Social Capital and Output per Worker

Megi Wiley

University of Maryland, Baltimore County

March 2018

I. Introduction

Hall and Jones (1999), estimate the impact of social infrastructure on capital accumulation, human capital accumulation, and output per worker. They argue that output per worker is a function of capital, human capital, and technology, and that the primary determinant of capital and human capital is social capital, of which social infrastructure is a component. Therefore, they estimate equations that relate capital accumulation, human capital accumulation and output per worker as a function of social infrastructure only. They find evidence that social infrastructure is a determinant of output per worker, but that the mechanism for how social infrastructure affects output per worker is that it affects capital accumulation and human capital accumulation, which in turn affects output per worker.

The contribution of this paper to the literature is to replicate the analysis of Hall and Jones and to add a new variable—social cohesion—that may affect capital accumulation, human capital accumulation, and output per worker as much as social infrastructure. Social infrastructure and social cohesion are two aspects of social capital. In this analysis, potential endogeneity of social infrastructure and social cohesion is addressed by using an instrumental variable technique. We use the same instrumental variables as Hall and Jones, but also test whether new instrumental variables (i.e. research and development spending) for social infrastructure could improve the estimates. In addition, we introduce new instrumental variables to address endogeneity in the variable social cohesion.

II. Literature Review

In this paper we examine the relationship between social capital and output per worker. According to the OECD definition, social capital represents the network, shared values, norms and understandings in society that influences individuals and groups to trust each other and therefore work together. In this paper, two aspects or determinants of social capital are examined: social infrastructure and social cohesion. Social infrastructure and social cohesion can also be thought of as inputs into the total amount of social capital. Social Infrastructure relates to the quality of the institutions and government policies that shape the economic environment within which individuals "accumulate skills and firms accumulate capital and produce output" (Hall and Jones 1999, pg 84). Social cohesion is a measurement of social institutions in terms of how much they foster the cooperation between ethnic, religious and other different identity groups. More specifically, the social cohesion index measures the level of non-discrimination and non-violence in the labor and capital markets (Foa 2011, pg 3).

Social infrastructure, such as social codes and rules, governs individuals of a society and regulates human interactions over time. The fact that there is a need for such codes and rules indicate that humans have a tendency towards corruption even through the degree of it varies depending on the country or government unit. Hence, in the absence of informal rules that constitute social infrastructure, there is a lack of good incentive to produce goods and services. According to the results of the article "Earnings Opacity and the Productivity of Nations", a highly productive country has a negative and strong relationship with lack of earning transparency (Belkaoui 1995, pg 2). Additionally, the authors found that the transparency of accounting stimulated the accumulation of human and physical capital and increased the country's total productivity factor. While the transparency of transactions is expected to help

production activities against nonproductive use of the resources, the academic literature finds that failure to do so could lead to a vicious cycle of extractive activities in the economy. The social Infrastructure Index is measured by taking the average between two coefficients. The first coefficient is made of 5 components: 1. Corruption, 2. Risk of Expropriation, 3. Government Repudiation of Contracts 4. Law and Order, 5. Bureaucratic Quality.

Social cohesion is a measurement of social institutions in terms of how much they foster cooperation between ethnic, religious and other different identity groups. More specifically, the social cohesion index measures the level of non-discrimination and non-violence in labor and capital markets (Foa 2011, pg 3). While social cohesion measures the level to which individuals of different identity groups are enabled to participate in the political and economic life of a country, social infrastructure also relates to the quality of law and order within which productivity and output per worker is organized. A higher social cohesion translates into increased productivity due to reduction in transaction costs, prevention in capital disaccumulation, improvement in allocative efficiency, and facilitated collective action (Foa 2011, pg 4). This means that the social cohesion index could be interlinked with some components of social infrastructure such as 4, Law and Order, and 5, Bureaucratic Quality. Although social infrastructure and social index measure slightly different components of the political and economic state of a country, some of the components within these indexes could be the same. Finally, social cohesion as well as social infrastructure affect social capital or the way people network, trust each other, and share value in a society. This also determines the way output is organized.

Corruption is one of the components used to calculate the social infrastructure index in the Hall and Jones paper. Since social infrastructure measures the quality of institutions and government policies, the higher the level of corruption, the lower the average of the index is. Social institutions that protect individual production units from corruption are a very important

component of social infrastructure (Hall and Jones 1999, pg 85). The adverse effects of corruption in the economy are a large concern for policy analysts. Corruption is the abuse of public office or authority for private gain. When private agents of an economy organize production activity around maximizing their individual benefit, they impose negative externalities and reduce social surplus for bystanders. Previous literature shows that the practice of manipulating public policy or economic conditions as a strategy for increasing profits leads to uncertainty and an increase in transaction costs. According to the article "Corruption, Income Distribution and Growth", corruption explains a large proportion of the difference in the Gini index between developing and developed countries (Hongyi Li, Lixin Colin Xu, Heng-fu Zou 2000, pg 1). One of the main reasons for the large difference in corruption levels is the simultaneous relationship that it has with poverty. While corruption slows down growth, the government has less incentive in fighting poverty, since bribery becomes a path to survival. Moreover, in a corrupt country, private agents view laws such as tax policy as questionable, which creates uncertainty between taxpayers and the government. Thus, taxpayers with a higher socioeconomic status exploit the system to their benefit, which contributes to the inequality gap. Finally, since corruption involves large transaction costs, it amounts for a share in the country's gross domestic product, which becomes an obstacle for sustainable economic development.

The government exercises a large power as a regulatory agent. Consequently, there is a large risk that government agents would use this power to maximize their private surplus. For instance, public projects, especially those that demand large financial capital, could be very tempting for the government officials to utilize for their own gain. As corruption increases the scarcity of resources, government reduces spending and allocates their remaining resources inefficiently. Thus, corruption increases the deadweight cost of government intervention by allocating limited resources around higher bribes (Ehrilch, Lui 1999, pg 272).

