國立政治大學經濟學(系)研究所

碩士學位論文

信任,個人所得與國家財富

Trust, Individual Income and Nation's Wealth

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中 華 民 國 106 年 7 月

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This paper presents two modified models in which social trust is constructed in the representative household's budget constraint. The solutions of both models predict that trust is positively related with the overall output, while the predictions for the growth effect of trust are ambiguous. Using the cross-country data and Chinese province data, we find our result of empirical analysis suggests that trust should only has income effect but no growth effect. Furthermore, we find there's an important mutually enhancing relationship between human capital and trust. On individual level, the positive income-trust relationship is further verified using the Chinese survey data.

I. Introduction

Ever since Kenneth Arrow (1972, p. 357) recognizing that "it can be plausibly argued that much of the economic backwardness in the world can be explained by the lack of mutual confidence", economists made considerable efforts with large amount of literature providing reasonable support for Arrow's conjecture.

Traditionally, economists tend to do analysis under the hypothesis of perfectly rational individuals and model economic transactions relying on contracts enforcing rather than mutual trust. Nevertheless, much evidence from social experiments suggests that individuals' behavior in real world deviates from the prediction of traditional economic analysis. During the anonymous sequential prisoner's dilemma experiment, which is the typical Nash equilibrium case, half of the first-move players choose to trust their stranger partner and three-quarters of second-move players choose to repay with the

same trust (Berg, Dickhaut, McCabe, 1995; Smith, 1998). These facts reveals the fact that probably we underestimate the power of trust when trying to economically modeling our real living world in the past.

Till now, much efforts has been made to improve the understanding of trust in economic activity and it is generally accepted that trust is positively related with economic performance by reducing transactional costs, providing more incentives to innovate, improving government policy efficiency and by improving the return of human capital (Putnam 1994; Porta et al. 1997; Keefer and Knack, 1997). In Zak and Knack's work (2001), they provide a general equilibrium heterogeneous agent growth model to determine the consequences of different levels of trust on economic performance, and their empirical result verifies the positive relationship between social trust and economic growth across countries. Apart from the analysis under the macro-level framework, economists recently also noticed the individual trust has substantial impact on personal economic performance. Individual income is hump-shaped in a measure of intensity of trust beliefs (Butler, Giuliano, Guiso, 2016). Highly trusting individuals has higher risk regarding being cheated while too much pessimistic attitude results in tendency to give up risky profit opportunities.

Though both on the country level and individual level, trust has been tested and confirmed to be positive related with economic performance, there's still little research concerning the subject that to build a bridge to combine both the macro and micro level results systematically. Thus the latter blank is the focus of this paper.

This paper presents a modified RBC model and a modified AK model to approach the mechanism of trust influencing the economic performance in real world. In both models, trust is introduced through a non-discriminative, risky

investment market aiming to influence the economic performance. In this investment market, a fully trusted society will repay the principal and all the revenues, while a poorly trusted society indicates that large risk for households to lose all the money. We permit households to choose the degree they invest based on the known social trust level and in this way, the individual investment decision and, in turn, the performance of the economy is characterized by the trust variable. In both models, we show that people tend to invest more with higher social trust level. As a result, higher social trust level predicts both a better welfare for individuals and a better overall output level for society. However, the growth effect of trust is ambiguous with the two models' distinguishing results. The RBC model suggest no growth effect while the AK model indicate positive growth effect of trust.

Following the predictions of both models, in the latter part of this paper, we provide empirical analysis to investigate the role of trust in real world economy. We use both Chinese province data and cross-country data to estimate the macro-level relationship between trust and economic performance. The advantage to introduce Chinese province data, is that it avoid the concern of translation bias in the survey which are commonly reported in cross-country research, and it also provides stronger causality implication as these provinces share a quite similar culture and thus less unidentified interferences than cross-country data. Because the models we introduced provide insights of both growth effect and income effect of trust, we investigate both the links between trust and economic growth, income level. The result of our empirical analysis suggests that trust has only income effect and no growth effect, which is consistent with the predictions of our modified RBC model. For the individual level test, we use Chinese individual data to test both how individual and social trust affect

each person's income. Through the empirical analysis, it is verified that trust has a significantly positive impact on individual income.

This paper is structured as follows. In Section II we present the two modified models and their implications. In Section III, we describe the survey data and present basic descriptive results. In Section IV we test the models' predictions with empirical analysis both on macro and micro economic performance level, and finally, Section V concludes.

II. The Theoretical Models

A. The Modified RBC Model

Consider an economy consists of a large number of identical, price-taking firms and a large number of identical, price taking, infinitely lived households. The inputs to production are capital (K), labor (L), and technology (A). Each period, a constant growth rate g and a disturbance constitute the growth of the technology. The production function is Cobb-Douglas, and the output in period t is

(1) $$Y_t = K_t^{\alpha}(A_t L_t)^{1-\alpha}, 0 < \alpha < 1,$$

(2) $$lnA_t = \bar{A} + gt + \tilde{A}_t.$$

Output is divided among consumption (C), investment (I), and government purchase (G). Each period, fraction δ of capital is depreciated. Therefore, the capital stock in each period $t+1$ is

(3) $$K_{t+1} = K_t + I_t - \delta K_t.$$

For firms are price-taking participants in the perfect competitive market, both labor and capital are paid with their marginal products. Thus the real wage and interest rate are

(4) $$w_t = (1-\alpha)\left(\frac{K_t}{A_t L_t}\right)^{\alpha} A_t,$$

(5) $$r_t = \alpha(\frac{A_t L_t}{K_t})^{1-\alpha} - \delta.$$

The representative household maximizes their expected value of utility function,

(6) $$U = \sum_{t=0}^{\infty} e^{-\rho t} u(c_t, 1 - l_t) \frac{N_t}{H}.$$

(7) $$u_t = lnc_t + bln(1 - l_t), b > 0$$

$u(\blacksquare)$ is the instantaneous utility function of the representative member of the household, and ρ is the discount rate. c_t is the consumption per member for the household, and l_t is the labor supply per member (for simplicity, the time endowment per member is normalized to 1). N_t is population and H is the number of households in the economy; therefore $\frac{N_t}{H_t}$ is the number of members of the household. For simplicity, we assume in the model that $\frac{N_t}{H_t} = 1$, i.e. only one member in each household. Population grows exogenously at a constant rate n:

(8) $$lnN_t = \bar{N} + n, n < \rho.$$

Assume all households can participate in a non-discriminative bond market with the help of agents, thus households can allocate their income either on current consumption for instant utility at period t, or they can invest a fraction of their income in the bond market for future consumption. Nevertheless, it is assumed that the bond market is not risk-free and agents in the bond market may choose to cheat their clients with the probability μ $(0 \leq \mu \leq 1)$. We consider the probability of successful investment $1 - \mu$ as a proxy for the society's objective trust level and assume the representative household has the full information about the overall risk in the bond market. The intuition for this hypothesis is straightforward that other things being equal, with higher social trust, it is reasonable for households to have better opportunity to gain profit

from investment and they should tend to invest more; thus the overall investment probability should reflect the social trust level. In a fully trusted society, no clients in the bond market will face the risk being cheated and thus $\mu = 0$. And in a society everyone distrust each other, consumers entering the market will always get cheated by their agents and $\mu = 1$. For a normal society in real life, the probability will range from 0 to 1, and the higher the cheating probability, the lower the trust level of the society. For each household facing the risk in the bond market, their expected value of the bond revenue equals to $(1-\mu)(1+r_t)b_t$, where b_t denotes the amount of money household paid for the bond at the beginning of period t. Therefore, as a representative household, the budget constraint for each period is

(9) $$c_t + b_{t+1} = (1-\mu)(1+r_t)b_t + w_t l_t,$$

(10) $$c_{t+1} + b_{t+2} = (1-\mu)(1+r_{t+1})b_{t+1} + w_{t+1} l_{t+1}$$

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Substitute the term b_{t+1} in equation (9) with equation (10) and rewrite the budget constraint. For one representative household, the maximization problem is

(11) $$\text{Max U} = \sum_{t=0}^{\infty} e^{-\rho t}[lnc_t + bln(1-l_t)],$$

(12) $$s.t \sum_{t=0}^{\infty} \frac{l_t}{(1-\mu)^t(1+r_t)^t} = \sum_{t=0}^{\infty} \frac{w_t}{(1-\mu)^t(1+r_t)^t}.$$

Therefore, the first order conditions for c_t and l_t, respectively, are

(13) $$\frac{1}{c_t} = e^{-\rho}(1-\mu)E_t \frac{1}{c_{t+1}}(1+r_{t+1}),$$

(14) $$\frac{w_t}{c_t} = \frac{b}{1-l_t}.$$

Equation (13) shows that for household's optimal decision, current consumption is positively related with the cheating probability, and thus negatively related with the society's trust level. With lower trust level and higher

cheating probability, rational household will tends to avoid to invest in the bond market and to increase current consumption compared with a high trust-level society. As under the framework of RBC model that society can only accumulate capital through private investment, the implication is rather straightforward that economy will suffer from underinvestment in a low trust-level society.

