1-1-2013

Financial Development And Health Capital Accumulation

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FINANCIAL DEVELOPMENT AND HEALTH CAPITAL ACCUMULATION

by

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DISSERTATION

Submitted to the Graduate School

of Wayne State University,

Detroit, Michigan

in partial fulfillment of the requirements

for the degree of

DOCTOR OF PHILOSOPHY

2013

MAJOR: ECONOMICS

Approved by:

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Advisor **Date**

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DEDICATION

To millions of brothers and sisters suffering from disease, hunger, poverty and financial deprivation around the world

ACKNOWLEDGEMENTS

I am profoundly grateful to Professor Allen C. Goodman for his kind consent to chair the dissertation committee. Professor Goodman's continuous guidance, motivation and professional advice during the graduate study have greatly influenced my success in the program. I am really impressed with his kind and cooperative nature and highly appreciate of his immediate responses to my mails. It would have been almost impossible for me to complete this work in a timely manner if Professor Goodman had not given his consent to become my advisor within few hours of my mail request. Professor Goodman deserves special thanks for being a great guru who teaches, advises, motivates and cares his disciples, and admires their new ideas.

I would like to extend my sincere thanks to other members of the dissertation committee, Professor Li Way Lee, Professor Janet Hankin, and Professor Tatsuma Wada for their thoughtful advices and kind cooperation. I am also thankful to other Professors in the Department who taught me during the graduate program and staff at the Economics Department, Delores Tennille and Cheri Miller for their continuous support. The graduate workshops organized by the Department remained helpful in refining the materials. Credit goes to Professor Robert Rossana. Thanks also to the conference participants at the Southern Economic Association Conference in New Orleans in November 2012 for constructive comments. I have a deep appreciation to Nepal Rastra Bank for providing me the study leave, without which my journey to graduate school would not have been possible. I am also thankful to all the Nepali friends who continuously gave me and my family a homely environment during our stay in Michigan.

I am indebted to my parents, Liladhar and Bishnadevi for their sacrifices, devotion and farsightedness. I salute you dad and mom for your commitment, courage and patience and for teaching me to aim higher, work hard and remain patient. My brothers and sisters always remain

wonderful and supportive in my educational pursuits. I am also thankful to other members of our family, friends and relatives for their good wishes and blessings.

Finally, let me thank and congratulate my wife Gita for her unconditional love, support and sacrifice. Our two wonderful daughters Pragyee and Shatakshi are our true source of happiness and inspiration. It would have been almost impossible for me to come to this stage without the patience and support of my wife Gita and daughter Pragyee during the graduate study. I respect you both for your perseverance and wisdom and always reminding me my PhD. I will never forget you Pragyee telling me: Baba, work hard! In fact, nothing was so wonderful for me than a seven year old encouraging me to study for my exams.

At the end, I am alone responsible for any errors and omissions in this dissertation work.

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Chapter 1 Introduction

1.1 Overview

This dissertation examines the interrelationship between financial development and health capital accumulation. While credit to GDP ratio, liquid liabilities to GDP ratio and market capitalization to GDP ratio are used as the proxies for financial development, health capital is represented by life expectancy, infant mortality and low birth weight. A simple static model in the utility maximization framework shows that financial development increases the medical care through income effect thus augmenting the health status. This is also supported by econometric analysis. Using various econometric models such as pooled OLS, fixed effect and instrumental variable approach, the study shows that higher level of financial development positively contributes to health capital accumulation in terms of higher life expectancy and lower infant mortality. But no such effect of financial development is observed on low birth weight.

Among various proxies of financial development, the credit to GDP ratio explains both life expectancy and infant mortality better. The effect of financial development on health outcomes is stronger in developing countries. This suggests a higher rate of return from financial development on health outcomes in these countries. It is also understandable that the higher level of financial deprivation in developing countries staggers the channels such as income and education, which contribute to health capital accumulation even in the short-run. Looking at the channels through which financial intermediation affects health outcomes, the study finds that income could be a better potential candidate in the developed countries and education in the developing ones. The impulse response analysis shows that financial shocks do not exhibit their immediate impact on outcome variables but show short to medium term impact on health spending.

1.2Background

In Grossman's model (1972), health capital can be maintained or augmented through purposeful health investment (Leung and Wang, 2010). This investment requires resources that an individual could allocate in accumulating health.[1] Financial development is one of the vehicles, which enlarges people's choices by offering them income generating opportunities and competitive options in acquiring health insurance services. Roubini and Bilodeau (2008) define financial development as the set of factors, policies and institutions that lead to effective financial intermediation and markets, and deep and broad access to capital and financial services.

Finance matters for growth and human capital accumulation given its special role in bridging the gap between saving and deficit units. Financial intermediaries channel funds to those areas where resources can be allocated efficiently. Levine (2004) argues that a well-functioning financial system contributes to the economy by performing the following functions:

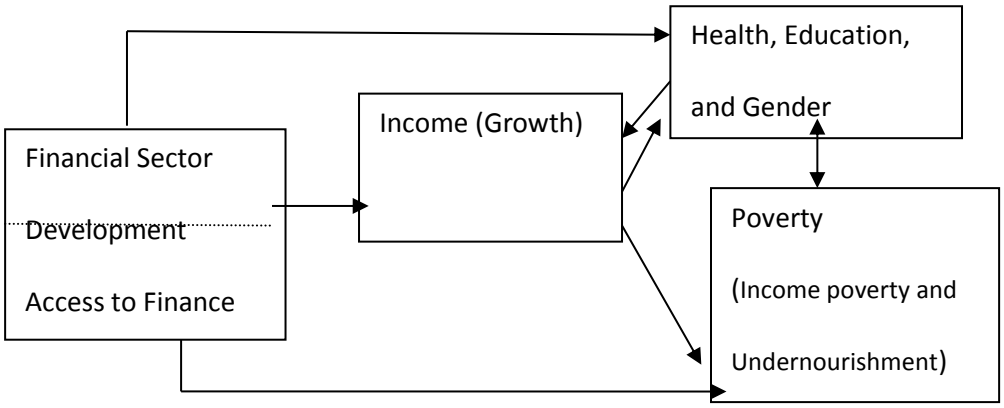
- producing information ex-ante about possible investments and allocate capital,
- monitoring investments and exert corporate governance after finance,
- facilitating the trading, diversification and management of risk,
- mobilizing and pooling savings, and easing the exchange of goods and services.

The effect of financial development on health capital accumulation runs through income growth and poverty reduction. The increased incomes of households make them able to consume nutritious food, visit doctors when they get seek, insure them against health and property catastrophes, send their children to school, and uplift their social prestige and dignity. Financial intermediation becomes especially important to get better health care when families are liquidity constrained. The developed financial system offers easier financial conditions. For individuals,

[1] Gross investments in health are produced by household production functions that relate an output of health to inputs such as medical care utilization, diet, exercise, cigarette smoking, and alcohol consumption (Grossman, 2000 pp.350).

these might include cheaper health insurance, cheaper loan to finance education, and housing, and lower financial constraints to run small businesses paving ways for human capital accumulation (Figure 1).

Figure 1: Financial Development to Human Capital Accumulation



Source: Claessens and Feijen (2006a)

1.3 Operating Channels

Financial intermediation can play an important role in promoting better health through income generating opportunities. Income generating opportunities for the families are important from the very beginning of the child health development process. People who experience poverty in childhood are highly prone to health disturbances. The consequences of child poverty are potentially far reaching and extend beyond the individual child by impacting on families, communities, tax payers and, ultimately, on the economy as a whole (Violato, Petrou, Gray and Redshaw, 2011).

Financial development affects life expectancy via better health. Easier access to finance leads to income generating opportunities easily for lower-middle income class families. For those already having their own enterprises, finance provides additional avenue to expand the entrepreneur skills. Higher income level advances the human potential towards nutritious food,

rewarding education and better health. Claessens and Feijen (2006a) further note that higher level of income resulting the country-level effects of financial development on health go through credit, savings, and insurance as these can greatly help financing health care and help in smoothing income in the face of health shocks.

The channels through which the effect of financial development runs to health capital accumulation are primarily the income effect, educational effect, infrastructure development, and risk management. We can also present this in a logical framework whereby the effect of financial development can be seen in better diets, medical care, awareness and self-satisfaction (Figure 2).

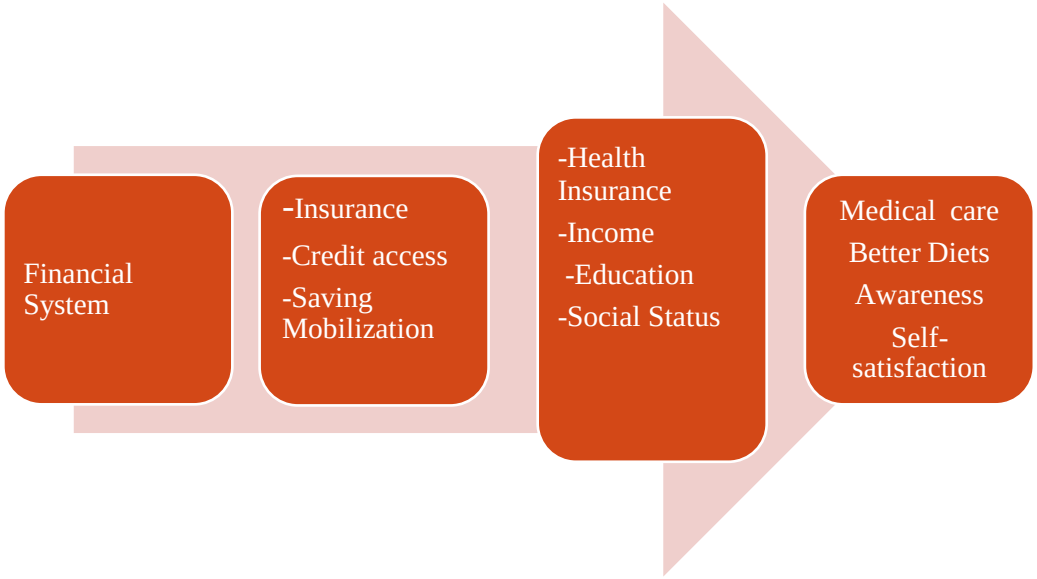
Income effect: The financial system offers income generating opportunities and access to insurance, credit and savings. Access to these financial services enables families to get better health care treatment and living and working conditions. There may be a higher prevalence of health care expenses for poor families because of the lack of the past health care treatment and poor living conditions. Health insurance makes it possible to treat diseases and take precautionary measures to prevent diseases.

Educational effect: Financial services may contribute to attain the better future health of households through education of their children. Also there could be backward linkage through better health to educational improvement. School returns could go up through better health care and reduced undernourishment.

Infrastructure Development: Financial development also contributes to develop infrastructures. Along with the expansion of the financial network, auxiliary services such as transportation, electricity, schools, trained health workers, and hospitals are established. These activities increase the employment and income generating opportunities paving way for higher investment in acquiring better health care services.

Risk Management: Finance can contribute to better health and long life through accessibility to credit in times of crisis, and provision of insurance to mitigate future risks. A number of financial instruments such as commodity bonds to minimize the adverse effect of commodity price shocks, weather derivatives, and catastrophe bonds could provide a great cushion to families in bad times.

Figure 2: From the Bank to Health



1.4 Motivation

The 2007/2008 financial crisis has forced policy makers to become more vigilant in managing the financial system, which could have a number of repercussions not only on the economic growth and stability but also on the livelihood of the masses. An unstable financial system forces households and small firms to undergo severe liquidity constraint in bad times and force millions of people to lose employment during these times. An unemployed mass resulting from the systemic disturbance in the financial system could pose threat to the overall wellbeing of the society through limited affordability to food and medical goods and deprivation of health

insurance. These deprivations ultimately reflect in lower life expectancy and higher mortality rates.

For example, Cutler, Knaul, Lozano, Mendez, and Zurita (2002) study the effect of 1995-96 financial crisis in Mexico and find that mortality rates were about 5 to 7 percent higher in the crisis years compared to the years just prior to the crisis. Currie and Tekin (2011) find that the 2007/2008 foreclosure crisis has negative impact not only on the health of the U.S. economy but also on the health of the ordinary people. They argue that an increase in the number of foreclosures is associated with increases in medical visits for mental health (anxiety and suicide attempts), for preventable conditions (such as hypertension), and for a broad array of physical complaints that are plausibly stress-related.

Also in the face of financial system disturbance, the national government's sources of financing on health sector can face a serious setback due to a number of other contingencies on the part of the government. The crisis might crowd-out government financing on health and pose serious challenge to the people living on marginal income. According to WHO Report (2011):

> "The economic crisis that started in 2007 has continued to pose major challenges in the WHO European Region. It has led to significant declines in economic activity, a rise in unemployment, depressed housing markets and an increasing number of people living in poverty. The rise in national debt is forcing governments to implement severe cuts in public spending. Significant risks remain in the world economy, and many countries are facing an era of austerity in health and welfare services."

Health financing has recently become a debatable issue and a matter of major concern in both the developing and the developed world.[2] "All countries, rich and poor, struggle to raise the funds required to pay for health services their populations need or demand. No country, no

[2] Health financing is primarily related to the ways of raising sufficient funds for health, overcoming financial barriers that exclude many people from accessing to health services and the provision of efficient and equitable mix of health services (WHO).

matter how rich, is able to provide its entire population with every technology or intervention that may improve health or prolong life (World Health Report, 2011 pp. 21)."

Sachs (2010) writes:

> "Each year, nearly nine million children die of conditions that could be prevented or treated, and nearly 400,000 women die because of complications during pregnancy. Almost all of these deaths are in the world's poorest countries. Ending these deaths would not only reduce suffering, but would also unleash economic prosperity in impoverished and unstable societies. The greatest barrier to doing so is that the poorest countries can't afford universal primary health care, even though the cost per person is very low. Using immunizations, modern medicines, state-of-the-art diagnostics, mobile phones, and other new technologies, universal primary health care is now highly effective and very inexpensive, costing around $54 per person per year in the poorest countries. Yet, because of their very low incomes, the poorest countries can afford only around $14 per person from their national budgets."

This clearly reinforces the fact that health financing is a daunting task for a number of people living below the poverty line. Health financing is challenging also in the developed countries. Anirudh Krishna opines, "Compared with other rich countries, the United States has one of the greatest numbers of people living in poverty, as well as a high risk of becoming poor. Why is that? Countries that do not have affordable health care have high rate of poverty, no matter how high their rate of economic growth or their level of wealth."[3]

The experience of a Bangladeshi woman Asea Begum suggests that financial development and health capital accumulation are interconnected. The UNDP web page on poverty reduction narrates Asea's story in an interesting way. Asea and her family ate just one meal a day, consisting of plain rice and a few pieces of chili. Her children were always hungry and her husband, who pulls a rickshaw all day, was continually exhausted. All this changed when Begum received a loan of 6,000 Bangladeshi Taka (about US$85) from her local community development committee. The loan allowed her to start a small grocery business and thereby

[3]Smeeding (2005 pp. 76) mentions, "The relative poverty rate for all persons varies from 5.4 percent in Finland to 17.0 percent in the United States, with an average rate of 10.3 percent across the eleven countries."

significantly increase her income. The financial access has enabled the Begum to replace her house's flimsy bamboo walls with sturdier material and her family now eats three meals per day including vegetables and fish.

The above mentioned facts are from the real life examples recommending that health capital accumulation requires resources and policy makers in both the developed and the developing world need to explore the alternative avenues to make families able to afford health financing. Conventional ways of financing such as government financing may not be enough to widen the coverage of health financing and in some cases may not be sustainable.

1.5 Research Avenue

Higher life expectancy, lower maternal and infant mortality and lower birth underweight are the major determinants of health capital accumulation, which depend on a number of factors such as medical goods, diet, public financing on health services, habits, and access to resources to finance health requirements. A sound and developed financial system could be instrumental in supporting families to raise resources for health financing.

The recent financial crisis has reinforced the fact that financial intermediation remains at the center of economic activities. An unstable financial system in the face of financial crisis restrains borrowing opportunities, adds more people to the unemployment pool and reduces income. Cutler et al. (2002) mention that this reduction in income lowers resources for goods that improve or maintain health such as out-of pocket medical spending and nutrition; crowding out public sector spending on health and distracting the informal care that families can provide to children and aged. They have empirically shown this effect in Mexico considering the impact of 1995-96 financial crisis.

Though Claessens and Feijen (2006b) made the pioneering effort to explore the relationship between health outcomes and financial development, they do not take major health indicators such as life expectancy, maternal mortality, and infant mortality into account. Also other studies dealing with economic growth and health relationship so far have treated health as an input for growth. However from the perspective of human happiness, better health should be the goal of the society and the level of economic growth or the level of financial development should be the means for better health.[4] Better health, whether in terms of higher life expectancy, lower mortality rates or less prevalence of diseases, should be the goal of the society and this study treats health outcome as the output and financial development as one of the inputs.

Exploring the relationship between financial development and health capital accumulation is also important from the policy perspective. This type of study could help policy makers to reorient efforts in reforming the financial system and health system in a coordinated manner and designing a framework in which financial development could be a conduit for health capital accumulation. Improved access to finance and cheaper health insurance facilities for liquidity constrained families are immensely important to offset the negative impact of financial deprivation on health care and personal risk management. Therefore, there is a need for academic research that could investigate these relationships.

1.6 Objectives

This study reviews the literature on the relationship between health capital accumulation and financial development, design a theoretical model to investigate the impact of financial development on health capital accumulation and test the model with econometric analysis. Specifically, the main objectives of this study are to:

[4] The WHO Commission on Social Determinants of Health suggests that better health and its fair distribution should be adopted as shared goals.

1. Design a theoretical model to investigate the relationship between financial development and health capital accumulation,
2. Examine econometrically the impact of financial development on health capital accumulation, and
3. 3) Draw policy lessons through which health policy and financial policy can be integrated together to widen the access of cheaper and better health services.

Based on these objectives, the study aims at answering following research questions.

General Research Question:

Does financial development matter for health capital accumulation?

Specific research questions:

1. Is there a correlation between financial development indicators and health capital indicators across countries over time?
2. Is there a long run relationship between the level of financial development and the level of health status in terms of life expectancy, maternal mortality and infant mortality?
3. What is the direction of causality between the level of financial development and health status? In other words, do healthy people contribute to the development of the financial system or does the financial system contribute to the better health of the people.
4. Do financial shocks matter for health capital accumulation?
5. Do the varying levels of financial development in developed and developing countries also affect the process of health capital accumulation differently?

1.7 Research Hypotheses

Null Hypothesis (Ho): Financial development does not have impact on health capital accumulation.

Alternative Hypothesis (H_1): Financial development contributes to health capital accumulation.

The remainder of this study proceeds as follows: Chapters 2, 3 and 4 discuss the literature review; theoretical framework, and the study of financial development and health capital accumulation in the OECD countries using fixed effect approach and instrumental variable approach respectively. Chapter 5 discusses the study of health and financial development relationship in developing countries, taking the case of the South Asian region, and Chapter 6 explores the effect of financial shocks on health indicators. Chapter 7 concludes.

Chapter 2 Literature Review

This Chapter briefly reviews the research done in the field of income, health and financial development. Though there have been studies relating to income and health, it is hard to find the literature directly dealing with financial development and health. Even though the study by Claessens and Feijen (2006b) is an important initiative in this direction, it does not explore the financial development and health relationship by directly taking health outcomes as the dependent variable.

Barro (1996) runs a panel regression of roughly 100 countries for the period from 1960-1990 and finds a substantial link between health status and economic growth. In his analysis, the dependent variables are the growth rates of real per capita GDP over three periods 1965-75, 1975-85 and 1985-1990. The population's overall health status is measured by the log of life expectancy at birth at the start of each period. The regression result shows the positive effect of growth from initial human capital in the form of health. The coefficient on log of life expectancy at birth is 0.042 (0.014) implying a statistically significant effect on per capita output.