A strong social capital is crucial for managing and monitoring limited economic resources. Moreover, social action provided by government is necessary to promote the output per worker (Belkaoui 1995, pg 5). Hall and Jones suggest that countries achieve long term productive output due to the high rates of investment in human and physical capital. Additionally, these countries use large investments in human and physical capital very productively (Hall and Jones 1999, pg 114). A higher level of social capital causes more human capital and capital accumulation. A country that has lower levels of corruption, risk of expropriation, and government repudiation of contracts, while having higher levels of bureaucratic quality and law and order, (all components of social infrastructure) can make larger investments in education and technology because of improved allocative efficiency of their resources. In addition, high levels of social cohesion, indicated by a government that is inclusive towards people of different identity groups, facilitates collective action, builds trust and prevents capital disaccumulation (Foa 2011, pg 3). Thus, countries with a low level of trust and low norms of cooperation between different identity groups bear larger costs that are driven by violent conflict between identity groups, due costs of policing and private security services (Foa 2011, pg 4). Due to these transaction costs, countries are unable to reach the optimization point and increase the stock of knowledge and habits necessary to increase human and physical capital. Finally, the policy and organizations that govern the economic system play a very strong role in determining economic productivity.

Even though there is an abundance of research showing a strong relationship between corruption and decreased economic performance, the existing literature on the effects of corruption is divided. Another body of literature finds that some level of corruption could be beneficial for the economy. According to this line of thought, corruption helps the government perform smoothly and overcome bureaucratic constraints. More specifically, this body has often concluded that some level of corruption helps recover from the unnecessary rigidities and

provides a more efficient provision of the public services. Empirical research at the firm level shows that the higher the mean of the corruption coefficient, the lower the performance of the firm, while a higher dispersal of individual firm bribes appears to facilitate firm performance (Hanousek, Kochanova 2016, pg 2). Moreover, a higher level of corruption at the firm level decreased sales as well as labor productivity growth (Hanousek, Kochanova 2016, pg 2). Nevertheless; the performance of the firm was improved when the bribery had a higher dispersion. While the first part is complementary to the existing research, the second shows that some level of bribery could prevent some bureaucratic obstacles and increase the efficiency of a transaction.

Corruption exists in different countries at different degrees. There seems to be a large diversity of corruption between different countries, political regimes and different stages of the business cycle (Ehrilch, Lui 1999, pg 270). Hall and Jones claim that educating citizens morally and giving them a credible threat or fear of punishment causes a lower level of extraction. Therefore, the nature of social infrastructure could also affect the degree to which micro agents choose to avoid certain policies. Essentially, too much intervention in the market or the wrong size of the social infrastructure could influence micro agents to engage in corrupt activities which in some cases avoid unnecessary obstacles.

The risk of expropriation is one of the components used in measuring the social infrastructure coefficient. The risk of expropriation is the likelihood that the government will take private property and turn it public. Since the government is a policy enforcing institution, expropriation imposes high risks in the local and international private investment. Nevertheless, expropriation could be beneficial to the economy when the firms do not make Pareto Optimal investment decisions (Restrepo, Correia , Peña , and Población 2014, pg 27). In terms of welfare, expropriation is not optimal and the compensation to the private agent is either nonexistent or below the real value of the property (Restrepo, Correia , Peña , and Población

2014, pg 2). Finally, expropriation imposes high risks on private firms which could compensate for a quick surplus that the government benefits by owning the asset as well as making better investment decisions of the property.

The consequences of expropriation rely on the economic performance of the private assets. For instance, when the business is essential for the economy, the gain in welfare is greater when the government does not expropriate (Restrepo, Correia , Peña , and Población 2014, pg 3). In this case, the optimal maximization is reached when the government offers an equivalent compensation instead of confiscating it (Restrepo, Correia , Peña , and Población 2014, pg 3). Nevertheless, when the business is not essential, the government maximizes its surplus by confiscating the firm or refunding equivalent to its worth (Restrepo, Correia , Peña , and Población 2014, pg 4).

Another study done by the Bank of France found that the market operates at an equilibrium that is below the optimal level when the government and the firm use the same discounting rates to account for the net present value of a private property or business (Olivella, Paris 2012, pg 1). More specifically, the loss of the firm is underestimated which translates into a misallocation of resources. The private firm makes decisions on investment according to a level of utility maximization. During expropriation, an effective allocation of the resources would require that the firm makes the decisions according to the productivity shock it receives during that time period (Olivella, Paris 2012, pg 3). Moreover, the more productive firms bear the largest burden of the risk of expropriation (Olivella, Paris 2012, pg 1) since larger private benefits translate into larger discounting bias in the net present value. Finally, the risk of expropriation generates resource misallocation of the firm's resources which leads to a loss in the long run output and total factor productivity.

Government repudiation, or the refusal of the government to perform the duties owed to the private party, is another component of a country's social infrastructure with an impact on the economic growth. Previous literature shows that the level of social trust is very dependent on whether the government protects property and contract rights. For instance, Knack and Keefer conclude that trust in the government significantly impacts physical and human capital accumulation. As they put it, social trust is a very important determinant of capital accumulation and forms of measuring economic performance (Kack and Keefer, 1997, pg 1255). The intuition behind these findings is that microeconomic agents rely on the future actions of others which are accomplished at lower cost when there is more trust in government contracts (Knack and Keefer 1997, pg 1252). Thus, a key component of high social trust is that it does not require investment and additional resources to protect firms or individuals from being exploited during transactions. In addition, when the level of repudiation is low, contracts are less needed. Finally, litigation or resources used during legal proceedings are less necessary, which translates into less tax payments, bribes or private security services (Knack and Keefer 1997, pg 1252).

The relationship between government repudiation and productivity imposes several implications for the economic policy. In Knack's and Keefer's study, the relationship between trust and economic growth is larger for poorer countries and smaller for richer ones (Knack and Keefer 1997, pg 1284). This is largely due to the less developed financial sector and insecure property rights (Knack and Keefer 1997,pg 1284). Thus, social trust plays a major role in the countries where there is less regulation in government contracts. Finally, countries that suffer high government repudiation or low social trust are likely to experience a very slow change in interpersonal trust (Knack and Keefer 1997, 1284).

