IONA

JOURNAL OF ECONOMICS

VOLUME IV 2019

Vancouver School of Economics

University of British Columbia
Vancouver, BC

Cover Design: Lily Suh
Logo Design: Sean Durfee

All published content featured in the *IONA Journal of Economics* is available online at ionajournal.ca.

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Printed in Canada.

First Printing, 2019.

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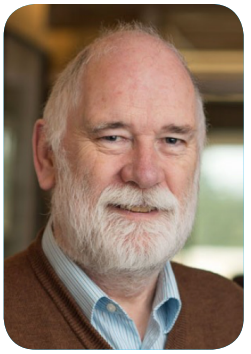

Kavya Dinesh, the Managing Editor of the IONA Journal of Economics (IJE), has asked me to write a brief foreword for this year's Vol. 4. I am very happy to do this, and I thank her for the opportunity.

The IJE is a very worthy, ambitious and successful student project, founded four years ago by Terralynn Forsyth (BA, Econ & IR; 2016) with the strong support of VSEUS. Terralynn organized a full editorial staff, commissioned a number of papers, and solicited submissions from the top 25 or 30 papers submitted in the previous year in the VSE's research courses (Econ 490 and Econ 499). She spent a lot of time organizing, editing, and producing the journal's first edition, and securing grant financing for publication of a paper version. In the end, her effort led to a very successful Vol. 1 of the IJE. More importantly, it led to the creation of a very successful ongoing student project, which, with the hard work of a Managing Editor and Editorial Staff, publishes a volume of the IJE every year. The journal is now publishing its fourth issue.

What is the mission of the IJE? Memorializing those humble souls that lie buried in a country churchyard, but who might have been great in different life circumstances, Thomas Grey used the metaphor

> *"Full many a gem of purest ray serene*
> *The dark unfathom'd caves of Ocean bear;*
> *Full many a flower is born to blush unseen*
> *And waste its sweetness on the desert air."*

Terralynn wrote in her editor's letter to Vol. 1 that "It is commonplace in the undergraduate world for great work to be left behind to collect dust on a shelf. On a campus vibrant with student life and resources, this is unfortunate and unnecessary." On this view the mission of the IJE is to serve as a platform for VSE undergraduates to showcase the exciting and relevant research work being done by them---to discover the gems and to savour the flowers' scent. The screening process for publication is very rigorous, and the ac-

cepted papers are thus of high quality, but they would have had little or no possibility of being known to a wider audience without the journal.

She also writes "In addition to their skilled composition, research aptitude and originality, the papers and research features published in this volume [1] showcase a wide variety of topical areas within economics." In this way, the IJE provides a platform for the exchange of a diversity of ideas related to economics. In this volume, three of the papers are related to the broad area of women and the economy ("Contraceptives and Long-run Economic Growth"; "Female Autonomy through Water Collection"; "Breastfeeding and Long-run GDP Growth"), while one relates to the importance of physical investment ("Mobile Broad Investment and Economic Growth"), and another to the importance of social-capital investment ("Caste, Community Networks and Business Incomes"), for income. All of the papers are relevant to the developing world.

In short, the journal stands as an exposition of and a salute to the quality of the papers it contains; it sets an ambitious level of aspiration for future research in the VSE undergraduate research courses; and, it demonstrates the breadth of undergraduate research and its relevance to the real world.

On a final note, the IJE achieves another, unintended, effect. Starting with Terralynn the journal has continued as a successful annual project only because of the self-sacrifice, dedication, and commitment of the managerial editors and staff who volunteer each year to put in the hard work necessary to achieve a great product. We should all be grateful to them for their time and effort. In effect, the published editions of the journal itself stand as the best (and substantial) memorial to the achievements of the Editor and Staff who produce it each year. Long may they continue the good work!

Hugh M. Neary
Professor Emeritus

Letter from the Editor-in-Chief

Dear Reader,

I'd like to thank you for the support you offer the IONA Journal by giving Volume IV a read. The undergraduate research presented here is intelligent, inquisitive and unique; far too often, however, it is limited in its abilities to be shared. Readers like you give new voices a chance to be heard and new ideas an opportunity to take root.

Inside you will find work produced by economics students across the arts major, international economics and honours programs. The rigour of these papers is complemented by the diversity of its authors to create a truly exemplary and distinctive showcase of undergraduate research efforts. Covering the topics of female autonomy, mobile broadband investment, social ties, breastfeeding and contraceptive access, the contributors to Volume IV reflect the breadth of applied economics at its best. Wherever your interests in economics may lie, there is surely something for you in the pages beyond.

Thank you to the IONA editorial board and staff for their unrelenting effort, their diverse opinions and their dedication to providing a platform for undergraduate research. We couldn't have done this if not together.

And finally, to current and future undergraduate students at the Vancouver School of Economics, from one student to another: it can be difficult to connect your coursework with the real world. The research presented in this volume is an example of how your education can equip and enable you to start answering questions about addressing global challenges. When reading through the journal, I hope you consider all that you are able to do with what you've learned, and the value of what you can produce. Enjoy!

Mina Sidhu
Editor-in-Chief
IONA Journal of Economics Volume IV

Letter from the Director of Business Operations

Dear Reader,

Thank you so much for taking the time to peruse Volume IV of the IONA Journal of Economics. Our team is extremely excited to share what we believe are the top papers of undergraduate economic research in this academic year.

The creation of this journal is all thanks to the countless hours of the dedicated IONA editorial board, staff, and VSE faculty. I am extremely proud to have worked alongside such a dedicated and brilliant team.

From our operations and logistics team who helped in design and took initiative to support us, to the meticulous effort from our editorial team, who has been the main pillar of support when it came to evaluating the large volume of high-quality papers. Foremost, to the Editor-in-Chief, Mina Sidhu, who has been imperative to the operation and successful completion of the journal. This journal truly would not have been published nor operating if not for your devotion and hard work. To the faculty of VSE, thank you for your guidance and comprehensive feedback that not only aided us as writers but future economists as well.

