financial innovation need to be reassessed at least partially. Now many policy developers argued that financial innovations need to be restricted or even prohibited. According to researchers financial innovations have positive and negative characteristics depend upon economic conditions. Financial innovations perform well in normal economic conditions but at the time of crisis it may increase the shocks of crisis (Norden et al., 2014).

Many researchers still consider that financial system is among one of the key factors which are important for economic growth. Firm level innovation is reflected the significant impact on economic development. Innovation at firm level is usually performed by individual entrepreneur or group of firm. Innovative projects are characterized as costly and having long tenure with uncertain payoff. These kinds of activities are heavily depending upon external financing. Banking sector is top performing external financing source in any country. We can say that production related innovation can't be possible without facilitation of financial sector. As Schumpeter 1934 explained that process of credit creation is an important way to run innovative process.

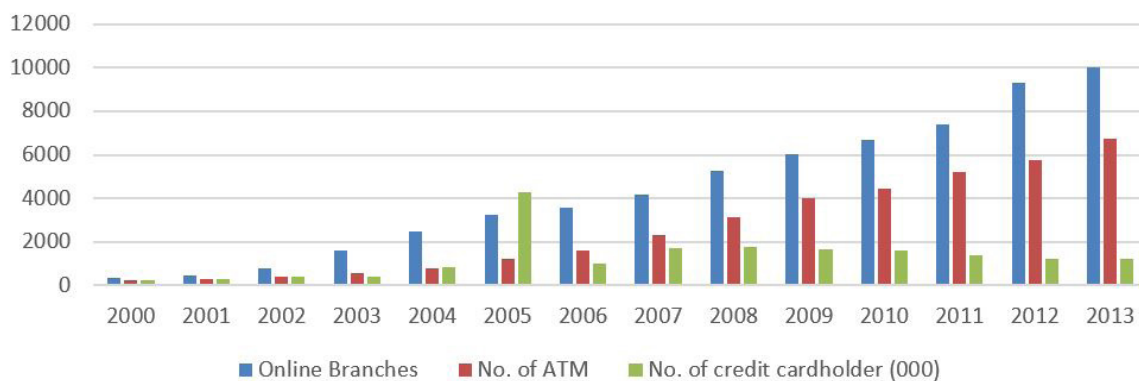
FINANCIAL INNOVATION IN PAKISTAN:

Globally banks are no more confined to the branch wall. Many countries step far ahead to facilitate customers with diverse range of products extensively used ICT (information and communication technology). Pakistan is among one of those countries which delay too much to

adopt electronic banking (financial innovation). Financial innovation became popular in Pakistan at the beginning of twenty first century by the introduction of electronic banking. A remarkable step in this way was adoption of Electronic Transaction Ordinance 2002. This ordinance facilitates legal recognition and minimization risk associated with electronic transactions. Now a day Pakistan is competing with international e-banking system with continuous improvement in the process and reliability of transactions. According to the payment and settlement report published by State Bank of Pakistan (Central Bank of Pakistan) E-banking transaction valued 7.9 trillion rupees in 2012-13 from 7.5 trillion a quarter ago with growth rate of 4.37%. Total number of transaction reached to 82.209 million in 2012-13 from 79.451 million transactions a quarter ago with 3.47% growth rate.

Financial innovation in banking sector of Pakistan is consisting of a verity of products like ATM, credit and debit cards, point of sale terminals, electronic banking, fund transfer, web facility, Islamic banking etc. while using these facilities customers can enjoy diverse range of features like inquiry, payment, request and downloading. Sometime these features are associated with some risk e.g. Risk of security, risk of fraud, power failure etc.

Financial Innovation (2000-2013)



THEORETICAL FRAMEWORK AND HYPOTHESES DEVELOPMENT:

1. Financial Innovation and Banking Performance:

Financial development and innovation is a tactical measure used by financial institutions as forbidding competition and improve performance for the sake of remaining effective in market (Bátiz-Lazo & Woldesenbet, 2006). Like industrial innovation, financial innovation also create competitive position for financial institution, this position leads to high financial performance. This competitive edge can only be retained through non-stop product/process innovation practices (Porter, 1980).

James Kamau Muiruri (2013), conducted a study to identify the impact of financial innovation (i.e. credit cards, mobile banking, internet banking) on banking financial performance in Kenya. They used sample size of forty four commercial banks operating in Kenya from 2008 to 2012. The results showed that there is positive impact of financial innovation on performance of commercial banks in Kenya. In a study of e-banking and financial performance of commercial

banks in Kenya, Monyoncho (2015) used technology acceptance model (TAM). He took ATM, credit card, mobile banking and electronic banking as a proxy of financial sector innovation. Sample size was consisting on forty four commercial banks in Kenya. The results showed the robust positive impact of E-banking on performance of banking industry in Kenya. He farther suggested that commercial banks in Kenya should continue to invest in ICT (information and communication technology).

Ongori and Migiro (2010), debated that information and communication technology shift the traditional way of banking performance and customer service in a new and better horizon. ICT rises to the usage of computer technology for capturing, processing and transmitting of data/information (Ashrafi & Murtaza, 2008). Financial sector ICT enable the institution to operate efficiently, effectively, access information and improve coordination within as well as outside organization. ICT also helpful to minimize overhead costs related to financial sector. Specifically cost related to physical branches maintenance, labor, marketing etc. Significant reduction in overhead cost leads to boost bank's profitability and performance (Hernando & Nieto, 2007).

