Dying for Banks: Banking Development and Mortality

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Abstract

We consider both the theoretical and empirical issues of the effects of banks on health in an economy. We measure health by adult mortality rate. We present a model where people survive longer in an economy with money and banks than they do in an otherwise identical economy with money but without bank. Our empirical results using cross country data show that the relationship between adult mortality rate and banking development, as measured by M2/GDP, is negative and significant, even when other variables, such as income per capita, health expenditure per capita, education, are held constant.

JEL Codes: I1, G2

1 Introduction

Banks provide a number of services to an economy. They provide households with savings and liquidity services. Bank deposits provide smaller and less sophisticated savers with a safe place to save and, since the deposit contract normally allows depositors to withdraw their funds on demand, to have immediate access to these savings. Some fraction of bank deposits are lent to firms, often and perhaps mostly for working capital. The existence of banks in an economy permits households to increase their precautionary savings so they can better meet the costs of emergencies (of interest here, medical emergencies). The increased savings can be used by the banks to finance working capital for firms and increase output.

One of the most important types of emergencies that households face are health emergencies. In many countries, there is a correlation between the amount of health care services that a household can finance by itself and the care that a sick member of the household receives. This can be true even in economies with extensive public health care services. Expensive medical procedures or tests are rationed, one way or another, and private funds often permit
quicker or easier access to such services. Quicker or easier access can result in better medical outcomes.

In this paper we study the relationship between banking sector development and health as represented by mortality rates. We present a model that compares an economy with money but without banks to an otherwise identical economy with banks. Adding banks to the model reduces mortality (and increases life expectancy). We also provide cross country data analysis that supports the results of that model. It is well known that per capita income and mortality rates are highly correlated in international panel data. So are the size of the financial system and per capita income. Our new empirical results are that, controlling for per capita income and health services, we find a strongly significant negative marginal correlation between adult mortality and M2/GDP, our measure of the size of the financial system.

We provide a model where adding a banking system can increase output and reduce mortality. For the comparison to be interesting, the economy needs a number of features. In the version without banks, both households and firms face cash in advance constraints. Households hold money for normal consumption purposes and to cover random large liquidity needs. The liquidity needs used here can be thought of as a medical emergency where medical services need to be hired and the more medical services purchased the higher the probability of surviving the emergency. Firms have to use either saved or borrowed money to meet their wage bill. In the economy with banks, the excess liquidity of the households can be lent to the firms for their working capital needs. One of the main activities of commercial banks is to use excess household liquidity to make short term loans to firms. That is exactly what banks do in this paper.

An interesting set of results come from this model. Introducing banks into the economy tends to (but does not always) increase output, increase consumption of goods by both those with the emergency and those without, increase the hiring of labor to produce more emergency service, increase survival rates (and life expectancy), and generate a jump in the price level. Under the best conditions, introducing banks raises the return that households get on holding money for precautionary needs and provides funds to the firms at an interest rate lower than the implicit interest rate that comes from the firms discount rate. The reduction in the interest rate paid by firms means that they hire more labor and drives up the wage rate.

Mortality declines and output increases when banks are introduced in many versions of the model. While there is a substantial literature on the importance of precautionary savings\textsuperscript{1} and the relationship between precautionary savings and health, the literature has not highlighted the importance of the banking system for household health. With banks, the returns on precautionary savings are higher and so the costs of health protection are lower. This has important policy implications with respect to banking: making banking services (in our case, deposit services) available to households who do not now have it increases their ability to accumulate precautionary savings. These additional precautionary

\textsuperscript{1}For example, Gourinchas and Parker [3] and Carrol and Samwick [1].
savings translate into lower mortality.

The data on the effect of a banking sector on health or mortality rates has not been studied previously. We investigate empirically this relationship using cross country data on mortality from the World Health Organization statistics. Using regression analysis we find, consistent with the model, a negative correlation between adult mortality rates and banking development, as measured by M2/GDP, even after controlling for income, health expenditures, and other variables that may be correlated with both mortality and financial development. We also analyze the sensitivity of our results to different specifications, the choice of the dependent variable and, to a lesser extent, the measure of banking development. Overall, our results suggest that the relationship between banking development and mortality that we find in the model is empirically important.

Section 2 presents the model with three types of cash-in-advance money but without banks. Section 3 introduces banks and compares the stationary state equilibrium with banks to that without. Section 4 presents the empirical results and section 5 concludes.

2 An economy without banks

We begin by constructing the economy without banks and then add banks to that economy\(^2\). Households and firms face cash in advance constraints. The constraint holds for consumption and emergency medical purchases in the case of households and for the wage bill in the case of firms. Without banks, both households and firms need to carry money over from the previous period. In this economy, not all money will be used for payments in each period since the households who do not experience a medical emergency will have precautionary money holdings that they do not use.