My hope is that while you read this journal, your curiosity to pursue greater knowledge is sparked or you become inspired to contribute to a community of research here at UBC. Wherever your academic journey takes you, I hope the IONA Journal of Economics can support you.

Cheers,

Sara Cortes
Director of Business Operations
IONA Journal of Economics Volume IV

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I

PAPERS

Let's Talk About Sex: Unmet Need for Contraceptives and Long-Run Economic Growth

Kat Gallant

ECON 490

ABSTRACT

There appears to be a gap between access and demand for contraceptives in developing countries today. For 46 countries, most of which are in Africa, less than 50% of the demand in 2017 for family planning was met by modern contraceptives (United Nations, 2017). The impact that unmet need for contraceptives has on economic growth has not received enough attention. I estimate the effect of unmet need for contraceptives for married women of ages 15-49 on the long-run economic growth of 98 countries. The results show that a 1% increase in unmet need for contraceptives leads to a 0.7% decrease in GDP per capita in rich countries and a 0.6% increase in GDP per capita in poor countries.

I. INTRODUCTION

Until the late 17th century, societies were characterized by high fertility and mortality rates, wherein any gains in technological advances were absorbed by an increase in population size. This stagnation in growth, commonly known as the Malthusian Trap, began to give way in now-developed countries during the Industrial Revolution when increases in technology that elevated standards of living superseded the increase in population size. Galor and Weil (2000) refer to this transition period as "Post-Malthusian", where high fertility persisted and small gains in technological advancement were made, increasing income per capita. Developed countries are now experiencing the "Modern Growth" regime, which is characterized by low fertility and low mortality combined with an exceptional rate of technological growth leading to large gains in income per capita. While mortality rates have declined significantly in developing countries (Acemoglu and Johnson, 2007), high fertility rates persist, especially in sub-Saharan Africa (United Nations, 2015).

Much of the literature today suggests that one of the largest factors affecting women's fertility is access to contraceptive technologies. Women have advocated for legal access to effective contraceptives since their availability in the developed world as of the 1890s (Greenwood and Guner, 2010). The emergence of contraceptives resulted in women protesting policy and laws that prohibited not only the distribution of contraceptives but also the spread of information about family planning techniques. Emma Goldman, a feminist, and birth control advocate in the early 1900s was imprisoned at least twice for her political actions supporting the birth control movement. The popularity of Goldman's lectures on birth control highlighted the importance of this issue to women of her time (Falk, Cole and Thomas, 1995). The increased efficacy and availability of birth control options

for women in recent decades has led to robust literature on the effects of fertility on economic growth. Recent research has shown how access to contraceptives not only limits fertility but increases women's human capital accumulation by allowing them to attend school and work for long uninterrupted periods of time, which increases their lifetime earnings (Goldin and Katz, 2002; Bailey, 2006; Troske and Voicu, 2013).

Policy makers, governments and NGOs have become more receptive to and aware of the need for legal contraceptives, which has resulted in a surge in the supply of contraceptives in developing countries (World Health Organization, 2017). Yet, there remains a gap between access and demand: In 2012, 68 of every 1000 pregnancies in Latin America and the Caribbean were unintended, and this number increases to 80 of every 1000 in Africa (Sedgh, Singh, and Hussain, 2014). More recently, the World Health Organization estimated that in 2017, less than 50% of the demand for modern contraceptives was met by modern contraceptives in 46 countries, most of which are in Africa (United Nations, 2017). Despite the increase in access to contraceptives, the fertility transition in sub-Saharan Africa has been stagnating, signaled by a higher decline in fertility rates in the mid-1990s than in 2000 (Bongaarts, 2008).

Does the demand for contraceptives partially account for different patterns in economic growth? It has been argued that access to contraceptives has important positive effects on economic growth (Miller, 2010), but there remains a gap in the economic knowledge of the demand-side effect. To broaden the literature on this topic, this paper will explore the effect of women's "unmet need" for contraceptives, which is defined as the percentage of married women of reproductive age (ages 15-49) who are fertile and do not want children but are currently not using contraceptives, on countries' long-run economic growth.

The results of this paper find a negative relationship for rich countries, with a 1% increase in married women's unmet need for contraceptives leading to a 0.7% decrease in GDP per capita. This can be attributed to the high opportunity cost of childbearing and childrearing for women in developed countries, in which women with more children and earlier-timed births accumulate less human capital over their lifetimes. However, the results of the regression also show a positive relationship between unmet need and economic growth in poor countries, where a 1% increase in unmet need for contraceptives results in a 0.6% increase in GDP per capita. I account for this positive relationship due to the imperfect measurement of "unmet need" by the World Bank. While this is the commonly-used measure for the gap in access and demand for contraceptives worldwide, it was likely created with a bias toward Western fertility preferences where women wish to reduce their fertility over time in order to pursue further education and careers, making it an inappropriate measure when applied to developing countries.

The structure of this paper continues as follows: Section II reviews previous literature on the factors influencing women's fertility choices, human capital accumulation, and other behaviour that influences economic growth. Section III covers the key details and limitations of the data collected from the World Bank database and the Penn World Table database. Section IV describes the long-run growth accounting model used to establish a relationship between unintended pregnancies on GDP per capita over time. Section V reviews the results of the analysis, and provides suggestions to policymakers in regards to implementing measures for more effective fertility control in developing countries.

II. PREVIOUS LITERATURE

The consensus is clear: high fertility rates lower economic growth worldwide. In developed countries high fertility takes a large toll on the economy because the cost of childbirth and childrearing is significant on parents – especially mothers. Goldin and Katz (2002) present a supply-driven explanation for the increase in women attaining a four-year college degree from 1970 to 1990 and an associated delay in age of first marriage, owing partially to the early legal access (ELA) to oral contraceptives. The authors hypothesize that because of ELA to oral contraceptive pills, fewer unwanted pregnancies occur; therefore, women are able to commit to longer-term educational programs and marry at a later age. Their data comes from the Census of Population from 1970, 1980 and 1990, which provides statistically significant results. Goldin and Katz find that ELA to oral contraceptives creates a 1.7% increase in the movement of college women into "nontraditional" professions, those that require longer time and financial commitments, in this time period, as well as a 24-27% decline in women married before age 23 compared to the total change from the 1940s cohorts to the early 1950s cohorts.