Banking sector is the key participant in financial innovation. By using information and communication technology, this sector continuously trying to provide something new and innovative to its customers. The usage of information and communication technology in banking sector increase competence and availability of information which farther improve co-ordination of activities within sector (Spanos et al., 2001). With the help of new and innovative products banks can improve their quality of services which foster to high and satisfied customer base, high sales and high profits. Financial innovation minimize the cost and increase efficiency of facilities offered by banking sector to its customers that enable to grow deposits, sales and ultimately high performance. In the environment of high competition, successful financial innovation give bank a unique competitive advantage over other rivals which leads to superior financial performance. This competitive position can only be maintained through continuous improvement and innovation in product (process) (James Kamau Muiruri, 2013).

Different studies found the positive effect of financial innovation on banking performance i-e ATM (Ogbuji et al., 2012; Rose, 1999) credit cards (Onchangwa, 2012) debit cards (Rauf et al., 2014) mobile banking (Hernando & Nieto, 2007) internet banking (Gerrard & Barton Cunningham, 2003). All the said studies mention positive relationship among financial sector innovation and performance. So we can hypothesize that.

H1: There is positive relationship between financial innovation and banking performance.

2. Financial Innovation and Banking Risk:

Beck et al. (2014), found that financial innovation has both positive and negative impact on country growth, bank profitability and GDP growth per capita. They used bank level and country level data of 32 high income countries from 1996 to 2006. Results showed that on the positive side high level of financial innovation leads to country growth, GDP per capita, industrial growth (which depend upon external finance and innovation). On the negative side during crisis financial innovation linked with high volatility of industrial growth, innovation and bank profit.

In a European banking sector, study of González et al. (2016), evaluate the effect of securitization and credit derivatives (Financial innovation) on banking sector risk. Data set consisted of 134 listed banks from 2006 to 2010. The results showed negative effect of securitization and

credit derivatives on financial stability among European banks. According to Boz and Mendoza (2014), financial innovation and overconfidence about new financial instruments are two main causes for US financial crisis 2008. Innovative-fragility point of view signifies dark side of financial innovation. According to innovation fragility theory financial innovation leads to unprecedented credit expansions that initially create the boom but subsequently result in financial crisis.

In the situation of the latest lending boom and following Global Financial Crisis, numerous authors have pointed to alterations introduced by financial innovations, like securitization and new security derivative, and how they contributed to belligerent risk taking, decrease in lending standards and therefore fragility (Dell’Ariccia et al., 2012; Gennaioli et al., 2012; Keys et al., 2008; Rajan, 2006). Financial innovation increase both the deposit and lending sides of financing through new and innovative products. For economic growth, equilibrium among these two should be maintained efficiently. Financial innovations abnormally increase the debt in financial sector which farther increase the price of mortgage and land. In 2008 this bubble suddenly crashed in to financial crises.

So the above arguments and literature presented negative effect of financial innovation on banking risk.

H2: There is positive relationship between financial innovation and banking risk.

3. Financial Innovation and Economic Growth:

In rapid changing situation, banks made investment in ICT towards knowledge base environment, which is the main determinant to achieve economic growth (San-Jose et al., 2009). Hao and Hunter (1997), examined empirical relationship between financial innovation and economic growth among 63 cross sectional countries dataset ranging from 1970 to 1988. They used financial future market and second stage innovation as proxies of financial development. By analyzing data through cross sectional regression model they found positive correlation between financial development (innovation) and economic growth.

Neoclassical economist considered, financial system has slight effect on economic growth but other economist like Goldsmith (1969), McKinnon (1973) and Shaw (1973), had considered financial system has significant effect on economic growth. In a study on Ghanaian economy Adu-Asare Idun and QQ Aboagye (2014), identified short term and long term effect of financial innovation on economic growth. The study used time series secondary annual data from 1990 to 2009. To found statistical relationship, ARDL model technique was used. Final results revealed that in short term financial innovation has positive effect on economic growth but for long term this relation become reverse to negative. According to King and Levine (1993), Levine (1997) and Demirgüç-Kunt and Levine (2008), financial system boost knowledge innovation and excite growth. They farther explained that financial system developed through mobilizing savings, project evaluation, risk management, manager monitoring and facilitation towards transactions.

In a study conducted by Dynan et al. (2006) on US economy to identify the relationship between economic activities transformation and effect of financial innovation of macroeconomic factors like consumer spending, housing investment and business fixed investment. They found link between above said variables and suggested that financial sector innovation are important for US economic stabilization. Hao and Hunter (1997) also found the same results in cross country analysis and elaborated that innovation in financial sector positively correlate

with economic growth enhancement. Carbó Valverde et al. (2007), in a study obtained positive impact of product as well as service innovation on regional gross domestic product, investment and savings. Michalopoulos et al. (2009), conducted a study to evaluate relationship between financial innovation and economic growth. Using USA as standard, they found that countries which facilitate financial innovation practices can fast-track the growth rate of economy. By using co-integration technique Mannah-Blankson and Belnye (2004), found positive effect of financial innovation on demand for money. By using Johannes co-integration technique Ansong et al. (2011), found long term effect of financial innovation on savings. Money demand and saving both are critical element for higher economic growth.

Nyasha and Odhiambo (2014), examined the impact of financial development on economic growth by using current literature. They divide financial development into bank base financial development and market base financial development. They concluded that financial development leads to economic growth. In most recent study of Tee and Ong (2016), on European countries to evaluate the effect of adoption of cashless payment on economic growth. Authors used panel data of five European countries (Austria, Belgium, France, Germany, and Portugal) from 2000 to 2012. They used cheque payments, electronic money, card payment and telegraphic transfer as proxy of cashless payments. By applying Vector Error Correction Model they found positive effect of cashless payments on economic growth in long run. However this relationship wasn't existing in short run.