Two other components used in the measurement of the social infrastructure variable are bureaucratic quality and law and order. Institutional quality and law and order are necessary components of the social infrastructure that help regulate economic activity. The cross section

differences in institutions have empirically proven to be one of the most important contributors of economic growth (Barro 2013, pg 41). Thus, focus on improving the quality of bureaucracy has positive returns to scale into the economy. One of the consequences of poor institutional quality and law and order is the influence of businesses and individuals to enter the black market. Even though it seems like this avoids the unnecessary obstacles imposed by the legal system, it does impose costs on the productivity of the business. For instance, businesses have to spend additional resources to hide their activity from the government as well as stay hidden from the government's resources (Barro 2013, pg 42). Moreover, the government is not able to collect taxes fully, which increases the cost for those who remain in the legal market (Barro 2013, pg 42). This becomes necessary since the government has to provide a given level of public expenditures. Finally, the investment in institutional quality and law and order is essential to promote economic growth and business productivity.

Hall and Jones find empirical evidence that social infrastructure is strongly linked to output per worker. In their language, norms and social institutions are essential in promoting the output of the production units from extractive activities such as corruption, expropriation and confiscatory taxation (Hall and Jones 1999, pg 84). While government institutions protect the output of individual firms, they are also very likely to cause extraction due to large power given by the masses. Finally, they show that countries with long lasting policies favorable to production have a considerable difference in output per worker, compared to countries that suffer low bureaucratic qualities such as corruption, risk of expropriation and government repudiation.

According to the OCDE definition, a socially cohesive country "works towards the well-being of all the members, fights exclusion and marginalization, creates a sense of belonging, promotes trust and offers members the opportunity of upward social mobility" (Cloete 2014, pg1). Moreover, the institutional system of a socially cohesive country protects the ethnic, religious

and other identity groups against discrimination in the labor and capital market (Foa pg 3). Similarly, the social cohesion coefficient which is used to explain the labor productivity in this paper is formed according to a country's norms of intergroup discrimination, and intergroup violence. These were measured by the evidence of discrimination cases, as well as norms that influence efficient allocation of the labor market within the country (Foa pg 7).

A socially cohesive country avoids transaction costs when enforcing contracts and allocates resources equally towards different identity groups. One of the potential negative consequences of being exposed to diverse groups is reduction in social trust. Academic literature has often defined social capital with social trust where people trust one another and cooperate according to a common set of ethical norms which reduces business costs (Foa 2011, pg 4). More specifically, when parties of a transaction do not trust one another they will need to operate under a formal legal system. Essentially, the distrust in society reduces the productivity of how we use the resources, since part of them have to be allocated towards the negotiation and agreement process. Moreover, violence and conflict between different groups includes unprofitable economic transactions such as private security services which causes inevitable deadweight loss in the economy (Foa 2011, pg 4). Finally, since trust and social cohesion take a long time to build, economic policies that negatively impact social cohesion could be counterproductive.

Another characteristic of socially cohesive countries is the facilitated collective action or cooperation towards common objectives. For instance, the previous studies have failed to explain why in a large scale, the free riding phenomenon does not occur especially when individuals are aware of the contribution of the others (Sønderskov 2009, pg 146). Nevertheless, academic literature in psychology has often proven that humans have the tendency of following a principle of conditional cooperation on perceived trust in a collective action uncertainty (Sønderskov 2009, pg 147). More importantly, in a larger scale of collective action, when there

is no information available, generalized social trust or a stereotypic perception of other people serves as an alternative source of information (Sønderskov 2009, pg 147).

Experimental studies, for instance, have shown that there is a strong and positive relationship between the belief that other people are trustworthy and the provision of public goods which indicates that trust between individuals influences cooperation and contribution to common goods and services (Sønderskov 2009, pg 155). Additionally, Montalvo and Querol (2005) find that ethnic fractionalization has a strong negative impact in economic development because it reduces investment while increasing the consumption of the public goods (pg 318). Finally, the presence of heterogeneous communities may not promote an environment of social trust which enforces a lower level of generalized social trust at a larger scale such as public projects.

Heterogeneous identities may often lead to a lower level of social trust which imposes a negative impact on the collective funds and public investments. A more recent piece of literature highlights the positive effects of social trust and collective action in the contribution of tax revenue. For instance, Habibov, Cheung and Auchynnikava (2017) find a strong positive relationship between increased social trust and increased willingness to pay contributions towards improving the healthcare system. Moreover, collective action is necessary for economic growth and regions with homogenous identities based on language and ethnicity show a larger support of public goods such as infrastructure, health, and education (Foa 2011, pg 5). The encouragement of cooperative behavior through increased social trust influences higher investments in collective funds which are used to increase the social surplus. For instance, higher levels of social trust are positively associated with lower mortality rates, higher fertility and overall healthier lifestyle (Habibov, Cheung and Auchynnikava 2017, pg 25). Essentially, public goods have a collective nature and people cannot afford them privately. Finally, social

cohesion facilitates collective action which is necessary in providing goods and services that increase the surplus of our society.

Social Cohesion is created by time and effort to increase the future benefits and is considered to be a public good since people living in a country cannot be excluded from enjoining it (Cloete 2014, pg 2). Nevertheless, underproduction of this good could occur because of the “free riding” problem. As previously mentioned, people are aware of sharing this public good with those who did not make a contribution for it and decide to contribute less (Cloete 2014, pg 3). Consequently, the norms become crucial for guiding the formation of trust and encouraging an equal participation of the collective action (Cloete 2014, pg 3). Additionally, economic growth is defined as “sustained capital accumulation; the size of the economy being the sum of goods and services that can be produced within it, and this quantity, in turn, being defined as the productivity of the factors of production land, labor, enterprise and capital” (Foa 2011, pg 5). Therefore, social cohesion is linked to economic growth and total factor by preventing capital disaccumulation (Foa 2011, pg 5). Finally, stronger norms towards collective action, prevent capital disaccumulation, increase land and labor productivity and encourage economic growth.

In conclusion, social cohesion increases the efficiency of resource allocation, which increases the total social welfare. Finally, productivity and economic growth could not be enhanced only by increased productivity factors such as technology if an appropriate atmosphere or institutional structure is missing (Prescott 1997, pg 549).