2.1 Households

There are a unit mass of households in this economy. A random fraction \(\rho\) of households suffer a medical emergency. The probability of surviving the medical emergency, \(p(h^*_t)\), is determined by the amount of medical services, \(h^*_t\), that a household hires. The workers who provide medical services receive the same wage as workers who produce goods. The \(\rho (1 - p(h^*_t))\) households who die each period are replace by an equal number of live but otherwise identical individuals who inherit their wealth of \(k_{t+1} + m_{t+1}/P_t\).

At the beginning of each period, a household discovers if it has a medical emergency or not. A fraction \(1 - \rho\) of the households do not need its emergency liquidity (\(nl\)) and faces the decision problem

\[
V_{nl}(k_t, m_t) = \max \left[ u(c^nl_t, h^nl_t) + E_t \beta \left( (1 - \rho) V_{nl}(k_{t+1}, m_{t+1}) + \rho V_l(k_{t+1}, m_{t+1}) \right) \right]
\]

\(^2\)The model here is based on McCandless [6]. Banks here do not have the kinds of risks one sees in models such as Diamond and Dybvig [2].
subject to

\[ k_{t+1} + \frac{m_{t+1}}{P_t} = w_t h_t^n + r_t k_t + \psi_t^{nl} + \pi_t + (1 - \delta) k_t + \frac{m_t}{P_t} - c_t^{nl} \]

and the cash in advance constraint

\[ c_t^{nl} \leq \frac{m_t}{P_t} \]

Here, \( k_t \) is the capital carried over from the previous period, \( m_t \) is the money carried over, \( c_t^{nl} \) is the goods consumption, \( h_t^{nl} \) is the labor supplied, \( \pi_t \) are lump sum dividend payments from the profits of the firms, and \( \psi_t^{nl} \) is a lump sum tax or transfer that will make all surviving families have the same wealth at the end of each period. The depreciation rate is \( \delta \), the wage rate is \( w_t \), the rental rate on capital is \( r_t \) and the price level is \( P_t \).

A fraction \( \rho \) of the households has to finance a medical emergency. How much medical services the household purchases determines the probability that it will survive to the next period. The decision problem of those with liquidity needs (\( l \)) is

\[
V_l(k_t, m_t) = \max \left[ u(c_t^l, h_t^l) + p(h_t^l) E_t \beta ((1 - \rho) V_{nl}(k_{t+1}, m_{t+1}) + \rho V_1(k_{t+1}, m_{t+1})) \right]
\]

subject to the budget constraint

\[ k_{t+1} + \frac{m_{t+1}}{P_t} = w_t h_t^l + r_t k_t + \psi_t^l + \pi_t + (1 - \delta) k_t + \frac{m_t}{P_t} - c_t^l - w_th_t^x \]

and the cash in advance constraint

\[ c_t^l + w_th_t^x = \frac{m_t}{P_t}. \]

This cash-in-advance constraint says that the household will pay \( w_t h_t^x \) for medical services and will still consume \( c_t^l \). The probability that a household will survive into the next period is monotonically related to the amount of medical services it hires.

To keep the model simple (and be able to aggregate the results), we add a lump sum transfers program so that end of period wealth, \( k_{t+1} + m_{t+1}/P_t \), is the same whether one has a liquidity demand (and lives) or not. Lump sum taxes for those who do not have liquidity demands are \( \psi_t^{nl} \) and the lump sum transfer to those who do it is \( \psi_t^l \). The transfer program has a balanced budget, so

\[ 0 = \rho \psi_t^l + (1 - \rho) \psi_t^{nl}. \]

Since the probability of death in any period is \( \rho (1 - p(h_t^x)) \), life expectancy of a person alive at the beginning of period \( t \) (before the liquidity need is revealed) is

\[ \sum_{i=1}^{\infty} i \left( 1 - \rho \left( 1 - p(h_{t+i-1}^x) \right) \right) \]
which, if one is in a stationary state, \( h_{t+i-1}^x = h^x \), is

\[
\sum_{i=1}^{\infty} i (1 - \rho (1 - p (h^x)))^i = \left[ \rho (1 - p (h^x)) \right]^{i+1} - \left[ \rho (1 - p (h^x)) \right]^{i+2}
\]

since \( \rho (1 - p (h^x)) \) is strictly between 0 and 1.

### 2.2 Production

There is a unit mass of identical, competitive firms. The goods production side of the economy can be expressed by the Cobb-Douglas production function

\[
Y_t = A_t K_t^g H_t^{1-g}
\]

where the equilibrium conditions for capital and labor are

\[
K_t = \int_0^1 k_t \, di,
\]

and

\[
H_t = \int_0^\rho h_t^0 \, di + \int_1^\rho h_t^1 \, di - \int_0^\rho h_t^\rho \, di,
\]

and where \( A_t \) is the time \( t \) technology level.