Borrowing from the Goldin and Katz model (2002), Bailey (2006) hypothesizes that ELA to the pill had a permanent and significant effect on women's labour-force participation rate and their eventual earnings. Using data from the March and June Supplements of the Current Population Status data from the U.S. Census Bureau, Bailey evaluates the effect of ELA on fertility and finds that it does not decrease women's total fertility; rather, it delays the timing of first birth. The regression results reveal that ELA decreases the chance of a woman having a child before age 22 by approximately 14%. The results also show a 7% increase in labour-force participation for women aged 26-30, and an increase of 2%

for women aged 31-35. Conclusively, Bailey finds that the delay in timing allows women to pursue higher education and participate in the labour-force for longer periods before the birth of their first child, increasing their level of human capital. Troske and Voicu (2013) also explore the effect of spacing and timing of births on the levels of labour market participation of married women in the United States. The authors use the 1979 National Longitudinal Survey of Youth, which contains panel data on young women aged 14-21 from 1979-2004, and includes information on women's labour supply history, children's birth dates, as well as beginning and end dates of women's marriages. Troske and Voicu find that women who delay the time of their first birth have higher levels of prenatal labour market participation, which also vary with race and education levels. Furthermore, their regressions show that delaying the time of first birth reduces the negative effect of first birth on women's labour market participation in the year following the birth.

Bailey, Hershbein and Miller (2012) extrapolate from Goldin and Katz's (2002) seminal model for ELA to oral contraceptives to specifically investigate the effect of ELA on women's life-cycle wages by measuring the effects on human capital accumulation over their reproductive lifetime. The authors use data from the National Longitudinal Survey of Young Women, which includes data on 5,159 women aged 14-24 with the initial interviews conducted in 1968 and an additional 21 interviews in the years afterward. Data from the 1970 National Fertility Study (NFS) was also used, which includes information on ever-married women's oral contraceptive usage throughout the 1960s. Bailey, Hershbein and Miller find that women with ELA had a 20% higher college enrollment rate in their early twenties, were 15% more likely to have occupation training, and 17-30% more likely to be in professional or managerial positions in their late twenties. The authors conclude that early legal access to oral con-

traceptives allowed women in the 1960s and 1970s to invest more in their human capital through education and work experience, which ultimately increased their hourly wages. In analyzing the effects of motherhood on wages, Staff and Mortimer (2012) argue that it is the cumulative effect of breaks in work and education that account for the residual, unexplained "motherhood wage penalty," which describes the phenomenon in which American women with children earn about 5% less than women without children. The authors use the Youth Development Study (YDS) data collected from ninth-graders and their parents in Minnesota from 1988-1991 and pooled data collected from the same respondents annually for 13 years post-high school (1992-2004). All questions focus on determining participation levels in human-capital forming activities, as well as respondents' family characteristics and socioeconomic status through time. Using a two-level hierarchical model, the authors determine that the residual motherhood wage penalty can be attributed to mothers' cumulative breaks in human capital-forming activities such as work and schooling caused by births and childrearing. For instance, the authors found that for women who did not work or attend school for a cumulative amount of seven months over the 13-year study period wages decreased by 3.5%.

Fitzenberger, Sommerfeld and Steffes (2013) estimate the age-specific effect of first birth on employment rates and use Germany as a test case because of the country's unique and extensive maternity leave coverage of 36 months. By using Germany's Socio-Economic Panel Study (SOEP) data spanning from 1991-2008, the authors look at the varying levels of employment of women ages 24-33 after first birth compared to women of the same age who have not yet had children. Additionally, they look at the effect of these women's levels of education on employment. Overall Fitzenberger, Sommerfeld and Steffes find that there is a significant and persistent negative ef-

fect of first births on employment rates of women. Furthermore, they find that the ability to reenter the labour market does in fact depend on age and education levels at the time of first birth, but not in the way the human capital theory would expect. According to their findings, older women, especially those with medium levels of education, have a harder time finding employment after first birth.

Unfortunately, much of the literature on contraceptives and their specific impact on the economic outcomes of countries and individuals has focused on developed countries. The few studies that have explored these issues find that developing countries' fertility transition from higher to lower birth rates tends to be spurred by birth spacing, which boosts the human capital accumulation of mothers, much like in developed countries. For instance, Miller (2010) investigates the impact of women's fertility and human capital accumulation in Colombia using data from the 1973 and 1993 Colombian population census, the latter being the most recent full-population census available at the time this paper was written, as well as a 2% sample from the 1964 population census obtained from IPUMS International. Miller estimates access to programs provided by Asociación Probienestar de la Familia Colombiana (Profamilia), one of the world's oldest and largest family planning organizations, as a proxy for access to contraceptives, and finds that women with access to the programs had around 5% fewer children throughout their lifetimes. However, this decrease only explains 6-7% of Colombia's total fertility decline in its major cities. Upon further investigation, Miller finds that when women had early access to contraceptives as teenagers, they were 7% more likely to work in the formal labour sector and were 2% less likely to cohabit with men as romantic partners. Miller concludes that contraceptives in developing countries do not account for much of the demographic transition, but do explain the increasing

levels of human capital attained by women contributing to the rising socio-economic gains in these countries.

Moultrie, Takudzwa and Timæus (2012) investigate the unique aspects of South Africa's fertility transition, where the fertility decline and higher time between births differs from that of Europe and Asia because of its simultaneous effect on all parities, where parity refers to the number of times a woman has carried a pregnancy to a viable gestational age, and ages. They use data collected from 76 Demographic and Health Surveys conducted since 1986, which includes data on birth intervals in 24 African countries. The authors find large variations in overall fertility through time, regions, and different social, economic, political and cultural conditions across Africa. The lowest fertility rate observed is in South Africa at approximately 2.3 children per woman, and the highest fertility rate is 8 children per woman in Niger. However, despite this variation, birth intervals have become longer in every single country and do not depend on the age or parity of the mother. These results differ from the early fertility transitions of Asia and Europe and suggest that the transition is being driven by postponement of births rather than limiting family size. Additionally, the authors find that birth intervals increase substantially within countries when women indicate that they have used modern contraceptives prior to time of indexed birth.