III. Theoretical model

Hall and Jones (1999) assume that output can be described with a Cobb-Douglas production function:

$$Y_i = K_i^a (A_i H_i)^{1-a} \quad (1)$$

Where Y denotes output in country I, K denotes the stock of capital or country i, H is the amount of human capital of country I, and A is a measure of productivity (technology). Defining each variable relative to labor (L), this equation becomes

$$y_i = (K_i/L_i)^{a/(1-a)} H_i/L_i * A_i \quad (2)$$

Taking logs

$$\text{Log } y_i = B1 \log(K_i/L_i) + B2 \log(H_i/L_i) + A_i \quad (3)$$

Further, assume that K_i/L_i and H_i/L_i are functions of social infrastructure and social cohesion. In this we also follow Hall and Jones (1999), who argue that "our specification for the determination of [output per worker] is parsimonious, reflecting our hypothesis that social infrastructure [capital] is the primary and fundamental determinant of output per worker" (p.99).[1] This leads me to the estimate three equations:

$$\text{Log } y_i = A1 * \text{SocInf}_i + A2 * \text{SocCoh}_i + A_i \quad (4)$$

$$\text{Log}(K_i/L_i) = C1 * \text{SocInf}_i + C2 * \text{SocCoh}_i + B_i \quad (5)$$

$$\log(H_i/L_i) = F1 * \text{SocInf}_i + D2 * \text{SocCoh}_i + C_i \quad (6)$$

[1] When performing a robustness test of the results, the authors document that the social infrastructure coefficient remains the same. Consequently, they argue that the extra exogenous variables such as education, technology transfers, human capital and physical capital are unnecessary in explaining productivity (Hall and Jones 1999, pg 113).

where $SocInf_i$ is social infrastructure in country i and $SocCoh_i$ is social cohesion in country i. Ai is the constant in the estimated equation.

II. Methodology and Data

In this project I focus on the relationship between social infrastructure and social cohesion with output per worker. Social infrastructure is one of the components used by Hall and Jones to test for differences in output per worker between countries. They document that the differences in capital accumulation, human capital accumulation, and output per worker are a consequence of government policies and programs (Hall and Jones 1999, pg 1). They conclude that social infrastructure is the primary determinant of capital and human capital. They also conclude that capital and human capital are the primary determinants of output per worker, and that therefore social infrastructure is the primary and fundamental determinant of the output per worker (Hall and Jones 1999, pg 114).

Another part of the literature on "social capital" focuses on the support of governments for broad participation and diversity inclusion. In "The Economic Rationale for Social Cohesion" article, Roberto Foa estimates the economic benefits of a country having policies that promote inclusion and hypotheses that lack of social inclusion imposes costs in the economy (Foa 2011, pg 1). The author presents a cross-country "social cohesion index" of 155 countries, which I use to explain the differences in output per worker. In measuring the indicator, the author has considered two aspects of social cohesion; whether there are norms of intergroup discrimination, and whether there is intergroup violence (Foa 2011, pg 7). Foa's research refers to evidence that lack of social inclusion impacts the allocation of the labor markets and other opportunities based on group membership (Foa 2011, pg 7). One of the contributions of my paper is to expand the econometric analysis of Hall and Jones (1999) by using the Foa (2011)

index to test whether social cohesion also influences output per labor, in addition to social infrastructure.

The data that I use in this paper are country level and cross sectional (across 127 countries) for the year of 1988. The variable “natural log of output per worker” is the natural log of GDP per worker across 127 countries. Dist is the absolute value of the degrees in latitude over 90 which measures the country’s distance from equator. Ln (frankel-roomer) is the natural log of Frankel-Romer predicted trade share. This share was computed from a gravity model based on two components; population and geography (Data Appendix for Hall and Jones 4). European Fraction is the fraction of population speaking one of the western European languages such as English, French, German, Portuguese and Spanish. Engfrac is the fraction of population speaking English only. Mining is the added value on the GDP that is earned in the mining industry which, is used to adjust the dependent variable, natural log of output per worker in the structural equation. Ecorg is the type of economic organization that measures the level to which the country is capitalised. Lncapital stands for country’s capital intensity or the stock of physical capital per unit of labor. Lnhcapital measures the human capital per unit of labor.

These 8 variables were collected from the Hall and Jones paper “Why do some countries produce so much more output than others”, which was published from The Quarterly Journal of Economics in 1999. The country’s distance from Ecuador data was collected by Hall and Jones from the Global Demography Project at the University of California, Santa Barbara (Hall and Jones 1999, pg 101). The type of economic organization was also collected by them. However, Hall and Jones do not explain what the original source of this data is. In addition, they collected the data on European and English language from Hunter (1992) and Gunnemark (1991) (Hall and Jones 1999, pg 102). The Frankel Roomer predicted trade share was collected by Hall and Jones from the paper of Frankel and Roomer (1996) (Hall and Jones 1999, pg 102).

Hall and Jones collect the output per worker, mining and human capital data from National income, product account and labor force data taken from “the Penn World Tables Mark 5.6 revision of Summers and Heston” (Hall and Jones 1999, pg 88). The data on the physical capital stock was also collected by Hall and Jones from the Summers and Heston data set (Hall and Jones 1999, pg 102). Hall and Jones have estimated the social infrastructure index as the average between two coefficients. They collect the data in the first coefficient from a firm that is specialized in estimating the risk to international investment and political services and follow Knack and Keefer in using the average on this data as a scale from 0 to 1 (Hall and Jones 1999, pg 97). The second element that is used to estimate the social infrastructure index captures the level of country’s openness and was initially collected from the Sachs and Warner (1995) paper (Hall and Jones 1999, pg 98).

In addition, I have collected the social cohesion index for 155 countries from “The Economic Rationale for Social Cohesion” paper by Roberto Foa (2013). Foa constructs the social cohesion index based on the data published on the ISS website and Gallup World Poll which were donated to him for use in this project (Foa 2013, pg 7). This index reflects weather there are policies that punish discrimination and weather there is intergroup violence.