Firms have a cash-in-advance constraint in that they need to hold cash from the previous period in order to cover their wage bill. Define \( m_t \) as the money that a firm has carried over from period \( t - 1 \). Let \( \int_0^1 m_t^l = M_t^l \). The budget constraint of the firms is

\[
\pi_t = Y_t - w_t H_t - r_t K_t + \frac{M_t^l}{P_t} - \frac{M_{t+1}^l}{P_t}
\]

subject to the cash-in-advance constraint

\[
w_t H_t \leq \frac{M_t^l}{P_t}.
\]

Firm managers maximize

\[
E_t \sum_{i=0}^{\infty} \beta^i \pi_{t+i},
\]

and if the rate of gross inflation is not less than \( \beta \), the cash-in-advance constraint holds with equality so that

\[
w_t H_t = \frac{M_t^l}{P_t}.
\]

In a competitive economy, because of the effects of having to hold money over from the previous period, profits will be

\[
\pi_t = Y_t - r_t K_t - \frac{M_{t+1}^l}{P_t}.
\]
Using the first order conditions on rentals, we have

$$\pi_t = Y_t - \theta A_t K_t^\theta H_t^{1-\theta} + \frac{M_{t+1}^f}{P_t}.$$  

The conditions for rentals is

$$\frac{1}{\beta} = E_t \left( \frac{(1 - \theta) A_{t+1} K_{t+1}^{\theta} H_{t+1}^{1-\theta}}{w_{t+1}} \right) \frac{P_t}{P_{t+1}}.$$  

### 2.3 Equilibrium conditions

All of the non-liquidity constrained households are alike as are the liquidity constrained households. That means that

$$C_{t}^{nl} = c_t^{nl}$$

and

$$C_{t}^{l} = c_t^{l}.$$  

The insurance plan means that

$$K_{t+1} = k_{t+1}$$

and

$$M_{t+1}^h = m_{t+1},$$  

since both the liquidity constrained and the non-liquidity constrained end up with the same wealth and will allocate it in the same manner.

Market clearing conditions in each period for capital and labor are

$$K_t = \int_0^1 k_t \, di,$$

and, defining

$$H_{t}^{nl} = h_{t}^{nl},$$

$$H_{t}^{l} = h_{t}^{l},$$

and

$$H_{t}^{x} = h_{t}^{x},$$

labor supplied to production is

$$H_t = (1 - \rho) H_t^{nl} + \rho H_t^{l} - \rho H_t^{x}.$$  

Define the aggregate money held by the households into period $t + 1$ as

$$M_{t+1}^h = \int_0^1 m_{t+1} \, di.$$
The total money held by the firms into period \( t + 1 \) is \( M^f_{t+1} \). A constant money stock\(^3\), \( M \), is equal to
\[
M = M^h_{t+1} + M^f_{t+1}.
\]
As mentioned above, the zero profit condition for the insurance plan is
\[
0 = \rho \psi^l_i + (1 - \rho) \psi^{nl}_i.
\]

### 2.4 Stationary states

It is possible to find the value of the value functions in a stationary state. By imposing the stationary state conditions that \( k_t, m_t \) are constant through time, we know that
\[
V_i = V_i (k_t, m_t) = V_i (k_{t+1}, m_{t+1})
\]
for both \( i = l \) and \( i = nl \). In addition, because of the insurance program, the liquidity constrained that survive, the new households that replace the liquidity constrained who die, the the non-liquidity constrained have the same stock of capital and the same money holdings. The discounted value of lifetime utility in a stationary state can be written as
\[
V_l = \frac{u(C^l, H^l)}{1 - \frac{p(H^x)\beta \rho}{(1 - \beta(1 - \rho))}} + \frac{p(H^x)\beta (1 - \rho) u(C^{nl}, H^{nl})}{[1 - \frac{p(H^x)\beta \rho}{(1 - \beta(1 - \rho))}] (1 - \beta (1 - \rho))}
\]
for the liquidity constrained and
\[
V_{nl} = \frac{u(C^{nl}, H^{nl})}{(1 - \beta (1 - \rho))} + \frac{\beta \rho}{(1 - \beta (1 - \rho))} V_l
\]
for those who do not face the constraint. The other first order conditions see that the values of \( C^l, H^l \) and \( C^{nl}, H^{nl} \) are those which meet the conditions for a maximum.

For our example economy, the sub-utility function we use is
\[
u(c^i_t, h^i_t) = \frac{(c^i_t)^{1 - \varphi}}{1 - \varphi} + b \frac{(1 - h^i_t)^{1 - \varphi}}{1 - \varphi},
\]
for \( i = l, nl \), with \( 0 < \varphi < 1 \).