The economic theories behind the impact of contraceptives and economic growth suggest that a lack of access should decrease women's human capital accumulation over time, and decrease potential future earnings. While there is little economic research on the demand-side effect on economic growth, the previous studies establish the argument that increased unmet need for contraceptives, which is used to measure the difference between women's demand for and access to contraceptives, should have a negative effect on long-run economic growth globally.

III. DATA DISCUSSION

The data I will use comes from two databases that provide cross-country panel data. The observations for the indicator of unmet need for contraceptives, UNMET, are obtained from the World Bank (2016) database, which sources information from each country's household surveys, including Multiple Indicator Cluster Surveys and Demographic and Health Surveys (DHS). The indicator itself is a measure of the percentage of married women of reproductive age (ages 15-49) who are fertile, and do not want children, but are currently not using contraceptives. To determine which women do not want children, or want to increase the time between births, DHS surveys ask if respondents want to have children in the next 2 years or at all (Bell and Bishai, 2017). The remaining indicators are from the Penn World Table 9.0 (Feenstra, Inklaar and Timmer, 2015), which combines data from various national surveys. The dependent variable, GDP, is a measure of real GDP per capita (in millions of USD) at constant 2011 national prices. POPG reflects the population growth plus an additional 0.05, which accounts for depreciation rate and technology growth (Mankiw, Romer, and Weil, 1992). The Solow growth model predicts a negative relationship between population growth and GDP per capita because it indicates decreasing resources per capita. The explanatory variable used for the human capital index, SCHOOL, is measured using the average years of, and returns to, education (Barro and Lee, 2013), which should have a positive relationship to GDP per capita (Mankiw, Romer, and Weil, 1992). The variable SAVINGS reflects the share of gross capital formation at current purchasing power parity (PPP), which can be interpreted as the amount of investment in physical capital in a given population and should have a positive relationship to GDP per capita. Likewise, the indicator, EXPORTS, reflects the

share of merchandise exports at current PPPs, and should also have a positive effect on GDP per capita.

Table 1 shows the summary statistics of the combined worldwide data for all years (1987-2014). From column 2, we see that UNMET has a mean value of 19.95 for the 98 countries; this means that on average, roughly 20% of women ages 15-49 experience unmet need for contraceptives. The country with the minimum unmet need is Albania in 2002 with 1.3%, and the maximum is Oman in 2008 with 55.9%.

Table 1: Summary of Data Characteristics

	Observations (1)	Mean (2)	Std. Dev. (3)	Minimum (4)	Maximum (5)
GDP	411	6923.257	10445.11	446.746	155911.3
POPG	411	0.068	0.012	-0.002	0.108
SAVINGS	411	0.189	0.078	0.0134	0.469
EXPORTS	411	0.156	0.143	0.0044	0.957
SCHOOL	378	2.045	0.585	1.041	3.702
UNMET	411	19.951	9.431	1.3	55.9

Sources: Penn World Table 2015, and The World Bank 2016.

The most obvious limitation of the data is that the observations only include married women or women in unions. This ignores the millions of unmarried women who engage in sex worldwide. If single, sexually active women were included in the dataset, the number of women with unmet need for contraceptives would likely be much larger; thus, the dataset I am working with is likely understating the true value of unmet need worldwide. Furthermore, it is always hard to ensure that the responses to surveys are unbiased and individually reported. Influence from spouses, family and community members, as well as fear of punishment may reduce the transparency of women's individual responses.

IV EMPIRICAL INVESTIGATION

IV.A The Model

The following model is the basis for my GLS regression, where $GDP_{i,t}$ is a function of six explanatory variables, four of which have been previously proven to contribute to economic growth. The subscripts i and t indicate country and time, respectively, β_0 reflects the intercept, β_1 through β_6 are the slope coefficients on the explanatory variables, YD_s is a year dummy for the dataset, δ is the coefficient on the year dummy, CD_j is a country dummy with coefficient α_j, and $\varepsilon_{i,t}$ is the error term.

$$ln(GDP_{i,t})^* = \beta_0^* + \beta_1(lnUNMET_{i,t})^* + \beta_2(lnUNMET_{i,t}^2)^* + \beta_3(lnPOPG_{i,t})^* + \beta_4(lnSAVINGS_{i,t})^* + \beta_5(lnEXPORTS_{i,t})^* + \beta_6(lnSCHOOL_{i,t})^* + \sum_{1988}^{2014} \delta_s(YD_s) + \sum_{2}^{98} \alpha_j(CD_j) + \varepsilon_{i,t}$$

With the following conditions,

$$GDP_{i,t}^* = GDP_{i,t} - \rho GDP_{i,t-1}$$
$$\beta_0^* = \beta_0 - \rho\beta_0$$
$$X_{i,t}^* = X_{i,t} - \rho X_{i,t-1}$$

Where X is any explanatory variable in the GLS regression.

IV.B Evidence to Support the Model

To test the suitability of the model I perform multiple tests[1]. I opt to use a fixed effects model as opposed to a random effects model given my results from the Hausman test, which tests whether the errors are correlated with the independent variables. To determine if

1. The following outliers were removed from the tests and from all regressions: Armenia (2000); Burundi (1987); Cameroon (1991); Côte d'Ivoire (2012); Dominican Republic (1986); Gabon (2000, 2012); Haiti (2012); Kazakhstan (2011); Liberia (1986, 2007); Mongolia (2013); Thailand (1987); Togo (1988, 2014); Trinidad and Tobago (1987, 2006); Zimbabwe (1994, 1999, 2006)

a year dummy variable is necessary in the model, I use a modified Wald test. The findings confirm what the Hausman test previously indicated- that a fixed effects model is ideal, and additionally support the use of a year dummy variable in the model (i.e. the coefficients on each year are not all equal to zero). Testing for multicollinearity reveals a mean variance inflation factor (VIF) value of 1.61. Typically, aVIF value less than 10 discloses that there is a strong multicollinearity, which is the conclusion I arrive to given the data. To determine if the data is heteroskedastic (i.e. the error variance changes for different values of the independent variable) I utilize a modified Wald test, which reveals the presence of heteroskedasticity. This supports the use of a GLS regression that corrects for heteroskedasticity. Unfortunately, I was unable to do a test for serial correlation due to the unbalanced panel data.