Ethnic and religion fractionalization measure the level of heterogeneity in terms of ethnic and religion within one country. The ethnic and religious fractionalization data that I use on this paper was accessed through the NSD Macro Data Guide website and compiled by Alberto Alesina. The data was compiled primarily by national census and also “Encyclopaedia Britannica (2001), CIA’s World Factbook (2000), Levinson’s Ethnic Groups Worldwide (1998),

Minority Rights Group International's World Directory of Minorities (1997) and Mozaffar & Scarrit (1999) for selected African countries" (The Macro Data Guide).[2]

I have followed the Hall and Jones method for adjusting the GDP observations to exclude mining. The value added in the country's output from the mining industry has been subtracted from the country's total GDP. By doing this subtraction, the rich countries in oil and gas such as Oman and Saudi Arabia are not on top of the list in terms of productivity (Hall and Jones 1999, pg 89). In addition, the authors use the traditional Cobb Douglas approach to measure the labor augmenting productivity. I have followed this approach, and used the log linear function, in order to estimate the impact of social infrastructure and social cohesion on the output per worker.

(a) Endogeneity

Estimating the impact of social infrastructure and social cohesion on output per worker, capital, and human capital with the ordinary least squares method would not provide optimal and unbiased model coefficients because the dependent and independent variables are simultaneously determined. For instance, a better social infrastructure influences higher output per worker, capital and human capital, and higher output per worker, capital and human capital leads to a better social infrastructure and cohesion environment. A social infrastructure that is favorable to high levels of output per worker influences an environment where the government is a more efficient provider of it (Hall and Jones 1999, pg 84). In addition, a socially exclusive country includes various transaction costs such as contract enforcement that are associated with unprofitable economic activity. Such costs create a deadweight loss that negatively impacts

[2] We also tested a country's research and development expenditure as a proportion GDP as a potential IV. This variable was collected from the World Bank database. After testing, we concluded that research expenditure as a proportion of country's GDP is correlated with the social infrastructure index but also with the error terms in the three structural equations. Thus this variable is not a valid instrument and we do not use it in predicting social infrastructure

the social surplus and the output per worker. Consequently, poor economic growth has a simultaneous impact on generalized social trust (Foa 2011, pg 4). Since these variables are likely to be correlated with factors that are omitted from the equation, a two stage least squares estimation is necessary to identify the true impact on output per worker.

Because of the simultaneous relationship between social cohesion and social infrastructure vs. output per worker, capital and human capital, OLS is not able to provide consistent parameter estimates. Thus a two stage least squares estimation with instrumental variables is necessary to take into consideration this endogeneity.

In addition to the simultaneous relationship between output per worker and social infrastructure, the factors of productivity are also correlated with social capital. This is the reason why Hall and Jones estimate three separate structural equations in the two stage least squares IV model. More specifically, they estimate the correlation of the social infrastructure and social cohesion on the capital per labor as a first structural equation, the correlation of these two endogenous variables on human capital per labor as second structural equation and lastly, the correlation of these variables on the output per worker as the third structural equation. In the language of Hall and Jones, a country that experiences an exogenous increase in productivity, will experience an increase in capital-labor ratio as well (Hall and Jones 1999, pg 88). Thus, part of the increase in output per labor could be due to increased productivity in the factors of production and social capital. Finally, I have followed the Hall and Jones method for analysis and have estimated the impact of social infrastructure and social cohesion on output per worker while considering the correlation of these endogenous variables with the factors of productivity such as human and physical capital.

(b) The instrumental variable technique.

In the instrumental variable estimation technique, first stage regressions are estimated where the endogenous right-hand-side variables in the structural equations are estimated as a function of exogenous and instrumental variables. In order to be appropriate instruments, the instrumental variables must satisfy two conditions. First, the instrumental variable must be correlated with the endogenous variable (in this case, social infrastructure and social cohesion), Second, the instrumental variables must be uncorrelated with the error term in the structural equations (in this case the dependent variables in the structural equations are the output per worker, capital per worker and human capital per worker equations).

To remove endogeneity in the model, I hypothesize that social infrastructure is determined by the following instruments: dist, ln (frankel-roomer) and european fraction, linearly. The reason that Hall and Jones think that these are valid instruments is explained by the historical and geographical factors. Western Europe is the first region of the world that adopted a set of social institutions favorable to production (Hall and Jones 1999, pg 86). Hall and Jones use these characteristics to measure the political impact that Western Europe had in the social institutions of these countries. The authors claim that Western Europeans were more likely to settle in areas that were similar in climate to Western Europe (pg 101). Since these areas are far from equator, the distance from equator variable is expected to have a positive relationship with social infrastructure. In addition, using fraction of population speaking Western European languages variables to measure the effect of Western European influence on the social institution follows the intuition.

The Frankel-Roomer trade share is also used as a measurement of Western European influence. In the “Does Trade Cause Growth?” article, Jeffrey Frankel and David Romer investigate how international trade affects the standard of living. They conclude that the amounts of trade cannot be determined exogenously since trade and income have a simultaneous relationship. Nevertheless, the Frankel-Roomer trade component is based on

population and geographic factors. For instance, some countries trade more just because they are less isolated than others (Frankel, Roomer 1999, pg 394). The Frankel -Roomer trade share being uncorrelated with the error term Ui follows the intuition since geographic factors are not a consequence of income or government policy. Finally, the listed instruments are important determinants of overall social infrastructure since the Western Europeans were not looking for places with high output productivity but rather rich in natural resources. (Hall and Jones 1999, pg 101).

The tested instrumental variables for predicting social cohesion are ethnic fractionalization, language fractionalization, and type of economic organization. The type of economic organization coefficient measures the level to which the economy is capitalized. A more capitalized country translates into a higher control of the labor market by private companies rather than the government. Hence, as private owners are more interested in profit maximization they care about the labor productivity rather than the identity group that each unit of labor is identified with. Therefore, I believe that this would impact the level of discrimination and inclusion in the labor markets or social cohesion. Thus, I expected type of economic organization to have a positive relationship with social cohesion. On the other side, there isn't a definite correlation between the degree of capitalism index or the degree of government intervention in the economy and the productivity per worker, which indicates that the variable is not necessarily correlated with the error term from the structural equation. Ethnic and religious fractionalization is used by Foa as instrumental variables for predicting years in conflict and civil conflict deaths. Since the level of conflict is one of the components that forms the social cohesion index, I have used these variables as instruments to directly predict social cohesion. On the other side, language and ethnic fractionalization do not directly affect the country's GDP. Finally, I use these instruments to explain the level to which minorities are enabled to participate in the economy.