The full set of 18 stationary state variables are
\[
\left\{ V_{nl}, V_l, Y, C^{nl}, C^l, H, H^{nl}, H^l, H^x, K, M^h, M^f, r, w, \psi^{nl}, \psi^l, p, \pi \right\}.
\]
The set of 9 parameters of the model are
\[
\{A, \beta, \varphi, b, a, \alpha, \rho, \theta, M\}.
\]

For an economy with \( \beta = .9, \varphi = .8, b = 1.2, a = 4, \alpha = .1, \rho = .1, \theta = .4, M = 1 \) and for a set of values for \( A = \{1, 2, 3, 4\} \), the stationary state values
of variables of interest are shown in Table 1. Real GDP is calculated by adding the real value of goods output to the real value of emergency services, $GDP = Y + wH^x$.

As might be expected, economies with higher levels of technology have higher output, capital stocks, consumption in all states, and wages. In addition, economies with higher levels of technology work more (not shown), hire more labor for emergencies, have a higher probability of surviving the emergency (and therefore a longer expected lifetime), use relatively more money in the production process and use relatively less money by the households.

## 3 Adding banks

We add a simple bank to the previous model. In each period, those who do not have a medical emergency deposit the money they are not going to use for consumption into a bank. The bank lends these funds to the firms to help cover the wage bill. The banks are mutual so that all interest paid by the firms is passed along to the households.

### 3.1 Households

Households maximize the same discounted utility function as in the previous section. However, the budget and cash-in-advance constraints are different. The households without emergencies maximize subject to the budget constraint

$$c_t^{nl} + k_{t+1} + \frac{m_{t+1}}{P_t} = w_t h_t^{nl} + r_t k_t + \psi_t^{nl} + \pi_t + (1 - \delta) k_t + \frac{m_t}{P_t} + (r^h_t - 1) \frac{n_t}{P_t}$$

and the cash-in-advance constraint

$$c_t^{nl} + \frac{n_t}{P_t} = \frac{m_t}{P_t}.$$

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3We are not considering the effects of inflation in this paper.
Instead of holding excess money, they deposit all the money they are not using for consumption into the financial system and receive the gross return $r^h_t$ on those deposits.

Households with the emergency expenditures maximize subject to the budget constraint

$$c^t_i + w_t h^x_t + k_{t+1} + \frac{m_{t+1}}{P_t} = w_t h^l_t + r_t k_t + \psi^t_t + \pi_t + (1 - \delta) k_t + \frac{m_t}{P_t}$$

and the cash-in-advance constraint

$$c^t_i + w_t h^x_t = \frac{m_t}{P_t}.$$

All of their cash holding is used to finance consumption and the services that they pay for given the emergency. Since, as we will see, capital pays a higher return than bank deposits, households will hold only the amount of money they need to cover their desired expenditures during an emergency. In an important and probably realistic way, households are credit constrained. In our economy, those who face a medical emergency cannot borrow from the banks to cover the expenses of that emergency.

There are some potential corner issues here. If the expected interest rate paid by the banks becomes less than $r^h_t = 1$ all households will hold only money since, with a constant money supply, the expected rate of return on money will not be less than 1.

Banks take in the deposits of those who do not have emergencies and lend these funds to the firms to cover all or part of their wage bill. Banks make no profits (are mutuals) and lend at the same rate that they borrow from the depositors. Banks do not make loans to individuals who have emergencies. They only make riskless in-period loans to firms. Since only those without emergencies deposit in the banks, total deposits available to the firms are

$$N_t = (1 - \rho) n_t.$$

Banks lend all their deposits to firms at the rate $r^f_t = r^h_t$.

### 3.2 Firms

If the interest rate on borrowing from the banks is less than $1/\beta$, their cost of holding money, the firms will borrow as much from the banks as they can. This is $N_t = (1 - \rho) n_t$. The firms will save from the previous period $M^f_t$ to cover the expected difference between their borrowings and their desired nominal expenditure on labor. The aggregate cash-in-advance constraint for the firms is

$$N_t + M^f_t = P_t w_t H_t.$$

The firms are maximizing the value of the firm

$$E_t \sum_{i=0}^{\infty} \beta^i \pi_{t+i}.$$
subject to the budget constraint

\[ \pi_t = Y_t - w_t H_t - r_t K_t - \left( r^f_t - 1 \right) \frac{N_t}{P_t} + \frac{M^f_t}{P_t} - \frac{M^f_{t+1}}{P_t} \]

and the cash-in-advance constraint. The production function is as before,

\[ Y_t = A_t K^\theta_t H^{1-\theta}_t. \]

First order conditions for the firms are

\[ (1 - \theta) A_t K^\theta_t H^{1-\theta}_t = r^f_t w_t \]
\[ \theta A_t K^{\theta-1}_t H^{1-\theta}_t = r_t \]
\[ \frac{1}{\beta} \geq E_t r^f_{t+1} \frac{P_t}{P_{t+1}}. \]

The last conditions is with inequality if \( M^f_t = 0 \), if the firm can borrow from the banks all of the funds it needs to finance the wage bill. If it cannot borrow enough, then \( M^f_t > 0 \) and the condition is an equality (which implies that in a stationary state without inflation, \( \bar{r}^f = 1/\beta \)).