Many authors identify the impact of electronic payment on economic growth. For example Oyewole et al. (2013) in Nigeria, Hasan et al. (2012) in European countries, Zandi et al. (2013) in 56 countries. They all discover positive impact of electronic payment on economic growth. In a study to evaluate the relationship between financial innovation and economic growth Laeven et al. (2015), used two proxies to measure financial innovations. First proxy was the growth rate of financial development measure as private credit to GDP. Second proxy was an indicator of how fast a country adopted specific improvement in entrepreneur screening system. Authors used different econometrics techniques and found that financial innovation boost the economic growth especially in poor countries as compare to economic leader. According to Beck et al. (2014) country's economic growth is positively related to banking sector innovation measure as banking R&D expenditure.

Financial innovation is also helpful to reduced poverty in the country. According to Abraham (2015), financial innovation (crop funding, rural household saving club, crop insurance etc.) help farmer to quick access to finance and manage risk. Which in return eliminate poverty and farther increase economic growth. Carbó Valverde et al. (2007), examined the impact of financial innovation on regional economic growth of Spain. Author used set of banking sector innovation as proxy of financial innovation. Data related to 17 administrative regions of Spain from 1986 to 2001 was used. Results revealed positive and significant relationship between product and services innovation and regional GDP, investment and savings.

Innovative-growth point of view represents bright side of financial innovation. According to innovative growth theory financial innovation is associated with reduce agency cost, risk sharing, improve allocation efficiency and ultimately leads to economic growth. There are twofold sources to channel innovation into economic growth. Firstly banks evaluate and provide finance to innovative project which are normally risky and long term in nature (King & Levine, 1993;

Levine, 1997). Secondly banks itself introduce new financial instruments which are beneficial for customer to eliminate adverse effect of macroeconomic changes i-e. Interest rate, inflation etc. both the above said means leads to economic sustainability and growth (Michalopoulos et al., 2009; Rousseau, 1998).

Past literature review and theory base analyses demonstrate positive relationship between financial innovation and economic growth. So we can draw hypothesis as,

H3: There is positive relationship between financial innovation and economic growth.

METHODOLOGY

1. Data:

This study is based on financial innovation and its impact on banking sector performance, risk and economic growth with respect to Pakistan. Sample of study consist of commercial banks registered in Pakistan from 2000 to 2013. Data contain bank level variables as well as country level variables. For bank level information Economic Survey by State Bank of Pakistan, Bank Scope and World Bank Global Financial Development database are used. For country level information Statistics Bureau of Pakistan, World Bank and Global Economy database are used. For statistics analysis ordinary least square technique (OLS) is used. Data are collected on yearly bases from 2000 to 2013.

2. Model:

For testing hypothesis stated in section 2, we develop three models. Each model contains dependent, independent and control variables.

2.1. Financial Innovation and Banking Performance:

To analyze the impact of financial innovation on banking performance (H1) we develop following econometric model.

$$\text{Bank Performance} = \beta_0 + \beta_1 \text{Financial Innovation} + \beta_2 \text{Bank Cost to Income} + \beta_3 \text{Bank Deposit to GDP} + \beta_4 \text{Bank Concentration} + \Sigma \tag{1}$$

Sr.#	Variable Name	Variable Type	Measurement
1	Return on Assets	Dependent Variable	Aggregated on country level ROA (Profit after tax/total assets*100)
2	Financial Innovation	Independent Variable	Aggregated on country level Log of financial innovation (No. of online branches + No. of ATM Machines + No. of credit card)
3	Bank Cost to Income	Control Variable	Aggregated on country level (bank cost/net income*100)
4	Bank Deposit to GDP	Control Variable	Aggregated on Country level (Demand, time and saving deposits of banks as a share of GDP*100)
5	Bank Concentration	Control Variable	Aggregated on country level (sum of market share of three largest banks/all banks*100)

In the above said model banking performance measure as return on assets and used as dependent variable (Monyoncho, 2015). Financial innovation used as key independent variable and measure as sum of online branches, number of ATM machines and number of credit cards issue during the year (Boz & Mendoza, 2014; Hannan & McDowell, 1984; James Kamau Muiruri, 2013; Monyoncho, 2015; Safdar & Khan, 2013). For control variables we use bank cost to income (%), bank deposit to GDP (%) and bank concentration (%).

2.2. Financial Innovation and Banking Risk:

To analyze the impact of financial innovation on banking risk (H2) we develop following econometric model.

$$\text{Bank Risk} = \beta_0 + \beta_1 \text{Financial Innovation} + \beta_2 \text{Bank Credit to Deposit} + \beta_3 \text{Bank Interest Margin} + \beta_4 \text{Bank Concentration} + \Sigma \quad (2)$$

Sr.#	Variable Name	Variable Type	Measurement
1	Return Z Score	Dependent Variable	Aggregated on country level Bank Z Score
2	Financial Innovation	Independent Variable	Aggregated on country level Log of financial innovation (No. of online branches + No. of ATM Machines + No. of credit card)
3	Bank Credit to Deposit	Control Variable	Aggregated on country level (bank credit/bank deposit*100)
4	Bank Interest Margin	Control Variable	Aggregated on country level ((Interest earned-interest expense)/average loaning*100))
5	Bank Concentration	Control Variable	Aggregated on country level (sum of market share of three largest banks/all banks*100)

In the above said model bank Z score measure as (ROA+(equity/assets))/SD(ROA) and used as dependent variable (Beck et al., 2014; Demirgüç-Kunt & Huizinga, 2010; Laeven & Levine, 2009). Financial innovation used as key independent variable and measure as sum of online branches, number of ATM machines and number of credit cards issue during the year. For control variables we use bank credit to deposit (%), bank interest margin (%) and bank concentration (%).