Bloom, Canning and Sevilla (2004) estimate a production function model of aggregate economic growth including two variables that microeconomists have identified as fundamental components of human capital: work experience and health. They constructed panel of countries observed every 10 years over 1960-1990 for 175 countries. Taking growth rate of GDP as the dependent variable and controlling for capital, labor, schooling, experience, life expectancy and some other variables, they find that each extra year of life expectancy raises the productivity of workers and leads to an increase of 4 percent in output.

Pritchett and Summers (1996) estimate the effect of income on health. They use the instrumental variable method for cross-country, time series data at five-year intervals over the

period from 1960 up to 1985 and find that the positive relationship between income and health is not merely associative but is causal and structural. They mention that approximately 40 percent of the cross-country differences in mortality improvements are explained by the country differences in income growth. Their key finding is that the long-run income elasticity of infant and child mortality is between -0.2 and -0.4 in developing countries. This supports the positive role of income in improving health status particularly due to the increased public and private spending on goods that are directly or indirectly beneficial for health.

Rodgers developed a macro-model in 1979 to analyze the impact of income on life expectancy using international cross-sectional data for 56 countries around the world. Rodgers' model takes mortality or life expectancy as the dependent variable and the function of mean income and mean income distribution as the explanatory variables. Rodgers uses different model specifications using three dependent variables: expectation of life at birth, at fifth birthday and infant mortality. The income variable was specified using income reciprocal, reciprocal quadratic and reciprocal logarithms. Rodgers' main finding is that while life expectancy increases with income at a decreasing rate, the Gini has a significant large and negative coefficient (Lazarova and Mosca, 2008). Rodgers' analysis implicitly recommended the role for some sectors in the economy that could be instrumental in developing income generating opportunities and bridging the gap between haves and have-nots. One possible candidate in this regard could be financial development.

The role of finance on economic growth started to become a topical issue with the pioneer work of Goldsmith, who (1969) tried to find out how the primary economic factors interact to facilitate the financial development (Hu and Zhou, 2001). Goldsmith used annual data for the period from 1860 to 1963 for 35 countries and employed a financial interrelations ratio

(FIR) to relate the process of financial development to modern economic growth.[5] He asserted that financial superstructure accelerates economic growth and improves economic performance by facilitating the migration of funds to the place in economic system where the funds will yield the highest social return (Goldsmith 1969, p. 400)

Noble Laureate Muhammad Yunus brought about a great change in the lives of common Bangladeshi people through his microfinance movement.[6] This microfinance movement has drawn the attention of policy makers and practitioners around the world to redefine the role of finance not only as an instrumental in supporting growth but also as a catalyst in promoting education and health particularly for lower middle class families. Referring to the success story of Grameen Bank in Bangladesh, Bornstein (1996) mentions that an experimental health program and access to loans for kitchen gardens to grow fresh fruit and vegetables improved the health and nutrition of family members, and also reduced the time women spend dealing with illness (Bernasek, 2003). The United Nations organized a global conference on finance for development in 2002. The conference argued for mobilizing and increasing the effective use of financial resources in order to fulfill internationally agreed development goals including those contained in the Millennium Declaration.

There has been a surge of interest in studying the causal role of finance on income growth and poverty reduction after the well documented study on finance and growth relationship by King and Levine (1993). They present cross-country evidence using data for 80 countries over the period of 1960-1980 and conducted both a purely cross-country analysis using data averaged over the 1960-1989 period and a pooled cross-country time series study using data averaged over 1960s, 1970s and 1980s. Their study shows that various measures of the level of financial

[5] FIR is the ratio of the value of all financial instruments outstanding at a given date to national wealth.
[6] Muhammad Yunus won the Noble Peace Prize in 2006 for his contribution in alleviating poverty through micro-finance.

development are strongly associated with real per capita GDP growth, the rate of physical capital accumulation and improvements in productivity.

Globally the financial system has expanded significantly in the last few decades. This expansion both at the country level and global level induced interest on the causal role of finance not only on income growth but also on poverty reduction and human capital accumulation. Honohan (2003) conducted a cross sectional study of 70 developing countries taking the percentage of population living below dollar a day, which is defined as the dollar one per day poverty ratio as the dependent variable and private credit to GDP ratio as the explanatory variable. Even after controlling for GDP per capita, Honohan finds that a 10 percentage point increase in private credit as percentage of GDP reduces the poverty ratio by 2.5-3.0 percentage points. Beck, Demirguc-Kunt, and Levine (2005) taking data from 58 countries for 1960-1999 show that financial development actually accelerates poverty reduction. Beck et al. regress growth of headcount and growth of poverty gap on the indicators of financial development, after controlling for the overall growth rate of GDP per capita, and each country's initial poverty level. Caprio and Honohan (2001) argue that financial systems contributed significantly to the prosperity of the advanced economies.

Claessens and Feijen (2006b) use the cross-country OLS regressions for the period between 1980 and 2003 taking the credit to GDP ratio for 99 countries. In their study, undernourishment is dependent variable and the credit to GDP ratio is the explanatory variable.[7] Their study shows the large impact of financial development on undernourishment. They find that a one percent increase in private credit to GDP would reduce the prevalence of undernourishment by between 0.22 percent and 2.45 percent. This shows that financial development contributes to health capital accumulation.

[7] They control a number of other variables and also control for the country fixed effect.

Nanda (1999) uses two-stage instrumental variable estimates to examine the effect of credit programs on the demand for health care among rural women in Bangladesh. She uses the non-unitary household preference model in which a household consists of a number of different members whose preferences may vary.[8] The model tests the hypothesis that women's empowerment through participation in these programs results in greater control of resources for their own demand for formal health care. The study shows the positive impact of women's participation in credit programs on their demand for formal health care suggesting that female participants in credit program are more likely to demand formal health care than nonparticipants.

Cutler et al. (2002) use four propositions to explain why the financial crisis in Mexico affected mortality. The first proposition argues that the crisis reduced income, which reduced resources for goods improving or maintaining health, such as out-of pocket medical spending or nutrition. The second proposition claims that the crisis lowered the public sector funding for health care, which affected families depending on government funding. The third claim is that the crisis caused more people to work, resulting in health reductions for affected workers and the final claim is that the crisis affected the informal care that families can provide for children and the aged. They use state level panel data and find that the magnitude of the economic shock, as measured by the share of women who enter the labor force, predicts increase in mortality.

The empirical work shows that mortality rates increased with economic crisis, particularly among the elderly and possibly among the very young. They find that mortality changes between 1994 and 1996 among the population aged 60 and over were 5 to 6 percentage points worse than expected based on pre-crisis trends. For children aged 0 to 4, mortality rates

[8] Using a non-unitary preference approach, this model focuses on the preferences of an individual woman within a household, in the reproductive age group, who may participate in credit programs in rural Bangladesh (Nanda, 1999).

were approximately 7 percentage points above the expected levels. This translates into about 7,000 additional deaths among children and 20,000 additional deaths among the elderly.

Though the studies so far reviewed explain the relationship between income growth and health, and financial development and health, none have explored the relationship between health outcomes and financial development. This study seeks to introduce this new idea of the linkage between health outcomes and financial development.

Chapter 3 Theoretical Model

A simple static model shows the interaction between medical care market (M) and loan market (L). Based on the premise of this model, the consumer's utility maximization shows the effect of financial development on health status. The major proposition is that a higher level of financial development has a positive impact on health status.

3.1 Model with medical care market and loan market

The first premise of this model is the coexistence of medical care market (M) and Loan market (L). The medical market attains equilibrium through the interaction between forces shaping the medical care supply and medical care demand. The factors defining the supply side of medical care market are health infrastructures such as physicians, hospitals and medical equipment (I), government efforts (G), and the development level of the financial system (F). While the role of infrastructures and government is obvious in influencing the supply side, the financial system affects the medical care supply by mobilizing resources for research and development, financing health education and development of health care infrastructures, and making health insurance competitive and accessible to the wider section of the population.

The demand side of the medical care market is defined by the health status of the individuals (H), price of the medical care (P^M), and interest rate on the borrowing (r). In the model, health status (H) of individuals depends on medical care (M), non-medical factors (Z) and the income level (Y), which depends on the level of the financial development in an economy. The higher the level of financial development, the more income generating opportunities people will have, paving way for dignified life in the society. Higher income also allows people to utilize medical facilities in a timely manner. Timely medical care in the form of regular doctor visits; medication and intervention have positive effect on the health of the individuals.

Nonmedical factors include food, shelter, sanitation, life styles, which have direct impact on public health.

The loan market equilibrium comes through the interaction of loan supply and demand. The major factor affecting the loan supply for medical care is the level of financial development. A developed and competitive financial system can better cater to the borrowing needs of the people and offer a number of schemes to insure against future uncertainty. A competitive and developed financial system can encourage lending for the development of medical care infrastructures by competitively setting the investment friendly interest rate. The demand for a loan depends on individual's demand for medical care (M), nonmedical factors such as food and shelter (Z) and interest rate (r), which depends on the level of financial development. A developed and competitive financial system enables people to borrow at the competitive interest rate. While more demand for medical care and nonmedical facilities, which are necessary for health increases the demand for bank loan, a higher interest rate on bank loan discourages borrowing.

Mathematically, there are two equations in the model: one for the medical care market and another for the loan market. Equation (1) represents the medical care market and equation (2) represents the loan market.

$$M^s[I, G, F] = M^d[H(M, Z, Y(F)), P^m, r(F)] \quad (1)$$

$$L^s(F) = L^d[M, Z, r(F)] \quad (2)$$

Where,

M^s= Supply of medical care

M^d= Demand for medical care

L^s= Supply of loans

L^d= Demand of loans

I= Medical care infrastructures such as physicians, hospitals and equipment

G= Government efforts to promote medical care

F=Level of financial development

H=Public health status

M=medical care

Z=Nonmedical factors affecting health status

r=Interest rate on borrowing

P^m= Price of medical care

Totally differentiating equations (1) and (2) gives:

$$M_I^s d_I + M_G^s d_G + M_F^s d_F = M_H^d H_M d_M + M_H^d H_Z d_Z + M_H^d H_Y Y_F d_F + M_{P^m}^d d_{P^m} + M_r^d r_F d_F \quad (3)$$

$$L_F^s d_F = L_M^d d_M + L_Z^d d_Z + L_r^d r_F d_F \quad (4)$$

Rearranging gives:

$$M_H^d H_M d_M + M_H^d H_Z d_Z = M_I^s d_I + M_G^s d_G + M_F^s d_F - M_H^d H_Y Y_F d_F - M_r^d r_F d_F - M_{P^m}^d d_{P^m} \quad (5)$$

$$L_M^d d_M + L_Z^d d_Z = L_F^s d_F - L_r^d r_F d_F \quad (6)$$

3.2 Comparative statics using equations (1) and (2)

This section examines the effect of financial development on public health status. For this purpose, equations (5) and (6) are presented in the matrix form assuming medical care (M), nonmedical factors (Z), income (Y) and interest rate (r) as endogenous variables and Infrastructures (I), government efforts (G), financial development (F) and price of medical goods (P^m) as exogenous variables.

$$\begin{bmatrix} M_H^d H_M & M_H^d H_Z \\ L_M^d & L_Z^d \end{bmatrix} \begin{bmatrix} d_M \\ d_z \end{bmatrix} = \begin{bmatrix} M_I^s & M_G^s & (M_F^s - M_H^d H_Y Y_F - M_r^d r_F) & -M_{P^m}^d \\ 0 & 0 & (L_F^s - L_r^d r_F) & 0 \end{bmatrix} \begin{bmatrix} d_I \\ d_G \\ d_F \\ d_{P^m} \end{bmatrix}$$

$|A| = \left(M_H^d H_M\right)\left(L_Z^d\right) - (M_H^d H_Z) L_M^d) < 0$, where $M_H^d H_M$<0 $L_Z^d > 0, M_H^d H_Z < 0$ and $L_M^d > 0$. $M_H^d H_M$ is negative implying that higher medical care (M) has positive effect on health status (H) so H_M is positive but better health status lowers the demand for medical goods, which gives negative M_H^d.Therefore, $M_H^d H_M$ is negative. L_Z^d is positive implying that higher demand for nonmedical goods increases demand for bank loan. Given the similar reasons for $M_H^d H_M$ and L_Z^d respectively, $M_H^d H_Z$ is negative and L_M^d is positive. The determinant $|A|$ is negative assuming that $M_H^d H_M$ is higher than $M_H^d H_Z$ owing to the larger effect of medical care on demand for medical goods and the value for L_Z^d and L_M^d are same.

Using Cramer's rule:

$$\frac{d_M}{d_F} = \frac{\begin{vmatrix} (M_F^s - M_H^d H_Y Y_F - M_r^d r_F) & M_H^d H_Z \\ (L_F^s - L_r^d r_F) & L_Z^d \end{vmatrix}}{|A|}$$

$$= \frac{(M_F^s - M_H^d H_Y Y_F - M_r^d r_F) L_Z^d - (M_H^d H_Z)(L_F^s - L_r^d r_F)}{|A|} = \frac{(-)}{(-)} > 0$$

The numerator is negative assuming that the value for the first term in the numerator $(M_F^s - M_H^d H_Y Y_F - M_r^d r_F)$ is higher than the value of any other individual term in the numerator. It is particularly because the effect of financial development on the supply of medical care (M_F^s) is dominated by the income effect on health $(M_H^d H_Y Y_F)$.

Given this, the positive sign for $\frac{d_M}{d_F}$ implies that a higher level of financial development encourages medical care, which has a positive impact on health status of individuals. It is also true that a developed financial system promotes health capital through investment in medical education, hospitals, medical research and development, and other infrastructures.

3.3 Introducing household utility maximization in the model

Following Grossman (1972), health output can be presented as a function of various individual inputs. In simplest static terms, H=f(X), where H is a measure of health output and X is a vector of individual inputs to the health production function. Given this, we can specify health outcome as a function of expenditure on medical care, food consumption (C), and behavioral factors such as smoking and alcohol consumption (S), job availability (E) and access to financial services (F) to maintain or augment health. This is shown in the following health production function, which is close to the idea of Strauss and Thomas (2008, pp. 3385).

$$H = f(M, F, S, E, \varepsilon) \qquad (1)$$

Further to develop the micro-foundation for the model, it is assumed that an individual maximizes a standard utility function over nonmedical consumption (C), and health status (H) subject to the resource constraint and production constraint. Financing comes from two sources, asset income or borrowing from the bank (V) and labor income (W). The labor income (W) depends on the national income level, which is a function of the level of financial development. A highly developed and stable financial system contributes to raising national income, which contributes to maintaining the health status. The non-labor incomes such as one from the investment in financial assets or bank borrowing (V) are directly related to the development and stability of the financial system. The incomes thus received from labor supply and financing managed from other sources are spent on nonmedical consumption (C) and medical services (M), which augment health status. The simple utility maximization model is presented below:

$$Max\ U(C, H) \qquad (2)$$

Subject to:

$$[W(Y(F))T + V(F)] = [P^C C + P^M M] \qquad (3)$$

$$H = f(M, Z, \varepsilon) \qquad (4)$$

Where,

C=Consumption of nonmedical goods

M=Consumption of medical goods

W=Wages per hour

T=Total hours spent on work

V=Non-wages income/Asset income/Borrowing from the bank

P^C=Price of consumable goods

P^M=Price of medical goods

Y= National output (Gross Domestic Output)

F= Level of Financial Development

Z= Other factors affecting heath status

The Lagrangian for the above problem is:

$$L = U(C, H) + \lambda\{[W(Y(F))T + V(F)] - [P^C C + P^M M]\} \qquad (5)$$

$$\frac{\partial L}{\partial C} = U_c = \lambda P^c \qquad (6)$$

$$\frac{\partial L}{\partial M} = U_M + U_H f_M = \lambda P^M \qquad (7)$$

$$\frac{\partial L}{\partial \lambda} = \{[W(Y(F))T + V(F)] - [P^C C + P^M M]\} = 0 \qquad (8)$$

Solving (6) and (7, we get the value for U_c, which is: $\frac{U_c P^M}{P^c} = U_M + U_H f_M$

After substituting for C in (8), the demand for M can be written as M=m (w, V, T, P^M, P^C)

Once we plug the value of M in health production function (4), we get

$$H = f(\mathrm{W}, \mathrm{V}, P^M, P^C, Z, \varepsilon) \qquad (9)$$

Next, we need to check the second order sufficient condition for a maximum.

$$|\bar{H}| = \begin{vmatrix} 0 & -P^C & -P^M \\ -P^C & U_{CC} & U_{CM} \\ -P^M & U_{CM} & U_{MM} + U_{HH} f_{MM} \end{vmatrix}$$

$= 2(\ P^C P^M U_{CM}) - (P^C)^2 (U_{MM} + U_{HH}\ f_{MM}) - (P^M)^2 U_{CC}\ > 0$

The objective of this analysis is to see the effect of financial development on health. For this purpose, we design the following matrix equation and check for the impact of financial development on health through medical care.

$$\begin{bmatrix} 0 & -P^C & -P^M \\ -P^C & U_{CC} & U_{CM} \\ -P^M & U_{CM} & U_{MM} + U_{HH} f_{MM} \end{bmatrix} \begin{bmatrix} \frac{\partial \lambda}{\partial F} \\ \frac{\partial C}{\partial F} \\ \frac{\partial M}{\partial F} \end{bmatrix} = \begin{bmatrix} (W_Y Y_F T + V_F) \\ 0 \\ 0 \end{bmatrix}$$

Check for $\frac{\partial M}{\partial F}$:

$$\frac{\begin{bmatrix} 0 & -P^C & (W_Y Y_F T + V_F) \\ -P^C & U_{CC} & 0 \\ -P^M & U_{CM} & 0 \end{bmatrix}}{|\bar{H}|}$$

$$\frac{\partial M}{\partial F} = \frac{(W_Y Y_F T + V_F)\{U_{CC} P^M - U_{CM}\ P^C\}}{|\bar{H}|} > 0$$

Since $W_Y Y_F T + V_F$ is positive given the positive effect of financial development on income, the term $\frac{\partial M}{\partial F}$ is positive. This suggests that the level of financial development positively contributes to medical care and thus affects health status through income generating opportunities.

Chapter 4 Financial Development and Health Capital Accumulation

This chapter examines the research hypothesis whether financial development contributes to health outcomes in context of the OECD countries. Using fixed effect estimates and instrumental variable approach, I find that financial development positively contributes to health outcomes such as higher life expectancy and lower infant mortality. Among the various proxies for financial development, private credit to GDP ratio is more effective. The transmission mechanism shows that the financial development in the OECD countries transmits to health outcomes through income effect.

This Chapter is presented as follows. Section 4.1 provides brief introduction, section 4.2 highlights the purpose, and sections 4.3 to 4.6 explain the research methodology, variables and data sources. Section 4.7 is about the econometric analysis using fixed effect approach and instrumental variable approach. Section 4.8 develops the transmission mechanism explaining the channels through which financial development transmits to health outcomes and section 4.9 concludes the Chapter.

4.1 Introduction

There has been a significant improvement of health outcomes in developed countries' population in the last half century.[9] For some countries, there have been major improvements in the accumulation of health capital. Japan, for example, set an exemplary record on the frontiers of life expectancy, maternal mortality, and infant mortality (Table 1).

Health capital accumulation is associated with the overall welfare and happiness of the society. This is also the reflection of a number of medical and nonmedical resources invested in the accumulation of health capital. However, the health status in terms of life expectancy, infant

[9] Health is broadly defined to include longevity and illness free days in a given year (Grossman, 2000).

mortality and maternal mortality varies even among OECD countries. There are some noticeable differences in health outcomes. For example, the health outcomes for the United States are below the average of OECD countries in 2010. This sort of variation requires analyzing the relationship between health status and various determinants of health well beyond the conventional paradigm by exploring the factors not taken into account so far. Thus, this study explores the relationship between health outcomes and the level of financial development in the OECD countries.