The model above however cannot be further solved as it contains a mixture of linear and log-linear ingredients. To simplify the situation, we make two changes to the model: we eliminate government purchase and assume that fully depreciation in each period. Therefore, the evolution of capital stock and the determination of the real interest rate follows the pattern

(15) $$K_{t+1} = Y_t - C_t,$$

(16) $$r_t = \alpha(\frac{A_t L_t}{K_t})^{1-\alpha} - 1.$$

Consider s_t denotes the saving rate for a representative household. Because household can only save to invest or to consume instantly in the period t, we have

(17) $$c_t = (1 - s_t)\frac{Y_t}{N_t}.$$

Substitute both equation (16) and (17) into the household optimization condition equation (13), we have

(18) $$-\ln\left[(1 - s_t)\frac{Y_t}{N_t}\right] = -\rho + lnE_t \frac{\alpha(1-\mu)(Y_{t+1}/K_{t+1})}{(1-s_{t+1})(Y_{t+1}/N_{t+1})},$$

or

(19) $$-ln(1 - s_t) = -\rho + \ln\alpha + \ln(1 - \mu) + n - lnE_t(1 - s_{t+1}) - lns_t.$$

For equation (19) has to holds for every time period t, there must be a constant saving rate $\bar{s}$ that satisfies the condition. Therefore, substitute both s_t and s_{t+1} with $\bar{s}$, the equation (19) becomes

(20) $$\ln(\bar{s}) = ln\alpha + \ln(1-\mu) + n - \rho,$$

or

(21) $$\bar{s} = (\alpha + 1 - \mu)e^{n-\rho}.$$

Now consider equation (14), as $c_t = C_t/N_t = (1-\bar{s})Y_t/N_t$, we can compute that

(22) $$l_t = \bar{l} = \frac{1-\alpha}{(1-\alpha)b(1-\bar{s})} = \frac{1-\alpha}{(1-\alpha)b[1-(ln\alpha+\ln(1-\mu)+n-\rho)]}.$$

Equation (21) and (22) have important implications how trust affect the consumption and labor supply of the representative household. Both equations indicate that the representative household tends to save more and work more with higher trust level of the society. As households' income can only come from wages and bond revenues, a society with higher trust level implies better income level for households. In turn, as only households provide investment and labor supply for the firms, the production of the economy will benefit from higher trust level.

To see the effect of trust on the economy directly, substitute $K_t = \bar{s}Y_{t-1}$ and $L_t = l_t N_t$ into the production function; thus

(23) $$lnY_t = \alpha ln\bar{s} + \alpha lnY_{t-1} + (1-\alpha)(lnA_t + ln\bar{l} + lnN_t).$$

Backward the equation (23) for one period and combine both equation (23) and (24); let g_t^Y denotes the growth rate of production in period t, thus

(24) $$lnY_{t-1} = \alpha ln\bar{s} + \alpha lnY_{t-2} + (1-\alpha)(lnA_{t-1} + ln\bar{l} + lnN_{t-1}),$$

(25) $$lnY_t - lnY_{t-1} = \ln(1+g_t^Y) = \alpha(lnY_{t-1} - lnY_{t-2}) + (1-\alpha)(\tilde{A}_t - \tilde{A}_{t-1} + g + n).$$

Equation (23) suggests that the level of output is positively related with both the saving rate and household's labor supply, thus is positively related with a society's trust level. However, equation (25) shows that the growth rate of the output is only affected by the growth rate of population and technology, as

both the output level in period $t-1$ and $t-2$ will be certain historical information when predicting the economic performance in period t. Both equations suggest that trust has only level effect but no growth effect on the output of the economy. A society with high trust level will experience better output level and thus better welfare for the households. Nevertheless, the growth rate of the output will not be affected by the trust level of certain economy.

B. The modified AK Model

The pitfall with the modified RBC model is that the result of no growth effect of personal investment, thus our trust indicator, is ultimately determined by the assumption of diminishing returns of the reproductive factors embedded in the production function. Thus it would be arbitrary to exclude the possibility of growth effect from trust. In this part, we provide a simply modified AK model with household optimization that trust actually provide certain growth effect.

Consider an economy consists of a large number of identical, price taking, infinitely lived households. The inputs to production are period-changing capital (K), and technology (A) which is assumed constant. The production function is a linear function of the capital stock that,

(26) $$Y_t = AK_t, \text{ (A>0, A is constant).}$$

In the economy, output is divided among consumption (C) and investment (I). Each period, faction δ of capital stock is depreciated.

In contrast with the RBC model, because labor is no longer an input factor in the production function, the representative household optimize their life-long welfare only by properly allocating their income between investment and consumption in each period. The utility function for each representative

household is set as

(27) $$U = \sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\alpha}-1}{1-\alpha} \frac{N_t}{H}.$$

In the utility function, β is the discount rate and c_t is the consumption per member for the household. N_t is population and H is the number of households in the economy; therefore $\frac{N_t}{H_t}$ is the number of members of the household. Similar as the RBC model, we assume $\frac{N_t}{H_t} = 1$ for simplicity

Following our trust setting in the RBC model, we hence assume that households face a risky investment market where they will be cheated by their agents with probability of μ $(0 \leq \mu \leq 1)$. Thus their expected total income equals to $(1-\mu)[y_t + (1-\delta)k_t]$, where y_t is the per capita income from investment and $(1-\delta)k_t$ is the capital stock after deducting the deprecation. The budget constrain of the representative household for each period is

(28) $$k_{t+1} + c_t = (1-\mu)[y_t + (1-\delta)k_t].$$

For a representative household, the maximization problem is

(29) $$\text{Max } U = \sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\alpha}-1}{1-\alpha},$$

(30) $$\text{s.t } k_{t+1} + c_t = (1-\mu)[y_t + (1-\delta)k_t].$$

Use the Lagrangian to solve the optimization problem, and the first order conditions for c_t and k_{t+1}, respectively, are

(31) $$\mathcal{L} = \sum_{t=0}^{\infty} \beta^t \{\frac{c_t^{1-\alpha}-1}{1-\alpha} + \lambda_t[k_{t+1} + c_t - (1-\mu)(Ak_t + (1-\delta)k_t)]\},$$

(32) $$\frac{\partial \mathcal{L}}{\partial c_t} = c_t^{-\alpha} + \lambda_t = 0,$$

(33) $$\frac{\partial \mathcal{L}}{\partial k_{t+1}} = \lambda_t - \lambda_{t+1}\beta(1-\mu)[A + (1-\delta)]=0.$$

Combing both equation (32) and (33), we have the necessary condition for household optimization that

(34) $$(\frac{c_{t+1}}{c_t})^{\alpha} = \beta(1-\mu)[A+(1-\delta)].$$

The result of equation (34) shows that with higher social trust, i.e. higher value of $(1-\mu)$, the share of consumption in the next period against the current consumption is higher. Because the technology level is fixed in our production function, the only way to increase future consumption for representative households is to sacrifice their current consumption and invest more. Hence, the implication of equation (34) is consistent with our findings in the modified RBC model that households tends to invest more in a society with high trust.

For the simplicity of our analysis, we only solve for the constant growth path so we don't need full policy functions. Let g_t^y, g_t^c, and g_t^k to denote the growth rate of per capita income, consumption and investment. With the condition from equation (34), we have the consumption growth rate equals to

(35) $$g_t^c = \left(\frac{c_{t+1}}{c_t}\right) - 1 = \{\beta(1-\mu)[A+(1-\delta)]\}^{\frac{1}{\alpha}} - 1.$$

Because the capital stock per capita in our model is solely determined by the investment and deprecation, we have the physical capital growth rate at

(36) $$g_t^k = \frac{k_{t+1}-k_t}{k_t} = \frac{Ak_t - c_t - \delta k_t}{k_t} = A - \frac{c_t}{k_t} - \delta.$$

Notice that under the assumption of constant growth rate of capital, the value of $\frac{c_t}{k_t}$ needs to be constant. Therefore, in a stationary state growth path, $g_t^c = g_t^k = g_t^y = g^*$. Combining both the equation of (35) and (36), we solve the value of $\frac{c_t}{k_t}$ that

(37) $$\frac{c_t}{k_t} = \frac{c}{k} = A - \delta - \{\beta(1-\mu)[A+(1-\delta)]\}^{\frac{1}{\alpha}} + 1.$$

Hence, the growth rate of physical capital and income per capita equals to

(38) $$g_t^k = g_t^y = A - \frac{c}{k} - \delta = \{\beta(1-\mu)[A+(1-\delta)]\}^{\frac{1}{\alpha}} - 1 = g_t^c.$$

The result of equation (38) suggests that with higher social trust level, the accumulation of physical capital and more importantly, the economy grow faster, i.e. that trust has growth effect. As the output of the economy is a linear function of the level of physical capital under the specification of AK model, the growth effect of trust will also promise the income effect. Notice the implication of equation (38) is dramatically different from the result of our modified RBC model. The mathematical results of our modified AK model suggest that trust has both output and growth effect, while the modified RBC model indicates that trust should only have income effect.