IV.C Results

Table 2 shows the GLS regression results for all 98 countries included in the dataset. There are two observations of note in this table. First, we see that in the initial regression, where UNMET is used as the sole explanatory variable for GDP, there is a statistically significant negative coefficient. However, when the squared variable is added in the next regression, and all other regressions afterward, UNMET has a significant positive effect on GDP. The other interesting component of the table is observed in columns 5 and 6, where the coefficient on population growth, POPG, shifts from statistically significant and negative to insignificant in the final regression, once the measure of human capital, SCHOOL, is added to the regression.

Table 2: GLS Fixed Effects Regression Results

GDP	(1)	(2)	(3)	(4)	(5)	(6)
UNMET	-1.129***	1.278***	0.945***	0.964***	0.748***	0.632***
	(0.044)	(0.214)	(0.220)	(0.179)	(0.186)	(0.180)
UNMET2		-0.461***	-0.352***	-0.349***	-0.282***	-0.211***
		(0.041)	(0.043)	(0.034)	(0.037)	(0.036)
POPG			-1.271***	-1.164***	-1.157***	-0.0349
			(0.141)	(0.127)	(0.133)	(0.131)
SAVINGS				0.252***	0.218***	0.158***
				(0.038)	(0.041)	(0.042)
EXPORTS					0.254***	0.194***
					(0.023)	(0.022)
SCHOOL						1.653***
						(0.088)
INTERCEPT	11.93***	9.024***	5.675***	6.553***	7.084***	8.586***
	(0.195)	(0.299)	(0.488)	(0.398)	(0.483)	(0.447)
N	349	349	349	349	349	349

Standard errors in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001

Table 3 reports the results of four GLS regressions: Column 1 shows the regression results for all 98 countries within the dataset, and column 2 shows the results for rich countries. The dataset contains little information on standard wealthy countries; for instance, there are only two countries in the dataset that have a GDP per capita greater than $50,000. Thus the threshold for rich countries in my data is a relative term. Accordingly, I define "rich countries" as any country in the dataset with GDP per capita greater than $8,000. To be consistent, I define a "poor country" as any country with GDP per capita less than $8,000. The regression results are reflected in column 3. Finally, column four shows the results for non-oil countries, which includes all countries in the dataset except for the 6 countries that are members of the Organization of the Petroleum Exporting Countries (OPEC). While OPEC is made up of developing countries, they have unusually high GDP per capita because of their oil wealth. By excluding OPEC countries from the regres-

sion we remove observations with this paradoxical relationship, which should hypothetically strengthen the results.

For rich countries, population growth has a significant and positive effect on economic growth (0.415%), countering the traditional economic theory that argues the opposite effect. The effect of population growth on GDP is reversed for poor countries. This makes intuitive sense, since population growth in countries with few resources per capita would put extra strain on households.

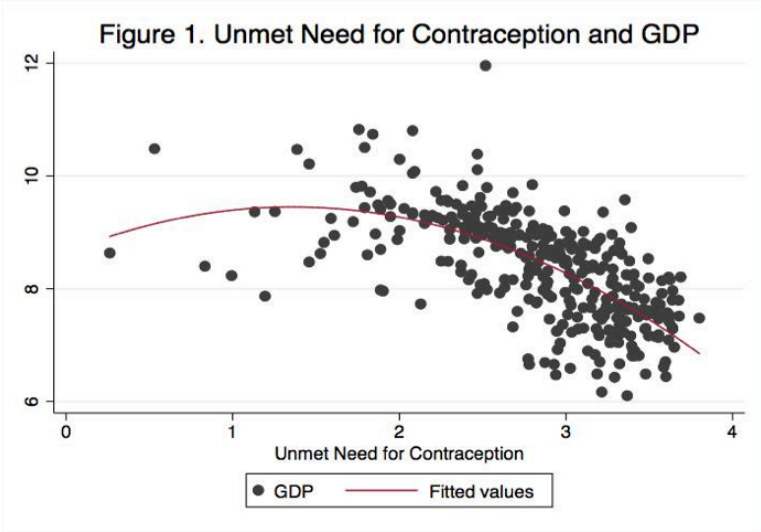
Table 3: The Effect of Unmet Need on GDP per Capita

GDP	All Countries (1)	Rich Countries (2)	Poor Countries (3)	Non-oil Countries (4)
UNMET	0.632***	-0.699***	0.601**	0.550**
	(0.180)	(0.142)	(0.197)	(0.190)
$UNMET^2$	-0.211***	0.088*	-0.154***	-0.193***
	(0.036)	(0.040)	(0.038)	(0.038)
POPG	-0.0349	0.415**	-0.438**	-0.126
	(0.131)	(0.158)	(0.160)	(0.141)
SAVINGS	0.158***	0.406***	0.132**	0.166***
	(0.042)	(0.063)	(0.039)	(0.044)
EXPORTS	0.194***	-0.093***	0.202***	0.178***
	(0.022)	(0.022)	(0.023)	(0.024)
SCHOOL	1.653***	1.551***	1.407***	1.658***
	(0.088)	(0.027)	(0.078)	(0.093)
INTERCEPT	8.586***	11.171***	7.102***	8.403***
	(0.447)	(0.443)	(0.515)	(0.476)
Fixed Effects	Yes	Yes	Yes	Yes
N	349	89	260	333
Countries	98	39	72	92