Table 1
Health Outcomes in the G7 Countries and OECD Average

Countries	Infant mortality		Life expectancy at birth		Maternal Mortality	
	1960	2010	1960	2010	1960	2010
Canada	27.3	5.0	71.1	80.7	45.0	9.0
France	27.7	3.6	69.9	81.1	NA	8.2
Germany	35.0	3.4	69.6	80.0	69.3	5.5
Italy	43.3	3.4	69.1	81.7	NA	2.0
Japan	30.7	2.3	67.7	82.9	130.6	4.2
United Kingdom	22.5	4.2	71.1	80.4	47.0	5.0
United States	26.0	6.1	69.8	78.2	37.1	13.3
OECD Average	55.7	6.7	67.5	79.3	NA	18.7

Source: OECD Health Data. 2010. www.oecd.org/health/healthdata and World Bank.

4.2 Purpose

The life expectancy in the developed countries increased significantly in the last half century. The average life expectancy increased by 12 years in the last fifty years in the OECD countries. This is the reflection of the production of health capital at a higher level. According to the OECD family database, all OECD countries have made remarkable progress in increasing life expectancies at birth. In 2008, a newborn girl in a typical OECD country could expect to live to age 82.0 years, that is, over 11 years more than a baby girl born in 1960. Similarly in 2008, a newborn boy could expect to live up to age 76.5 years; nearly 11 years more than a boy born in 1960.

A number of determinants affect health capital accumulation. The health production function could include capital, labor, schooling, lifestyles, environment, and health services. Folland, Goodman and Stano (2010) summarize literature indicating that health status is a function of health care, life style, environment and human biology and improvement in any of the latter three increases the marginal product of health care inputs. This reasoning asserts that both medical and non-medical factors play an important role in shaping better health. Among nonmedical factors, competitiveness and effectiveness of the financial system could also be instrumental in ensuring better access of common people to private health insurance, cheaper loans and better financial services. The advanced economies have developed financial systems and the contribution of such a system is reflected in various indicators of financial development (Table 2). An important reason to choose the OECD countries for the analysis is that the effect of financial development on various facets of socio-economic development can meaningfully be studied only in reference of those countries having passed certain threshold of financial development. Countries in their early stages of financial development may not reveal the full effect of such development on socio-economic outcomes.

Table 2
Some Financial Indicators

Countries	Private Credit to GDP Ratio			Liquid Liabilities to GDP Ratio		
	1960	1990	2008	1960	1990	2008
France	0.19	0.9	1.1	0.47	0.62	0.75
Canada	0.18	0.88	1.3	0.36	0.72	1.15
Germany	0.39	NA	1.1	0.39	0.62	1.11
UK	0.16	1.12	2.1	0.39	0.91	1.53
Italy	NA	0.53	1.0	NA	0.62	0.75
Japan	0.51	1.69	1.72	0.47	1.86	1.95
USA	0.71	1.17	1.9	0.6	0.73	0.74
OECD Average (1960-2008)	0.6	1.1	1.6	0.57	0.98	1.19

Source: World Bank. 2010. Financial Structure Database. *worldbank.org/INTRES/Resources/FinStructure.*

The significant strides attained by the developed world in the area of health and financial development could establish a path breaking paradigm for a number of underdeveloped countries, which have been experiencing poor health outcomes, poor growth and lack of financial services. The problem of poverty and lack of health insurance is important in the developed world as well as in the less developed world. For example, according to the US Census Bureau, there was a rise in the poverty rate in 2009.[10] Also the percentage of US population without health insurance rose to 16.7 percent in 2009 from 15.4 percent in 2008.

Additionally, the Great Recession originating from the financial crisis has affected the global growth along with higher unemployment and economic uncertainty. These problems require some kind of coordination at the policy level, which can address finance, health and poverty related issues in an integrated manner. This chapter explores the financial development and health relationship using data for the OECD countries. Thus, this chapter examines the hypothesis whether financial development matters for health capital accumulation.

4.3 Methodology

The econometric analysis consists of estimating a panel regression using fixed effect approach and instrumental variable approach for the OECD countries. The panel regression studies the general relationship between financial development and health capital accumulation and explores the direction of causality.

4.4 Variables

Major variables reflecting the health capital include life expectancy, infant mortality, maternal mortality and low birth weight. Of these, life expectancy, infant mortality and low birth weight are taken as the dependent variables for the purpose of econometric analysis. The explanatory variables include the financial development indicators and other determinants of life

[10] In 2009, the poverty rate was 14.3 percent and it is the highest poverty rate since 1994.

expectancy. The financial development variables are private credit to GDP ratio, liquid liabilities to GDP ratio and market capitalization to GDP ratio. These measures are widely used to show the size and depth of the financial sector (King and Levine, 1993). Other control variables are alcohol consumption liters per capita, public expenditure on health care as a percentage of GDP, unemployment rate, vaccination and low birth weight. Low birth weight, among others, is included as a control variable while explaining the relationship between infant mortality and financial development. Low birth weight is a leading cause of infant mortality since infants with low birth weight (LBW) face higher risk of heart disease and diabetes, stunted growth, and other health related problems.[11] Also infant mortality is controlled while regressing life expectancy on financial variables. The idea is that countries having higher infant mortality should have lower life expectancy.

4.5 Variable Descriptions

The definition of health indicators such as life expectancy, infant mortality and low birth weight are as given in the OECD health data. The dependent variable EXPECTANCY, defined as the life expectancy at birth and ages 40, 60, 65 and 80, is the average number of years that a person at that age can be expected to live assuming that age-specific mortality levels remain constant. The infant mortality rate is the number of deaths of children under one year of age in a given year, expressed per 1000 live births.

The low birth weight for an infant is defined as a weight at birth of less than 2500 grams (5.5 pounds) irrespective of the gestational age of the infant (UNICEF). There are a number of risk factors for low birth weight infants. These include poor health or death, requiring a longer period of hospitalization after birth, and higher chance of developing significant disabilities. Low

[11] WHO mentions low birth weight as a major determinant of mortality, morbidity and disability in infancy and childhood. Also it has a long-term impact on health outcomes in adult life (http://www.who.int/nutrition/topics/feto_maternal/en/index.html).

birth weight is also assumed to control for the effect of the consumption of both medical and nonmedical goods on health outcomes.

The financial development variables follow King and Levine (1993). One measure of the financial depth defined in the literature is the ratio of private credit of the financial system to GDP. This ratio indicates the relative size of the financial system and availability of the credit. Another measure of the financial development is the ratio of the liquid liabilities of the financial system to GDP.[12] This measures the general level of financial development relating broad money supply to the level of nominal GDP. Market capitalization to GDP ratio measures the size of the stock market relative to economy. A larger market has better ability to mobilize capital and diversify risk.

Alcohol consumption is included in the analysis to control for the effect of life styles and behavioral risk factors. Alcohol consumption is recognized as an important risk factor for many chronic illnesses such as the disease of the digestive system, cancer, cirrhosis as well as for accidents and violent deaths (Fayissa and Gutema, 2008). Total expenditure on health as a percentage of GDP controls for the effect of health spending on health outcomes. The vaccination variable is included to control for the utilization of health care. Since it is hard to control for all the variables representing vaccinations, only DTP is included in the analysis.[13] Unemployment rate is directly related to the income generation of families and is included to control for the effect of macroeconomic situation on family health. Wage earnings are also reflected on the employment availabilities. A brief description of the variables is presented in Appendix 1.

[12] Liquid liabilities are also known as M3. They are the sum of currency and deposits in the central bank (M0), plus transferable deposits and electronic currency (M1), plus time and savings deposits, foreign currency transferable deposits, certificates of deposit, and securities repurchase agreements (M2), plus travelers checks, foreign currency time deposits, commercial paper, and shares of mutual funds or market funds held by residents.

[13] Diphtheria, tetanus, and pertussis are serious diseases caused by bacteria (US department of Human Services).

4.6 Data Sources

The study collects data relating to health capital from the OECD Health data software (2010). The financial development indicators: private credit to GDP ratio, liquid liabilities to GDP ratio and market capitalization to GDP ratio come from the Financial Structure dataset of the World Bank. Data on some health indicators for countries not available in the OECD health data software are taken from the World Development Indicators of the World Bank. For the panel regression, annual data from 1990 to 2010 for 27 OECD countries are taken.

Appendix 2 shows the average values of the variables of interest, by country, for the whole period 1990-2010. Countries with highest and lowest life expectancy in the sample period are Japan and Mexico respectively. Japan's life expectancy in the sample period remained 81.1 years and Mexico had average life expectancy of 73.6 years. Commensurate with lowest life expectancy, Mexico had highest rate of infant mortality that is 22.24 per thousand in the sample period. Iceland had the lowest infant mortality that is 3.33 per thousand. On the financial development frontiers, Switzerland leads on credit to GDP ratio and market capitalization to GDP ratio with such ratios being 161 percent and 196 percent respectively. Also a noticeable point is that Switzerland has the second highest life expectancy among the sample countries. Mexico, which has the lowest life expectancy and highest infant mortality, is also a least performer on financial development frontier. Mexico's credit to GDP ratio was approximately 21 percent and market capitalization to GDP ratio was 30 percent during the sample period.

The data on legal origin, which is an instrumental variable in the panel analysis, comes from Barth, Caprio and Levine (2006).[14] Legal origin for countries is divided into five categories: common, French, German, Scandinavian and socialist. While French and socialist legal origin are restrictive on institutional development impeding the pace of financial

[14] Barth, Caprio and Levine have taken this from La Porta, López-de-Silanes, Shleifer, and Vishny (1998).

development, other legal origins have positive impact on financial development. La Porta, López-de-Silanes, Shleifer, and Vishny (1998) show that historically determined legal origin help in explaining the international differences in financial development today. For example, the English common law protected private property rights against the crown and developed public confidence with positive repercussions on financial development (Barth, Caprio and Levine). The summary statistics and correlation matrix among major variables are presented in Appendix 3 and Appendix 4 respectively.

4. 7 Econometric Analysis and Findings

4.7.1 Panel Estimation

Panel regressions using data from 1990 to 2010 for 27 OECD countries are developed.[15] The panel regression examines the impact of financial development on life expectancy, infant mortality and low birth weight.[16] For this, the following fixed effect model is estimated first.

$$H_{it} = \alpha_i + \beta F_{it} + \gamma X_{it} + u_{it} \qquad (1)$$

where, H is the matrix of health capital measured in life expectancy, infant mortality and low birth weight. F is the indicator of financial development and X is the matrix of other life expectancy determinants. The constant term α controls for country characteristics, which are supposed to be stable over the period studied. Subscripts i and t refer to country and time respectively.

In addition to explaining the general relationship between health and financial development, exploring the causal role of finance is important. Theoretically speaking, there could be the problem of reverse causality. A higher level of financial development should

[15] Names of the countries included in this study are presented in Appendix 1.
[16] Almost 60 percent of the studies rely on some measure of life expectancy or the adult survival rate for the measures of health capital formation (Hartwig, 2010).

increase life expectancy and lower infant mortality but the higher level of financial development is likely a function of population with better health. It could be that more healthy people having extended life expectancy might require more financial services and the health capital can be the causal factor instead of the financial development. Thus, the instrumental variable approach is used to address the problem of simultaneity bias between financial development and health capital accumulation. The structural model for instrumental variable estimation consists of the following system of regressions:

$$F_{it} = \delta Z_i + \varepsilon_{it} \quad (2)$$

$$H_{it} = \alpha_i + \beta \hat{F}_{it} + \gamma X_{it} + u_{it} \quad (3)$$

While H, F, and X follow the notation as defined earlier, Z is the instrumental variable for financial development. Both u and ε are error terms and α, β, γ and δ are the estimated parameters. We use two stage least squares to explore this causal relationship.

For the instrumental variable, it is necessary to find something that is not correlated with unobserved factors such as person specific characteristics and individual lifestyle affecting one's health status but is correlated with financial development. Further, the instrumental variable should affect the dependent variable only through the endogenous variable. Legal origin of the countries fits into this category and is used as an instrumental variable for financial development. It is used as a set of dummy variables representing differences in legal systems and origins as instruments for financial development. Countries are divided into five groups: Common, French, German, Scandinavian and Socialist. The selection of instrumental variable is based on theory and follows the recent research done in this field. For example, there is extensive literature such as those by La Porta, López-de-Silanes, Shleifer, and Vishny (1998), Barth, Caprio and Levine

(2006) and Beck, Demirgüç-Kunt, and Levine (2003) suggesting that legal origin matters for financial development.

Beck, Demirgüç-Kunt, and Levine (2003) mention that both political channel and adaptability channel, though through different mechanisms support the view that legal origin shapes financial development.[17] While the political channel argues that legal traditions that give priority to private property rights and protect the private contracting rights form the basis of financial development, the adaptability channel stresses that legal traditions that adapt efficiently to minimize the gap between the contracting needs of the economy and the legal system's capabilities will more effectively foster financial development. The literature shows that countries with common law origin have strong institutional environment supporting the growth of financial sector. This is also true largely in the case of countries having German law origin. However, the pace of financial development is rather slow for countries having French law origin and socialist law origin due to the institutional rigidities.

4. 7.2 Panel Unit Root Test

Given the time series component in the panel data, testing for unit root is necessary. The regression analysis can be misleading and regression equation can be spurious if the time series data are not stationary. Therefore, panel unit root test is performed for all variables. The result of panel unit root test is presented in Table 3. The result shows all variables are stationary. While life expectancy and financial variables are stationary in their log form, variables such as unemployment and alcohol are stationary in their level.

Levin-Lun-Chu test is performed for log of life expectancy, log of infant mortality, alcohol, unemployment and log of DTP. The AIC lag selection criterion is used to select the

[17] The political channel focuses on the power of the state and the adaptability channel focuses on the process of law making.

appropriate lag order. However, the Fisher type Augmented Dickey Fuller Test is used to check for unit root in other variables having unbalanced panels. Maddala and Wu (1999) suggest the use of Fisher test in case of unbalanced panel. Under the Fisher test, inverse chi squared can be used to test the unit root when the number of panel is finite. One lag is selected for these variables since we have annual data.

Table 3
Panel Unit Root Test

Variables	P-value	Lags	Lag Selection Criteria
Log EXPECTANCY	0.02	2	AIC
Log INFMORTALITY	0.00	2	AIC
ALCOHOL	0.01	1	AIC
UNEMPL	0.00	1	AIC
Log EXPEND	0.00	1	AIC
Log DTP	0.00	1	AIC
Log CREDIT	0.00	1	Estimation
Log LIQLIAB	0.00	1	Estimation
Log MKTCAP	0.00	1	Estimation

4.7.3 Life Expectancy and Financial Development

Financial development should positively contribute to life expectancy in various ways. First, it provides avenues for people to save and borrow using formal sources of financing. People with surplus income can deposit their savings and use such savings to finance their health and education needs on one hand and people facing cash crunch may be able to borrow from banks to finance such needs on the other. These expenses on education and health directly and indirectly support to accumulate more health. Second, banks help to diversify the risk by managing resources more efficiently since they have better and additional information than an individual. Management of an individual's portfolio by a bank with better judgment and informed decisions can help to overcome information asymmetry. This should help in lowering

uncertainty and reducing the chances of financial shocks whereby health shocks can be mitigated.[18] Third, a developed financial system provides competitive choices for an individual and families in obtaining health insurance. This should broaden the coverage of health insurance by making it affordable to a large section of the society. Last but not least, clientele relationship with the bank particularly from the perspective of a borrower is a dignified option. Borrowing from a bank does not hurt the pride of an individual as compared to those from informal sources such as friends, relatives and local money lenders.

Given the above background, panel regression is developed in this section to consider the effect of financial measures, life style measures and health care consumption measures on life expectancy.[19] For this purpose, life expectancy is taken as the dependent variable and financial development proxies, alcohol consumption, and expenditure on health as the explanatory variables. For the instrumental variable estimation, financial development proxies are instrumented taking the legal origin of the country as the instrumental variable.

Before running the regression, hetroskedasticity is tested for the model below in (4). Drukker (2003) argues that serial correlation in linear panel-data models biases the standard errors and causes the results to be less efficient. This requires researchers to identify serial correlation in the idiosyncratic error term in a panel-data model. I use Wooldridge's test as suggested in Drukker (2003). The test shows that the null hypothesis of no first order autocorrelation is rejected (Table 4). Generalized least square (GLS) is used to correct for

[18] Currie and Tekin (2010) have shown that foreclosures in the aftermath of 2007/08 financial crisis have negative effect on public health.

[19] Shaw, Horrace and Vogel (2005) mention that population life expectancy (or mortality) is a function of environmental measures (e.g., wealth, education, safety, regulation, infrastructure), lifestyle measures (e.g., tobacco or alcohol consumption), and health care consumption measures (e.g., medical or pharmaceutical expenditures).

hetroskedasticity in case of IV approach. However, standard errors that are robust to hetroskedasticity are reported in case of the fixed effect approach.

Table 4
Wooldridge's Test for Hetroskedasticity

Dependent Variable	Explanatory Variables	F-Statistic	Probability
Log EXPECTANCY	CREDIT ALCOHOL EXPEND UNEMPLOYMENT DPT	76.22	0.0000
Log EXPECTANCY	LIQLIAB ALCOHOL EXPEND UNEMPLOYMENT DPT	77.52	0.0000
Log EXPECTANCY	MARKETCAP ALCOHOL EXPEND UNEMPLOYMENT DPT	98.87	0.00

Under the model specification in section 4.7.1, the panel regression of life expectancy on explanatory variables is run using the fixed effect approach. This controls for country specific unobserved characteristics, which are stable over time. In other words, the fixed effect approach is used assuming that country dummies are expected to be correlated with explanatory variables in the analysis. The panel regression for the fixed effect model is:

$$\log(\text{Life Expectancy}_{it}) = \alpha_i + \beta_1 \text{Credit}_{it}/\text{Liqliab}_{it}/\text{Mktcap}_{it} + \beta_2 \text{Alcohol}_{it} + \beta_3 \text{Expend}_{it} + \beta_4 \text{DPT}_{it} + \beta_5 \text{Unempl}_{it} + \varepsilon_{it} \quad (4)$$

The above regression is run after controlling for various proxies of financial development. The fixed effect estimation in Table 5 shows that all three indicators of financial development, CREDIT, LIQLIAB and MKTCAP have significant positive impact on life expectancy. The coefficient on CREDIT shows that a one percent increases in credit to GDP ratio increases life expectancy by 0.01 percent. Other variables in model (1) in Table 5 have also expected signs. Variables DPT and public expenditure on health are statistically significant. The coefficient on DPT shows that a one percent increase in the number of immunized population increases life expectancy by 0.04 percent and the coefficient on EXPEND shows that a one percent increase in health expenditure as a ratio of GDP increases life expectancy by 0.12 percent. The effect of expenditure is relatively bigger.

Table 5
Life Expectancy and Financial Development
Dependent Variable: Log of Life Expectancy

Variables	Fixed Effect Estimation					
	(1)	(2)	(3)	(4)	(5)	(6)
Log Credit	0.009 (0.003)**	-	-	0.00 (0.00)	-	-
Log Liqliab	-	0.03 (0.00)***	-	-	0.02 (0.006)***	-
Log Mktcap	-	-	0.009 (0.001)***	-	-	0.004 (0.001)**
Log DPT	0.04 (0.02)**	0.03 (0.01)**	0.03 (0.01)**	0.03 (0.02)*	0.02 (0.01)**	0.02 (0.02)
Log Expend	0.12 (0.01)***	0.10 (0.008)***	0.12 (0.01)***	0.07 (0.01)***	0.05 (0.01)***	0.07 (0.01)***
Alcohol	-0.00 (0.00)	0.000 (0.001)	-0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Log Infmortaltiy	-	-	-	-0.04 (0.006)***	-0.04 (0.007)***	-0.034 (0.005)***
Constant	3.87 (0.08)	3.86 (0.06)	3.92 (0.07)	4.14 (0.09)	4.12 (0.08)	4.15 (0.09)
R-Square (within)	0.72	0.69	0.76	0.83	0.83	0.84
No. of countries	27	27	27	27	27	27
No. of Observations	562	492	553	562	492	553

Note: Standard errors in parentheses. *, **, *** refer to 10 percent, 5 percent and 1 percent significance level respectively.