To sum up, the two models in which households face risky investment market provide several important insights about the economic effect of trust that needs to be tested in our later empirical analysis:

a. Both model suggest that a higher trust level will encourage households to increase private investment. In the long run, such decision will benefit the households with better welfare level.
b. Both model suggest that an economy with higher trust level, benefit from higher private investment, will produce a higher overall output, i.e. that trust should have income effect.
c. The growth effect of trust is ambiguous. The modified RBC model suggests that growth rate of the output of certain economy is not affected by the trust level in that society, while the modified AK model, on the contrary, indicates that trust has growth effect.

III. Data

A. Measuring Trust

The most important step in testing the prediction of the model is to identify a reliable measure of trust. For cross-country data, we use the measure based on the data from the sixth wave of World Value Survey (WVS) conducted from year 2010 to year 2014. The advantage to use the latest wave of the WVS data is that we can includes as many as the number of the countries in our estimation and it helps to see the general trust effect on economy in different countries, the drawback is obviously that it may mess with the causality in the equation with the time lag between trust indicator and countries' economic performance. Nevertheless, literature in the past cautiously consider trust is less sensitive to time, or in other words, generalized trust is stable over time (Bjørnskov, 2007); in Keefer and Knack's estimation (1997, p. 1267), they find " trust value for 1980 and 1990 are correlated at .91" and "changes in trust over the decade are uncorrelated with growth rates". Thus these findings imply that trust however can be viewed as a slowly-changed characteristic of certain society in a quite large time scale.

The question used to access the level of trust for a certain country is:" Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people". The trust indicator we use in the paper is the percentage the respondents in each country replying "Most people can be trusted". This trust indicator we use follows Zak and Knack's framework when testing the trust's growth effect in their 2001's work, and since then many other researches concerning the subject of general trust also pick the same trust indicator. Furthermore, Knack and Keefer (1997) provide empirical support for the validity of these data and find that values for trust is consistent with lab experiment results and case study across countries.

For Chinese data, we use the measure based on the data form the Chinese

General Social Survey (CGSS) conducted in year 2003, 2005, 2010 and 2013. The question used in the survey to measure trust level is that "Generally speaking, how do you trust the strangers" in the year 2003 and 2005; and for year 2010 and 2013, the question is "Generally speaking, would you say that most people can be trusted". Different from the World Value Survey, the Chinese General Social Survey measures the intensity of individual's trust beliefs on a scale from 1 to 5, in which "1" means that strongly distrust and "5" means strongly trust. With this trust intensity data, we are able to estimate the relationship between trust and individual income. Furthermore, we use the mean value of individuals' trust in each province as the trust indicator on province-level and then test the trust effect on macro economy performance as our theoretical models predict.

One problem with using survey data to represent and compute society trust level is that the survey can only capture the subjective trust level of individuals. Though using mean value can predict the average trust level for all individuals in the society by eliminating the impact of certain individual's subjective deviation from the society trust, it is still necessary to verify that if the mean of subjective individual trust is a good proxy for the overall society's objective trust level. Aiming this, we provide a Monte Carlo simulation based on a simplified trust model to test the relationship between the individuals' subjective mean trust value and the society's objective trust level.

In order to realistically imitate the mechanism of how real social trust works, the simulation model includes the randomness of the individual's trust, the way subjective social trust is established, and the mutually adjustment of trust levels between society and individuals. In the trust model for the purpose of simulation, we use a uniform distribution between 0 and 1 to randomly

generate the initial trust level of individuals. The subjective trust level, is calculated using the individuals' average. And the key adjustment mechanism is represented with a one-time Bernoulli trial as an approximation for the individual investment.

The simulation starts with only one individual. The system first generates a random number between 0 and 1 for the individual to represent the born trust level. Thus at the start, the subjective social trust equals to the individual trust, as it is calculated as the individuals' average in the whole society. Later the first individual do the one-time Bernoulli trial with the success probability equals to the objective social trust given in advance. Recall the models in Section II, as all households face a non-discriminative investment market, the probability for successive investment equals to the objective trust level, or more specifically $1-\mu$. If the investment trial succeeds, the individual will increase his trust but no more than the ceiling limit of the uniform distribution. The process of the increase will be generated by the system randomly within the uniform distribution. If the investment trial fails, the individual will decrease his trust level randomly, in the same way with a result of success investment. With the adjustment of the individual's trust, the subjective social trust will in turn be calculated again. Following the same process, the system includes more individual for one person each time and repeat the loop continuously. Under this framework, we are able to investigate the dynamic of subjective social trust and compare it with the exogenous objective trust level. Figure 1 shows the logic of a single loop for the process,

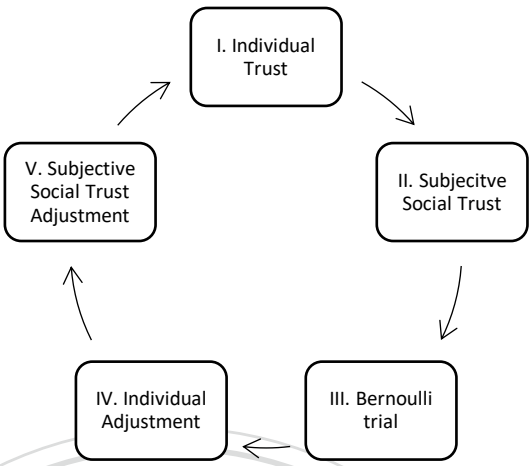

Figure 1 the Simulation Process

Figure 2 shows the simulation results with the success probability value, i.e. the objective social trust, set at 0.2, 0.6 and 0.9. The line from bottom to top are the results for success values set at 0.2, 0.6 and 0.9, showing the dynamic values of subjective social trust level during the simulation. The results show that the system equilibrium for average subjective trust level is critically determined by the success level. With higher success level or social trust level, the mean value of individuals' subjective trust tends to be higher than it in a low social trust level society. The confusion of the result is that the average subjective though accurately reflect the rank of the objective trust, the value of the average subjective trust is not exactly the same as the objective trust given. This problem lies in the fact that for the simplicity of the simulation, the born trust level of individuals is randomly generated using the uniform distribution and not affected by the objective social trust; that is to say, only the mutual relationship between individuals and social trust is included in the simulation, but the mutual relationship between individuals is neglected. Anyway, the focus of the simulation is to test whether average subjective trust can be a proxy for the objective trust, and as long as the rank of trust is not affected, it is reasonable to use mean value of individuals' subjective trust survey data as

an approximation for the objective social trust level. Therefore, the trust data from both WVS and CGSS can be confidently used in our estimation.

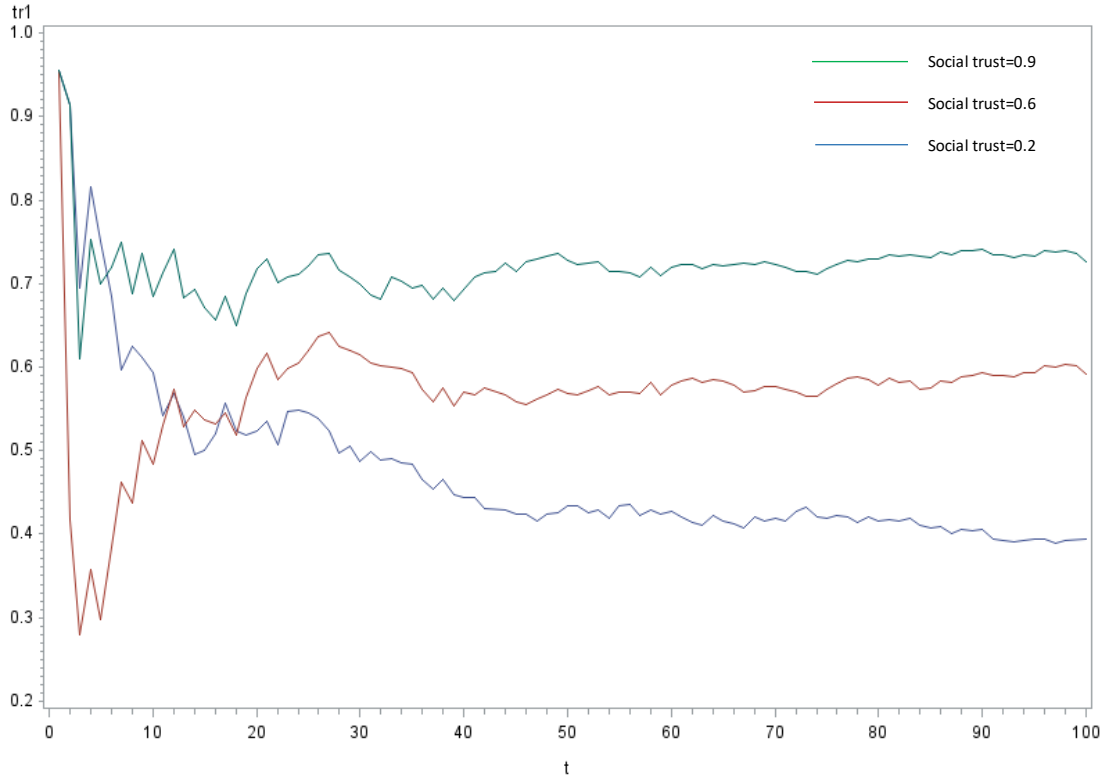

Figure 2 Simulation Result for Different Social Trust Level

Notes: From bottom to top, the values of social trust are set at 0.2, 0.6 and 0.9.