### 3.3 Equilibrium conditions

Most of the equilibrium conditions are the same as those in the economy without banks. The major differences are in the conditions for the banks, which we assume are competitive and therefore lend all the deposits they receive if the interest rate that the firms pay is greater than \( r^f_t > 1 \).

### 3.4 Stationary state

We use the same sub-utility function and probability function as in the no bank economy.

The full set of 20 stationary state variables are

\[ \{ V_{nl}, V_t, Y, C^{nl}, C^t, H, H^{nl}, H^t, H^r, K, M^h, N, M^f, r, r^f = r^h, w, \psi^{nl}, \psi^t, P, \pi \}. \]

The set of 9 parameters of the model are

\[ \{ A, \beta, \varphi, b, a, \alpha, \rho, \theta, M \}. \]

The two additional variables are the interest rate, \( r^f \), and bank deposits, \( N \). Results for simulated economies with the same parameter values as for the no-bank economy and with \( A = 1, 2, 3, \) and 4 are given in Table 2.

Compare the results here to those of Table 1. For the example economy with banks, output is higher, expenditures on medical services are higher and therefore the probability of surviving to the next period is higher. While not shown here, it can be the case that with banks, the additional savings pulls so much extra labor into the medical services industry that output of goods declines.
variables & $A = 1$ & $A = 2$ & $A = 3$ & $A = 4$ \\
\hline
\textit{GDP} & 0.5460 & 1.9861 & 4.2191 & 7.1891 \\
\textit{Y} & 0.4889 & 1.7926 & 3.8244 & 6.5357 \\
\textit{C}_{nl} & 0.4226 & 1.5361 & 3.2612 & 5.5546 \\
\textit{C}_{l} & 0.1755 & 0.7582 & 1.7567 & 3.1645 \\
\textit{H}^x & 0.6331 & 0.6924 & 0.7261 & 0.7493 \\
\textit{w} & 0.9008 & 2.7946 & 5.4346 & 8.7210 \\
\textit{P} & 1.3407 & 0.3713 & 0.1754 & 0.1031 \\
\textit{M}^h & 1.0000 & 1.0000 & 1.0000 & 1.0000 \\
\textit{M}^f & 0 & 0 & 0 & 0 \\
$p(H_2^T)$ & 0.9673 & 0.9696 & 0.9708 & 0.9716 \\
r & 1.0083 & 1.0327 & 1.0442 & 1.0513 \\
N & 0.3901 & 0.3867 & 0.3853 & 0.3846 \\
\hline
\end{tabular}

Table 2: Values for simulation in bank economy

4 Empirical Evidence on the Relationship between Banking Development and Mortality

The data on the effect of a banking sector, as a mechanism for self protection, on health or mortality rates has not been studied previously. In this section we investigate empirically this relationship using cross country data on mortality from the World Health Organization statistics. The results we present in this section support our model and find that the association between banking system development, as measured by M2/GDP, and adult mortality is quite important.

In most empirical studies on the determinants of health, education and income appear as the most important correlate of good health, regardless of whether health is measured by mortality rates, morbidity rates, or self evaluation of health status, and regardless of whether the units of observation are individuals or groups (see Grossman [4]). Some recent work has concentrated on the effects of health risk on saving behavior. Using data for Italy Japelli, Pistaferreri and Weber [8] found a positive relationship between health dispersion and precautionary savings. The study exploit district-wide variability in health care quality and provision to assess the effects of quality on income inequality, health inequality and precautionary savings. On the other hand, Starr-MacCluer [7] found mixed evidence on the effects of health risk on precautionary savings.

Before entering into the econometric analysis, it is worth noting that savings for precautionary purposes at the household level are empirically important. For instance, according to the 2007 Federal Reserve Board’s Survey of Consumer Finances, the second most frequently reported motive for savings is liquidity related (with 32 percent of the households), the first being retirement motives with 33.9 percent of the households. Liquidity-related reasons include “emergencies,” the possibilities of unemployment and illness, and the need for ready money.
The same survey also shows that U.S. families estimate the fraction of savings they need for emergencies and other unexpected contingencies at around 9.2 percent of their income. For low income U.S. families, this fraction is even larger and desired precautionary savings represents 14 percent of their income.