Similarly, the fixed effect estimation in Table 5 using liquid liabilities as a proxy for financial development shows the statistically significant positive effect on life expectancy even after controlling for other variables. For example, the LIQLIAB coefficient in model (2) shows that a one percent increase in liquid liabilities to GDP ratio is associated with 0.03 percent increase in life expectancy. All other variables have expected signs and are also statistically significant, except the alcohol. The coefficient on DPT suggests 0.03 percent increase in life expectancy with a one percent increase in immunized population. The coefficient on expenditure

also shows statistically significant positive impact on life expectancy suggesting 0.1 percent increase in life expectancy with a one percent increase in health expenditure to GDP ratio.

Another proxy for financial development, the market capitalization to GDP ratio in model 3 is positive and statistically significant. The coefficient on MKTCAP shows that a one percent increase in market capitalization to GDP ratio increases life expectancy by 0.01 percent. This suggests the positive correlation between capital market development and life expectancy. Other variables in model 3 have also expected signs. In models 4, 5 and 6, life expectancy is regressed on all variables controlled earlier and on infant mortality. This follows the assumption that life expectancy might depend on the level of infant mortality among other variables. Though this deviates from the model designed in chapter 3, which assumes health outcomes as a function of input variables and infant mortality is an outcome variable. However, two of the proxies of financial development LIQLIAB and MKTCAP are positive and statistically significant even after controlling for infant mortality.

Next, the instrumental variable approach is used to test for the endogeneity of the financial development proxies by using generalized two-stage least squares (G2SLS).[20] First, the endogenous variables CREDIT, LIQLIAB and MKTCAP are regressed on other explanatory variables and legal origin dummies namely Common, French, German and Scandinavian as shown in the following regression equation.[21]

$$F_{it} = \alpha_i + \gamma_1 \text{Alcohol}_{it} + \gamma_2 \text{Expend}_{it} + \gamma_3 \text{DPT}_{it} + \delta_1 \text{Common} + \delta_2 \text{French} + \delta_3 \text{German} + \delta_4 \text{Scand} + \varepsilon_{it} \quad (5)$$

This equation gives the estimated value for financial development proxies. Then life expectancy is regressed on the estimated value of financial development proxies and other explanatory

[20] G2SLS is used to adjust for any hetroskedasticty in the data.
[21] Socialist legal origin is the omitted dummy variable.

variables. The coefficients from the second stage generalized least square are presented in Table 6.

Table 6
Life Expectancy and Financial Development
Dependent Variable: Log of Life Expectancy

Independent Variables	**IV-GLS**		
Log CREDIT	0.04 (0.009)***	-	-
LIQLIAB	-	0.04 (0.02) ***	-
MKTCAP	-	-	0.03 (0.004)***
ALCOHOL	-0.20 (0.06)***	-0.22 (0.06)***	-0.10 (0.05)**
Log EXPEND	0.06 (0.01)***	0.10 (0.01)***	0.06 (0.006)***
UNEMPL	0.03 (0.04)	-0.09 (0.03)***	0.07 (0.04)
Log DPT	0.04 (0.01)***	0.03 (0.01)***	0.01 (0.01)
CONSTANT	3.86 (0.05)	3.91 (0.04)	4.07 (0.06)
Instrumental Variable	Legal origin	Legal origin	Legal Origin
R^2	0.55	0.70	0.48
Sargan-Hansen (p value)	0.25	0.02	0.38
Cragg-Donald Wald F-Stats	85.76	74.81	43.86
Number of Countries	27	27	27
Number of Observations	562	492	553

Note: Standard errors in parentheses. *, **, *** refer to 10 percent, 5 percent and 1 percent significance level respectively**.**

The validity of the instruments is evaluated using a post-estimation Sargan-Hansen test, which has the null hypothesis that over-identifying restrictions are valid. In other words, the instrumental variables are uncorrelated with the error term. The Sargan-Hansen test statistic is well above the 5 percent significance level while regressing life expectancy on credit and market

capitalization. This supports the null hypothesis that the instrumental variable and unobserved factors are not correlated and the legal origin is a valid instrument. However, we fail to accept null while regressing life expectancy on liquid liabilities suggesting that legal origin is not a valid instrument in the case of LIQLIAB. On the issue of whether the instrumental variable is weak, the size of the first stage coefficients is checked and it is found that the estimated coefficients are significantly different from zero.[22] Also Cragg-Donald Wald F statistic is greater than 10, which supports that instrumental variable is not weak.

The instrumental variable estimation using CREDIT as the explanatory variable of interest shows that one percent increase in credit to GDP ratio increases life expectancy by 0.04 percent after controlling for other variables. Since the CREDIT is instrumented, it can be interpreted as a causal relationship. Alcohol consumption, as expected, has a negative effect on life expectancy. A one liter increase in alcohol consumption per capita lowers life expectancy by 0.2 percent. This is statistically significant and economically convincing. Similarly, the coefficient on DPT suggests 0.04 percent increase in life expectancy with a one percent increase in vaccinated population. The coefficient on health expenditure is positive and statistically significant.

Column 2 in Table 6 shows the regression of life expectancy on liquid liabilities to GDP ratio (LIQLIAB) as a proxy for financial development after controlling for other variables. The coefficient on LIQLIAB shows the statistically significant positive correlation between life expectancy and LIQLIAB. The statistical finding shows that a one percent increase in financial deepening increases life expectancy by 0.04 percent. Other variables in the analysis have also expected signs. The coefficient on ALCOHOL shows that a one liter increase in per capita

[22] If the number of instruments is equal to the number of endogenous variables, the bias is approximately zero. Also if the reduced form estimates are not significantly different from zero, the effect of the interest is either absent or the instruments are too weak to detect it (Angrsit and Krueger, 2001).

consumption of alcohol lowers life expectancy by 0.22 percent. Similarly, the effect of unemployment on life expectancy is negative. The coefficient on UNEMPL shows that one percentage point increase in unemployment rate lowers life expectancy by 0.1 percent. As expected, the effect of DPT and PUBLIC is positive on life expectancy. The coefficient on EXPEND shows that a one percent increase in health expenditure increases life expectancy by 0.10 percent. Though the instrumental variable approach while regressing life expectancy on LIQLIAB is not supported by the over-identification restriction test, most of the variables have expected signs consistent with the fixed effect estimation in Table 5. Another proxy for financial development, market capitalization to GDP ratio also shows the positive and statistically significant effect on life expectancy.

4.7.4 Infant Mortality and Financial Development

This section explores the econometric relationship between infant mortality and financial development. Similar to the earlier section, Wooldridge's test (Table 7) is used to check for autocorrelation for the model specified below in (6). The null of no autocorrelation is rejected in two of the three regression equation specifications. Standard errors robust to hetroskedasticity are computed to correct the problem of hetroskedasticity in the case of the fixed effect approach and GLS is used to correct for hetroskedasticity in the IV approach.

Table 7
Wooldridge's Test for Hetroskedasticity

Dependent Variable	Explanatory Variables	F-test	Probability
INFANT MORTALITY	CREDIT ALCOHOL DPT LBW PUBLIC	4.01	0.05
INFANT MORTALITY	LIQLIAB ALCOHOL DPT LBW PUBLIC	3.31	0.08
INFANT MORTALITY	LIQLIAB ALCOHOL DPT LBW PUBLIC	7.29	0.01

The panel regression uses infant mortality as the dependent variable and financial development proxies, alcohol consumption, public expenditure on health, vaccination, and low birth weight of the children as the explanatory variables as specified in the following equation.

$$\text{Infant mortality}_{it} = \alpha_i + \beta_1 \text{Credit}_{it}/\text{Mktcap}_{it}/\text{Liqliab}_{it} + \beta_2 \text{Alcohol}_{it} + \beta_3 \text{Expend}_{it} + \beta_4 \text{DPT}_{it} + \beta_5 \text{LBW}_{it} + \varepsilon_{it} \quad (6)$$

For the instrumental variable estimation, financial development proxies are instrumented taking the legal origin of the country as the instrumental variable similar to the one in the previous section.

The fixed effect estimation in Table 8 shows that financial development helps to lower the infant mortality. Two of the financial development proxies, CREDIT and MKTCAP are statistically significant. Another proxy LIQLIAB has also negative sign, even though it is not statistically significant. The coefficient on financial development proxies show that one percent increase in the level of financial development lowers infant mortality rate approximately by 0.2 percent. Other two variables having large effect on lowering infant mortality rate are DTP and EXPEND. The coefficient on DTP shows that one percent increase in vaccinated population lowers infant mortality by 0.40 percent and the coefficient on EXPEND shows that one percent increase in health expenditure lowers infant mortality rate by more than one percent.

Table 8
Infant Mortality and Financial Development
Dependent Variable: Log Infant Mortality

Independent Variables	**Fixed Effect Estimation**		
Log CREDIT	-0.21 (0.08)**	-	-
Log LIQLIAB	-	-0.18 (0.15)	-
Log MKTCAP	-	-	-0.18 (0.02)***
DPT	-0.43 (0.17)**	-0.40 (0.18)**	-0.38 (0.13)***
Log EXPEND	-1.43 (0.24)**	-1.62 (0.19)***	-1.42 (0.16)***
CONSTANT	7.54 (0.71)	7.65 (0.80)	7.0 (0.70)
R^2 Number of Countries Number of Observations	0.59 27 562	0.52 27 492	0.65 27 553

Note: Standard errors in parentheses. *, **, *** refer to 10 percent, 5 percent and 1 percent significance level respectively.

Table 9 presents the result from instrumental variable estimation. The coefficient on CREDIT, as expected is negative and statistically significant at 5 percent level suggesting that a one percent increase in credit to GDP ratio lowers infant mortality by 3 per one thousand. This supports the claim that financial development contributes to lower infant mortality. Other explanatory variables in the model have also expected signs. Vaccination (DPT) has a negative coefficient suggesting that consumption of medical goods contributes to lower the infant mortality and the relationship is statistically significant. The DPT coefficient shows that one percent increase in vaccinated population lowers infant mortality nearly by 10 per one-thousand. The coefficient on PUBLIC is negative and statistically significant, suggesting a decline in infant

mortality rate by 5 per one-thousand with an increase in public expenditure to GDP ratio by one percent.

Table 9
Infant Mortality and Financial Development
Dependent Variable: Infant Mortality

Independent Variables	**IV-GLS**		
Log CREDIT	-2.69 (1.37)**	-	-
Log LIQLIAB	-	-3.2 (2.44)	-
Log MKTCAP	-	-	-1.21 (1.21)
DPT	-9.7 (1.6)***	-8.7 (1.9)***	-9.8 (1.6)***
Log EXPEND	-5.3 (2.01)***	-7.73 (1.47)***	-7.44 (1.07)***
LBW	0.15 (0.13)	0.31 (0.24)	0.23 (0.25)
Alcohol	0.05 (0.08)	0.26 (0.16)	0.05 (0.09)
CONSTANT	36.81 (2.86)	39.56 (4.97)	33.43 (2.47)
Instrumental Variable R^2 Sargan Hansen p-value Cragg-Donald Wald F-Stats Number of Countries Number of Observations	Legal origin 0.43 0.17 65.54 27 561	Legal origin 0.36 0.32 43.97 27 491	Legal origin 0.46 0.32 48.18 27 553

Note: Standard errors in parentheses. *, **, *** refer to 10 percent, 5 percent and 1 percent significance level respectively.

Other proxies for financial development LIQLIAB and MKTCAP have expected signs but they are not statistically significant. However, other variables DPT and PUBLIC are statistically significant. The coefficient on DPT and PUBLIC suggest the large role of

vaccination and health spending in lowering the infant mortality rate. The econometric analysis suggests that financial development through the effect of credit is largely supportive in lowering infant mortality.

4.7.5 Low Birth Weight and Financial Development

This section explores the relationship between low birth weight and the level of financial development. Low birth weight is the outcome of both medical and non-medical factors. Various factors explain the difference in birth weight of a child. These include mother's health, child characteristics, prenatal care, socio-economic status, and socio-economic and health care environment of mother's health. Infants with LBW face higher risk of heart disease and diabetes, stunted growth, low IQ and other problems. Lhila and Long (2011) mention that prenatal care, mother's socioeconomic status, unemployment rate at the time of conception and the availability of health services are important inputs into the birth weight production function. Given these facts, it is important to examine whether a higher level of financial development is helpful in lowering low birth weight. For this purpose, the following econometric model is presented:

$$\text{Lowbirthweight}_{it} = \alpha_i + \beta_1 \text{Credit}_{it}/\text{Mktcap}_{it}/\text{Liqliab}_{it} + \beta_2 \text{Alcohol}_{it} + \beta_3 \text{Expend}_{it} + \beta_4 \text{Unempl}_{it} + \varepsilon_{it} \quad (7)$$

The result of econometric analysis is presented in Table 10. Though the CREDIT proxy of financial development is negative, it is not statistically significant. Other proxies, LIQLIAB and CAPMKT do not have expected signs. Also alcohol and unemployment do not have expected signs. Thus, the econometric analysis in this section does not support the role of financial development in affecting low birth weight.

Even though coefficients on alcohol and unemployment do not have expected signs, they are statistically significant. This requires some interpretation. One interesting implication from the negative sign of alcohol and unemployment could be that when there is higher level of unemployment and alcohol consumption is high, there may be lower level of fertility and consequently lower level of LBW is observed. However, I do not proceed further on this topic since the objective of this section is limited to the examination of the relationship between financial development and low birth weight rather than exploring the determinants of low birth weight.

Table 10
Low Birth Weight and Financial Development
Dependent Variable: Log Low Birth Weight

Independent Variables	**Fixed Effect Estimation**		
Log CREDIT	-0.01 (0.01)	-	-
Log LIQLIAB	-	0.18 (0.02)***	-
Log MKTCAP	-	-	0.03 (0.006)***
Log EXPEND	0.45 (0.04)***	0.28 (0.04)***	0.38 (0.003)***
Alcohol	-0.04 (0.004)***	-0.05 (0.005)***	-0.04 (0.004)***
Unempl	-0.007 (0.002)***	-0.005 (0.002)***	0.004 (0.002)**
CONSTANT	1.38 (0.09)	0.97 (0.12)	1.33 (0.091)
R^2 (within) Number of Countries Number of Observations	0.41 27 561	0.46 27 491	0.45 27 553

Note: Standard errors in parentheses. *, **, *** refer to 10 percent, 5 percent and 1 percent significance level respectively.

4.7.6 Discussions

The key idea from the econometric analysis is that financial development positively contributes to health capital in terms of higher life expectancy and lower infant mortality. The relationship between health capital indicators and financial development proxies is statistically significant and economically meaningful (Table 11). The proxies of financial development casually affect the health capital in terms of both life expectancy and infant mortality. This is observed when we regress health outcome indicators on various proxies of financial development along with other explanatory variables. Among various proxies, credit has important and statistically significant role in explaining health outcomes. This validates the argument that access to financial services enables society to purchase health.

Table 11
OECD Countries: Summary of Major Findings

	Life Expectancy		Infant Mortality	
	Fixed Effect	IV	Fixed Effect	IV
Log CREDIT	0.009 (0.003)**	0.04 (0.009)***	-0.21 (0.08)**	-2.69 (1.37)**
Log LIQLIAB	0.03 (0.00)***	0.04 (0.02)***	-0.18 (0.15)	-3.2 (2.44)
Log MKTCAP	0.009 (0.001)***	0.03 (0.004)***	-0.18 (0.02)***	-1.21 (1.21)
Log EXPEND	0.12 (0.01)***	0.06 (0.006)***	-1.62 (0.19)***	-5.43 (2.01)***
Log DPT	0.04 (0.02)**	0.04 (0.01)***	-0.43 (0.17)**	-9.7 (1.6)***

Though the effect of financial development proxies is small in magnitude, a point to note here is that health capital accumulation is a long term process taking decades for improvement and financial system should not enter directly in such a process. Rather it supports the channels such as income and education, which might have direct effect in the short-run. Thus, a small statistically significant effect eliminates the questioning on the positive effect of financial development on health. If I had observed large effects, the findings could have been questioned.

It is because the large effect on health outcomes passes only through the consumption of medical and non-medical goods, which might be effective even in the sort-run.

The econometric analysis on the role of health spending, given the statistically significant expected signs of coefficients on health expenditure, supports the rationale that public investment in health yields positive outcomes. Most notably but not surprisingly, the econometric analysis shows that vaccination is an important factor, contributing to health capital accumulation.

4.8 Transmission Mechanism

The previous section establishes a relationship between health outcomes and financial development. This section develops the channels through which financial development affects health outcomes. It is proposed that financial development affects health outcomes through income growth and educational attainment. Thus, first following model is developed to show the effect of income on health outcomes:

$$H_{it} = \alpha_i + \beta Y_{it} + \gamma X_{it} + u_{it} \qquad (8)$$

In this equation, H is health outcomes, Y is income, X is other explanatory variables and u is an error term. If income has the effect on health outcomes, β should be positive while regressing life expectancy on incomes. However, β should be negative while regressing infant mortality on incomes. A higher income should increase life expectancy but it should lower the infant mortality.

The econometric analysis is presented in Table 12.[23] The analysis shows that income has a statistically significant positive effect on life expectancy. The analysis shows that a one percent increase in GDP per capita increases life expectancy by 0.06 percent.

[23] For income variable, GDP per capita on purchasing power parity is taken from the World Bank dataset.

Table 12
Effect of Income on Health Outcomes
Dependent Variables: Log of life expectancy and infant mortality

	Log of Life Expectancy.	**Log Infant Mortality**
Log GDP per Capita	0.06 (0.004)***	-0.78 (0.08)***
ALCOHOL	-0.2 (0.09)**	0.04 (0.02)
Log PUBLIC	0.05 (0.002)**	-0.53 (0.14)***
Log DPT	0.002 (0.01)	0.10 (0.20)
CONSTANT	3.70 (0.05)	9.69 (1.17)
R-Square	0.90	0.75
No of Countries	27	27
No of Observations	567	567

Note: Standard errors in parentheses. *, **, *** refer to 10 percent, 5 percent and 1 percent significance level respectively. Fixed effect used in both of the models.

The econometric analysis shows economically convincing and statistically supporting relationship between life expectancy and income growth. Higher income provides access to nutritious food, timely medical treatment and better social status thus leading to higher life expectancy. As expected, the econometric analysis shows negative relationship between infant mortality and income growth. A one percent increase in GDP per capita lowers infant mortality by 0.80 percent. This shows the large role of income growth in infant mortality reduction. Economically speaking, higher income provides healthier bearing and rearing environment. Mothers having nutritious food during prenatal and postnatal care give birth to healthier babies. Also medical treatment is easily accessible to those who can afford. Thus, better food for mothers and easily accessible health care for both infant and mothers lower the chance of infant mortality.

Next the effect of schooling on life expectancy and infant mortality is analyzed (Table 13).[24] For this, secondary school enrollment is taken as a measure of education using the following econometric model:

$$H_{it} = \alpha_i + \beta E_{it} + \gamma X_{it} + u_{it} \qquad (9)$$

In this equation, H is health outcomes, E is educational achievement, X is other explanatory variables and u is error term. If education has the effect on health outcomes, β should be positive while regressing life expectancy on education. However, β should be negative while regressing infant mortality on education. The idea is as follows. Additional educational achievement should affect income, life style and health awareness of an individual. Thus, education should help to accumulate health by increasing life expectancy and lowering infant mortality.

Table 13
Effect of Education on Health Outcomes
Dependent Variables: Log of life expectancy and infant mortality

	Log Life Expectancy	**Log Infant Mortality**
Log EDUCATION	0.015 (0.01)	-0.67 (0.19)***
ALCOHOL	-0.06 (0.17)	0.2 (0.2)
Log PUBLIC	0.14 (0.008)***	-1.58 (0.19)***
Log DPT	0.04 (0.02)**	-0.38 (0.16)**
CONSTANT	3.81 (0.088)	9.53 (0.96)
R-SQUARE	0.71	0.59
No of Countries	27	27
No of Observations	566	566

Note: Standard errors in parentheses. *, **, *** refer to 10 percent, 5 percent and 1 percent significance level respectively. Fixed effect used in both models.