B. Other Data and Estimation Model

To investigate the trust effect on the macro economic performance, we use both cross-country data and Chinese province data to test the predictions of our theoretical models. The cross-country data used in the paper is an unbalanced panel data covering 57 countries from year 1950 to year 2011. Except that the trust level data for each country is derived from the World Value Survey, all other data for cross-country analysis comes from the Penn World Table Database. The Chinese province data is an unbalanced panel data

covering 19 provinces with the period in year 2003, year 2005, year 2010 and year 2013. Only provinces in eastern, middle and north-eastern region are included in the estimation dataset. The reason to exclude western provinces is that the economic development strategy in these provinces are highly natural resourced-oriented and government investment depended. This kind of economic development strategy deviates greatly from the generally accepted economics model, and quite different from the market-oriented economic development in which trust can make a difference, thus will surely cause unnecessary confusion in our estimation result if included. Similar to the cross-country dataset, the trust level data on province level are derived from the survey data, more specifically, the Chinese General Social Survey. All other economic related data sources from the National Bureau of Statistics of China (NBSC).

In order to test both the growth and income effect of trust, the primary variables are the 5-year average GDP growth rate and the 5-year average GDP per capita. The reason to use 5-year mean value for both growth rate and per capita income, is that it provides a time lag between the dependent economic performance variable, and other independent explanatory variables. Therefore, the causality in the estimation result is clearly displayed rather than using one-year dependent economic performance variable.

Following the production form in the model, we set the basic regression equation as

$$Y_{i,t} = c + \beta_T Trust_{i,t} + \beta_y y_{i,t} + \beta_{pop} pop_{i,t} + \beta_I I_{i,t} + \beta_{HC} HC_{i,t} + \beta_{TFP} Tec_{i,t} + \sigma_i + \tau_{i,t}.$$

To test the growth effect of trust, $Y_{i,t}$ denotes the 5-year average GDP growth rate at time t for country or province i depending on the dataset

used. And to test the income effect of trust, $Y_{i,t}$ denotes the 5-year average GDP per capita. The variable $Trust_{i,t}$ denotes the mean value of individual trust survey data at time t for country or province i. The variable $y_{i,t}$, $pop_{i,t}$, $I_{i,t}$, $HC_{i,t}$, $Tec_{i,t}$ denote the GDP per capita, the growth rate of population, the investment rate, the human capital indicator and the technology level. Notice that the variable of GDP per capita and the growth rate of population are only included as explanatory variable when testing the growth effect. While testing the income effect, the variable GDP per capita is the dependent variable in the estimation process. For cross-country data, all these variables are offered or can be computed from the Penn World Table database directly. However, for Chinese province data, no commonly used human capital indicator, average population schooling years for example, is available on province level. Therefore, we use the share of the number of college students among the overall population in each province as an approximation for human capital indicator. Using this proxy implies a very strong assumption that all college students studying in certain province will stay and work in the same province to provide the benefit of their human capital, and thus should overestimate the human capital stock in the province. Particularly, we include the share of first industry of GDP in our Chinese province estimation. The reason is that the economic gap between agriculture and non-agriculture provinces in China is substantial, thus agriculture provinces may experience fewer productivity growth opportunities than industrial provinces in China (Demurger, 2001).

Notice that for cross-country data, only one wave of WVS data is added as the trust variable, thus the panel dataset can only be estimated using the random effects model. Otherwise, the same trust variable for each country will

be automatically dropped if try fixed effects model. For the Chinese province data, the result of Hausman test is 0.0036 for the base model estimating the growth effect, and 0.0105 estimating the income effect. Both values are less than the commonly used critical value 0.05. Therefore, all regression related with Chinese province data are estimated using the fixed effects model.

According to the past literature results and the prediction of our model, the expected sighs of parameters are $\beta_T >, or = 0, \beta_y < 0,\ \beta_{pop} > 0,\ \beta_I > 0,$ $\beta_{HC} > 0$ and $\beta_{TFP} > 0$ when testing the growth effect of trust; and $\beta_T > 0,$ $\beta_I > 0,\ \beta_{HC} > 0$ and $\beta_{TFP} > 0$ when testing the income effect. As our model predicted in the Section II, the growth effect of trust is ambiguous but it is certain that trust ought to be positively related with the output level. Labor supply, physical capital, human capital and technology are direct inputs in the production function, and thus should reasonably contribute to a better economy performance.

Table 1 provides summary statistics for the main variables. The cross-country trust level ranges from 0.028 to 0.682 with an average of 0.261. The Chinese province trust level ranges from 1.430 to 3.710 with an average of 2.706. The difference between cross-country data and Chinese province data comes from the different scale assigned to the survey answer. While the WVS for cross-country data only provide two answers for the respondents (0 for distrust and 1 for trust), the CGSS data provides the intensity data of individuals' trust belief ranging from 1 to 5. The trust data cannot be compared across the two datasets, but can only be done so between the samples within the dataset themselves.

Table 1 Descriptive Statistics for Cross-Country and Chinese Province Data

Panel A. Cross-Country Data

Variables	Mean	SD	Min	Max
GDP Growth Rate	0.050	0.086	-0.663	1.608
GDP per capita(US dollar)	11485.859	12778.201	515.663	134040.000
Population growth rate	0.017	0.018	-0.181	0.204
Trust	0.261	0.183	0.028	0.682
Investment Rate(I/Y)	0.220	0.089	0.007	0.802
Human Capital Index	2.294	0.597	1.071	3.619
TFP	0.782	0.505	0.145	7.364

Based on a sample of 2383 observations

Panel B. Chinese Province Data

Variables	Mean	SD	Min	Max
GDP Growth Rate	0.118	0.022	0.077	0.174
GDP per capita(Yuan)	32314.632	22614.331	6375	100105
Population growth rate	0.009	0.017	-0.056	0.058
Trust	2.706	0.715	1.430	3.710
Investment Rate(I/Y)	0.480	0.118	0.311	0.879
Human Capital Index	0.017	0.007	0.005	0.036
First Industry Share	0.110	0.069	0.006	0.342

Based on a sample of 76 observations

Because the intensity of individual's trust belief data are only available in the CGSS database, only Chinese individual data are used to investigate the trust effect on personal income. The Chinese individual data used in the estimation sources from the 4 waves of the CGSS in year 2003, 2005, 2010 and 2013. For the reason that CGSS chooses the survey respondents randomly each wave, we can only construct a pooled dataset and use OLS method for estimation.

The primary dependent variable is the personal income over the year. To eliminate the price effect on the income, we take the price level in year 2003 as the base and use consumer price index provided by the NBSC to adjust the income data in the later 3 waves of the survey. Other explanatory variable included in the estimation are the status of household registration (or Hukou),

gender and schooling years of the respondent, the average working hours per week and working experience of the respondent, and most importantly, the individual trust level and the social trust level. The individual trust level uses the respondent's answer facing the question that "Generally speaking, how do you trust the strangers" in the year 2003 and 2005; and "Generally speaking, would you say that most people can be trusted" in the year 2010 and 2013. The social trust level equals to the mean value of all the individuals' trust in the same province and the survey wave that the respondent belongs to.

Following the past literature, we set the basic regression model as

$$Y_i = \beta_T Trust_i + \beta_{ST} ST_{i,t} + \beta_{HK} HK_i + \beta_g G_i + \beta_{Edu} Edu_i + \beta_{WH} WH_i + \beta_E E_i + \beta_{E^2} E_i^2 + \varepsilon_i$$

In the equation, Y_i denotes the personal income over the year for individual i. The variable $Trust_i$ denotes the individual trust level while ST_i denotes the social trust level the respondent belongs to. The variable HK_i and G_i are dummy variables and denote the respondent's status of household registration and gender; the value "0" implies that the respondent lives in rural area and is female, while the value "1" implies the respondent lives in urban area and is male. The variable Edu_i, WH_i, and E_i denote the respondent's schooling years, the average working hours per week and working experience. The variable E_i^2 included in the estimation aims to capture the non-linear income effect of working experience. According to the past literature results and the prediction of our model, the expected sighs of parameters are $\beta_T > 0$, $\beta_{ST} > 0$, $\beta_{HK} > 0$, $\beta_g > 0$, $\beta_{Edu} > 0$, $\beta_{WH} > 0$ and $\beta_E > 0$, $\beta_{E^2} < 0$. It is predicted according to the model that trust has a positive effect on the individual's income. Both past research results and evidences in China indicates that male residents live in urban area generally earn more. And

because education, working experience help individual to accumulate higher human capital, the effect of both should enhance one's ability to earn more income.