The model developed in previous sections can be interpreted as predicting a negative relationship between mortality rate and the relative size of the banking system across economic units, after controlling for income and regular health expenditure. In the model, households save some resources for health precautionary motives, aside from the standard reasons for saving. The banking system allows households to save at lower costs, which encourage precautionary savings and as a consequence reduces household’s mortality.

The banking systems allows individuals to improve the outcome of a medical emergency through a better timing in health spending. Using a banking system, individuals can have access to their money precisely when they need it the most.

Two things should be noted about how we interpret our model as we do the empirical analysis. In the model, the health care services that a larger banking system promotes, $H^x$, are expenditures for emergencies. Normal or regular health care expenditures should be considered part of consumption expenditures, $C$. Since economies with higher income normally have higher consumption, we would expect them to have higher regular health care expenditures as well. The part of higher regular health care expenditures that are correlated with lower mortality are not those we are trying to explain by the size of the banking system. Therefore, we control for average health expenditures in most specifications. We do not want to control for emergency expenditures since this is precisely the channel through which the liquidity provision of the banking system operates. In addition, households in the model save both in the form of deposits in the banking system and in the form of physical capital. We are assuming that savings in the form of capital is sufficiently illiquid so that it is not available to cover emergency medical expenditures.

There are various ways to measure banking sector size and development. The traditional indicator utilized for assessing the size and development of a country’s banking sector is the ratio of M2 to GDP. Other measures used in the literature include the ratio of private credit to GDP, number of accounts, bank branches and ATMs per population. In order to make our sample as large as possible, we use the ratio of M2 to GDP for the purposes of evaluating the model. Table 3 provides details on the data used in the analysis.

Figure 1 shows the relation between adult mortality rate (probability of dying between 15 to 60 years per 1000 population) and the size of the banking sector in logs, as measured by M2 over GDP (without any additional controls). The figure shows a strong negative association between both variables. The correlation coefficient between the two variables is $-0.49$. As the size of the banking sector increases, the mortality rate declines. However, taking into account the well known relationships between income and both mortality rate (see Figure 2) and financial development (see Table 4), the relationship plotted in Figure 1 might not seem surprising. Table 4 shows the simple correlation between the main variables of interest.
Table 3: Data Sources

<table>
<thead>
<tr>
<th>Variable</th>
<th>Source</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult mortality rate</td>
<td>World Health Organization</td>
<td>2005</td>
</tr>
<tr>
<td>(probability of dying between 15 to 60 years per 1000 population)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life expectancy at birth</td>
<td>World Health Organization</td>
<td>2005</td>
</tr>
<tr>
<td>(years)</td>
<td></td>
<td></td>
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<tr>
<td>Per capita total expenditure on health (PPP) US$</td>
<td>World Health Organization</td>
<td>2005</td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average M2/GDP</td>
<td>Own Calculation using data from International Financial Statistics - IMF</td>
<td>1970-2005 or available years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP per capita (PPP) US$</td>
<td>World Bank</td>
<td>2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net primary school enrolment ratio male (%)</td>
<td>World Bank</td>
<td>2005</td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gini-coefficient of inequality</td>
<td>World Bank</td>
<td>2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1: Adult Mortality Rate and M2/GDP across countries
Figure 2: Adult Mortality Rate and GDP per Capita across countries

Table 4: Means and correlations of adult mortality rate, M2/GDP and other independent variables

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Mortality (per 1000 population)</td>
<td>225</td>
<td>148</td>
<td>1</td>
</tr>
<tr>
<td>M2/GDP</td>
<td>44</td>
<td>32</td>
<td>-0.49</td>
</tr>
<tr>
<td>GDP per capita (PPP US$)</td>
<td>11,789</td>
<td>14,198</td>
<td>0.53</td>
</tr>
<tr>
<td>Health Expenditure per capita (PPP US$)</td>
<td>860</td>
<td>1,202</td>
<td>-0.52</td>
</tr>
<tr>
<td>Africa</td>
<td>0.27</td>
<td>0.45</td>
<td>-0.31</td>
</tr>
</tbody>
</table>

There are 150 observations.
Table 5: Baseline Relationship between Adult Mortality and M2/GDP across countries - Average Mortality Rate by M2/GDP and GDP per Capita

<table>
<thead>
<tr>
<th>GDP per Capita (PPP US$)</th>
<th>Less than 36% (Median)</th>
<th>More than 36%</th>
<th>All Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 6757 (Median)</td>
<td>347.3</td>
<td>203.5</td>
<td>307.7</td>
</tr>
<tr>
<td>More than 6757 (Median)</td>
<td>204.6</td>
<td>122.5</td>
<td>147.8</td>
</tr>
<tr>
<td>All Countries</td>
<td>302.5</td>
<td>168.1</td>
<td>225.1</td>
</tr>
</tbody>
</table>

There are 150 observations.