[24] For education variable, gross enrollment in secondary school is taken from the World Bank dataset.

The econometric analysis suggests that one percent increase in secondary school enrollment ratio increases life expectancy by 0.02 percent and lowers infant mortality rate by 0.7 percent. Though the education coefficient is not statistically significant while regressing life expectancy on it and other explanatory variables, it is statistically significant while regressing infant mortality. This supports the positive role of education in accumulating health capital.

Theoretically speaking, education contributes to positive health outcomes by creating health awareness, generating employment opportunities, and providing access to incomes. In addition, educational achievements open the gates of socialization for individuals and learn from others experiences. People learn from cultural norms, and share in network through the help of education. People having higher level of education have better health and well-being and healthier behaviors. Education reduces the need for health care, the associated costs of dependence, lost earnings and human suffering. It also helps to promote and sustain healthy lifestyles and positive choices, supporting and nurturing human development and human relationships, and personal, family and community well-being (Feinstein, Sabates, Anderson, Sorhaindo and Hammond; 2006).

After establishing a link between income, education and health outcomes, an analysis on the effect of financial development on income and education is made. For this, income and education are regressed on financial development proxies (Table 14). Though the purpose of this section is not to analyze the determinants of income and education; following regression equations are simply developed to examine the effect of financial development on income growth and education.

$$Y_{it} = \alpha_i + \beta E_{it} + \gamma F_{it} + \delta F_{it-1} + u_{it} \qquad (10)$$

$$E_{it} = \alpha_i + \beta E_{it-1} + \gamma F_{it} + \delta F_{it-1} + u_{it} \qquad (11)$$

where Y, E and F refer to GDP per capita, financial development proxies and education respectively. One period lag of explanatory variable is taken to capture the lag effect. Equation 10 shows the relationship between GDP growth and factors of production. It follows the idea of production function by incorporating education as a proxy for labor (L) and financial development indicators as a proxy for physical capital (K). Equation 11 regresses education on its own lag and on financial development proxies.

Table 14
Financial Development, Income and Education
Dependent Variables: log of GDP Per Capita and Education

Variables	Log(GDP per capita)			Log EDUCATION		
	(1)	(2)	(3)	(4)	(5)	(6)
Log CREDIT	0.38 (0.08)***	-	-	-0.007 (0.005)	-	-
LIQLIAB	-	0.87 (0.09)	-	-	-0.017 (0.01)*	-
MKTCAP	-	-	0.22 (0.03)***	-	-	-0.004 (0.003)
Log EDUCATION	0.76 (0.25)***	0.83 (0.23)***	0.56 (0.28)***	-	-	-
Log EDUCATION(t-1)	-	-	-	0.82 (0.03)***	0.79 (0.04)***	0.82 (0.03)***
CONSTANT	4.86 (1.07)	2.43 (1.04)	6.59 (1.24)	0.86 (0.17)	1.02 (0.08)	0.83 (0.17)
R-Square	0.35	0.45	0.35	0.77	0.75	0.78
No of countries	27	27	27	27	27	27
No of Observs	561	491	552	533	463	528

Note: Standard errors in parentheses. *, **, *** refer to 10 percent, 5 percent and 1 percent significance level respectively. Both are fixed effect models.

The econometric analysis shows that financial development contributes to economic growth. The results reported in Table 14 suggest significant role of private credit, liquid liabilities and market capitalization in ushering the output in an economy. This is consistent with the literatures in finance and growth arguing that both bank and capital market are important for

higher growth. However, the econometric analysis does not suggest the direct role of financial development in promoting education. All the indicators of financial development, CREDIT, LIQLIAB and MKTCAP are not statistically significant. Given this, a conclusion can be drawn that financial development contributes to health capital accumulation through income growth in the OECD countries.

The findings show that a one percent increase in credit to GDP ratio increases GDP per capita by 0.38 percent and a one percent increase in per capita GDP increases life expectancy by 0.06 percent. These estimates are statistically significant. However, such a statistically significant relationship does not exist between financial development, education and health implying that it is the income growth that transmits the effect of financial development on health outcomes in the OECD countries.

4.9 Conclusions

The empirical analysis following the instrumental variable approach suggests that there is a causal relationship between financial development and health outcomes. As expected, the causality runs from financial development to life expectancy and infant mortality. This finding has significant economic meaning implying that a sound and well-developed financial system positively contributes to health capital accumulation. Financial development matters for public health since it provides opportunity to finance medical requirements, acquire health insurance, transfer risk and manage fund. Also financial development could be instrumental in increasing the access to private health insurance. Like other insurance companies, health insurers also invest in financial market. From the policy perspective, a stable financial system could lower the premium by increasing the investment income of the insurers and widen the access to health insurance.

The analysis relating to the transmission mechanism explains channels such as income and education through which financial development transmits to health outcomes. The analysis shows that it is the income effect, which transmits from financial development to health outcomes suggesting that a developed and stable financial system in the OECD countries helps in gaining health capital by contributing to income generating opportunities.

Chapter 5 Financial Development and Health in South Asia

This Chapter uses pooled OLS and fixed effect models to investigate whether financial development matters for health capital accumulation in developing countries. Using data for the South Asian countries, I find that financial development contributes to attain better health status in terms of higher life expectancy and lower infant mortality. This positive relationship between health outcomes and financial development is observed in the statistically significant coefficients of credit. The coefficients are higher than those observed in the case of the OECD countries, suggesting a stronger role of the financial development in promoting better health outcomes in developing countries. The analysis of the transmission mechanism shows that financial development transmits to health outcomes through educational achievement in the South Asian countries. This is different from the one observed in Chapter 4, which shows that it is the income effect that transmits financial development to health outcomes.

This chapter is presented as follows. Section 5.1 introduces the background of the South Asian region; sections 5.2 to 5.6 highlight the objective, methodology, variables, variable descriptions and data sources and section 5.7 presents the empirical analysis and findings. Finally, section 5.8 concludes.

5.1 Introduction

Gottret and Schieber (2006) mention that developing countries account for 84 percent of global population, 90 percent of the global disease burden and 20 percent of global GDP but only 12 percent of global health spending. These facts necessitate the need for analyzing the determinants of health care and health outcomes in developing countries from a wider perspective. In this regard, this chapter deals with the relationship between financial development and health outcomes in South Asian Countries. Bangladesh, Bhutan, India,

Maldives, Nepal, Pakistan and Sri Lanka are chosen for this study since all these are developing countries accounting nearly one-third of the world population.[25]

Also these countries have recently made progress in their health care sector and financial development frontiers. For example, the health care industry in India has become an attraction even for foreigners. According to Brown (2011), key procedures are substantially cheaper in India. Estimates show that knee surgery costing $15,000 in the UK can be done for $1,000 in India, while a $300,000 US liver transplant is available just for $4,000. Brown (2011) further writes seven hundred thousand uninsured patients from the US alone are now seeking treatment abroad each year. Despite these attractions and availability of relatively cheaper health care facilities, a large portion of the population in these countries is deprived of necessary medical facilities. In this regard, this chapter explores the role of financial sector in augmenting health outcomes in developing countries taking the case of South Asia.

The above mentioned South Asian countries are the members of the South Asian Association for Regional Cooperation (SAARC).[26] They, to a large extent, share common culture though have different religions and languages and different political systems. Most of these countries started development process after 1950s once India became free from British colonizers. Traditionally, all countries in South Asia are agrarian. However, currently a large part of the national income in South Asia comes from services sector. Services sector has become an emerging vibrant sector in this region (Table 1). In almost all countries except Bhutan, services sector contributes more than 50 percent to Gross Domestic Product (GDP). The growth in services sector has made this region possible to integrate into the global economy at a faster pace.

[25] While the population of high income OECD countries is 1.039 billion, the population in the South Asian region is 1.65 billion in 2011 (World Bank Data).
[26] Altogether there are eight countries in SAARC including Afghanistan.

Table 1
Composition of Gross Domestic Product

Countries	Share in GDP in 2009		
	Agriculture	Industry	Services
Bangladesh	18.6	28.6	52.8
Bhutan	20.6	41.8	37.6
India	17.1	28.2	54.6
Maldives	4.9	16.8	78.4
Nepal	32.6	15.8	51.6
Pakistan	20.8	24.3	54.9
Sri Lanka	13.8	31.7	54.5

Source: UNESCAP (2009)

Along with structural transformation, South Asian countries have witnessed significant gains in health outcomes (Table 2). Average life expectancy increased nearly by 44 percent and infant mortality declined by 70 percent between 1970 and 2008. These are remarkable achievements. Among these countries, Maldives alone has gained largely, with an increase in life expectancy by 70 percent and decline in infant mortality by 90 percent.

Table 2
Achievements in Health Outcomes in South Asia

	Life Expectancy			Infant Mortality		
	1970	2008	% Change	1970	2008	% Change
Bangladesh	41.9	68.0	0.6	150.6	42.5	-0.7
Bhutan	40.6	66.2	0.6	190.3	47.5	-0.8
India	49.1	64.4	0.3	126.8	50.8	-0.6
Maldives	44.2	75.8	0.7	161.8	16.5	-0.9
Nepal	42.7	67.5	0.6	162.9	45.2	-0.7
Pakistan	53.2	64.7	0.2	129.8	71.9	-0.4
Sri Lanka	62.7	74.4	0.2	56.2	15.2	-0.7
Average	47.8	68.7	0.4	139.8	41.4	-0.7

Source: World Bank, *data.worldbank.org/topic/**health.***

Despite these gains in the health outcomes, South Asian countries are prone to public health problems. The majority of these countries' population is deprived of access to proper sanitation. For example, only 33 percent populations in India, which account for nearly one-fifth of the world population, have access to sanitation facilities. This is not much different for other

countries except Maldives and Sri Lanka (Table 3). The secondary school enrollment ratio is only around 50 percent in these countries. Financial deprivation, lack of opportunities, unemployment and poverty are on the top list of these countries' problems. The World Bank estimate shows that out of 1.6 billion people living in the South Asian region, around 36 percent live below the poverty line.[27] The level of financial development is also low in this region. Two major indicators of financial development, credit to GDP ratio and broad money to GDP ratio on average remained 28 percent and 44 percent respectively during 1995-2009 (Appendix 5).

According to Hate and Gannon (2010), South Asia has a tremendous problem with regard to the incidence of TB and HIV/AIDS, poor sanitation, poor maternal health, poor access to healthcare services, and widespread malaria. They further write:

> "Gains in the region's health in recent decades have been distributed unevenly, both within countries and across them. Rural areas do worse than urban areas in life expectancy, immunization rates, maternal health, malaria incidence, and access to almost all health services".

The World Health Statistics (2010) shows that Skilled Health Personnel attend 24 percent more urban births than rural births in Bangladesh, 36 percent more in India, 33 percent more in Nepal, and 30 percent more in Pakistan. While 72 percent of one year-old children in Indian cities are vaccinated against measles, only 54 percent of rural children receive the same protection. In Nepal's rural regions, 84 children out of every 1,000 will die in their first five years. In its cities, that number falls to 47 (Hate and Gannon, 2010).

[27] Though poverty has declined in South Asia in the last decade, it is still high. Poverty head count ratio at $1.25 a day in purchasing power parity was 51.7 percent in 1993, 45.11 percent in 1999 and 35.98 percent in 2008 (data.worldbank.org).

Table 3
South Asia: Some Challenges[28]

Countries	% of Population with Access to Sanitation (2009)	Gross Secondary School Enrollment Ratio	Poverty Head Count Incidence
Bangladesh	54	49.3	31.5
Bhutan	44	60.8	23.2
India	33	60.2	29.8
Maldives	96	82.1	NA
Nepal	30	43.5	25.1
Pakistan	48	34.2	22.3
Sri Lanka	92	87.1	8.9

Source: World Bank.

Health infrastructures and access to those infrastructures have a large impact on public health. Overcoming the problem of infrastructure and widening the access to those infrastructures particularly in developing countries is a daunting task due to the presence of multitude of problems. These might relate to individual life style, use of sanitation facilities, access to finance, doctor visits, availability of doctors and number of hospitals. Further, the progress made in the health sector may be crowded out by foreign clients given substantially cheaper services from their perspectives. However, health care services from the perspective of domestic clients are highly costlier. Addressing problems related to these requires a holistic approach of development. Any policy in isolation may not be enough to address these problems evident in the process of health capital accumulation. Mukhopadhyay (2011) in this regard writes:

> "The unsatisfactory health condition of the economically and socially deprived sections of the communities is caused by unequal distribution of income, goods and services. Their vulnerability makes it difficult for them to achieve satisfactory health status since they are continuously affected by poor social policies and programs, unfair economic

[28] The data on school enrollment ratio and poverty incidence are for different years based on recent availability.

> arrangements and decades of economic and social deprivation. Their health condition can be substantially altered only by a social determinants approach, which improves their daily living conditions, help to tackle inequitable distribution of power and resources and policies to address their multiple development challenges adequately."

Given these references, we need to think from the long-term perspective of gaining health outcomes through sustainable means of financing. Merely relying on government to finance the health infrastructures may not be a viable option since the resource allocation problem is severe in poor developing countries. Gottret and Schieber (2006) write that in the existing health financing patterns in many low-and middle-income countries, the costs of chronic non-communicable diseases (NCDs) are likely to weigh more heavily on those least able to afford. Also the poorer countries do have more regressive health care financing system in which higher fraction of health costs are borne by patients themselves.

External financing in the form of foreign grant or loan also has its own limitations. The WHO report in Social Health Insurance mentions that external financing programs impose certain conditions such as the use of technical assistance, expertise and buying equipment from donor countries and in some cases the grant funds cannot be used for local expenses which the receiving countries require the most.

Also looking for out-of-pocket financing is a difficult option in countries where a large chunk of population struggles to secure half meal a day. Considering the effect of the large amount of household out-of-pocket payments for medical bills resulting in household financial disruption and impoverishment, the World Health Assembly Resolution on financial protection was adopted in 2005.

In this backdrop, countries need to explore alternatives that might be helpful in mobilizing resources and contributing to public health. Financial development can be an important option not only to provide income generating opportunities and bring millions of

people out of the poverty trap in developing countries; it can directly affect health outcomes by providing cheaper health insurance, creating awareness and helping families to get medical treatment even if they are liquidity constrained.

5.2 Objectives

The primary objective of this chapter is to examine the interrelationship between financial development indicators and health outcomes in the South Asian countries. This chapter shows whether the varying level of financial development affects health outcomes differently. To be specific, Chapter 4 showed that there is a statistically significant positive relationship between financial development and health outcomes in the developed countries and the effect runs from financial development to income growth to health outcomes. This chapter reexamines whether the findings of chapter 4 prevail in context of the developing countries.

5.3 Methodology

Data availability and reliability of available data is a major concern in conducting any study with respect to developing countries. Based on the data availability, the econometric analysis consists of estimating a panel regression using pooled cross section and the fixed effect approach. The panel regression studies the relationship between financial development and health capital accumulation.

5.4 Variables

Variables used in this study are life expectancy and infant mortality. These are taken as the dependent variables for the econometric analysis. The explanatory variables include the financial development indicators, which are private credit to GDP ratio and broad money to GDP ratio. Other control variables are vaccination in terms of DPT and total expenditure on health care as a percentage of GDP. Variables such as GDP per capita and education are introduced to

examine the channels through which financial development affects health outcomes. I couldn't include a number of other determinants of health due to unavailability of data.

5.5 Variable Descriptions

The dependent variable EXPECTANCY refers to life expectancy. This is defined as the life expectancy at birth, which indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. The INFMORTALITY refers to infant mortality. It is the number of infants dying before reaching one year of age, per 1,000 live births in a given year. DPT is the child immunization, which measures the percentage of children ages 12-23 months receiving vaccinations. A child is considered adequately immunized against diphtheria, pertussis (or whooping cough), and tetanus (DPT) after receiving three doses of vaccine. EXPEND refers to total health expenditure. This is the sum of public and private health expenditure. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation. GDP per capita is the annual percentage growth rate of GDP per capita based on constant local currency.[29] Education and sanitation refer to gross enrollment ratio in secondary school and percentage of population with access to improved sanitation facilities respectively.

The financial development variables are similar to those used in chapter 4. One measure of the financial depth is the ratio of private credit of the financial system to GDP. This ratio indicates the relative size of the financial system and availability of the credit. Another measure of the financial development is the ratio of broad money to GDP. This measures the general level of financial development relating broad money supply to the level of nominal GDP.

[29] GDP per capita is gross domestic product divided by midyear population.

5.6 Data Sources

The study uses South Asian countries' data from 1995 to 2009 for the purpose of econometric analysis. All the data relating to health capital and all other indicators affecting the health as well as the financial development indicators: private credit to GDP ratio and broad money to GDP ratio come from the Databank of the World Bank. Looking at the group average of some variables, the mean of life expectancy is 65.8 years and the mean of infant mortality is 52.5 per thousand. Similarly the mean of the credit to GDP ratio is 28.4 and the mean of the broad money to GDP ratio is 44.4. A summary statistics of all the variables is presented in Appendix 5. Most of the variables demonstrate the expected correlation with each other (Appendix 6). There is a positive correlation between life expectancy and other explanatory variables such as credit, GDP, health expenditure, education and sanitation facilities. As expected, these variables are negatively correlated with infant mortality.

Appendix 7 presents the average of some key variables for each country during the sample period. The analysis shows that Sri Lanka has the highest life expectancy and lowest infant mortality. Average values for these variables are 72.1 and 18.4 respectively. Maldives follows Sri Lanka with life expectancy of 71.6 years and infant mortality of 32.77 per thousand. Though the average life expectancy for the people of Bhutan, India, Nepal and Pakistan is almost same, Pakistan has the highest infant mortality rate in the region. Pakistan's infant mortality rate is 78.4 per thousand. Regarding the financial development proxies, credit to GDP ratio is highest in India that is 33.45 percent. Maldives follows India with a credit to GDP ratio of 33.2 percent. Bhutan has the lowest credit to GDP ratio that is 15.6 percent. India surpasses all other countries in the value of another financial development proxy that is broad money to GDP ratio. This ratio

remained 55.6 percent for India. Other countries have also higher value for this ratio compared to credit to GDP ratio.

5. 7 Econometric Analysis and Findings

5.7.1 Panel Estimation

Panel regression is estimated using 15 years data from 1995 to 2009 for seven South Asian countries. The panel regression examines the impact of financial development on life expectancy and infant mortality. Pooled OLS and fixed effect models are developed to test the hypothesis whether financial development affects health capital accumulation. Though I originally planned to use dynamic panel such as Arellano-Bond estimators to control for any endogeneity problem, I dropped that idea because of the large T and small N in the sample. Before estimating any one-way model (fixed or random), following pooled OLS model is estimated first:

$$H_{it} = \alpha + \beta F_{it} + \gamma X_{it} + u_{it} \qquad (1)$$

But to control for individual country characteristics, the following fixed effect model is estimated.

$$H_{it} = \alpha_i + \beta F_{it} + \gamma X_{it} + u_{it} \qquad (2)$$

where, H is the matrix of health capital measured in life expectancy and infant mortality. F is the indicator of financial development and X is the matrix of other life expectancy determinants. The constant term α is intercept in equation (1). However, in equation (2), it also controls for country characteristics, which are supposed to be stable over the period studied. Subscripts i and t refer to country and year respectively.

5.7.2 Financial Development and Life Expectancy

This section explores the econometric relationship between financial development and life expectancy in the South Asian countries. The panel regression is run by taking life expectancy as the dependent variable and CREDIT and BROADMONEY as proxies for financial development. Before running the regression, I check for hetroskedasticity in the model. Wooldridge's test is used to test for autocorrelation and the test result rejects the null that there is no first order autocorrelation (Table 4). To address this problem, hetroskedasticity robust standard errors are computed in both pooled OLS and fixed effect model.