2.3. Financial Innovation and Economic Growth:

To analyze the impact of financial innovation on economic growth (H3) we develop following econometric model.

$$\text{Economic Growth} = \beta_0 + \beta_1 \text{Financial Innovation} + \beta_2 \text{Government Spending} + \beta_3 \text{External Debt} + \beta_4 \text{Inflation} + \Sigma \quad (3)$$

Sr.#	Variable Name	Variable Type	Measurement
1	Economic Growth	Dependent Variable	Log GDP per capita
2	Financial Innovation	Independent Variable	Aggregated on country level Log of financial innovation (No. of online branches + No. of ATM Machines + No. of credit card)
3	Government Spending	Control Variable	Log government spending
4	External Debt	Control Variable	Log of external debt
5	Inflation	Control Variable	Rate of inflation

In the above said model economic growth measure as log of GDP per capita and used as dependent variable (Adu-Asare Idun & QQ Aboagye, 2014; Beck et al., 2014; Hao & Hunter, 1997). Financial innovation used as key independent variable and measure as sum of online branches, number of ATM machines and number of credit cards issue during the year. For control variables we use log of government spending, log of external debt and inflation (%).

EMPIRICAL ANALYSIS:

1. Descriptive Statistics:

Table 1 present descriptive statistics of all variables used to test our study hypotheses. Variables are described as number of observation, means, standard deviation, minimum and maximum value. For analysis we used data range from 2000 to 2013. The reason to start analysis from year 2000 is that Pakistan adopted financial innovation a bit late as compare to other countries. We measure financial innovation as aggregate value of online branches, number of ATM and credit cards. It presented average value of 8,270,000 with the minimum number of 206,000 in year 2000 and maximum number of 17,970,000 in year 2013. These values show constant increase in financial innovation from 2000 to 2013. Major participation in financial innovation is due to credit cards. Which show 1,275,000 cards on average as compare to averagely 2615 ATM machines and 4380 online branches.

Table 1: Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Online Branches	14	4380	3188.988	322	10013
No. of ATMs	14	2615	2255.909	206	6757
No. of Credit Cards (000)	14	1275	1022.581	217	4257
Financial Innovation (000)	14	8270	5791.205	745	17970
Bank ROA (%)	14	1.1154	0.4652	0.4300	1.9297
Bank Z-Score	14	10.6363	2.2085	7.5236	14.9348
GDP (Constant)	14	8349.077	3194.838	4306.17	4306.17
Bank Concentration (%)	14	88.0925	5.7358	80.4838	100
Bank Cost to Income (%)	14	70.0873	8.7966	53.5215	80.6690
Bank Deposit to GDP (%)	14	30.7622	3.1651	26.5419	35.0987
Variable	Obs.	Mean	Std. Dev.	Min	Max
Bank Credit to Deposit	14	71.5950	10.1727	50.3692	86.9253
Bank Interest Margin (%)	14	3.9151	1.0796	2.5475	6.8709
Govt. Spending (% of GDP)	14	9.4328	1.07981	7.78	10.96
External Debt (% of GNI)	14	33.6721	8.0354	22.77	46.51
Inflation (%)	14	8.7752	4.9122	2.9141	20.2861

Online Branches: Aggregate all banks annual online branches, No. of ATM: Aggregate all banks annual ATM Machines, No. of credit cards: Aggregate all banks annual issued credit cards, Financial Innovation: Sum of online branches + No. of ATM Machines + No. of credit cards, ROA (%): Aggregated on country level ROA (Profit after tax/total assets*100), Bank Z-Score: Aggregated on country level Bank Z Score, GDP: Log GDP constant, Bank Concentration (%):Aggregated on country level (sum of market share of three largest banks/all banks*100), Bank cost to income: Aggregated on country level (bank cost/net income*100), Bank deposit to GDP (%):Aggregated on Country level (Demand, time and saving deposits of banks as a share of GDP*100), Bank credit to deposit (%):Aggregated on country level (bank credit/bank deposit*100) , Bank interest margin (%):Aggregated on country level ((Interest earned-interest expense)/average loaning*100)), Government Spending: % of GDP, External Debt: % of GNI, Inflation: Annual %

Bank return on assets (ROA) show average percentage value of 1.1154 with the minimum value of 0.43% and maximum of 1.92%. Bank Z-score present the chance of bankruptcy among banking industry. According to Z-score analysis a value lower than 1.8 indicates that the bank is heading for bankruptcy. Banks with scores above 3 are unlikely to enter bankruptcy. Scores in between 1.8 and 3 lie in a gray area. According to this analysis none of the bank lies in the danger zone during the study period (2000-2013). As value show average of 10.63 with lower as 7.52 and higher as 14.93. It indicates that banking industry in Pakistan is really out of bankruptcy issue. Gross domestic product also show constant growth trend from 2000 till 2013 i-e from 4603.17 to 14614.39.

The value of bank concentration is presented in percentage and it show average of 88% with higher as 100% and lower as 80%. Bank cost to income show that average cost of banks in Pakistan with respect to income is 70%, which show the gross profit margin is 30%. For earning 100 rupee banks suffer 70 rupee as cost. Deposit in banking industry show average of 30% of GDP with higher rate of 35% and lower of 26%. In Pakistani banking sector, out of total deposit

received by banks averagely 70% are used to give farther credit. 30% of deposits are retaining for day to day transaction and reserve with State Bank of Pakistan. Bank interest margin show the profitability margin of banks. In Pakistan on average banks interest margin are 3.91% with high margin of 6.87% in year 2012 and low margin of 2.54% in year 2000.