Table 2 provides summary statistics for the main variables for the Chinese individual data.

Table 2 Descriptive Statistics for Chinese Individual Data

Variables	Mean	SD	Min	Max
Income(Yuan)	19738.744	30652.840	500	800000
Individual Trust	2.474	1.174	1	5.000
Social Trust	2.498	0.730	1.430	3.960
Household Registration(1 stands for urban area)	0.645	0.478	0	1
Gender(0 stands for female)	0.549	0.498	0	1
Schooling Years	10.204	3.867	0	18.500
Average Working Hours per Week	51.454	14.268	20	98.000
Working Experience(Year)	20.799	12.697	0	50.000

Based on a sample of 18809 observations

IV. Empirical Analysis

A. Trust and Nation's Wealth

Table 3 shows the result for testing the growth effect of trust. Equation (1) and Equation (3) provide base regression result for cross-country data and Chinese province data.

For cross-country data, the basic regression model performs well in predicting the dynamic of country level 5-year growth rate. The variable GDP per capita, the growth rate of population, investment rate, human capital indicator and technology indicator are all statistically significant. Nevertheless, the total R^2 for both the cross-country regression equations are not ideal. The possible reason for this result is that different countries may have quite different economic growth strategy. Consider only labor supply,

Table 3 Estimation Result for Growth Effect of Trust

	Cross-country Date		Chinese Province Data			
Equation	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Growth	Growth	Growth	Growth	Growth	Solow residual
GDP per capita(log)	-0.0211345***	-0.021456***	-0.1231263***	-0.1248364***	-.1231908***	
	(0.002648)	(0.0026574)	(0.0115759)	(0.0147904)	(.0150213)	
Growth of Pop	0.2094946***	0.211396***	0.0482587	0.0767829	.0769898	
	(0.069101)	(0.0692188)	(0.0985474)	(0.1001783)	(.1006493)	
I/Y	0.0554472***	0.0540036***	0.0148418	0.017605	.0098945	
	(0.0138296)	(0.0138847)	(0.0192141)	(0.0195354)	(.022161)	
Human Capital	0.0127934***	0.0128063***	2.014531**	1.931158**	1.793417**	
	(0.0040128)	(0.0040412)	(0.7762165)	(0.7992508)	(.8237765)	
TFP	0.0140022***	0.0138946***				
	(0.0030672)	(0.0030702)				
First Industry Share			-0.24466**	-0.2567873**	-.256286**	
			(0.0920267)	(0.0987128)	(.0991788)	
Trust		0.0113992		-0.0001801	.0002436	-0.0023621
		(0.0119075)		(0.0031814)	(.0032459)	(0.0027123)
Saving/Y					-.022079	
					(.0294652)	
R-squared	0.0395	0.0386	0.5092	0.5054	0.5821	0.0070
Observations	2,383	2,383	76	72	72	109

Notes:

a. As the result of Hausman test suggests, equation (1), (2), (6) are estimated using random effects model; equation (3), (4), (5) are estimated using fixed effects model.

Sources: Author calculations.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

investment, human capital and technology may not be sufficient to account for all factors that contributes to particular country's growth. Thus it may not be suitable to use one simple and same growth regression to portray the dynamic of growth in 57 different countries included in our dataset. However, as the growth effect of trust is the main concern for the paper, comparing the equation (1), (2) and we see that no evidence according to the regression suggest trust contributes to positive growth for certain economy.

For Chinese province data, the basic regression we used in the estimation performs as predicted with only two exceptions, the growth rate of population and the investment rate. The level of GDP per capita, the human capital indicator and the share of first industry in GDP are statically significant. Economy tends to grow faster with lower GDP per capita and higher human capital level; in addition, agricultural provinces experience less growth compared with industrial province, which is commonly observed in China. Combining both equation (3) and (4), similar to the result for the cross-country data, the estimated coefficient for trust is not statistically significant thus implying trust has no growth effect on province level in China. Therefore, both regression from cross-country data and Chinese province data are consistent with the prediction of the modified RBC model in Section II that the growth rate of the output of certain economy is not affected by the trust level in that society.

Recall that in the modified RBC model of Section II, the mathematical solution indicates that trust affect the macro economy through a constant saving rate under the assumption of no government purchase and fully depreciation. Controlling for the saving rate in the growth regression (equation 5), we see that both the trust coefficient and the saving rate coefficient remain statistically insignificant. This finding indicates that the economic growth in provinces of China is not affected by trust directly, or through saving rate indirectly.

To further justify our empirical finding that trust may have no growth effect, we include the concept of Solow residual. Follow the method Chang-Tai Hsieh (1999) provided in his work, Solow residual equals to

$$SR = \hat{Y} - s_k\hat{K} - s_l\hat{L} = s_k\hat{r} + s_l\hat{w},$$

where $s_k \equiv rK/Y$, $s_l \equiv wL/Y$ are the factor income share. Variable r and w denote the payments to per unit capital and labor so that $Y = rK + wL$. Variable $\hat{Y}$, $\hat{K}$ and $\hat{L}$ denote the growth rate of output, capita and labor. Therefore, Solow residual is the residual that the growth rate of output after subtracting the share-weighted growth in factor quantities. In other words, Solow residual is the residual growth rate of output that cannot be explained by direct factor inputs and if trust contributes to certain economy's growth, then trust should be significantly related with the Solow residual. As the constraint of data availability, only the Solow residual of Chinese provinces are calculated. Equation (6) provides the empirical result for the link between Solow residual and trust. The result of Hausman test equals to 0.9399, thus the regression is estimated using random effects model. The finding of the estimation shows that no statistically significant relation exists between these two variable and thus furthermore verifies that no growth effect of trust.

Combing the empirical result both from the cross-country data and Chinese province data, we are confident with the estimation finding that trust has no growth effect.

Table 4 shows the result for testing the income effect of trust using cross-country data. Our base model specification performs well in predicting the income per capita level on cross-country data. Similar to economic theory and past literature suggests, both investment rate, human capital and the technology level are statistically significant, positively related with the country's income per capita level. Combing the estimation result of equation (7) and (8), it seems strangely that trust also has no income effect. However, inspired by Knack and Keefer (1997)'s estimation that their trust-growth relationship is sensitive to the choice of human capital measures, we then first test the income-trust relationship with the absence of human capital indicator in our regression. Eliminating the interference of human capital indicator (equation 9), the estimation result shows clearly that trust is strongly positive related with income per capita level.

Table 4 Estimation Result for Income Effect of Trust with Cross-Country Data

Equation	(7)	(8)	(9)	(10)	(11)
Dependent variable(Log)	GDP per capita	GDP per capita	GDP per capita	Human Capital	GDP per capita
I/Y	0.9401036***	0.9375689***	1.829229***		0.9709215***
	(0.0839421)	(0.0839434)	(0.1658596)		(0.0816935)
Human Capital	1.272623***	1.272192***			1.034523***
	(0.0151541)	(0.0151812)			(0.025009)
TFP	0.4546421***	0.454106***	0.3106909***		0.43983***
	(0.0159471)	(0.0159452)	(0.031505)		(0.0155575)
Trust		0.158176	1.53416***	1.154551***	-2.17814***
		(0.261632)	(0.4515722)	(0.4198693)	(0.3213552)
Trust*HC					0.9435113***
					(0.0801758)
R-squared	0.6730	0.6733	0.3414	0.1279	0.6773
Observations	2,383	2,383	2,383	2,668	2,383

Notes:

a. GDP per capita as dependent variable is taken 5-year average for clear causality purpose.

b. Because only one wave trust data are used to construct cross-country dataset, all equations are estimated using random effects model.

Sources: Author calculations.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Table 5 Estimation Result for Income Effect of Trust with Chinese Province Data

Equation	(12)	(13)	(14)	(15)	(16)	(17)
Dependent variable(Log)	GDP per capita	GDP per capita	GDP per capita	GDP per capita	GDP per capita	GDP per capita
I/Y	0.5125063	0.0463404	0.7674266*	0.1220121	0.0450573	0.0564968
	(0.3869525)	(0.2929024)	(0.4100303)	(0.3328201)	(.2474157)	(0.2999501)
Human Capital	76.9608***	61.88246***	79.69946***	62.71834***	22.49756*	58.12971***
	(12.87152)	(9.626655)	(12.76775)	(9.849428)	(11.88093)	(9.690117)
First Industry Share	-4.810724**	-2.876773*	-4.295493**	-2.858322*	-2.376992*	-3.272964**
	(1.827107)	(1.466759)	(1.823611)	(1.478708)	(1.243842)	(1.605464)
Trust		0.258044***		0.2516935***	-0.1267612	0.2259023***
		(0.0371792)		(0.0396286)	(.0902714)	(0.037888)
Saving/Y			0.945721*	0.2190103		
			(0.5653059)	(0.4449003)		
Trust*HC					20.19377***	
					(4.441325)	
FDI/Y						-2.189576
						(3.226047)
Rural Population Share						-.5221559
						(0.927342)
Rural Consumption						0.8626399*
Level/Urban Level						(0.4401818)
R-squared	0.7162	0.7848	0.6696	0.7741	0.7544	0.7767
Observations	76	72	76	72	72	72

Notes:

a. GDP per capita as dependent variable is taken 5-year average for clear causality purpose.

b. As the result of Hausman test suggests, all equations are estimated using fixed effects model.