Table 4
Wooldridge's Test for Hetroskedasticity

Dependent Variable	Explanatory Variables	F-Statistic	Probability
Log expectancy	Credit DPT EXPEND	1581.898	0.0000
Log expectancy	BROADMONEY DPT EXPEND	1090.131	0.0000

Based on the idea of regression equation (1), following pooled OLS regression of life expectancy on explanatory variables is estimated.

$$\log(\text{Life Expectancy}_{it}) = \alpha + \beta_1 \text{Credit}_{it} + \beta_2 \text{DPT}_{it} + \beta_3 \text{Expend}_{it} + \varepsilon_{it} \quad (3)$$

Fixed effect panel regression is also used assuming that country dummies are expected to be correlated with explanatory variables. The panel regression for the fixed effect model is:

$$\log(\text{Life Expectancy}_{it}) = \alpha_i + \beta_1 \text{Credit}_{it} + \beta_2 \text{DPT}_{it} + \beta_3 \text{Expend}_{it} + \varepsilon_{it} \quad (4)$$

Regression equation (4) is different from (3) mainly with respect to constant, α. While α in equation (4) controls for country specific characteristics and thus varies for each country but is time invariant, α in equation (3) is only a constant similar to the one in OLS. The result for equations (3) and (4) are presented in Table 5. In the process of model specification, only one indicator of financial development, CREDIT (credit to GD ratio) is selected since

BROADMONEY is found to have very weak correlation with life expectancy and infant mortality.

The pooled OLS after correcting for hetroskedasticity shows the expected signs for all variables, though the coefficient on expenditure is not statistically significant. The coefficient on credit estimates that a one percent increase in credit to GDP ratio increases life expectancy by 0.08 percent. This supports the role of bank credit in accumulating health. The coefficient on DPT is also statistically significant at one percent. The effect of DPT is quite stronger compared to other variables. The DPT coefficient shows one percent increase in DPT vaccinated population increases life expectancy by 0.24 percent. This suggests that utilization of medical goods is highly important in determining health outcomes in the developing world.

Table 5
Financial Development and Life Expectancy
Dependent Variable: Log of Life Expectancy

Variables	Pooled OLS	Fixed Effect
Log CREDIT	0.08 (0.008)***	0.08 (0.008)***
Log DPT	0.24 (0.026)***	0.13 (0.026)***
Log EXPEND	0.012 (0.010)	0.07 (0.011)**
CONSTANT	2.83 (0.116)	3.25 (0.17)
R-Square	0.69	0.74
No of Countries	7	7
No of Observations	105	105

Note: Standard errors in parentheses. *, **, *** refer to 10 percent, 5 percent and 1 percent significance level respectively. Fixed effect used in both of the models.

Though the computation of robust standard errors correct the hetroskedasticity observed in the pooled OLS model, it is hard to guarantee whether the results are unbiased given the presence of individual country specific characteristics. Countries in the region have varying characteristics particularly in the process of institutional development. For example India has

remained a stable democracy for the last six decades; other countries in the region have undergone a number of experiments in their political set-ups. This and similar other factors might be correlated with the process of financial development. Thus the fixed effect panel regression is estimated to control for country characteristics and also to account for any omitted variable bias and measurement error.

The fixed effect estimation further asserts the result from the pooled OLS and supports the positive role of bank credit in contributing to life expectancy. The effect of credit even after controlling for country characteristics is same. However, the coefficient on DPT is relatively smaller from the one estimated under pooled OLS. The coefficient on DPT shows that a one percent increase in DPT vaccinated population increases life expectancy by 0.13 percent. After controlling for the individual characteristics, the model shows statistically significant large role of health expenditure in promoting life expectancy as reflected in the EXPEND coefficient. The coefficient on expenditure shows that a one percent increase in total health expenditure to GDP ratio increases life expectancy by 0.07 percent.

5.7.3 Financial Development and Infant Mortality

This section explores the relationship between financial development and infant mortality. For this, following model specifications are developed taking infant mortality as the dependent variable and credit, DPT and expenditure on health as the explanatory variables. The pooled OLS regression model is:

$$\text{INFMORTALITY}_{it} = \alpha + \beta_1\, Credit_{it} + \beta_2 DPT_{it} + \beta_3 Expend_{it} + \varepsilon_{it} \qquad (5)$$

The Fixed effect panel regression is run using the following model specification.

$$\text{INFMORTALITY}_{it} = \alpha_i + \beta_1\, Credit_{it} + \beta_2 DPT_{it} + \beta_3 Expend_{it} + \varepsilon_{it} \qquad (6)$$

Before running the regression, hetroskedasticity is checked for the above model. The Wooldridge's test rejects the null of no auto correlation with an F-statistic of 719.898 and the probability value of 0.000. Therefore, robust standard errors are calculated in both pooled OLS and fixed effect model. The results from both pooled OLS and fixed effect models are presented in Table 6. Both these models show that credit has statistically significant effect in lowering infant mortality.

The pooled OLS shows that a one percent increase in credit to GDP ratio lowers infant mortality by 0.51 percent. Though other variables DPT and EXPEND have expected signs, only DPT is statistically significant. The DPT coefficient shows that a one percent increase in vaccinated population lowers infant mortality by 1.78 percent. The results under the fixed effect model are consistent with the pooled OLS and even the magnitude of the coefficient on CREDIT is same. After controlling for country characteristics, the effect of DPT is small. However, the variable EXPEND is not significant either in the fixed effect estimation.

Table 6
Financial Development and Infant Mortality
Dependent Variable: Log Infant Mortality

Variables	Pooled OLS	Fixed Effect
Log CREDIT	-0.51 (0.049)***	-0.51 (0.104)***
Log DPT	-1.78 (0.197)***	-0.37 (0.042)***
Log EXPEND	-0.105 (0.09)	-0.083 (0.097)
CONSTANT	13.48 (0.82)	7.25 (0.55)
R-Square	0.62	0.76
No of Countries	7	7
No of Observations	105	105

Note: Standard errors in parentheses. *, **, *** refer to 10 percent, 5 percent and 1 percent significance level respectively. Fixed effect used in both of the models.

5.7.4 Transmission Mechanism

This section analyses the channels though which financial development affects health outcomes. Using fixed effect approach, the effect of per capita GDP growth on life expectancy and infant mortality is examined (Table 7). The econometric model takes health outcomes (H) as dependent variables and GDP per capita as the explanatory variable. The model also controls for other determinants of health such as vaccination and expenditure on health. The model specification is:

$$H_{it} = \alpha_i + \beta_1\, GDP\ per\ capita_{it} + \beta_2 DPT_{it} + \beta_3 Expend_{it} + \varepsilon_{it} \qquad (7)$$

Table 7
Effect of Income on Health (Fixed Effect Approach)

Dependent variables	Log Life Expectancy	Log Infant Mortality
GDP per Capita growth rate	0.03 (0.07)	-0.07 (0.4)
Log DPT	0.21 (0.06)**	-0.90 (0.34)**
Log EXPEND	0.05 (0.04)	0.04 (0.36)
Constant	3.17 (0.30)	7.76 1.65
R-Square	0.32	0.21
No. of Countries	7	7
No. of Observations	104	104

Note: Standard errors in parentheses. *, **, *** refer to 10 percent, 5 percent and 1 percent significance level respectively. Fixed effect used in both of the models.

Before running the regression, I check for hetroskedasticity and could not reject the null of no auto correlation.[30] The regression analysis shows no statistically significant effect of income on health. Further, I also examine the effect of GDP growth instead of GDP per capita growth and the results do not differ. Though the finding seems awkward given no statistically significant

[30] The F statistics for the model is 6681.119 and p-value is 0.000.

effect of income on health in the developing countries, the econometric analysis does not support the hypothesis that income growth leads to higher health in the South Asian countries (Table 7).

Next the relationship between education and health outcomes is examined using the following fixed effect model.

$$H_{it} = \alpha_i + \beta_1 Education_{it} + \beta_2 DPT_{it} + \beta_3 Expend_{it} + \varepsilon_{it} \qquad (8)$$

Again, before running the regression, hetroskedasticity is checked. Also the null of no first order autocorrelation is rejected.[31] The econometric analysis shows statistically significant effect of education on health (Table 8). The coefficient on education shows positive effect of education on health with a one percent increase in gross secondary school enrollment ratio increasing life expectancy by 0.17 percent and lowering infant mortality by one percent. These are significant effects.

Table 8
Effect of Education on Health (Fixed Effect Approach)

Dependent variables	Log Life Expectancy	Infant Mortality
Log EDUCATION	0.17 (0.02)***	-0.99 (0.18)***
Log DPT	0.127 (0.06)*	-0.39 (0.30)
Log EXPEND	0.05 (0.03)	-0.01 (0.25)
Constant	2.89 (0.25)	9.39 (1.27)
R-Square	0.67	0.60
No. of Countries	7	7
No. of Observations	105	105

Note: Standard errors in parentheses. *, **, *** refer to 10 percent, 5 percent and 1 percent significance level respectively. Fixed effect used in both of the models.

After establishing the effect of income and education on health, it is necessary to examine the effect of financial development on income and education to explore the channel of transmission. For this, an econometric model is developed to examine whether financial

[31] The F value is 947.474 and p value is 0.000.

development affects income growth and educational achievements in South Asian countries. Following models similar to the one developed in chapter 4 are presented:

$$\text{GDP per capita}_{it} = \alpha_i + \beta_1 Credit_{it} + \beta_2 Education_{it} + \varepsilon_{it} \quad (9)$$

$$Education_{it} = \alpha_i + \beta_1 Education_{it-1} + \beta_2 Credit_{it} + \varepsilon_{it} \quad (10)$$

Equation (9) follows the idea of production function approach where capital and human resources determine the level of output. Equation (10) follows the idea that the previous level of education and availability of credit determine the level of current education. I plan to include other plausible determinants of education such as public spending on education or the growth rate of education expenditure, but could not do so due to data unavailability for some countries in the sample. Results of econometric estimations for models (9) and (10) are presented in Table 9.

Table 9
Effect of Credit on Income and Education

Dependent Variables	GDP per capita growth	Education
Log Credit	0.4 (1.68)	0.10 (0.04)**
Log Education	1.97 (2.19)	-
Log Education (t-1)	-	0.67 (0.14)***
Constant	-4.84 (4.32)	12.07 (5.56)
R-Square	0.14	0.70
No. of countries	7	7
No. of observations	104	98

Note: Standard errors in parentheses. *, **, *** refer to 10 percent, 5 percent and 1 percent significance level respectively. Fixed effect used in both of the models.

The GDP per capita is not explained by credit and education variables well and their coefficients are also statistically not significant. However, I do not further explore other determinants of income in this section since the findings in Table 7 show that income has no statistically significant effect on health in South Asia. Nonetheless education is well explained by credit and previous level of education. The coefficient on credit is positive implying that a one

percent increases in credit to GDP ratio increases secondary school enrollment ratio by 0.10 percent. The large part of educational achievement is explained by the previous stock of education. This is reasonable. If someone possesses certain level of education in period t, he or she should be motivated to have additional education in period t+1. The key point from this analysis is that financial development contributes to attain additional stock of education and education affects health capital accumulation in terms of higher life expectancy and lower infant mortality in the South Asian countries.

5.7.5 Discussions

The econometric analysis in previous sections explains the effect of financial development on health. I find a direct positive effect of financial development on health outcomes in terms of higher life expectancy and lower infant mortality. The effect of financial development is seen through credit effect, which seems plausible. Almost all the countries in the South Asian region still have low income and high poverty. In these countries, millions of people live in stark needs of financing to meet their resource gap either for daily living or to finance health and education. Thus the econometric result showing the direct effect of financial development on health through credit disbursement is meaningful (Table 10).

Table 10
South Asia: Summary of Major Findings

Variables	Log of Life Expectancy		Log of Infant Mortality	
	Pooled OLS	Fixed Effect	Pooled OLS	Fixed Effect
Log Credit	0.08 (0.008)***	0.08 (0.008)***	-0.51 (0.049)***	-0.51 (0.104)***
Log DPT	0.24 (0.026)***	0.13 (0.026)***	-1.78 (0.197)***	-0.37 (0.042)***
Log Expend	0.012 (0.010)***	0.07 (0.011)***	-0.105 (0.09)	0.083 (0.097)
R-Square	0.69	0.74	0.62	0.76

Though the statistically significant positive effect of financial development is seen in the health outcomes, it is hard to explain the channels through which such effect is passed through. As I hypothesized that financial development affects health outcomes through income growth and education, I could not establish such relationship between health outcomes and per capita GDP growth. Neither could I explain such relationship using GDP growth instead of GDP per capita growth. So at least in the case of South Asian countries based on the available data, I could not suggest that financial development affects health outcomes through income growth.

However, there is statistically significant and economically meaningful relationship between health outcomes and education in these countries. The effect of credit on education is statistically significant and economically meaningful. In a financially constrained society, access to credit should open the gates of education. People can afford education if they have financing schemes and support. The analysis also shows that the effect of education on health is positive and statistically significant at one percent. Higher level of education contributes positively to increase life expectancy and lower infant mortality (Table 8).

5.8 Conclusions

South Asian countries have gained significantly in health outcomes in the last few decades. Life expectancy has increased and infant mortality has declined in all countries. However, these countries still face problems in widening the access to sanitation facilities, narrowing down the gap in health services between urban centers and rural villages, and fighting against diseases such as malaria and tuberculosis. Health financing like in other parts of the world is also a challenge for South Asian countries. Since government financing the health is a challenging task even in the developed countries, private financing is also not a feasible option in South Asian countries where nearly forty-percent people live below the poverty line. Thus some

alternative measures such as expanding the access to financial services enabling individuals and families to afford for better health could be a viable option in the long run.

The analysis suggests that though there is a direct effect of financial development on health, the indirect effect through income channel could not be detected easily. Unlike the case of developed countries where we find financial development affecting health outcomes through income growth as seen in chapter 4, I could not establish such a linkage between financial development, income growth and health outcomes in the South Asian countries.

However, I find statistically significant positive effect of education on health. Following the empirical evidence resulted in the case of the South Asian countries, it is imperative that financial development generally affects health outcomes in developing countries through education channel. But an important point to keep in mind is that the datasets used in this study are only for a limited period of time and sample size is not very large. Even though nearly one-fourth of the world population lives in the South Asian region, the analysis includes only seven developing countries. So this analysis requires further scrutiny before generalizing the case for all developing countries. Expanding the number of countries and increasing time period should help in exploring the better channel through which financial development affects health in developing countries.

Chapter 6 Effect of Financial Shocks on Health Indicators

This chapter analyzes the effect of financial shocks on health indicators using panel data used for the OECD countries in Chapter 4. In particular, this chapter explores how do health related indicators such as life expectancy, infant mortality and public expenditure on health respond to financial shocks using an unrestricted panel VAR framework. For the impulse response computation, a Cholesky decomposition is used in the order of financial development proxies, public expenditure on health, and health outcomes (infant mortality and life expectancy). The impulse response analysis shows that health outcome variables do not respond to financial shocks in the short run but the health expenditure responds immediately to credit and capital market shocks.

6.1 Introduction

The financial crisis of 2007/08 has established that negative financial shocks could prolong the path of economic recovery. With economic slowdowns, the effect of negative financial shocks might also transmit to health outcomes through lower income, unemployment, food insecurity, decline in health care spending, and siphoning government resources from social investment to restructuring and reliefs. A developed and stable financial system on the other hand should provide income generating opportunities, opportunities for spending on medical goods and a better cushion for individuals and families in bad times. Given this reference, this chapter analyzes the response of health indicators to financial development innovations. The dynamic response of health indicators to innovations in financial development proxies is examined through impulse response functions.

6.2 Impulse Response Functions and Variance Decomposition Analysis

Impulse response functions and variance decomposition analysis are based on the following model of unrestricted panel VAR with the order of p:

$$Y_{i,t} = \sum_{i=1}^{p} A_i . y_{i,t-1} + B . Z_{i,t} + \epsilon_{i,t}$$

where y is a vector of endogenous variables, Z is a vector of exogenous variables, the value of which is determined outside the VAR system, A_i and B are coefficient matrices, p is the optimum lag number and i and t are countries and time respectively. The vector of endogenous variables under the unrestricted VAR is as follows:

$Y_{i,t}$ = [FINANCIAL DEVELOPMENT PROXIES, EXPEND, INFMORTALITY, LIFEEXPECTANCY].

As a Cholesky ordering in the VAR system, the first variable implies that it has an immediate impact on all other variables. The idea for ordering with financial development proxies first is that these variables are largely determined by a number of factors in the OECD countries. These factors might include the government policy, market reaction, developments in global financial market, capital flows and risk factors. Thus among the variables taken for the analysis, financial development proxies are the most exogenous variables. Expenditure on health follows the second ordering given that it is largely influenced by the government policy on health sector, which is also determined by the political party in power. Infant mortality and life expectancy follow the third and last in the ordering since these variables are determined not only by the government policy and market forces but also depend on personal income, education, individual habits, life style and behavior.

The exogenous variables vector is Z = [constant, dum08]. The variable dum08 stands for the structural break depicted in the time series data. The underlying idea for the structural break

in the chosen set of variables is attributed mainly to the financial crisis, which could have both immediate and long-term effect on health spending and health outcomes. For example, the austerity measures taken in the European countries in the aftermath of the financial crisis and debt crisis might have significant effect on health care spending and health outcomes.

The test of the stability condition for the estimated VAR at the log of FINANCIAL DEVELOPMENT PROXIES, EXPEND, INFMORTALITY and EXPECTANCY satisfies the stability condition, no root lies outside the unit circle. In other words, all roots have modulus less than one. Two lags are selected following the SIC and HQ criteria for all three models of VAR using three different proxies of financial development.

6.2.1 Impulse Response Functions

The impulse response function is carried out to depict the effect of a one standard deviation increase in financial development proxies on health indicators. I develop the VAR on the log of variables, which satisfies the stability condition even though variables are non-stationary at the level. Hamilton (1994, p. 652) in this regard argues that the drawback of differencing the variables may not be a true VAR since some of the series may be stationary or a linear combination of the series are stationary and a VAR in differenced form may be mis-specified. This study develops 68 percent confidence interval to estimate the IRFs and 1000 Monte Carlo simulations are employed to build the confidence band. The response of various health indicators to a one standard deviation shock in financial development proxy is shown by the middle line in IRFs (Fig 3 to 5). The dotted lines are for confidence bands. While the horizontal line in the IRFs show the time period after the initial shock, the vertical line shows the magnitude of response to shocks. The impulse response is not statistically significant if the

horizontal line in the IRFs falls between confidence bands. In other words, we fail to reject the null that financial development does not have effect on health indicators.

Figure 3 shows the impulse response of different health indicators to a one standard deviation shock in credit to GDP ratio for the period of 1990-2010. Innovations to credit are found to have significant positive effect on health spending and life expectancy. The effect on health spending is significant and persistent from period one but such significant effect on life expectancy is observed only after period three.