In Table 5, we take a rough look at partial correlation between banking development and mortality conditioned on income per capita by breaking down mortality rates by a country’s per capita income and by banking development (M2/GDP). The table provides an overview of the data and shows that the differences in mortality rates according to the level of development of the banking sector are significant among both high and low income countries. The difference in mortality rates with high and low banking development is larger for less developed countries, but they are similar for both group at around 40%.

Using regression analysis we show that, consistent with the model, the negative correlation between adult mortality rates and M2/GDP survives even after controlling for income and other variables that may be correlated with both mortality and financial development. We also analyze the sensitivity of our results to different specifications, the choice of the dependent variable and, to a lesser extent, the measure of banking development. Finally, we discuss alternative interpretations to our empirical results and some endogeneity problems that we could have in our estimates.

To document the basic relationship between health and banking development we estimate the following equation using OLS:

\[
\ln \text{Mortality}_i = c + \beta \ln \text{Banking\_Development}_i + X_i \delta + e_i,
\]

where \( \text{Mortality}_i \) is adult mortality rate for country i and \( \text{Banking\_Development}_i \) is a measure of country i’s banking development, \( X_i \) is a vector of other controls (including Income per Capita and Health Expenditures per Capita) with coefficient vector \( \delta \) and \( e_i \) is an error term capturing all other omitted factors.

Table 6 presents our baseline results. All regressions are OLS, and the dependent variable is the log of the adult mortality rate. There are 7 different specifications. We focus on the coefficient of M2/GDP, our measure of banking development and we control for the usual correlates included in health regressions including education, income and health expenditures, the main explanatory variables in health regressions. In most of the specifications we also include dummy variables for continents. The sample is a panel of 150 countries.

The results show that the relationship between adult mortality rate and M2/GDP is negative and significant, even when other variables, such as income per capita, health expenditure per capita, education, are held constant. In
Table 6: Cross Country OLS Regressions of ln of Adult mortality rates on M2/GDP and other variables

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln M2/GDP</td>
<td>-0.17*</td>
<td>-0.17*</td>
<td>-0.18*</td>
<td>-0.14*</td>
<td>-0.27*</td>
<td>-0.27*</td>
<td>-0.23**</td>
</tr>
<tr>
<td></td>
<td>(0.06)</td>
<td>(0.05)</td>
<td>(0.05)</td>
<td>(0.10)</td>
<td>(0.10)</td>
<td>(0.09)</td>
<td></td>
</tr>
<tr>
<td>Ln GDP per capita</td>
<td>-0.18**</td>
<td>-0.16***</td>
<td>-0.15**</td>
<td>-0.13</td>
<td>-0.06</td>
<td>-0.04</td>
<td>-0.13</td>
</tr>
<tr>
<td></td>
<td>(0.09)</td>
<td>(0.07)</td>
<td>(0.07)</td>
<td>(0.12)</td>
<td>(0.13)</td>
<td>(0.14)</td>
<td>(0.16)</td>
</tr>
<tr>
<td>Ln Health Expenditure per capita</td>
<td>-0.18*</td>
<td>-0.10</td>
<td>-0.11***</td>
<td>-0.14</td>
<td>-0.14</td>
<td>-0.17</td>
<td>-0.14</td>
</tr>
<tr>
<td></td>
<td>(0.06)</td>
<td>(0.06)</td>
<td>(0.09)</td>
<td>(0.10)</td>
<td>(0.11)</td>
<td>(0.11)</td>
<td></td>
</tr>
<tr>
<td>Ln education</td>
<td>0.11***</td>
<td>0.03</td>
<td>0.08</td>
<td>0.07</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.07)</td>
<td>(0.06)</td>
<td>(0.05)</td>
<td>(0.07)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln Gini</td>
<td>0.60*</td>
<td></td>
<td>-0.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.22)</td>
<td></td>
<td>(0.41)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continent Dummies</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of Observations:</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>113</td>
<td>150</td>
<td>150</td>
<td>113</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.68</td>
<td>0.74</td>
<td>0.75</td>
<td>0.78</td>
<td>0.75</td>
<td>0.75</td>
<td>0.77</td>
</tr>
</tbody>
</table>

Robust standard errors are reported in parentheses. Numbers with ** significant at 5%. Numbers with *** significant at 10%.

In columns 5, 6 and 7, we report OLS results of similar specifications but weighting each country by its population. The effect of M2/GDP on mortality is larger when not weighed by population size.

As a robustness check, Table 7 reports regressions results using as dependent variable mortality rates by gender and life expectancy instead of mortality rates for the population. As the table shows, the effect of our measure of banking development, M2/GDP, is significant at 1% level in most specifications. One curious result of this analysis is that the effect of banking development on mortality rates is much stronger for males than for females. When we use life expectancy as dependent variable, the coefficient is not significant without weighting for population.