Sources: Author calculations.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

The reason that the income-trust relationship is sensitive to human capital indicator is that human capital is strongly related with trust as equation (10) shows. Therefore, we include a new cross term $Trust * HC$ which equals to the value of human capital indicator multiplied by the value of trust indicator, in the income-trust estimation. Controlling the relation between human capital and trust, the result of equation (11) provides several important implications: (a) Controlling the trust and human capital level at the observations' mean which equals to 0.261 and 2.294, 1 percent positive change of human capital will lead to a 0.0237(2.294*1 percent *1.034523) positive income change from human capital itself, and 0.00565 (0.261*2.294*1 percent *0.94351113) positive income change from the mutual relationship between trust and human capital. Notice that the sum of 0.0237 and 0.00565 equals 0.02935 is larger than the result of 1 percent human capital change in equation (7) and (8) which equals to 0.02919(2.294*1 percent *1.272623) and 0.02918(2.294*1 percent *1.272192). This finding suggests that trust increase the revenue for human capital. (b) Controlling the trust and human capita level at the observations' mean which equals to 0.261 and 2.294, 1 percent positive change of trust change will result in a 0.00568(0.261*1 percent *2.17814) negative income change directly from trust itself, and 0.00565 (0.261*2.294*1 percent *0.94351113) positive income change from the mutual relationship between trust and human capital. The sum of these two effects equals to -0.00003, suggesting a very small negative overall income change with 1 percent positive trust change, when the value of trust and human capital are controlled at observations' mean. (c) The finding described in implication (b) also indicates that for trust to improve the income, the value of certain country's human capital indicator must meet a minimum value. The threshold condition for human capital indicator according to the equation (11) is 2.309(2.17814/0.9435113), which is slightly larger than the mean human capital indicator 2.294 of our observations. It indicates that trust has a positive income effect in those countries with human capital indicator exceeding the value of 2.309. As long as a country has a human capital indicator lager than the threshold, the increase of trust will always lead to a positive income effect. On the contrary, the increase trust in a society with low accumulation of human capital, can

only cause economic loss. As Douglas North noticed, “the inability of societies to develop effective, low-cost enforcement of contracts is the most important source of both historical stagnation and contemporary underdevelopment in the Third World” (North, 1990, p. 54). Considering the mutual relationship between human capital and trust, it is reasonable to conclude that the Northian poverty trap can be solved by increasing both the social trust level and human capital level. As is accepted that trust can generate economic revenues by reducing the transaction cost, it is important for individuals in the society to fully understand and appreciate the value of trust for the trust-income relationship to work. More importantly, the successful transactions based on trust require both parties to strictly dripline themselves. Therefore, to overcome the poverty trap and realize the benefit of trust, it is essential for a society to accumulate enough human capital and increase the civilized population base who respect the value of mutual trust. In the real world, it is common to observe less developed countries still stuck in poverty trap after repeated political reforms which are supposed to have positive economic benefit. The key problem for these struggles may lies in the insufficient accumulation of human capital. Recall the economic success of eastern Asia, it is certain that after proper institution reforms, high accumulation of human capital plays an important base in their economic take-offs.

Table 5 shows the result for testing the income effect of trust using Chinese province data. Similar to the situation in cross-country data, the base model specification as equation (12) shows performs well. Equation (13) demonstrates the result when adding the trust indicator into the base model. Because the coefficient of trust indicator is statistically significant, it is clear that income per capita level is strongly influenced by trust indicator.

Equation (14) and (15) provide the estimation when saving rate is added in the regression process. Recall in Section II, that the mathematical solution for our modified RBC model implies that output level is determined by the saving rate of the economy and individual saving rate are strongly influenced by the social trust level. The estimation in equation (14) clearly demonstrates that income per capita level is

strongly and positively related with each province's saving rate. Notice that the coefficient for investment rate becomes statistically significant when controlling the saving rate for province, this change indicates that personal saving is an important part for investment to improve the income level per capita. When controlling both the saving rate and trust level, the equation (15) shows that only the coefficient of trust indicator is statistically significant and the income effect of saving rate is dominated by the income effect of trust. This estimation result is consistent with our modified RBC model's prediction that representative household's saving rate is determined by trust level of the society.

Inspired by the mutual relationship between human capital and trust, the same cross term is added in the Chinese provinces' estimation. The equation (16) shows the result controlling the relationship between human capital and trust: (a) Controlling the trust and human capital level at the observations' mean which equals to 2.706 and 0.017, 1 percent positive change of human capital will lead to a 0.0038 (22.49756*1 percent *0.017) positive income change from itself, and 0.0093 (20.19377*2.706*1 percent *0.017) positive income change from the mutual relationship. Notice the sum of the positive income change equals to 0.0131 which is larger than the result of 1 percent of solely human capital change in equation (12) which equals to 0.0130. This finding is consistent with the result of cross-country data that trust will increase the revenues of human capital. (b) Controlling the trust and human capital level at the observations' mean which equals to 2.706 and 0.017, 1 percent positive change of trust will lead to 0.0093 (20.19377*0.017*1 percent *2.706) positive income change solely from the mutual relationship. Notice the positive income change from 1 percent trust change in equation (13) equals to only 0.0070 (0.258044*1 percent *2.706). Thus it is reasonable to conclude that in China, human capital can also increase the revenues of trust. This result is slightly different from the cross-country data which require a minimum value of human capital indicator for increasing trust to have positive income change; the key difference lies in that the variable trust is not statistically significant after controlling the mutual relationship between human capital and trust in the estimation of Chinese provinces. The result may be confusing at first glance,

however, when referring back to the human capital indicator in our cross-country dataset, we find that after year 2003, the human capital indicator of China ranges from 2.410701 to 2.579169. Thus the solely positive income change from trust is because after year 2003, the human capital indicator in China is larger than the threshold value we calculated in the cross-country data which equals to 2.309. Therefore, the result is in fact consistent with our analysis for the cross-country data.

Equation (17) provide a simple robust test for our trust indicator. As it is known that the difference between rural area and urban area is substantial and foreign investment plays an important role in some province's economic performance, we include the rural population share, the proportion of rural individual consumption on urban individual consumption and the share of foreign direct investment in GDP in the estimation. Notice only the variable equals to the rural consumption level divided by the urban consumption level is statistically significant, thus it suggests that the smaller the gap between rural area and urban area, the better average income level in that province. Therefore, this result verifies the common agreement in China that to stimulate the economic development, it is essential for local government to pay their attention in the rural area. In addition, the estimation result also shows that the trust indicator is rather robust with all these new variables added. During our estimation, other variables are also included to test the robustness of the income-trust relationship. All regression shows that the trust indicator in this paper is generally robust regardless which new variable is included in the regression model.

Both the estimation result of cross-country data and Chinese province data indicate that trust can only influence the economy's income level but not the growth. An economy with higher trust level will produce higher overall output. However, the growth rate of the output of certain economy is not affected by the trust level in that society. That is, our empirical finding suggest that trust has only income effect but no growth effect, which is consistent with the predictions of the modified RBC model.

B. Trust and Individual Income

Recall the representative household optimization problem in Section II, the two models both predict that households earn higher income with higher social trust level. In this part, we test the income-trust relationship on individual level based on the CGSS survey data.

Table 6 shows the result for the estimation. The basic model specification as equation (18) shows, indicates that male residents living in urban area tend to have higher overall income level. The estimation suggests an income gap between rural and urban residents, male and female individuals, which is commonly observable in Chinese society. Furthermore, human capital is positively related with the individual income level. The Intuition of this result is rather straightforward, individuals get more wage paid with higher human capital as it enhances individuals to work more efficiently. The residents living in provinces located in eastern region, especially coastal provinces, have higher income level because the fact that the eastern provinces are more developed in China. Notice the sign of the coefficient of the working experience is surprisingly negative, in addition, both the coefficients of working hours and square of working experience remain statistically insignificant. These findings somehow contradict with our prediction in Section III. There may be two possible reasons for this strange estimation result: (a) The wage gap in China is rather large and thus the income in the polarizing job market may not necessarily determined by individuals' working hours and experience. (b) The reason may also lie in the nature of the dataset that it is constructed based on the survey data. All data are self-reported by respondents and errors shall be expected. Though it may take more work to specify a clear relationship between individual income and working hours, experience in China, it is not the main concern of this paper.