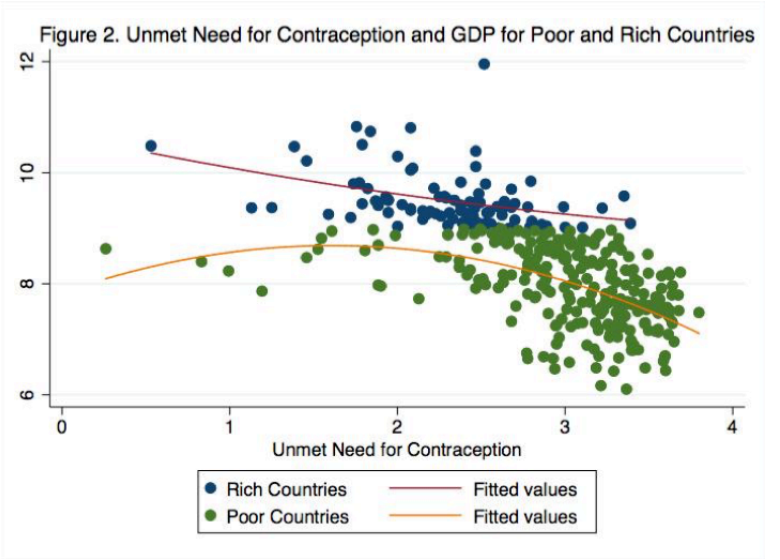
Standard errors in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001

Interestingly, the results from Table 3 reveal differences in the relationship between unmet need for contraceptives and economic growth depending on a country's

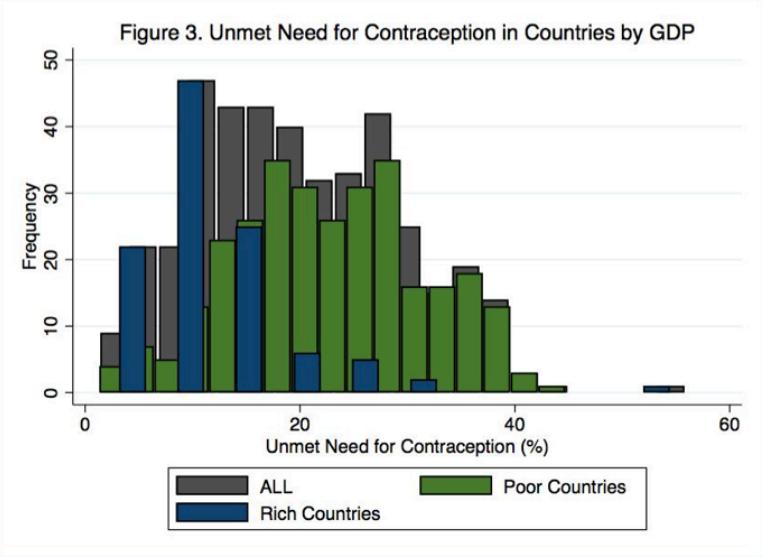
income per capita. As I had originally predicted, unmet need for contraceptives (UNMET) has a statistically significant and negative relationship with GDP per capita. Interestingly, however, this only applies to rich countries (-0.699%). For all countries included in the regression, unmet need for contraceptives has a positive impact on GDP per capita (0.632%), and has a decreasing relationship at an increasing rate, as shown in Figure 1. When GDP is high in rich countries, an additional unit of unmet need has a larger negative impact on GDP than when GDP is lower.

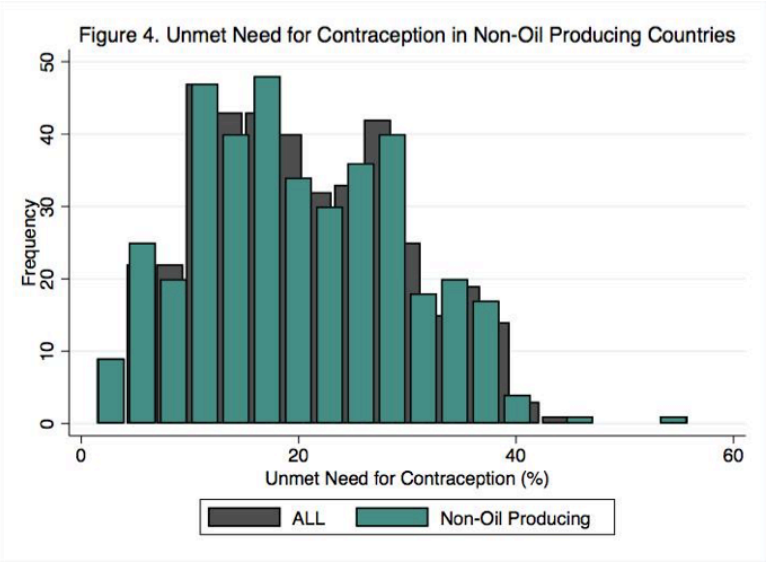


Similarly, for poor countries, unmet need for contraceptives has a statistically significant and positive relationship with GDP per capita (0.601%), and a statistically negative relationship for the squared variable (-0.514%). This indicates that there is an increasing relationship at a diminishing rate. When GDP is low in poor countries, an additional unit of unmet need has a larger impact on GDP than when GDP is higher. The relationships with GDP for poor and rich countries are shown in Figure 2.



Figures 3 and 4 show the frequency distribution of unmet need for contraceptives in all countries compared to that in rich and poor countries, and in non-oil producing countries, respectively:





From Figure 3, we see the same trends as previously noted: the distribution of unmet need for poor countries is quite similar to that for all countries. The distribution for all countries is, however, skewed slightly leftward due to the majority of the rich countries' observations lying between 0-20 percent. As would be expected, we see that the percentage of unmet need is higher and in greater frequency in poor countries, with the majority of observations between 20 and 40 percent. Figure 4 reflects similar trends as well: with the exclusion of oil producing countries, the distribution of non-oil producing countries is similar to the distribution of all countries, with many observations reported.