Table 1: Descriptive Statistics

Variable	Obs	Mean	St.Dev	Description
Socohesindex (S2)	128	5.112266	1.337337	The level of nondiscriminatio n in the political-economical system towards different identity groups
ecorg	152	3.197368	1.659967	The type of economic organization
Socinf (S1)	130	.4680509	.2501475	Country's level of anti-extraction
ecuadordist	152	.2597722	.1765884	Country's distance from Ecuador
logfrankroom	150	2.981647	.799217	The amount of trade based on population and geographical factors.

eurfra	152	.2661974	.4040497	The fraction of population speaking European languages including English
lnyladj	134	8.743045	1.077552	Output per labor excluding the contribution from the mining industry
religionfrac	148	.4334291	.2429692	The portion of population that is religiously fractionalized

ethnicfra	149	.4362738	.2692476	The portion of population that is ethnically fractionalized
logkl	127	9.259673	1.559372	The natural log of capital per

				unit of labor
loghl	127	.5854607	.2895141	The natural log of human capital per labor

III. Analysis and Results

Reduced Form Equations

Table 2 reports the results of the reduced form OLS regression of social infrastructure on the three instruments; distance from equator, Frankel Romer trade share, and portion of the population speaking European languages (including english).

Social Infrastructure = B_{11}* dist+ B_{12}* ln (frankel-roomer) + B_{13}* european fraction + Ui (7)

Table 2: Results For First Reduced Form Regression

Repressors	Dist	European Fraction	Ln (Frankel-Roomer)
Social Infrastructure	.697***	.174***	.056***
	(.095)	(.0229)	(.022)

The standard deviations (in parenthesis) reported.

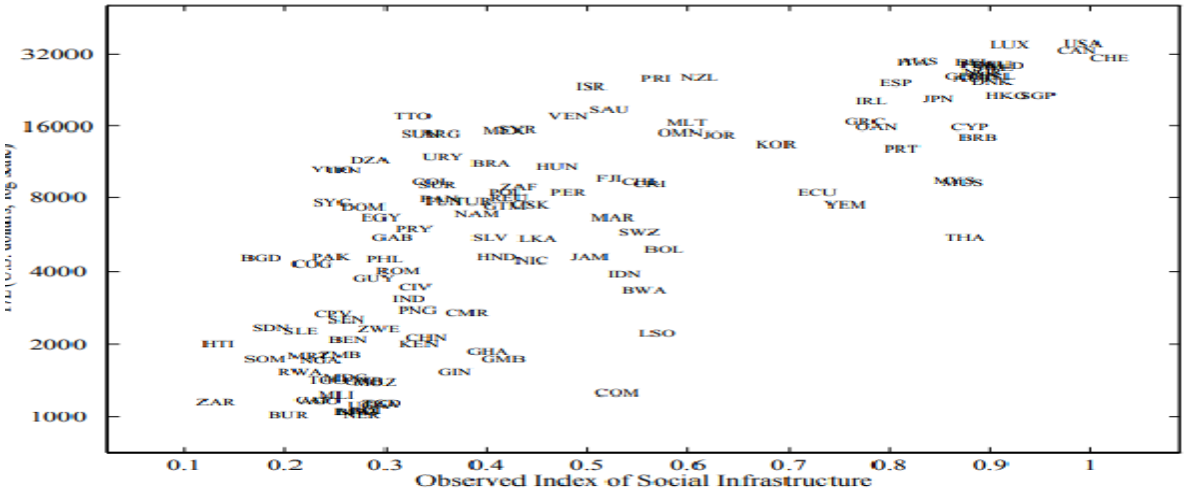
R^2=.38

The results show that the distance from the equator, the Frankel-Romer predicted trade share, and the fraction of the population speaking a European language (including English) explain 38% of the variation in the social infrastructure. The instruments are significant and positively correlated to social infrastructure which, confirming that there is a strong correlation between Western European influence and social infrastructure. In addition, these three coefficients are statistically significant at 5% level which proves that there is a high correlation between the instruments and social infrastructure. This fulfills the first condition of endogeneity.

Hall and Jones use the fraction of population speaking English in addition to the fraction of population speaking European languages (including English) to allow for separate impacts. Nevertheless, in my analysis, the exclusion of fraction of population speaking English variable makes the distance from equator coefficient more efficient. In addition, there is substantial correlation between English fraction and European fraction while holding other coefficients constant. This correlation could be due to repeated observation of individuals who speak English in both variables.

A one unit increase in distance from equator is associated with a .697 unit increase in the social infrastructure. The sign of this coefficient confirms the Hall and Jones intuition behind this instrument. The further we move from equator the stronger the impact of the Western Europeans in the country's social infrastructure is. A 1% increase in the predicted Frankel-Roomer trade share increases the level of social infrastructure by .06 units. As expected, the fraction of population speaking European languages is positively correlated to the social infrastructure. For 1 unit increase in this fraction, social infrastructure increases by .17 units, ceteris paribus. The fraction of population speaking European languages is a good indicator of Western European influence in the social infrastructure which is reaffirmed by the highly significant and positive coefficient.

The countries with the highest coefficient of social infrastructure are the United States, Canada and Switzerland (see fig 1). U.S.A has the highest output per worker while Canada and Switzerland are among the highest. Countries that list the lowest in terms of social infrastructure are Zaire and Haiti. More importantly, these two countries are among the lowest in terms of output per worker as well. In figure 1 we can observe a relatively strong and positive relationship between output per worker and social infrastructure. In addition, there is a higher variation of the output per worker between countries in the medium level of the social infrastructure compared to low or high. The variation could be partially measurement error and partially variation in true social infrastructure (Hall and Jones 104).



Graph from Robert E. Hall and Charles I.Jones, Why Do Some Countries Produce So Much More Output Per Worker Than Others, (The Quarterly Journal of Economics 1999)

Equation 8 is the reduced form equation for predicting social cohesion. Table 3 reports the output of the first stage least square for estimating the social cohesion with three instruments

Social Cohesion= B_{21}*ethnicfrac + B_{22}*Religions Frac + B_{23}*ecorg +Ei (8)

Table 3 Results For Second Reduced Form Regression

Repressors	Ecorg	Religion Fraction	Ethnic Fraction
Social Cohesion	.241***	.421	-1.798***
	(.069)	(.477)	(.420)

The standard deviations (in parenthesis) reported.