Equation (19) and (20) test the link between individual income and trust. In equation (19), only individual trust is included in the regression, and the estimation result demonstrate a strong positive income-trust relationship. The finding suggests that with higher individual trust level, people generally earn more than those distrust the society. This finding has two possible explanations: firstly, with higher individual trust level, people tends to feel safe when investing. Thus for people holds high trust

Table 6 Estimation Result using CGSS Individual Survey Data

Equation	(18)	(19)	(20)	(21)	(22)	(23)
Dependent variable	Income	Income	Income	Income	Income	Income
Hukou (1 as urban	0.2678224***	0.2876917***	0.3204453***	0.3219156***	0.2961358***	0.3299439***
residents)	(0.0163504)	(0.0157568)	(0.0143537)	(0.01438)	(0.015636)	(0.0143416)
Gender (1 as male)	0.3937577***	0.3505052***	0.2984744***	0.2985042***	0.3466457***	0.2981885***
	(0.0136098)	(0.0131418)	(0.0119926)	(0.0119921)	(0.0130023)	(0.0119441)
Schooling Years	0.1119743***	0.1045475***	0.0953194***	0.0953404***	0.103549***	0.0950151***
	(0.002136)	(0.002065)	(0.0018857)	(0.0018857)	(0.0020428)	(0.0018777)
Average Working Hours	0.0005873	0.0005191	-0.0005841	-0.0005674	0.0004723	-0.0005877
per Week	(0.0004983)	(0.0004798)	(0.0004371)	(0.0004372)	(0.0004744)	(0.0004351)
Working Experience	-0.0149011***	-0.0112481***	-0.0023036	-0.0023722	-0.0111345***	-0.0024897
	(0.0019052)	(0.0018348)	(0.0016765)	(0.0016769)	(0.0018163)	(0.0016709)
Square of Working	-6.43e-06	-0.0000105	-0.0000417	-0.0000406	-3.11e-06	-0.0000374
Experience	(0.0000399)	(0.0000384)	(0.000035)	(0.000035)	(0.000038)	(0.0000349)
East Region	0.465123***	0.4382382***	0.392691***	0.3947532***	0.4482743***	0.3955195***
	(0.0136897)	(0.0131891)	(0.0120289)	(0.0120917)	(0.0130732)	(0.0120141)
Individual Trust		0.2271343***	0.0024275	-0.0309399		
		(0.0056544)	(0.006289)	(0.0209769)		
Social Trust			0.6574203***	0.6251566***		.6536393***
			(0.0105712)	(0.0220491)		(0.0109215)
Individual Trust* Social				0.0126292*		
Trust				(0.0075743)		
Trust Value=2					0.2156505***	-0.0725112***
					(0.0171256)	(0.0164176)
Trust Value=3					0.2289155***	-0.049614***

					(0.0203408)	(0.0192145)
Trust Value=4					0.7913898***	0.0139832
					(0.0193436)	(0.0219779)
Trust Value=5					0.7259889***	-0.0677873*
					(0.036756)	(0.036204)
Adjusted R-squared	0.3578	0.4079	0.5093	0.5094	0.4180	0.5111
Observations	18,809	18,716	18,716	18,716	18,809	18,809

Sources: Author calculations

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

belief, it is more likely for them to seize the profitable investment opportunity. Secondly, people with higher trust belief, are more cooperative and their trust in other people, especially strangers, makes them better team player than those individuals who hold pessimistic attitudes. Therefore, people with high trust belief tends to work more efficiently.

Controlling the social trust level, however as equation (20) shows, the social trust level dominates the income effect of individual trust. The estimation suggests that as long as people live in a society with high social trust level, the income will be higher than those live in society with low trust level. The estimation also suggests that no matter what the individual's trust belief is, it is the society's trust level mostly matters for income rather than the individual's belief. No matter what the subjective individual trust belief is, all in all, the individual economic performance is constrained by the structure of the society. In a society with high trust level, individuals with pessimistic attitudes can still enjoy the benefits provided by the positive trust-income relationship. However, individuals with strong faith in the society but living in a low trust level society, will only suffer from others' cheating.

So does the result of equation (20) means that individual trust will have no effect at all on income when social trust being controlled? To further explore the mutual relationship between the individual and social trust, we introduce a cross term of both trust indicators in equation (21). With the relationship between both the trust indicators controlled, the result of equation (21) provides two interesting implications: (a) Controlling the individual trust and social trust at the observations' mean which equals to 2.474 and 2.498, 1 percent positive change of individual trust will lead to a 0.0078(0.126292*2.474*1 percent *2.498) positive income change solely from the mutual relationship as the estimation for the individual trust indicator is not statistically significant. Thus the result indicates that even though the social trust level is the dominating factor, it is still beneficial for individuals to increase their own trust because of the mutual relationship between the social and individual trust. (b) Controlling the individual trust and social trust at the observations' mean which equals to 2.474 and 2.498, 1 percent positive change of social trust will lead to a

0.0156(0.6251566*2.498*1 percent) positive income change from itself and 0.0078(0.126292*2.498*1 percent *2.474) positive income change from the mutual relationship. Notice the combined effect equals to 0.0234 which is larger than the result of 1 percent positive change of social trust in equation (20) which equals to 0.0164(0.6574203*2.498*1 percent). Therefore, for those individuals who hold high trust believes, the positive income change from the increase of the social trust will be larger than those who distrust. In other words, individual trust will increase the income revenues of the social trust. Considering both the implications from the equation (21), all in all, it is still beneficial for individuals to trust more even when the dominating effect of social trust being considered.

One disadvantage of using intensity data for trust in our empirical analysis, is that the difference between each answer may not be meaningfully compared. For different respondents, the difference of trust level between "3" and "4" for example, may not be the same. Worrying about the disadvantage, we include dummy variables according to the respondent's answer in our regression. For one specific respondent, if he choose the trust value "3" in the survey, then the value of variable "Trust Value=3" will be "1", and the value of other variables including "Trust Value=1", "Trust Value=2"," Trust Value=4" and "Trust Value=5" will be "0".

Equation (22) demonstrates the estimation result using the dummy variables of trust. The regression shows that generally trust will positively benefit one's income. Another important finding that equation (22) implies is that the relationship between income and individual income follows a lump-shape pattern, consistent with the finding of J. Butler, P. Giuliano and L. Guiso's work using the European Social Survey database. The possible reason as they suggest is that "highly trusting individuals tend to assume too much social risk and to be cheated more often", while "individuals with overly pessimistic beliefs avoid being cheated, but give up profitable opportunities" (Butler, Giuliano, Guiso, 2016, p. 1155). It might be a little confusing at first when comparing the result of equation (22) that suggests an optimal individual trust while the result of equation (19), (21) that indicate the purely income increasing effect of individual trust. However, when referring back to the individual

dataset itself, we find that the mean and standard deviation of individual trust is 2.474 and 1.175 which indicates that most observations in the dataset hold the trust believes less than 4. Notice that in the result of equation (22), the estimation parameters for individual trust variables are increasing before the indicators reaching the trust level of 4. Therefore, it is reasonable for the results of equation (19) and (21) to suggest increasing income effect of individual trust as the constraint of OLS estimation that it mainly captures the dynamic of means rather than those extreme values.

Equation (23) add the social trust level in the estimation compared with equation (22), and shows again that the dominating effect of social trust over individual trust. With different trust variable used, the estimation result of equation (19) and (20), equation (22) and (23) verifies each other.

To conclude the estimation findings of individual data, trust will positively influence one's income level. Furthermore, it is the social trust rather than individual trust that dominate the individual's income level. That is, for individuals living in trusting society, their welfare is generally better off than those living in distrusting society.

V. Conclusion and Extensions

Both the modified RBC model and AK model in this paper present a society with infinitely-lived representative household facing a non-discriminative investment market in which the investment risk is determined by the objective society trust level. The solutions to the representative household's optimization problem in both models imply that the individual investment level is positively influenced by the social trust level. Along the positive trust-investment relationship on individual level, with different production function specification, our two models, however, predict distinguishing trust effects on the macro economic performance. For the modified RBC model, with two assumptions that no government purchase and fully depreciation, the model is solvable and the mathematical solutions indicate that the economy's output level is positively related with the social trust level, while the growth rate of the output is unrelated. For the modified AK model, the mathematical

solutions for the constant growth path predict that, on the contrary, trust has both income effect and growth effect.

One thing about the prediction of our two theoretical models, however, needs careful caution. To some extent, the prediction of our model is pre-determined by the model specification itself. As the social trust variable is constructed in the household's budget constrain, the variable can only affect the individual investment in our models. Thus, in the modified RBC model, with the assumption of diminishing returns of reproductive factors, the social trust in the model has no growth effect but income effect. Nevertheless, in the AK model, without the constraint of diminishing returns, trust then have both income and growth effect. The two models aim to approach the mechanism of trust but much is sacrificed for the sake of the simplicity for analysis. Though neither of the model in this paper should be seen as the true model, they shall offer avenues to think about the various ingredients that are behind the dynamic between trust and economic performance in real world.