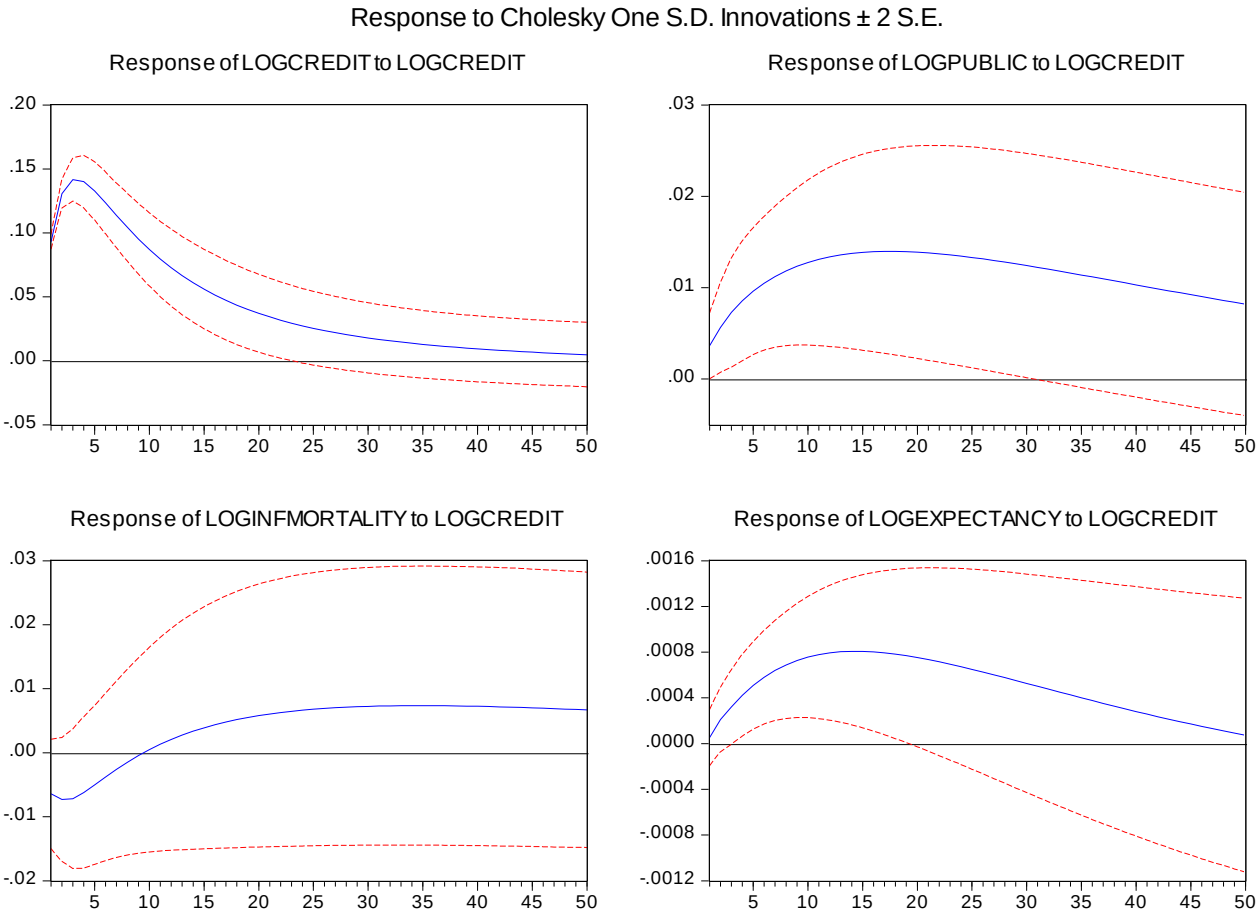


Figure 3: Responses of Health Indicators to Credit innovations

The idea is that credit shock immediately affects health spending but takes time to show its effect on life expectancy. Practically, it seems reasonable since the accumulation of health capital in terms of life expectancy is a long term process. In other words, it is not an event whereby we

could see the effect of credit shock immediately on life expectancy rather it is an ongoing process. However, the impulse response function does not show a statistically significant effect of credit shock on infant mortality.

Figure 4 shows the effect of capital market shock on various health indicators. Though the effect of capital market shock is positive on life expectancy, it is not statistically significant. But such capital market impulse is statistically significant on health spending for the first few years and on infant mortality after seven years. It shows that innovations to market capitalization lower health spending in the first few years. Though it is hard to depict clearly what drives such a situation, a logical explanation would be that increase in the size of the capital market accompanies an increase in the household wealth having positive effect on health outcomes and lower health spending.

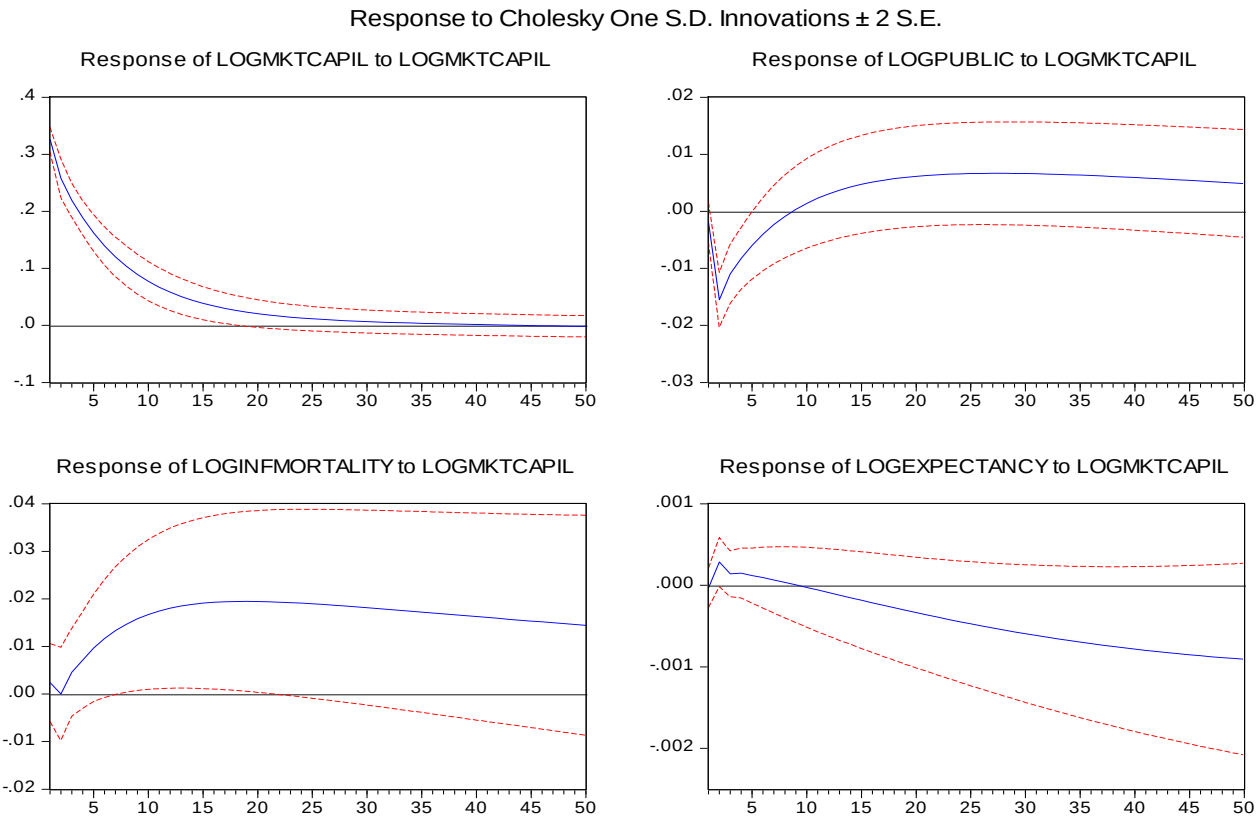


Figure 4: Responses of Health Indicators to Capital Market Innovations

Though the innovations to liquid liabilities to GDP ratio show economically meaningful impact on infant mortality and life expectancy, these are not statistically significant (Figure 5). The effect of liquid liabilities to GDP ratio shock on health spending could not be interpreted easily since the shock lowers health spending in the first few years, then the effect is largely constant. However, these effects are also not statistically significant.

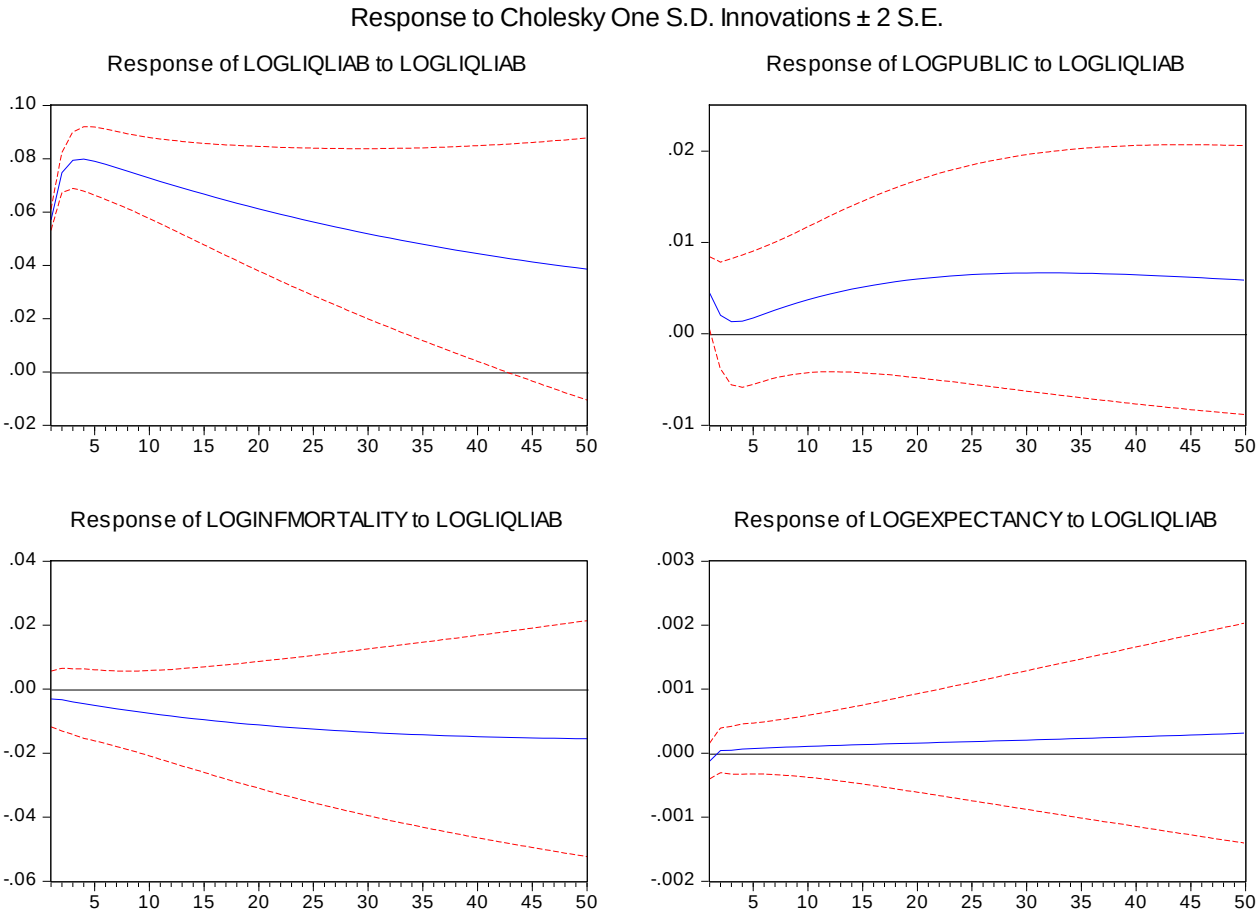


Figure 5: Responses of Health Indicators to Liquid Liabilities innovations

The key idea from the impulse response analysis is that shocks to credit should affect health care spending and life expectancy steadily in the medium to long run. But shocks to capital market might affect the level of health spending immediately in the short run. The underlying policy implication could be that any innovations in the financial system also affect

public health, though the effect in the case of health outcomes such as life expectancy might be observed in the medium to long run.

6.2.2 Variance Decomposition Analysis

This section explores the relative importance of financial shocks in changes of other variables in the VAR system. Variance decomposition analysis provides the proportion of movement in a specific variable in connection with its own shock against the shocks to other variables. For the computation of variance decompositions, the Cholesky ordering presented earlier is used by taking various proxies of financial development into account. Variance Decompositions are presented in Tables 1, 2 and 3.

Table 1
Variance Decomposition: CREDIT

Years ahead	Credit	EXPEND	INFMORTALITY	EXPECTANCY
Variance Decomposition of CREDIT				
1	100	0	0	0
5	99.83	0.02	0.01	0.05
10	99.00	0.13	0.60	0.26
Variance Decomposition of EXPEND				
1	0.76	99.23	0.00	0.00
5	3.33	95.64	0.64	0.40
10	6.88	90.87	1.56	0.69
Variance Decomposition of INFMORTALITY				
1	0.45	0.01	99.53	0.00
5	0.79	0.01	99.10	0.01
10	0.51	0.00	99.37	0.11
Variance Decomposition of EXPECTANCY				
1	0.04	0.16	3.73	96.08
5	2.20	0.98	5.57	91.24
10	5.69	2.89	8.81	82.60

The variance decomposition in table 1 shows that credit plays no role in explaining the variation in life expectancy in the first year, but increasing role in the subsequent years. Though the role of credit in explaining the variation in infant mortality is negligible, it explains about six

percent of variation in life expectancy in the tenth year. Infant mortality explains almost four percent variation in life expectancy in the first year, six percent in the fifth year and 9 percent in the tenth year. This is a plausible explanation since countries having higher infant mortality tend to have relatively lower expectancy. Expenditure explains about three percent of variation in life expectancy in the tenth year that is caused by public spending on health in the OECD countries. In explaining the long run variation, role of credit is higher than the role of health spending. This implies that a society providing easier access to credit might help in promoting health investment.

Table 2
Variance Decomposition: MKTCAP

Years ahead	MKTCAP	EXPEND	INFMORTALITY	EXPECTANCY
Variance Decomposition of MKTCAP				
1	100	0	0	0
5	99.27	0.28	0.39	0.06
10	98.68	0.77	0.36	0.19
Variance Decomposition of EXPEND				
1	0.25	99.75	0.00	0.00
5	6.74	92.14	0.66	0.46
10	4.17	93.74	1.40	0.69
Variance Decomposition of INFMORTALITY				
1	0.07	0.02	99.91	0.00
5	0.68	0.13	99.13	0.06
10	2.75	0.21	97.00	0.04
Variance Decomposition of EXPECTANCY				
1	0.01	0.00	1.25	98.74
5	0.57	0.23	4.48	94.71
10	0.34	1.37	9.54	88.75

Table 2 presents the variance decomposition using market capitalization as a proxy for financial development. Capital market shock explains almost 7 percent of the variation in health spending in period 5. This trend is evident in the medium term between period two to six years and then slowly comes down. Capital market shock explains little of the variations in life

expectancy but 3 percent of the variation in infant mortality in the 10th year. Table 3 presents the variance decomposition using liquid liabilities as a proxy for financial development. Liquid liabilities does not explain much of the variation in life expectancy, around 1 percent of the variation in health spending in the first year and approximately 1 percent of the variation in infant mortality in ten periods ahead.

Table 3
Variance Decomposition: LIQLIAB

Years ahead	LIQLIAB	EXPEND	INFMORTALITY	EXPECTANCY
Variance Decomposition of LIQLIAB				
1	100	0	0	0
5	99.83	0.048	0.027	0.09
10	99.40	0.10	0.30	0.19
Variance Decomposition of EXPEND				
1	1.20	98.80	0.00	0.00
5	0.36	98.75	0.61	0.28
10	0.51	97.56	1.38	0.54
Variance Decomposition of INFMORTALITY				
1	0.12	0.02	99.87	0.00
5	0.35	0.01	99.49	0.14
10	0.74	0.01	98.97	0.28
Variance Decomposition of EXPECTANCY				
1	0.18	0.02	3.67	96.12
5	0.10	0.11	4.26	95.53
10	0.14	1.08	8.38	90.40

6.3 Behavior of Health Indicators in the post 2007/08 Financial Crisis Period

The above mentioned discussions show that financial development proxies affect health outcome variables such as life expectancy and infant mortality in medium to long run. However, such effect on health spending can be observed in the short-run. This also bears practical significance. It is true that life expectancy and infant mortality are determined by a number of other factors and accumulation of health capital, whether gaining better health and living longer or lowering infant mortality rates, maternal mortality rates or low birth weight rates do not

happen overnight. Like physical capital, building health capital requires time, efforts, better technologies, which can be supplemented by a developed and stable financial system but the outcomes may not realize in the short-run. However, financial development shows its effect on health spending in the short-run since health spending also depends on income level or access to credit and a better financial system provides these opportunities even in the short-run.

Having these discussions, this section explores whether the financial crisis of 2007/08 affected health indicators in the OECD countries. Given the limited observations for the post crisis period, the effect of financial crisis might not be revealed perfectly since financial shocks take time to transmit to health outcomes. For the empirical purpose, various regression equations are developed revealing a number of possible implications by taking the full sample observations (1990-2010).

Table 4 presents result of various models, which may capture the effect of financial crisis. In model 1, I regress life expectancy on a number of determinants including a dummy for the period of financial crisis. The 'crisis' dummy takes value 1 if the years are from 2008-2010 and otherwise zero. Model 2 includes a dummy for crisis hit countries. Though most of the countries are hit by the financial crisis of 2007/08, I classify countries into two broad categories. These are countries hard hit by the financial crisis and others. The selection criterion is based on the rate of unemployment. Countries experiencing unemployment rate increase by more than 3 percentage point during 2008-2010 are classified into hard hit category. These include Greece, Iceland, Ireland, Spain, Portugal and USA. So the 'hit' dummy takes value 1 if countries are hard hit and rest of the other countries take a value of zero. Model 3 develops an interaction term 'crihit' by interacting 'crisis' and 'hit' dummy.

Table 4
Regression of Health Outcomes on Financial Crisis Dummies

Variables	Log (LIFE EXPECTANCY)			Log (INFANT MORTALITY)		
Log (CREDIT)	0.007 (0.001)***	0.01 (0.001)***	0.009 (0.002)***	-0.2 (0.03)***	-0.23 (0.03)***	-0.22 (0.029)***
Log (PUBLIC)	0.11 (0.01)***	0.12 (0.004)***	0.12 (0.004)***	-1.32 (0.09)***	-1.28 (0.08)***	-1.39 (0.08)***
DPT	0.0005 (0.0001)***	0.0005 (0.0001)***	0.0005 (0.00)***	-0.005 (0.001)***	-0.006 (0.002)***	-0.005 (0.002)***
ALCOHOL	-0.0006 (0.0005)	-0.001 (0.005)	-0.0009 (0.0005)	0.025 (0.01)**	0.02 (0.009)**	0.03 (0.009)***
CRISIS	0.0092 (0.0015)***	-	-	-0.054 (0.03)**	-	-
HIT	-	-0.0085 (0.009)	-	-	0.11 (0.14)	-
CRIHIT	-	-	-0.002 (0.003)	-	-	0.017 (0.05)
Constant	4.04 (0.013)	4.03 (0.013)	4.01 (0.013)	5.57 (0.24)	5.69 (0.23)	5.75 (0.23)
R-Square	0.74	0.72	0.72	0.60	0.60	0.60
No of Observations	562	562	562	562	562	562
No of Countries	27	27	27	27	27	27

The idea is that if the countries are hard hit by the financial crisis, they have value 1 for the crisis period 2008-2010 and zero for other countries for that period. Similarly, another health outcome variable, infant mortality is regressed on other explanatory variables and various dummies for financial crisis in models 4, 5 and 6.

The fixed effect model presented in Table 4 shows that even in the crisis periods (2008-2010), life expectancy has increased. Life expectancy increased in the crisis period by 0.92 percent compared to the non-crisis period. While regressing life expectancy on another dummy 'hit' after controlling for other variables, the coefficient is found to be negative implying that life expectancy in countries hard hit by financial crisis has declined by 0.85 percent compared to countries that are not hard hit. However, the coefficient is not statistically significant. Regressing life expectancy on another crisis dummy 'crihit', which is an interaction of dummy for countries hard hit by financial crisis in 2008 and for the crisis duration of 2008-2010 shows negative effect of financial crisis on life expectancy. However, it is also not statistically significant. Similar observations are revealed for infant mortality in models 4 to 6. Infant mortality went down in crisis periods even after controlling for other variables as observed in model 4. However, other dummies are not statistically significant.

Table 5 presents the various regression specification results using market capitalization to GDP ratio as a proxy for financial development. The idea is to check if there is a different effect of financial crisis on health outcomes in the presence of alternative proxy of financial development. The alternative specification also does not alter results remarkably. Most of the signs and significance are consistent with the analysis made in table 4. These analyses indicate that health outcomes are not much sensitive to crisis in the short-run supporting the conclusion drawn earlier from the impulse response analysis.