Government spending is the main source of utilization of government income. It show that on average 9.43% of GDP is spend by government, maximum of 10.96% and minimum of 7.78%. Since 2000 until now economy of Pakistan is heavily depend upon external debt. This value shows that 33.67% of gross national income is from external debt which higher ratio of 46.51% and lower ratio of 22.77%. Inflation rate in Pakistan show on average 8.77% increase in the price of goods and services.

2. Financial Innovation and Bank Performance:

In this portion impact of financial innovation on bank performance is evaluated. Table 2 presented correlation coefficients of variable used in model 1. Coefficient values in correlation matrix table inform the existing relationship between variables. High correlation among independent variables or control variables causes the problem of multi-co linearity which leads to untrustworthy and biased outcomes. So before move to regression analysis it is necessary to get knowledge that is there any issue of multi-co linearity exist between variables or not.

Table 2: Correlation Matrix

	ROA	Financial Innovation	Cost to Income	Deposit to GDP	Concentration
ROA	1.0000				
Financial Innovation	0.5642	1.0000			
Cost to Income	-0.6176	-0.1411	1.0000		
Deposit to GDP	0.4588	0.2480	-0.4952	1.0000	
Concentration	-0.1034	0.0548	0.0068	-0.2387	1.0000

ROA (%): Aggregated on country level ROA (Profit after tax/total assets*100), Financial Innovation: Sum of online branches + No. of ATM Machines + No. of credit cards, Bank cost to income: Aggregated on country level (bank cost/net income*100), Bank deposit to GDP (%):Aggregated on Country level (Demand, time and saving deposits of banks as a share of GDP*100), Bank Concentration (%):Aggregated on country level (sum of market share of three largest banks/all banks*100)

As mentioned in table 2 there is no problem of multi-co linearity exit in out model variables. Independent and control variable present high correlation with dependent variable which indicates that these variables are good explanatory variables for dependent variable. Financial innovation show positive relation with bank return on assets which is according to our first hypothesis. But for farther examine we have to check this relationship which regression analysis. Cost to income (%) and bank concentration (%) show negative relationship with ROA. Deposit to GDP (%) presented positive annex with banks ROA.

Regression analysis is the widely used statistical technique for more detail analysis of dependent, independent and control variables. For this purpose of farther analysis we use ordinary least square (OLS) statistical technique. According to many econometricians ordinary least square techniques is the best regression tool because of BLUE (Best Linear Unbiased Estimator) characteristics.

Table 3: Regression Analysis

Variable	Expected Sign	Coefficient	Std. Error	T-Stat
Financial Innovation	+	0.4874	0.2120	2.30**
Cost to Income	-	-0.0276	0.0124	-2.22**
Deposit to GDP	+	0.0077	0.0365	0.21
Concentration	-	-0.0092	0.0171	-0.54
Constant		1.7958	2.5599	0.70
F-value				3.86**
R2				0.4677

Financial Innovation: Sum of online branches + No. of ATM Machines + No. of credit cards, **Bank cost to income:** Aggregated on country level (bank cost/net income*100), **Bank deposit to GDP (%):** Aggregated on Country level (Demand, time and saving deposits of banks as a share of GDP*100), **Bank Concentration (%):** Aggregated on country level (sum of market share of three largest banks/all banks*100)

*Significant at 10% level

**Significant at 5% level

***Significant at 1% level

In table 3 regression analysis results in form of expected sign as per literature, coefficient of variables, standard error and t stat with probability are reported. Results show that by controlling various variables (cost to income, deposit to GDP and bank concentration) there is positive and statistically significant relationship between financial innovation and bank return on assets (ROA) in Pakistan. According to regression analysis 1% increase in financial innovation will increase in ROA by 0.48%. This relationship is significant at 5% level and consistent with past literature. It is widely accepted that higher cost will reduce the rate of return. Our finding of cost to income ratio is consistent with theory and exhibit negative relation with ROA. Statistics show that 1% increase in cost to income will decrease ROA by 0.02%.

Deposits are the main inputs for banking sector, according to the economic theory increase in input will boost output. Our results indicate that 1% increase in deposit as percentage of GDP will farther increase ROA by 0.0077%. Concentration in any economic sector reduces the overall efficiency and aggregate performance. Regression results indicate that increase in 1% of bank concentration will reduce ROA by 0.0092%. Our first model pass the F-stat and statistically significant at 5% level. R-square shows that our model variables explain 46% of dependent variable. Overall results are parallel to our hypothesis, so we can accept first hypothesis (H1) i-e there is positive relationship between financial innovation and bank performance.

3. Financial Innovation and Bank Risk:

In this section we evaluate impact of financial innovation on bank risk. To examine this relationship we use correlation matrix and regression analysis techniques. In table 4 correlation coefficients outcome are reported. Table describes the existing relationship between dependent, independent and control variables.