Using the cross-country data and Chinese province data, our empirical result demonstrates only income effect and no growth effect of trust which is consistent with the prediction of our modified RBC model. This result is different from the P. Zak and S. Knack's work (2001), and the possible reason is that they mainly use the OLS method because the constraint of data availability while we are able to construct our panel dataset. Furthermore, the estimation result of cross-country data and Chinese province data verifies each other well in this paper and it shall improve the credibility of our empirical result. In addition, the CGSS survey data is used to investigate the link between individual income and trust. The empirical result implies that personal income is positively related with both individual trust and social trust, while the social trust plays a dominating role.

Apart from the trust-income effect, another important finding in our empirical analysis is that for trust to generate positive revenue in economy, there's a threshold of human capital for society to meet. A society without enough civilized individuals will fail to operate with transactions relying on trust as people take advantage of others repeatedly. Only in society with high level of human capital accumulated, the

trust-income relationship can generate positive revenues as people can discipline themselves and not to break promises. Therefore, to maximize the positive revenues of trust, it is important for society to invest in human capital. Only then, the trust-income effect can benefit the economy.

Several extensions for our work can be performed and should be interesting to undertake. For the model part, most importantly, ours is constructed based on a system whose trust level is given exogenously in advance. In the real world, the trust level of a society should be closely related with the penalty for cheating, the development of the social institutions, and so on. Therefore, it would be beneficial to consider the alternatives that trust is determined endogenously and in turn, affect the economic system. Secondly, only social trust is included in our theoretical model as a budget constraint for the representative household while individual trust is not. The extensions can include individual trust as another important variable into the individual's decision-making process and thus may affect the economy's performance. Along this line, further extensions should consider other channels that social trust could influence the individual's decision-making process. In our model, because the social trust affects the expected value of bond, therefore the investment is affected by the social trust level. In the real world, trust not only affect the investment decision but also other aspects, therefore other mechanism of trust to influence economic performance should be considered. Finally, we only use the newest wave of World Value Survey to construct our cross-country dataset, an alternative approach is to organize all waves of WVS data and place different country-level trust data along the time. This approach shall provide a more accurate estimation when testing the trust effect on economic performance.

All in all, the mechanism that trust affect the real world economic performance are much complicated than what we present in this paper and further work shall be done in the future.

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Appendix:

A. Variable Definitions

Table 7 Definition for All Variables

Panel A. Cross-Country Data and Chinese Province Data	
Variables	Definitions
Growth	5-year average GDP Growth rate for certain country or province.
GDP per capita	Log value of GDP per capita level for certain country or province. Log value of 5-year average GDP capita if the variable is the dependent variable. US dollar for cross-country data and Yuan for Chinese data.
Growth of Pop	The growth rate of population for certain country or province.
Trust	The social trust level calculated using WVS data or CGSS data.
I/Y	The investment rate for certain country or province. The variable equals to the share of investment of GDP for certain country or province.
Human Capital	The human capital indicator. Variable for cross-country data sources from the Penn world table. Particularly, for Chinese province data, the variable is calculated using the share of the number of college students among the overall population in each province.
TFP	The total-factor productivity sources from the Penn World Table.
First Industry Share	The share of first industry in the GDP for certain country or province.
Saving/Y	The saving rate equals to the share of overall saving against the level of GDP in certain province.
Trust*HC	The cross term equals to the level of trust multiplied by the level of human capital.
Solow Residual	The variable is the residual that the growth rate of output after subtracting the share-weighted growth in factor quantities.
FDI/Y	The variable equals to the share of foreign direct investment against the level of GDP.
Rural Population Share	The variable equals to the rural population divided by the overall population in certain province.
Rural Consumption Level/Urban Level	The variables equals to the level of average rural population's consumption divided by the level of average urban population's consumption.

Panel B. Chinese Individual Data	
Variables	Definitions

Income	The log value of individual's yearly income.
Individual Trust	The reported trust value for the respondent. The variable ranges from "1" to "5".
Social Trust	The variable equals to the mean value of all the individuals' trust in the same province and the survey wave that the respondent belongs to.
Hukou	The status of household registration. Dummy variable that "0" stands for rural residents and "1" stands for urban residents.
Gender	Dummy variable that "0" stands for female residents and "1" stands for male residents.
Schooling Year	The education level for the respondent.
Average Working Hours per Week	The average working hours per week for the respondent.
Working Experience	The variable equals to the value of years since the respondent's first job.
Square of Working Experience	The square value of the respondent's working experience since the first job.
East Region	Dummy variable that "0" stands for residents not living in eastern provinces and "1" stands for those living in eastern provinces.
Individual Trust* Social Trust	The cross term equals to the level of individual trust multiplied by the level of social trust.
Trust Value="2", "3", "4", "5"	Dummy variable that represents the respondent's individual trust level.

B. Descriptive Statistics for All Variables

Table 8 Descriptive Statistics for all variables

Panel A. Cross-Country Data				
Variable	Mean	SD	Min	Max
Growth	0.050	0.086	-0.663	1.608
GDP per capita(US dollar)	11485.859	12778.201	515.663	134040.000
Growth of Pop	0.017	0.018	-0.181	0.204
Trust	0.261	0.183	0.028	0.682
I/Y	0.220	0.089	0.007	0.802
Human Capital	2.294	0.597	1.071	3.619
TFP	0.782	0.505	0.145	7.364
Trust*HC	0.638	0.541	0.050	2.144

Panel B Chinese Province Data				
Variable	Mean	SD	Min	Max
Growth	0.118	0.022	0.077	0.174
GDP per capita(Yuan)	32314.632	22614.331	6375	100105
Growth of Pop	0.009	0.017	-0.056	0.058
Trust	2.706	0.715	1.430	3.710
I/Y	0.480	0.118	0.311	0.879
Human Capital	0.017	0.007	0.005	0.036
First Industry Share	0.110	0.069	0.006	0.342
Solow Residual	0.071	0.021	0.011	0.149
Trust*HC	0.048	0.025	0.012	0.113
FDI/Y	0.727	0.157	0.492	1.205
Rural Population Share	0.014	0.012	0.001	0.060
Rural Consumption Level/Urban Level	0.634	0.197	0.120	0.900

Panel C. Chinese Individual Data				
Variable	Mean	SD	Min	Max
Income	19738.744	30652.840	500	800000
Individual Trust	2.474	1.174	1	5.000
Social Trust	2.498	0.730	1.430	3.960
Hukou	0.645	0.478	0	1
Gender	0.549	0.498	0	1
Schooling Year	10.204	3.867	0	18.500
Average Working Hours per Week	51.454	14.268	20	98.000

Working Experience	20.799	12.697	0	50.000
East Region	0.442	0.497	0	1
Individual Trust* Social Trust	6.676	4.555	1.430	19.800
Trust=2	0.334	0.472	0	1
Trust=3	0.170	0.375	0	1
Trust=4	0.218	0.413	0	1
Trust=5	0.035	0.183	0	1

Sources: Author calculations

C. SAS code for trust simulation

```
Data sim1(keep=tr1);
seed=123456789;
s=0.2;
y=0;
u=0;
n=1;
do i=1 to 100;
x=ranuni(seed);
y=y+x;
tr1=y/n;
p=ranbin(seed,1,s);
if p=1 then do;
u=x;
x=x+(1-x)*ranuni(seed);
end;
else do;
u=x;
x=x-x*ranuni(seed);
end;
y=y-u+x;
n=n+1;
output;
end;
run;

data sim2(keep=tr2);
seed=123456789;
s=0.6;
y=0;
u=0;
n=1;
do i=1 to 100;
x=ranuni(seed);
y=y+x;
tr2=y/n;
p=ranbin(seed,1,s);
if p=1 then do;
u=x;
x=x+(1-x)*ranuni(seed);
end;
else do;
u=x;
x=x-x*ranuni(seed);
end;
y=y-u+x;
n=n+1;
output;
end;
run;

data sim3(keep=tr3);
seed=123456789;
s=0.9;
y=0;
u=0;
n=1;
do i=1 to 100;
x=ranuni(seed);
y=y+x;
tr3=y/n;
p=ranbin(seed,1,s);
if p=1 then do;
u=x;
x=x+(1-x)*ranuni(seed);
end;
else do;
u=x;
x=x-x*ranuni(seed);
end;
y=y-u+x;
n=n+1;
output;
end;
run;

data sim1;
set sim1;
t=_N_;
run;

data sim2;
set sim2;
t=_N_;
run;

data sim3;
set sim3;
t=_N_;
run;

data combine;
set sim1;
set sim2;
set sim3;
run;

symbol1 interpol=join ;
symbol2 interpol=join ;
symbol3 interpol=join ;
proc gplot data=combine;
plot tr1*t tr2*t tr3*t/
overlay;
run;
```