R^2= .20

The only significant coefficients in the estimate of the reduced form equation for Social Cohesion are the ethnic fractionalization and type of economic organization. Religion fractionalization is highly insignificant which indicates that this variable does not fulfill the first condition for being a valid instrument. Ethnic fractionalization and type of economic organization are significant at the 1% level, with ethnic fractionalization being the most significant. 20% of the variation in the social cohesion index is explained by the right hand side variables. According to previous literature, ethnic diversity is uncorrelated with economic and political outcomes of interest (Alesina & Ferrara 2005, pg 24). Thus, the variable seems to be independent from other variables in the system. Religious fractionalization is not a significant determinant of Social Cohesion. Therefore, it does not satisfy the first condition of an appropriate instrument, and therefore I next re-estimate the reduced form equation for Social Cohesion without this variable.

Social Cohesion= B_{31}*ethnicfrac + B_{32}*ecorg +Ei (9)

Table 3a: Results for Re Estimated Second Reduced Form Regression

Repressors	Ecorg	Ethnic Frac
Social Cohesion	.257***	-1.732***
	(.066)	(.402)

The standard deviations (in parenthesis) reported.

R^2=.19

Table 3a represents the estimation where the irrelevant instruments: religion fractionalization and language fractionalization has been excluded. We can observe that after removing this variable, the strength of the type of economic organization slightly increases, while ethnic fraction slightly decreases. Additionally, the R^2 value decreases by less than 1%. Both coefficients maintain the same sign and are significant at 1% level of confidence. Therefore, these instruments fulfill the first condition of endogeneity.

Previous empirical literature suggests that there is a negative relationship between diversity and social cohesion. For instance, individuals who live in more diverse communities tend to feel less trust and be less involved. Furthermore, it had also been suggested that immigration and ethnic fractionalization have a negative relationship with social cohesion. In the "Diversity and Community in the 21 Century", Robert Putnam states that in areas of greater diversity the respondents reported lower confidence in local governments and lower political efficacy. More specifically, the author concludes that the measures that they used in civil engagement were negatively correlated with the ethnic diversity (Putnam 2014, pg 149).

Another project of the literature that observes the effect of ethnic diversity in an economic point of view was provided by Harvard Institute of Economic Research. In the "Ethnic Diversity and Economic Performance" Alesina and La Ferrara (2015) found that diversity has a strong negative effect on trust (pg 18). Finally, a large part of the literature points towards the negative effects of diversity into the social cohesion component.

Structural Equations

a. Capital Structural Equation

Equation (10) is the structural equation for estimating the impact of social infrastructure and social cohesion on the capital/labor ratio.

$$logkl = B_{0k} + B_{1k}*S^1 + B_{2k}*S^2 + + K_i \quad (10)$$

where logkl is the natural log of capital per unit of labor, S^1 is the predicted social infrastructure, S^2 is the predicted social cohesion and K is an error.

Table 4: Results For First Structural Regression

Repressor	Social Infrastructure'	Social Cohesion'
logkl	.620***	.589***
	(.067)	(.174)

The standard deviations (in parenthesis) reported.

R^2=.58

Table 4 presents the results of the second stage structural equation estimate of equation (10). These results suggest that both social infrastructure and social cohesion have similar positive and statistically significant impacts on the capital/labor ratio. As both indexes of social

capital range from 0 to 1, these results suggest that a 0.1 unit increase in social cohesion (out of 1) increases the capital/labor ratio by 5.9%, while that a 0.1 unit increase in social infrastructure (out of 1) increases the capital/labor ratio by 6.2%.

b. Human Capital Structural Equation

Table 5 presents the results of the estimation of equation 11, the correlation between the human capital with predicted social infrastructure and predicted social cohesion.

$\log h/l = B_{0h} + B_{1h}*S^1 + B_{2h}*S^2 + Z_i$ (4) (11)

where logh/l is the natural log of human capital per labor, S^1 is the predicted social infrastructure, S^2 the predicted social cohesion, Z is an error term.

Table 5: Results For Second Structural Regression

Repressor	Social Infrastructure'	Social Cohesion'
Loghl	0.119***	.0791**
	(0.013)	(.034)

The standard deviations (in parenthesis) reported.

R^2=.53

Social cohesion and social infrastructure both have a strong and significant correlation with human capital. In this case, social infrastructure has a slightly larger impact on human capital than social cohesion. A 0.1 unit increase in social infrastructure is associated with 1.19% increase in the human capital, while a 0.1 unit increase in social cohesion is associated

with a 0.79% increase in human capital. However, since at least one of the instruments is likely to be correlated with the error term in equation (11)—see below--the results presented in table 5 are not reliable.

c. Output per Worker Structural Equation

Equation 12 is the structural equation that measures the impact of social infrastructure and social cohesion on the natural log of output per worker.

$$lnyladj = B_{0p} + B_{1p}*S^1 + B_{2p}*S^2 + F_i \quad (12)$$

where lnyladj is the natural logarithm of output per worker excluding the contributions from the mining industry, S^1 is the predicted social infrastructure, S^2 is the predicted Social Cohesion and F is an error. The results of this regression are presented in table 6.

Table 6: Results For Third Structural Regression

Repressors	Social Infrastructure'	Social Cohesion'
lnyadj	0.453***	0.449***
	(0.111)	(0.043)

The standard deviations (in parenthesis) reported.

R^2=.62

Social infrastructure and social cohesion are highly significant and positive which follows the intuition. The impact of social infrastructure and social cohesion on output per worker is similar. A 0.1 unit increase in social infrastructure follows a 4.5% increase in the adjusted output per worker. A 0.1 unit increase in social cohesion also increases the output per worker by 4.5%.

Testing the overidentification restrictions (the 2nd condition of a valid instrument).