Table 4: Correlation Matrix:

	Z-Score	Financial Innovation	Credit to Deposit	Interest Margin	Concentration
Z-Score	1.0000				
Financial Innovation	0.6367	1.0000			
Credit to Deposit	0.0589	-0.4201	1.0000		
Interest Margin	0.1892	0.5820	-0.2440	1.0000	
Concentration	0.6844	0.0548	0.1624	-0.3948	1.0000

Bank Z-Score: Aggregated on country level Bank Z Score, Financial Innovation: Sum of online branches + No. of ATM Machines + No. of credit cards, Bank credit to deposit (%): Aggregated on country level (bank credit/bank deposit*100), Bank interest margin (%): Aggregated on country level ((Interest earned-interest expense)/average loaning*100), Bank Concentration (%): Aggregated on country level (sum of market share of three largest banks/all banks*100)

As reported in table, all the control variables and independent variable are correlated with dependent variable which shows that these variables are good explanatory variables. As far as relationship between independent variable and control variables are concern, we did not find any multi-co linearity issue. Furthermore according to our hypotheses (H2) there is positive relationship between financial innovation and bank risk. Our results also present the positive relationship between dependent and independent variable. Control variables (credit to deposit, interest margin, and bank concentration) also indicate positive relationship with bank risk.

For more detail analysis we use ordinary least square (OLS) technique. Table 5 contains variables information regarding expected sign, variable coefficients, standard error and t-stat value with its probability. F-stat and R square vale are also reported in the table.

Table 5: Regression Analysis

Variable	Expected Sign	Coefficient	Std. Error	T-Stat
Financial Innovation	+	2.91163	0.7571	3.85***
Credit to Deposit	+	0.0530	0.0267	1.99*
Interest Margin	+	0.3298	0.3231	1.02
Concentration	+	0.2599	0.0506	5.14***
Constant		-28.2688	4.8326	-5.85***
F-value				19.05***
R2				0.8474

Financial Innovation: Sum of online branches + No. of ATM Machines + No. of credit cards, Bank credit to deposit (%): Aggregated on country level (bank credit/bank deposit*100), Bank interest margin (%): Aggregated on country level ((Interest earned-interest expense)/average loaning*100), Bank Concentration (%): Aggregated on country level (sum of market share of three largest banks/all banks*100)

*Significant at 10% level

**Significant at 5% level

***Significant at 1% level

According to the results mentioned in the table (5) after controlling different variables (credit to deposit, interest margin, bank concentration) we find positive relationship between financial innovation and Z-Score (proxy of financial risk). According to the Altman Z-score model, higher the values of Z-score indicate lower the bankruptcy risk. Result show that financial innovation leads to increase in Z-score value and high Z-score indicate less risk of bankruptcy as mention before. These results are significant at 1% statistical level and consistent with past studies. As per results 1% increase in financial innovation will increase bank Z-score by 2.91 points (or reduce bank risk by 2.91).

In normal situation high credit leads to danger of bankruptcy to cover this situation bank grant more credit so that its negative effect can be reverse. Farther more high credit leads to high interest earning which also leads to reduction in risk (increase in Z-Score). Our results exhibit positive effect of credit to deposit ratio on Z-score at 10% significance level. 1% increase in credit to deposit ratio will increase in Z-score by 0.05%. According to theoretical prospective, increase in interest margin will increase the profitability of bank, which subsequently increase in Z-score (reduce bankruptcy risk). Regression results indicate the positive relationship between interest margin and Z-Score. High industrial concentration reduces the chance of insolvency due to the monopoly control over market. OLS results explain the positive effect of bank concentration on Z-Score at 1% significance level. Overall model pass the F-test at 1% significant level and R-square is 84%. Result of model is contrast with our hypothesis (H2) i-e financial innovation leads to bank risk. We find that financial innovation reduce the chance of bank risk (measure as Z-Score).

5.4. Financial Innovation and Economic Growth:

In this section we determine the impact of financial innovation on economic growth in Pakistan. To test this hypothesis (H3) we conduct correlation and regression test. Results of correlation analysis are report in table 6. The outcome indicates that there is positive relationship between financial innovation and economic growth (measure as GDP current value). All other control variables except external debt indicate the positive relationship with GDP. Data also not exhibit multi-co linearity issue.

Table 6: Correlation Matrix:

	Gross Domestic Product	Financial Innovation	Govt. Spending	External Debt	Inflation
Gross Domestic Product	1.0000				
Financial Innovation	0.8955	1.0000			
Govt. Spending	0.8045	0.7104	1.0000		
External Debt	-0.7875	-0.8839	-0.7055	1.0000	
Inflation	0.6056	0.7011	0.4978	-0.5387	1.0000

GDP: Log GDP constant, Financial Innovation: Sum of online branches + No. of ATM Machines + No. of credit cards, Government Spending: % of GDP, External Debt: % of GNI, Inflation: Annual %

Regression analysis is used for in-depth information as compare to correlation analysis. We use OLS technique to identify the impact of financial innovation on economic growth. Table 7 reports the results of regression analysis. It contains expected relationship signs, variable coefficients, standard error and t-stat with its p-value.

Table 7: Regression Analysis

Variable	Expected Sign	Coefficient	Std. Error	T-Stat
Financial Innovation	+	0.2944	0.1133	2.60**
Govt. Spending	+	1.1714	0.5699	2.06*
External Debt	+	0.2787	0.4413	0.63
Inflation	-	-0.0023	0.0058	-0.40
Constant		1.2484	1.1908	1.05
F-value				14.55***
R2				0.8066

Financial Innovation: Sum of online branches + No. of ATM Machines + No. of credit cards, Government Spending: % of GDP, External Debt: % of GNI, Inflation: Annual %

*Significant at 10% level

**Significant at 5% level

***Significant at 1% level

Regression results show positive relationship between financial innovation and economic growth. This relationship is statistically significant at 5% level. Consistent with literature review, 1% increase in financial innovation will increase in economic growth by 0.29%. Large portion of government spending belongs to education, infrastructure, health etc. These projects are long run and have positive effect on economic growth. Our analysis also shows that 1% increase in government spending will increase economic growth by 1.17%. External debts play vital role in the economic growth of country like Pakistan which is highly dependent on external debt. These external debts use for development project and for the betterment of flow of funds. As per study outcome, 1% increase in external debt will increase in 0.27%. Inflation means increase in the general price level, this increase reduce the purchasing power of customers which directly affect industrial production and subsequently minimize economic growth. According to estimated results 1% increase in inflation will reduce economic growth by 0.0023%. Our regression model pass F-value at 1% significance level and R-square is 80%. Overall results of model 3 are consistent with our hypothesis (3) i-e there is positive relationship between financial innovation and economic growth.