In the last column of Table 7, instead of using M2/GDP as explanatory variable we use an index of banking development from the Financial Development Report of the World Economic Forum. Even though the sample is reduced because of data availability, we find a significant negative effect of bank development on mortality rates.

Overall, the results presented in this section suggest that the relationship between banking development and mortality that was found in the model is empirically important. These estimates suggest that banking development significantly reduces the mortality rate.

We realize that our estimates could have endogeneity problems and, as a consequence, there could be alternative interpretations to our empirical results. One alternative interpretation to our results is that the causality goes the other way around, better health implies that people in the economy are more likely...
Table 7: Cross Country OLS Regressions of ln of Adult mortality rates by gender and ln of Life Expectancy on Banking Development and other variables

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Ln Male Adult Mortality (1)</th>
<th>Ln Female Adult Mortality (2)</th>
<th>Ln Life Expectancy (3)</th>
<th>Ln Adult Mortality (4)</th>
<th>Ln Adult Mortality (5)</th>
<th>Ln Adult Mortality (6)</th>
<th>Ln Adult Mortality (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln M2/GDP</td>
<td>-0.18*</td>
<td>-0.22**</td>
<td>-0.23**</td>
<td>-0.22**</td>
<td>-0.08</td>
<td>-0.16</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>(0.05)</td>
<td>(0.08)</td>
<td>(0.10)</td>
<td>(0.05)</td>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.02)</td>
</tr>
<tr>
<td>Ln Financial Index</td>
<td>-0.81***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.45)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln GDP per capita</td>
<td>-0.11</td>
<td>-0.16</td>
<td>-0.12</td>
<td>-0.08</td>
<td>-0.07</td>
<td>0.07</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>(0.11)</td>
<td>(0.15)</td>
<td>(0.18)</td>
<td>(0.15)</td>
<td>(0.04)</td>
<td>(0.04)</td>
<td>(0.28)</td>
</tr>
<tr>
<td>Ln Health Expenditure per capita</td>
<td>-0.12</td>
<td>-0.08</td>
<td>-0.15</td>
<td>-0.18</td>
<td>0.01</td>
<td>0.02</td>
<td>-0.18</td>
</tr>
<tr>
<td></td>
<td>(0.08)</td>
<td>(0.10)</td>
<td>(0.12)</td>
<td>(0.03)</td>
<td>(0.03)</td>
<td>(0.03)</td>
<td>(0.17)</td>
</tr>
<tr>
<td>Ln Gini</td>
<td>0.60*</td>
<td>0.13</td>
<td>0.63*</td>
<td>-0.14</td>
<td>-0.26*</td>
<td>-0.06</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>(0.21)</td>
<td>(0.34)</td>
<td>(0.24)</td>
<td>(0.12)</td>
<td>(0.03)</td>
<td>(0.09)</td>
<td>(0.43)</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>113</td>
<td>113</td>
<td>113</td>
<td>113</td>
<td>112</td>
<td>112</td>
<td>44</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.72</td>
<td>0.73</td>
<td>0.82</td>
<td>0.79</td>
<td>0.80</td>
<td>0.82</td>
<td>0.73</td>
</tr>
</tbody>
</table>

All specifications include continent dummies. Robust standard errors are reported in parentheses. Numbers with ** significant at 5%. Numbers with *** significant at 10%.

to reach the retirement age and as a consequence they use the banking system more in order to save. Finally, there could be a third factor that explain both, banking development and health. For instance, "patient" economies are more likely to save and to invest more in health.

5 Conclusions

This paper considers both the theoretical and empirical issues of the effects of banks on health in an economy. We present a model and evidence that suggests that a more developed banking sector positively affects the health of the population.

The model predicts a negative relationship among mortality rate and the relative size of the banking system across economic units, after controlling for income. In the model, households save some resources for health precautionary motives, aside from the standard reasons for saving. The banking system allows households to save at lower costs, what encourage savings (and banks) and, as a consequence, reduces household’s mortality.

Using cross country data on countries mortality rates from WHO, we estimate the relationship between M2/GDP and mortality rates. The results show that the relationship between adult mortality rate and M2/GDP is negative and significant, even when other variables, such as income per capita, health expenditure per capita, education, are held constant. Overall, the results presented in this paper suggest that the relationship between banking development and
mortality is empirically important.

According to our analysis, the existence and size banks are important for health in a society including when output and other relevant variables are taken into account. Our model suggests that regions with less access to banking services are likely to be less healthy. A direct implication of the analysis is that banking regulations that make it more costly to use banking services probably are affecting people’s health.

References