This analysis partially supports the hypothesis of this research project. I originally believed that unmet need would be negatively related to economic growth worldwide. From the table we can see that this relationship holds true for rich countries, where a 1% increase in unmet need for contraceptives decreases GDP per capita by 0.699%. This makes sense given the literature: as women in developing countries have a higher unmet need

for contraceptives, their fertility and timing of births is altered which reduces their human capital accumulation, resulting in lower earnings over their lifetime.

However, this economic theory does not account for the results for poor countries, which show that a 1% increase in unmet need for contraceptives leads to a 0.601% increase in GDP per capita. This implies that poor countries are better off when women have higher unmet need for contraceptives, which defies all of the conclusions in previous economic literature. The most plausible explanation for this anomaly is that perhaps the definition of unmet need does not truly measure women's restricted access to contraceptives in developing countries, like governments and organizations such as the World Bank and the United Nations have assumed. Instead, if we take into account the differing fertility preferences of women in developing nations, then perhaps this outcome is not entirely unexpected; the result of unmet need may not be unintended pregnancies and higher fertility because these women already have higher fertility preferences to begin with.

V. CONCLUSION

This paper explores the relationship between unmet need for contraceptives and economic growth throughout the world. As was expected given the previous literature, there exists a negative relationship for rich countries with a 1% increase in married women's unmet need for contraceptives leading to a 0.7% decrease in GDP per capita. This can be attributed to the high opportunity cost of childbearing and childrearing for women in developed countries, where women with more children and earlier timed births accumulate less human capital over their lifetimes. However, the results of the regression show a positive relationship between unmet need and economic growth in poor countries, where a

1% increase in unmet need for contraceptives results in a 0.6% increase in GDP per capita. I account for this positive relationship due to the imperfect measurement of unmet need. While this is the most commonly used measure to describe the gap in access and demand for contraceptives worldwide, it was likely created with Western fertility preferences in mind, and thus is an inappropriate measure when applied to developing countries. Sedgh and Hussain (2014) find that the top three most cited reasons for nonuse of contraceptives by women in developing countries are infrequent or no sex, perceived side effects or health risks, and opposition grounded in moral or religious reasons. Lack of access was the second least cited reason for non-use. Furthermore, fertility preferences of women in developing countries are highly fluid. In a recent study it was found that while women in developing countries have higher total fertility than women in developed countries, the percentage of total pregnancies that are reported as "unintended" is higher in more developed countries (Sedgh, Singh and Hussain, 2014). This indicates that women in developing countries are likely to feel differently about having a child after becoming pregnant, which can drastically skew results of a regression whose variable of interest is dependent on long-run responses of "not wanting children" in the next two years. Another study specifically addressing the inefficiencies of DHS surveys found that women's responses to survey questions about fertility preferences such as "Do you want any more children?" are subject to change depending on the unpredictability of their future circumstances (Johnson-Hanks 2007, 1038).

With this in mind, future research would benefit from a more precise measure of demand for contraceptives in developing countries. Additionally, the study would greatly benefit from an increase in observations, especially in consecutive years, by asking women about their demand in more DHS surveys worldwide. These

future surveys should also include information about unmarried women's demand for contraceptives, as the current measure only accounts for married women. This research also suggests that there are more effective ways to encourage contraceptive usage in developing countries than simply increasing the supply of contraceptives. It would be more effective for policymakers to acknowledge women's reasons for non-use and target these reasons, rather than making normative assumptions.

Mobile Broadband Investment on Economic Growth: Evidence from Africa

Jack Jefferson

ECON 490

ABSTRACT

Mobile broadband is widely acknowledged as an important determinant of economic growth. However, the impact of telecommunications historically has attracted attention mostly towards developed economies. This paper represents a newer line of inquiry, examining the nature and impact of mobile broadband investment on long-run economic growth in Sub-Saharan Africa. I expect higher levels of broadband diffusion to have a positive relationship with economic growth, especially once a critical threshold of penetration has been met. Constructing a dataset of mobile connections and using an endogenous growth model, I evaluate this impact. I find evidence that higher broadband penetration in these areas has a positive and significant impact on economic growth. Recent rapid diffusion of mobile broadband among developing economies also suggests important indirect spillover effects in the future.

Policymakers and governments alike have recognized mobile broadband as a transformative technology that enables positive socioeconomic outcomes in developed and developing countries. Broadband can be characterized as high-speed, always-on internet connection. Mobile broadband, as an extension, is a wireless technology that allows you to connect to a broadband connection through a portable modem, USB wireless modem, a tablet/smartphone or other mobile device. The rapid diffusion and deployment of mobile broadband has been made possible by advances in technology, including greater service availability and lower costs. For many developing economies, a new era of trade liberalization and privatization has further catalyzed the transformational impact of wireless mobile technology.

Broadband networks often now provide the framework necessary for the delivery of many core services sectors such as transport, multimedia, and communications (Castaldo et al. 2018). Unlike other infrastructure, the number of subscribers is crucial for the size of networks and potential gains. These network effects often have indirect impacts on education, social welfare, and overall productivity in the economy (Briscoe & Tilly 2006).

While economic theory has much to say about the social and political implications of mobile broadband, this study focuses on empirical evidence of the relationship between mobile broadband and growth. Despite the social and economic importance of mobile broadband being recognized by researchers and policy makers alike, empirical evidence on this topic remains relatively scarce throughout the developing world, where its impact could be most profound. Further, there is near nonexistent academic literature investigating the long-term effects of mobile broadband in Sub-Saharan Africa. This study attempts to fill the gap in this research.

This study investigates the long-run impact of mobile broadband penetration on economic growth in

Sub-Saharan Africa over 22 years and across 32 African countries. I expect higher levels of broadband diffusion to have a positive relationship with economic growth, especially once a critical threshold of penetration has been met. Additionally, I examine the direction of causality. That is, I test whether broadband infrastructure has contributed to economic growth or if its deployment is itself a consequence of economic growth. I find a causal relationship does exist between mobile broadband and economic growth. Leading indicators suggest telecommunications infrastructure is reaching a critical number of people globally (Qiang et al 2009).

The study will proceed as follows: Section I presents stylized facts and empirical literature around broadband and long run economic growth. Sections II and III present the data and empirical strategy employed. Results are presented and discussed in Section IV. Finally, policy implications, concluding remarks, and suggestions for future research are presented in Section V.