When there is more than one instrumental variable it is possible to test the over-identification restriction, the condition that the instruments are not correlated with the error term in the structural equation. Specifically, the following three steps are needed to test this assumption (see Wooldridge, 2009, p. 537):

1. Estimate the structural equation using 2SLS and save the 2SLS residuals.

2. Regress the 2SLS residuals on all exogenous variables, save the R^2.

3. Compare n*R2 to the critical values from the chi-square distribution. If the test statistic (n*R2) is greater than the 5% critical value the chi-square table, you can conclude that at least some of the IVs are correlate with the error term in the structural equation.

When testing for the correlation of the 2SLS residual from the first structural equation (capital) with the exogenous variables or the instruments in the first and second reduced form equation we find that all the coefficients are statistically insignificant at 1% level. The test statistic of N*R^2= (145*.014)=2.03 is less than the 7.81 critical value in the Chi-square

distribution at 5 % level of significance and three degrees of freedom. These results indicate that the instruments are not correlated with the predicted error term from the first structural equation. When testing for the correlation of the 2SLS residuals from the second structural equation (human capital) with the exogenous variables we find that the Frankel Roomer trade share is significant at the 5% level while the other coefficients are highly insignificant. The test statistic of 9.84 is higher than the critical value in the Chi-square distribution at 5 % level of significance and three degrees of freedom. This result indicates that one or more instruments are correlated with the predicted error term in the second structural equation. We also found that the 2SLS residuals from the third structural equation (output per worker) are uncorrelated with the exogenous variables and the coefficients are highly insignificant. The test statistic of .66 is smaller than the critical value in the Chi-square distribution. This indicates that the exogenous variables are uncorrelated with the error term in the third structural equation.

Testing for Endogeneity

It may be that there is no endogeneity issue with the two social capital variables. In that case, OLS is more efficient that IV 2SLS estimation. The test for endogeneity involves the following steps (see Wooldridge, 2009, p. 535):

(1) Estimate the two reduced form equations and save the residuals.

(2) Add the residuals from the two reduced form equations as explanatory variables to each structural equation (in addition to the two social capital variables). Estimate the structural equation with OLS. If the coefficient on the residual from the reduced form equation is statistically significant, this is evidence of endogeneity of that variable. If the coefficient on the residual from the reduced form equation is not statistically significant, this indicates that variable is not endogenous. If the variable is not endogenous, then you should re-estimate the structural equations using OLS (not 2SLS) because OLS is more efficient.

After re-estimating the first structural regression with the addition of the residuals from the two reduced form equations we notice that the saved error term from the social infrastructure reduced form equation is highly significant at 1% level. Meanwhile the predicted error term from the second reduced form equation is highly insignificant. Nevertheless, the coefficients are both highly significant when regressed on the second structural equation. Finally, when regressing the estimated errors in the third structural regression we notice that only the predicted error term from the first reduced form equation (social infrastructure) is significant while the other is highly insignificant. According to the results of these tests there is an endogeneity issue with the social capital variables and relying on the OLS estimation will provide biased and inefficient coefficients.

Discussion

I also estimated a linear regression model where the dependent variable is the natural logarithm of the adjusted output per worker regressed on social infrasctructure, social cohesion, human capital and physical The purpose of this equation is to see if there is evidence for the Hall and Jones conclusion that social capital affects output per labor indirectly through it's impact on human capital and social capital and not directly. If the coefficients on social infrastructure and social cohesion are insignificant in this equation while the coefficients on capital and human capital are significant, then this is evidence that social infrastructure and social cohesion affect output per worker only through their impact on human capital and physical capital. According to the results, all the coefficients of this regression are statistically significant at 5% level. Thus, social capital (social infrastructure and social cohesion) seems to have independent, separate impacts on output per labor that goes beyond the impact on physical capital and human capital--the opposite of what Hall and Jones conclude.

Conclusion

We present evidence that, as Hall and Jones (1999) show, social infrastructure is an important determinant of capital, human capital and output per labor. In addition, we also show that social cohesion (another type of social capital) is also an important determinant of capital, human capital and output per labor. In these estimates we use the instrumental variable technique to control for possible endogeneity/simultaneity between social capital, social infrastructure and the dependent variables of interest (capital, human capital and output per worker). We tested that the instrumental variables fulfilled the conditions for appropriate instrumental variables. We also tested for whether endogeneity was present, presenting evidence that it was. Therefore, we were justified in using the instrumental variable technique rather than OLS.

Limitations

The instrumental variable technique requires the instrumental variables to fulfill two conditions. First, they must be correlated with the included endogenous variables. Second, they must be uncorrelated with the error term in the structural equations. All included instruments passed the first test. However, while the instruments passed the second test for the structural equations where the dependent variables were physical capital and output per labor, they did not for the structural equation where the dependent variable was human capital. More specifically, on the overidentification test we observe that at least one of the instruments used to predict the two endogenous variables is correlated with human capital in the second structural equation. This is a limitation of the estimate of the structural equation where the dependent variable is human capital.

Other possible limitations in the data include measurement error and omitted variable bias. For instance, there could be other independent variables that are not captured in the model and that measure the social capital and social infrastructure and the other independent

variables included in the model. In addition, measurement error or the measurement noise within the independent variables, such as the social infrastructure index, could also cause bias. The social infrastructure index is computed as the average of GADP and YrsOpen. The GADP component captures the level of government anti extraction policies and is the equally weighted average of 5 variables; law and order, bureaucratic quality, corruption, risk of expropriation, and government repudiation of contracts. YrsOpen measures the openness to trade with other countries. The measurement error consists on the fact that social infrastructure is not observed directly and is computed as a sum of the openness and GADP variables. Furthermore, these two components individually incorporate some level of measurement error; 17 countries do not include data on the GADP variable and 16 countries on the openness variable (Hall and Jones 1999, pg 102). In addition, 22 countries were missing data on the research expenditure variable and 15 on the mining as a share of country's GDP. Even though the index captures the main components that determine the quality of the social infrastructure, other factors that contribute to social infrastructure could be neglected. For instance, the coefficient does not include hospitals, schools or police and fire stations. Hall and Jones recognize the possibility for having measurement error in estimation of the social infrastructure coefficient and claim that incorporation of this index into private returns and productive activities is ambiguous (Hall and Jones 1999, pg 97).

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