Table 5
Regression of Health Outcomes on Financial Crisis Dummies

Variables	Log (LIFE EXPECTANCY)			Log (INFANT MORTALITY)		
Log (MKTCAP)	0.01 (0.001)***	0.01 (0.001)***	0.01 (0.001)***	-0.2 (0.03)***	-0.17 (0.01)***	-0.19 (0.014)***
Log (PUBLIC)	0.09 (0.004)***	0.12 (0.004)***	0.12 (0.004)***	-1.01 (0.08)***	-1.35 (0.07)***	-1.29 (0.07)***
DPT	0.0005 (0.0001)***	0.0004 (0.0001)***	0.0003 (0.00)***	-0.005 (0.001)***	-0.005 (0.002)***	-0.004 (0.002)***
ALCOHOL	-0.0003 (0.0005)	-0.0004 (0.0005)	-0.0001 (0.0005)	0.014 (0.009)**	0.019 (0.009)**	0.019 (0.009)**
CRISIS	0.016 (0.001)***	-	-	-0.20 (0.02)***	-	-
HIT	-	-0.0067 (0.01)	-	-	0.07 (0.18)	-
CRIHIT	-	-	0.008 (0.003)	-	-	-0.20 (0.04)***
Constant	4.06 (0.011)	4.03 (0.013)	4.03 (0.012)	4.95 (0.21)	5.43 (0.22)	5.32 (0.21)
R-Square	0.81	0.76	0.76	0.70	0.65	0.67
No of Observations	553	553	553	553	553	553
No of Countries	27	27	27	27	27	27

Chapter 7 Summary and Conclusions

This dissertation has examined the relationship between financial development and health outcomes. While life expectancy, infant mortality and low birth weight are used as the measures of health capital; credit to GDP ratio, liquid liabilities to GDP ratio and market capitalization to GDP ratio are taken as the proxies for financial development. The examination of financial development and health relationship in context of the high income OECD countries shows that there is a strong positive correlation between the level of financial development and health outcomes. Both the fixed effect approach and instrumental variable approach suggest the supportive role of financial development in accumulating better health. While credit to GDP ratio is instrumental in promoting better health in terms of higher life expectancy and lower infant mortality, liquid liabilities to GDP ratio and market capitalization to GDP ratio are significant mainly in explaining life expectancy. The transmission mechanism discusses channels through which financial development potentially transmits to health outcomes. The analysis shows that it is the income effect through which financial development affects health outcomes in high income OECD countries.

The analysis of financial development and health relationship in developing countries taking the case of South Asian countries also supports the findings obtained from the analysis made in the case of the OECD countries. More importantly, the magnitude of the effect of financial development on health outcomes in the South Asian countries is higher than that of the OECD ones. The credit effect is instrumental in increasing life expectancy and lowering infant mortality. This reinforces the role for effective and efficient credit disbursement mechanisms in developing countries even also for attaining better health status. The transmission mechanism in

the context of the developing countries shows the role of financial development in promoting higher level of education, which is positively correlated with better health outcomes.

The impulse response analysis develops a simple panel VAR framework to explain the forecast of the financial development impulses on health indicators. The analysis of the effect of financial shocks on health indicators taking data for the OECD countries shows mixed results. While credit shock explains the responses observed in health spending and life expectancy, infant mortality does not respond in a statistically significant manner to credit impulses. However, market capitalization shock shows its effect on infant mortality and health care spending in a statistically significant manner but in different time intervals. One important finding consistent with real life phenomenon is that while health care spending responds to financial development shocks in short to medium run, health outcome variables such as life expectancy and infant mortality respond in medium to long term. This is intuitive in the sense that accumulation of health capital is a process rather than an event and thus takes long time. However, health care spending depends on health care demand and thus financial variables might affect such spending in the near term. An exercise is made to examine the effect of 2007/08 financial crisis on health outcomes. This does not show any immediate effect of crisis on outcome variables supporting the findings of the impulse response analysis, which showed that financial shocks impulse outcome variables only after certain interval.

This dissertation has opened a new discussion in the field of financial development and health economics by introducing the idea that financial variables can also affect health outcomes. Though conventional literatures have mainly focused on the medical, income and education determinants of health, there has been a significant progress on health outcomes and financial development frontiers in both the developed and the developing countries around the world. The

recent financial crisis has suggested that health financing can be more difficult in times of crisis when governments might be forced to take austerity measures and individuals might be liquidity constrained. This type of situation requires the need for a stable financial system, which can be helpful through sustainable means of financing.

Though this study has introduced new discussion in context of these developments, there are a number of ways future researchers in this field can work. Further extensions can be made by using the data of health insurance as a proxy for financial development since insurance companies' performance also depends largely on the functioning and stability of financial system. Other financial development proxies such as population per bank branch, number of bank accounts, and number of credit cards issued can also be introduced as the proxies for financial development. This study has only introduced a discussion on the frontier of transmission mechanism. A detailed analysis on exploring the channels through which financial development transmits to health outcomes can be made by further exploring various determinants of income and education.

APPENDIX 1
SUMMARY OF THE VARIABLES USED IN THE OECD COUNTRIES' ANALYSIS

Variables	**Description of the Variables**
EXPECTANCY	Life expectancy as defined by the OECD
INFMORTALITY	The number of deaths of children aged under one year of age that occurred in a given year, expressed per 1000 live births.
MATMORTALITY	Maternal mortality rate is the death of a woman during pregnancy and childbirth per 100, 000 live births
LBW	Number of live births weighing less than 2500 grams (5.5 pounds) as a percentage of total number of live births.
CREDIT	Private credit by deposit money banks and financial institutions to Nominal GDP ratio.
LIQLIAB	Liquid liabilities of banks and financial institutions to Nominal GDP ratio.
MKTCAP	Market capitalization to GDP ratio. Market capitalization (also known as market value) is the share price times the number of shares outstanding. Listed domestic companies are the domestically incorporated companies listed on the country's stock exchanges at the end of the year. Listed companies does not include investment companies, mutual funds, or other collective investment vehicles (World Bank).
ALCOHOL	Alcohol consumption liters per capita
EXPEND	Total expenditure on health as percentage of GDP. Includes both public and private current and capital formation spending on health.
DTP	% of children immunized with DTP
UNEMPL	Unemployment rate
GDP (Y)	GDP per Capita on purchasing power parity basis

EDUCATION (E)	Gross enrollment ratio in secondary school
COMMON	Countries with common law origin
FRENCH	Countries with French law origin
GERMAN	Countries with German law origin
SCAND	Countries with Scandinavian law origin
SOCIALIST	Countries with Socialist law origin
27 OECD countries included in the study are	Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, South Korea, Luxemburg, Mexico, Netherland, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States

Source: OECD Health data and the World Bank data.

APPENDIX 2
AVERAGES OF THE VARIABLES FOR THE OECD COUNTRIES

	Life Expectancy	Infant Mortality	Credit to GDP	Liqliab to GDP	Mktcap to GDP	Alcohol	Unempl	DPT	Expend to GDP	Per Capita GDP
Australia	79.4	5.4	86.3	86.4	92.1	9.9	7.1	89.9	7.9	28315
Austria	78.2	5.0	101.6	88.5	20.7	13.4	4.1	85.4	9.9	28580
Belgium	78.0	5.3	73.4	82.9	57.4	10.7	9.2	95.5	8.7	27080
Canada	79.1	5.6	121.6	93.7	92.5	7.8	8.3	89.3	9.6	28585
Czech Republic	74.9	5.5	53.1	65.7	23.5	11.8	5.9	98.2	6.4	16904
Denmark	76.9	6.4	105.3	56.2	52.0	12.0	6.3	91.8	9.2	27751
Finland	77.8	3.7	70.8	53.6	88.6	9.2	10.0	98.0	8.1	24910
France	79.1	4.9	91.1	66.3	64.3	14.1	9.2	96.8	10.3	24840
Germany	78.0	4.7	105.8	82.3	39.8	12.6	8.3	87.4	10.3	27041
Greece	78.5	5.8	53.5	66.2	44.7	9.5	9.7	90.7	8.8	19404
Hungary	71.6	9.1	39.1	46.0	19.6	12.7	8.4	99.0	7.6	12808
Iceland	79.9	3.3	100.9	46.0	69.9	6.0	3.7	97.6	9.0	28731
Ireland	77.4	5.4	114.2	69.5	52.8	12.6	8.9	81.7	7.2	27909
Italy	79.6	5.2	74.4	58.9	32.7	8.9	9.6	94.2	8.2	24503
Japan	81.1	3.4	157.0	206.9	75.6	8.5	4.0	90.1	7.5	26116
South Korea	76.0	4.8	114.5	53.1	54.9	9.0	3.5	90.0	4.9	17787
Luxemberg	77.9	4.8	119.9	312.4	152.2	15.8	2.7	97.0	6.6	58639
Mexico	73.6	22.2	20.7	25.7	29.7	5.2	3.7	92.6	5.4	10180
Netherland	78.5	5.1	146.5	91.6	93.2	9.8	4.8	97.0	9.2	28693
New Zealand	78.3	6.2	109.9	82.9	40.3	9.2	6.3	87.6	7.9	20786
Norway	78.9	4.0	93.1	54.1	42.0	5.6	4.2	93.1	8.7	35268
Portugal	76.8	5.9	111.8	92.8	32.4	13.2	6.4	95.6	8.6	17305
Spain	79.4	4.8	111.9	82.9	63.4	11.5	15.7	93.3	7.8	21612
Sweden	79.7	3.7	109.6	44.6	91.3	6.5	7.1	98.7	8.6	27092
Switzerland	80.1	4.9	161.0	130.0	196.2	11.1	3.4	91.2	10.3	32089
UK	78.0	5.7	137.4	94.5	129.7	10.3	6.8	91.7	7.5	26083
USA	76.8	7.3	160.9	66.6	114.8	8.5	5.8	93.5	14.7	34629

APPENDIX 3
SUMMARY STATISTICS OF THE VARIABLES FOR THE OECD COUNTRIES

Variables		Mean	Std. Dev.	Min	Max
Expectancy	overall	77.9	2.6	69.2	83.0
	between		2.1	71.6	81.1
	within		1.6	73.3	82.6
Infant Mortality	overall	5.9	4.0	1.4	39.2
	between		3.5	3.3	22.2
	within		2.0	-2.3	22.8
Low Birth Weight	overall	6.2	1.5	2.6	10.0
	between		1.4	3.7	8.8
	within		0.6	4.1	8.4
Liqliab to GDP ratio	overall	85.9	57.6	17.1	393.7
	between		56.6	25.7	312.4
	within		13.2	50.1	167.2
Credit to GDP ratio	overall	101.7	47.8	14.5	269.8
	between		35.5	20.7	161.0
	within		32.5	26.3	270.5
Market cap to GDP	overall	69.7	54.1	1.5	323.7
	between		42.3	19.6	196.2
	within		34.3	-59.3	249.2
Alcohol	overall	10.2	2.7	4.5	17.9
	between		2.7	5.2	15.8
	within		0.8	8.0	13.1
Unemployment	overall	6.8	3.5	0.5	23.9
	between		2.9	2.7	15.7
	within		2.1	-0.6	15.0
DPT	overall	92.8	6.6	53.0	99.3
	between		4.4	81.7	99.0
	within		5.0	53.3	105.1
Exepend	overall	8.5	2.0	3.8	17.7
	between		1.8	4.9	14.7
	within		0.9	5.6	11.5
Education	overall	105.3	16.9	53.4	162.3
	between		14.7	71.1	143.7
	within		8.7	66.5	141.3
GDP per capita	overall	26060.7	10687.9	6714.0	74113.9
	between		8881.8	10179.5	58638.8
	within		6175.2	8677.6	41535.8

APPENDIX 4
CORRELATION MATRIX OF THE VARIABLES FOR THE OECD COUNTRIES' ANALYSIS

	EXPEC	INFMO	CRED	LIQL	MKTC	EXPD	ALC	DPT	UNEM	EDU	GDP	LBW
EXPEC	1.00	-0.64	0.53	0.32	0.45	0.38	-0.15	0.09	-0.02	0.40	0.58	-0.10
INFMO	-0.64	1.00	-0.44	-0.26	-0.28	-0.31	-0.19	-0.18	-0.07	-0.49	-0.46	0.36
CRED	0.53	-0.44	1.00	0.41	0.52	0.41	0.00	-0.05	-0.35	0.13	0.50	-0.12
LIQL	0.32	-0.26	0.41	1.00	0.44	-0.04	0.39	0.03	-0.29	-0.11	0.64	0.09
MKTC	0.45	-0.28	0.52	0.44	1.00	0.26	-0.01	0.16	-0.23	0.13	0.60	-0.04
EXPD	0.38	-0.31	0.41	-0.04	0.26	1.00	0.02	0.11	0.03	0.17	0.38	0.17
ALC	-0.15	-0.19	0.00	0.39	-0.01	0.02	1.00	-0.08	0.09	-0.05	0.19	-0.01
DPT	0.09	-0.18	-0.05	0.03	0.16	0.11	-0.08	1.00	0.01	0.09	0.17	0.05
UNEM	-0.02	-0.07	-0.35	-0.29	-0.23	0.03	0.09	0.01	1.00	0.20	-0.34	0.03
EDU	0.40	-0.49	0.13	-0.11	0.13	0.17	-0.05	0.09	0.20	1.00	0.18	-0.30
GDP	0.58	-0.46	0.50	0.64	0.60	0.38	0.19	0.17	-0.34	0.18	1.00	-0.15
LBW	-0.10	0.36	-0.12	0.09	-0.04	0.17	-0.01	0.05	0.03	-0.30	-0.15	1.00

EXPEC= Life Expectancy, INFMO= Infant Mortality, CREDIT= Private credit to GDP ratio, LIQL= Liquid Liabilities to GDP ratio, MKTC= Market Capitalization to GDP ratio, EXPD= Public spending on health to GDP ratio, ALC= Alcohol, DPT= DPT vaccination, UNEMPL= Unemployment rate, EDU= Secondary school enrollment ratio, GDP= GDP per capita, LBW= Low birth weight

APPENDIX 5
SUMMARY STATISTICS OF VARIABLES FOR THE SOUTH ASIAN ANALYSIS

Variables		Mean	Std. Dev.	Min	Max
EXPECTANCY	overall	65.8	4.7	56.7	76.2
	between		4.3	62.3	72.1
	within		2.5	59.4	70.7
INFANTMORTALITY	overall	52.5	21.0	14.7	89.3
	between		20.1	18.4	78.4
	within		9.5	34.7	76.7
CREDIT	overall	28.4	12.1	7.0	73.3
	between		6.2	15.6	33.4
	within		10.6	8.7	68.5
BROADMONEY	overall	44.4	10.0	27.3	71.5
	between		6.5	35.7	55.6
	within		8.0	29.4	66.6
GDP Growth	overall	5.9	3.6	-7.1	21.4
	between		1.6	4.1	7.9
	within		3.3	-9.1	19.5
Per Capita GDP Growth	overall	4.1	3.6	-8.4	19.7
	between		1.7	1.8	6.1
	within		3.3	-10.4	17.8
DPT	overall	82.9	14.5	46.0	99.0
	between		13.4	65.4	97.3
	within		7.4	59.5	101.5
EXPEND	overall	4.7	1.8	2.2	9.9
	between		1.8	3.0	8.2
	within		0.6	2.8	7.3
SANITATION	overall	49.5	24.0	15.0	96.0
	between		25.0	22.5	84.1
	within		4.9	36.1	62.1
EDUCATION	overall	51.4	18.6	27.0	92.0
	between		18.3	29.0	84.6
	within		7.6	21.3	70.6

APPENDIX 6

CORRELATION MATRIX OF VARIABLES USED IN SOUTH ASIAN ANALYSIS

	EXPECT	INFMO	CREDIT	BROAD	GDP	PERCAP	DPT	EXPEN	SANIT	EDUC	PERCAM
EXPECT	1.00	-0.91	0.46	-0.11	0.08	0.19	0.74	0.25	0.92	0.83	0.10
INFMO	-0.91	1.00	-0.43	0.03	-0.11	-0.23	-0.77	-0.29	-0.83	-0.94	-0.24
CREDIT	0.46	-0.43	1.00	0.52	0.00	0.08	0.13	-0.01	0.22	0.39	-0.06
BROAD	-0.11	0.03	0.52	1.00	0.04	0.06	-0.14	0.07	-0.38	-0.12	-0.08
GDP	0.08	-0.11	0.00	0.04	1.00	0.95	0.19	0.19	0.10	0.12	0.07
PERCAP	0.19	-0.23	0.08	0.06	0.95	1.00	0.24	0.16	0.20	0.23	0.07
DPT	0.74	-0.77	0.13	-0.14	0.19	0.24	1.00	0.35	0.74	0.64	0.16
EXPEN	0.25	-0.29	-0.01	0.07	0.19	0.16	0.35	1.00	0.26	0.20	0.27
SANIT	0.92	-0.83	0.22	-0.38	0.10	0.20	0.74	0.26	1.00	0.79	0.12
EDUC	0.83	-0.94	0.39	-0.12	0.12	0.23	0.64	0.20	0.79	1.00	0.31
PERCAM	0.10	-0.24	-0.06	-0.08	0.07	0.07	0.16	0.27	0.12	0.31	1.00

EXPECT= Life expectancy, INFMO= Infant Mortality, CREDIT= Credit to GDP ratio, BROAD= Broad Money to GDP ratio, GDP= GDP growth rate, PERCAP= GDP per capita growth rate, DPT= DPT vaccine, EXPEN= Total Health Expenditure, SANIT= Access to sanitation facilities, EDUC= Secondary school enrollment ratio, PERCAM= GDP per capita amount

APPENDIX 7
SAMPLE AVERAGES OF VARIABLES FOR SOUTH ASIA

	Life Expectancy	Infant Mortality	Credit to GDP	Broad to GDP	DPT	Health Expend to GDP	Per Capita Growth	Sanitation	Education
Bangladesh	65.49	57.66	29.66	41.75	85.60	3.14	3.83	48.20	45.12
Bhutan	62.42	60.98	15.60	45.33	90.73	5.40	5.46	40.54	43.27
India	62.31	59.91	33.45	55.61	65.40	4.33	5.46	27.13	49.89
Maldives	71.59	32.77	33.19	40.50	97.33	8.19	6.07	83.33	65.82
Nepal	63.04	59.53	31.51	49.26	77.33	5.43	1.82	22.47	42.12
Pakistan	63.52	78.39	25.59	42.35	66.67	2.98	2.05	39.33	42.12
Sri Lanka	72.09	18.37	29.74	35.69	97.07	3.69	4.05	84.13	84.56

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ABSTRACT

FINANCIAL DEVELOPMENT AND HEALTH CAPITAL ACCUMULATION

by

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May 2013

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This dissertation examines the interrelationship between financial development and health capital accumulation. While credit to GDP ratio, liquid liabilities to GDP ratio and market capitalization to GDP ratio are used as the proxies for financial development, health capital is represented by life expectancy, infant mortality and low birth weight. A simple static model in the utility maximization framework shows that financial development increases the medical care through income effect thus augmenting the health status. This is also supported by econometric analysis. Using various econometric models such as pooled OLS, fixed effect and instrumental variable approach, the study shows that higher level of financial development positively contributes to health capital accumulation in terms of higher life expectancy and lower infant mortality. But no such effect of financial development is observed on low birth weight.

Among various proxies of financial development, the credit to GDP ratio explains both life expectancy and infant mortality better. The effect of financial development on health outcomes is stronger in developing countries. This suggests a higher rate of return from financial development on health outcomes in these countries. It is also understandable that the higher level of financial deprivation in developing countries staggers the channels such as income and

education, which contribute to health capital accumulation even in the short-run. Looking at the channels through which financial intermediation affects health outcomes, the study finds that income could be a better potential candidate in the developed countries and education in the developing ones. The impulse response analysis shows that financial shocks do not exhibit their immediate impact on outcome variables but show short to medium term impact on health spending.

Key Words: Financial Development, Health Capital, Life Expectancy, Infant Mortality

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