CONCLUSIONS

The purpose of this study is to investigate the impact of financial innovation on bank performance, bank risk and economic growth with respect to Pakistan. For this we use diverse range of bank level variables as well as country level variables. Data related to bank level variables are collected from Bank Scope database, World Bank Financial Development database and state bank of Pakistan database. For country level information we use Economic Survey of Pakistan, World Bank Development Indicators and Global Economy database. Period of study consist of 14 year from 2000 to 2013.

Past studies presented positive (negative) relationship between financial innovation and bank performance, financial innovation and bank risk, financial innovation and economic growth. In the context of Pakistan, only limited studies are conducted on financial innovation. So

this study is one of the unique study in which we discuss three unfold aspect of Pakistan banking industry and financial development (innovation).

For statistical evaluation we use correlation matrix and ordinary least square technique. We develop three econometric models separately, to test the hypothesis explained in chapter 2. We use first model to evaluate impact of financial innovation on bank performance. By controlling different bank level variables we found positive and statistically significant relationship between financial innovation and bank performance. Moreover we use second model to identify the impact of financial innovation on bank risk measure as bank Z-Score. By using different control variables we found that financial innovation decrease the chances of bankruptcy. Finally we use third model to inspect the relationship between financial innovation and economic growth. After controlling various country level variables we found positive impact of financial innovation on economic growth.

Key study findings elaborate that, financial innovations are very important for the success in highly competitive banking environment in Pakistan. Banking industry in Pakistan delayed too much to adopt financial innovations. But within few years this sector present remarkable growth. Financial innovation is not only important for the performance of banking industry but it is also very important to save banking sector from danger of insolvency as well as for country's economic growth. Current study has some limitations. In the context of Pakistan, concept of financial innovation is relatively new and growing, so limited data is available. Econometric issues like unit root etc. not taken into account. This study is only consists of 14 years data because banking industry in Pakistan adopted financial innovation after 2000. We only take Pakistan's economy in the study to evaluate financial innovation and its impact. Future study can be conducted by cross country analysis and high number of observations.

BIBLIOGRAPHIC REFERENCES

Abraham, T. W. (2015). *Financial innovation and poverty reduction: evidence from rural northern nigeria*.

Adu-Asare Idun, A., & QQ Aboagye, A. (2014). *Bank competition, financial innovations and economic growth in Ghana*. *African Journal of Economic and Management Studies*, 5(1), 30-51.

Afuah, A. (2003). *Innovation management: strategies, implementation and profits*: Oxford University Press, USA.

Ansong, A., Marfo-Yiadom, E., & Ekow-Asmah, E. (2011). *The Effects of Financial Innovation on Financial Savings: Evidence From an Economy in Transition*. *Journal of African Business*, 12(1), 93-113.

Armeiy, L. E., Lipow, J., & Webb, N. J. (2014). *The impact of electronic financial payments on crime*. *Information Economics and Policy*, 29, 46-57.

Ashrafi, R., & Murtaza, M. (2008). *Use and Impact of ICT on SMEs in Oman*. *Electronic Journal Information Systems Evaluation*, 11(3), 125-138.

Bátiz-Lazo, B., & Woldeesenbet, K. (2006). *The dynamics of product and process innovations in UK banking*. *International Journal of Financial Services Management*, 1(4), 400-421.

Beck, T., Chen, T., Lin, C., & Song, F. M. (2014). *Financial innovation: The bright and the dark sides*. Available at SSRN 1991216.

Boz, E., & Mendoza, E. G. (2014). *Financial innovation, the discovery of risk, and the US credit crisis*. *Journal of monetary economics*, 62, 1-22.

Carbó Valverde, S., López Del Paso, R., & Rodríguez Fernández, F. (2007). *Financial innovations in banking: impact on regional growth*. *Regional Studies*, 41(3), 311-326.

Dell'Ariccia, G., Igan, D., & Laeven, L. U. (2012). *Credit booms and lending standards: Evidence from the subprime mortgage market*. *Journal of Money, Credit and Banking*, 44(2-3), 367-384.

Demirgüç-Kunt, A., & Huizinga, H. (2010). *Bank activity and funding strategies: The impact on risk and returns*. *Journal of Financial Economics*, 98(3), 626-650.

Demirgüç-Kunt, A., & Levine, R. (2008). *Finance, financial sector policies, and long-run growth*. *World Bank Policy Research Working Paper Series*, Vol.

Dynan, K. E., Elmendorf, D. W., & Sichel, D. E. (2006). *Can financial innovation help to explain the reduced volatility of economic activity?* *Journal of monetary economics*, 53(1), 123-150.

Gennaioli, N., Shleifer, A., & Vishny, R. (2012). *Neglected risks, financial innovation, and financial fragility*. *Journal of Financial Economics*, 104(3), 452-468.

Gerrard, P., & Barton Cunningham, J. (2003). *The diffusion of internet banking among Singapore consumers*. *International journal of bank marketing*, 21(1), 16-28.

Goldsmith, R. W. (1969). *Financial structure and development*. Retrieved from

González, L. O., Gil, L. I. R., Cunill, O. M., & Lindahl, J. M. M. (2016). *The effect of financial innovation on European banks' risk*. *Journal of Business Research*.

Hannan, T. H., & McDowell, J. M. (1984). *The determinants of technology adoption: The case of the banking firm*. *The RAND Journal of Economics*, 328-335.

Hao, J., & Hunter, W. C. (1997). *A test of the impact of financial innovation on economic growth*. *Managerial Finance*, 23(11), 64-78.

Hasan, I., De Renzis, T., & Schmiedel, H. (2012). *Retail payments and economic growth*. Bank of Finland research discussion paper(19).

Hernando, I., & Nieto, M. J. (2007). *Is the Internet delivery channel changing banks' performance? The case of Spanish banks*. *Journal of Banking & Finance*, 31(4), 1083-1099.

James Kamau Muiruri, J. M. N. (2013). *Effects of Financial Innovations on the Financial Performance of Commercial Banks in Kenya*. *International Journal of Humanities and Social Science*, 4(7), 51-57.

Keys, B. J., Mukherjee, T. K., Seru, A., & Vig, V. (2008). *Did securitization lead to lax screening? Evidence from subprime loans*. Evidence from Subprime Loans (December 25, 2008). EFA.

King, R. G., & Levine, R. (1993). *Finance and growth: Schumpeter might be right*. *The quarterly journal of economics*, 717-737.

Laeven, L., & Levine, R. (2009). *Bank governance, regulation and risk taking*. *Journal of Financial Economics*, 93(2), 259-275.

Laeven, L., Levine, R., & Michalopoulos, S. (2015). *Financial innovation and endogenous growth*. *Journal of Financial Intermediation*, 24(1), 1-24.

Levine, R. (1997). *Financial development and economic growth: views and agenda*. *Journal of economic literature*, 35(2), 688-726.

Mannah-Blankson, T., & Belnye, F. (2004). *Financial innovation and the demand for money in Ghana*. Retrieved from

McKinnon, R. I. (1973). *Money and Capital in Economic Development* (Washington, DC: Brookings Institution, 1973). McKinnon Money and Capital in Economic Development 1973.

Michalopoulos, S., Laeven, L., & Levine, R. (2009). *Financial innovation and endogenous growth*. Retrieved from

Monyoncho, L. N. a. (2015). *Relationship between banking technologies and financial performance of commercial banks in kenya*.

Norden, L., Buston, C. S., & Wagner, W. (2014). *Financial innovation and bank behavior: Evidence from credit markets*. *Journal of Economic Dynamics and Control*, 43, 130-145.

Nyasha, S., & Odhiambo, N. M. (2014). *Bank-based financial development and economic growth: A review of international literature*. *Journal of Financial Economic Policy*, 6(2), 112-132.

Ogbuji, C. N., Onuoha, C. B., & Izogo, E. E. (2012). *Analysis of the negative effects of the automated teller machine (ATM) as a channel for delivering banking services in Nigeria*. *International Journal of Business and Management*, 7(7), 180.

Onchangwa, G. A. M., S. F. (2012). *Credit cards and performance of commercial banks portfolio*.

Ongori, H., & Migiro, S. O. (2010). *Information and communication technologies adoption in SMEs: literature review*. *Journal of Chinese Entrepreneurship*, 2(1), 93-104.

Oyewole, O. S., El-Maude, J. G., Abba, M., & Onuh, M. E. (2013). *Electronic payment system and economic growth: a review of transition to cashless economy in Nigeria*. *Int J Sci Eng Technol*, 2, 913-918.

Porter, M. E. (1980). *Techniques for analyzing industries and competitors*. *Competitive Strategy*. New York: Free.

Rajan, R. G. (2006). *Has finance made the world riskier?* *European Financial Management*, 12(4), 499-533.

Rauf, S., Qiang, F., & ullah Sajid, K. (2014). *Electronic Debit Card Usage and their Impact on Profitability of Pakistan Banking Sector: ROA, Model*.

Rose, N. (1999). *Powers of freedom: Reframing political thought*: Cambridge university press.

Rousseau, P. L. (1998). *The permanent effects of innovation on financial depth:: Theory and US historical evidence from unobservable components models*. *Journal of monetary economics*, 42(2), 387-425.

Safdar, S., & Khan, A. (2013). *Financial innovation and monetary policy transmission Mechanism in Pakistan*.

San-Jose, L., Iturralde, T., & Maseda, A. (2009). *The influence of information communications technology (ICT) on cash management and financial department performance: An explanatory model*. *Canadian Journal of Administrative Sciences/Revue Canadienne des Sciences de l'Administration*, 26(2), 150-169.

Shaw, E. S. (1973). *Financial deepening in economic development*.

Spanos, Y., Prastacos, G., & Papadakis, V. (2001). *Greek Firms and EMU:: Contrasting SMEs and Large-Sized Enterprises*. *European Management Journal*, 19(6), 638-648.

Tee, H.-H., & Ong, H.-B. (2016). *Cashless payment and economic growth*. *Financial Innovation*, 2(1), 1.

Tufano, P. (2003). *Financial innovation*. *Handbook of the Economics of Finance*, 1, 307-335.

Zandi, M., Singh, V., & Irving, J. (2013). *The impact of electronic payments on economic growth*. Moody's Analytics: Economic and Consumer Credit Analytics.