I. BACKGROUND

There are a wealth of studies around telecommunications and their economic impact in the long run. As mentioned, most studies conclude that a positive link exists between telecommunications and growth, which is not surprising given the transformative effect the internet has had on income per capita over the past decade. The discussion below outlines some of the major areas of research as it relates to mobile broadband infrastructure. An early study by Datta and Agarwal (2006) tests new telecommunications infrastructure on long run growth within OECD countries. It finds the link between telecommunications and economic growth is subject to diminishing returns. For policy makers this is an important implication, suggesting that the quickest and largest economic gains are to be had in less developed countries with

lower penetration rates. They use a panel data approach and construct their data set from the OECD Telecommunication Database during 1980-1992. The results appear to be robust, and suggest a statistically significant relationship between telecommunications and GDP growth. However, given the rapid rate of change in broadband diffusion, their dataset is relatively outdated and leaves many unanswered questions regarding the transitional dynamics of broadband.

An early study by Koutroumpis (2009) investigates the relationship between broadband penetration rates and economic growth in 15 European countries from 2003 to 2006. He measures the effect of broadband infrastructure on growth and finds increases in capabilities among the labor force and important spillover effects to other parts of the economy. He also finds empirical evidence to suggest that once a critical mass is reached there are positive returns to economic growth. Variables within the study include: GDP levels, broadband penetration levels, stock of telecommunication investment, internet connection prices, measures for urbanization, research and development, and government deficits. Across the full data set he finds that European countries had roughly 28% growth in broadband penetration and a corresponding 0.42% in annual economic growth.

Qiang and Rossotto (2009) attempt to fill in the gap in both the developed and the developing world. Broadly, they explore how broadband enables economic growth, and use a cross-sectional model to evaluate 120 developed and developing countries from 1980-2006 to empirically test the connection. They find a significant impact on growth and suggest policy measures to leverage the potential of broadband, including an emphasis competition, more market freedom and more flexible regulatory environments. The coefficient for higher income countries is positive and robust, suggesting an increase in broadband penetration rates by 10% will translate to a

1.21% increase in GDP per capita. For low income countries broadband penetration has a positive correlation but is not statistically significant at the 5% level. The authors suggest this is because broadband has not reached the critical levels needed to generate aggregate effects as robust as those in developed countries.

Yousefi (2011) furthers this line of inquiry by exploring the extent to which information and communication technology (ICT) investment has contributed to economic growth in developed and developing countries. She uses a time series model over six years to explore contributions of labor, ICT, and non-ICT capital among income groups and across countries. Ultimately, she finds that ICT investment fails to contribute to the growth in lower income, less developed countries. Employing a classical Cobb-Douglas production function and a growth accounting framework based off of the seminal Solow model, she finds statistical insignificance for lower income groups, and 0.27 for upper-middle income groups; a 1% increase in ICT capital investment resulted in, on average, a 0.27% increase in the rate of output growth, suggesting a weaker rate of output growth for developing countries. Thus, stages of development may play an important role for how ICT investment impacts overall growth.

Thomson and Garbacz (2011) are some of the first to employ a panel data approach. They investigate the effect of fixed and mobile broadband on GDP per household in developed countries from 2005 to 2009. The focus on mobile broadband is particularly relevant for developing countries given the easier diffusion and lower infrastructure installation costs. They find mobile broadband actually reduces GDP per household, which is contrary to what is expected. However, they suggest that the negative relationship could be due to nonproductive applications of technology. Specifically, they find a 10% increase in mobile broadband reduces GDP per house-

hold by 0.52%. This is likely due in part to the fuzziness of the ICT variable as there is no way to disaggregate some of the potential "non productive" applications described.

Katz, Raul and Koutroumpis (2012) produce one of the only studies that explores the impact of mobile broadband on economic growth in Africa. They conduct a national study in Senegal from 2004-2011 using a production function modelling the operation of the economy and subsequent demand, supply and output functions. Their results are not statistically significant, implying mobile broadband has no significant effect on gross domestic product. However, they find that 2G network penetration has a significant impact on economic growth in Senegal's economy. Their results indicate that from 2004 to 2010 the contribution of 2G towards GDP has been roughly 0.044% for every 1% increase in mobile penetration. In addition, their results suggest that mobile phones were responsible for 13.6% of all economic growth.

In a more recent study, Pradhan et al. (2018) explore the relationship between ICT infrastructure and long run economic growth. They investigate this relationship between 2001 and 2012 for G-20 countries using a panel cointegration method. Their attempt to provide a more robust measure of the empirical link between ICT and long run growth builds on the existing literature that suggests a reinforcing relationship between mobile broadband and economic growth. Data sources are mostly collected from the World Bank. They find proper capital formation is the most effective catalyst for increasing the impact of new ICT infrastructure on GDP per household. Finally, this study offers a very similar econometric approach for addressing causality in developed countries. Thus, it serves as a useful benchmark that can be employed in the African context.

Finally, another recent study by Fiorini & Maggi (2018) investigates the impact of broadband diffusion as

a technological determinant of economic growth over 15 years and across 23 OECD countries with a dataset constructed from the ITU database. In particular, they explore this relationship during a time of crisis and argue that ICT investment can be used as a policy measure to counteract economic crises like that of 2007/08 f. Additionally, they improve on existing methodological techniques by controlling for countries' initial endowments, disaggregating technological shifts, and transitional effects among fibre networks. They use a number of models within the study, but the most influential model for their results is based off the Mankiw, Romer and Weil model. The broadband penetration rate is positive and significant. They find public intervention significantly impacts broadband's diffusion rate. Ultimately, this allows policy makers to better estimate the expected benefits of promoting particular types of broadband infrastructure. However, there are still relevant problems within existing empirical studies that need to be addressed. This study improves on the existing literature with two major contributions. First, it focuses on Sub-Saharan Africa, an area that has received little to no direct focus to date and has one of the fastest growing mobile subscription growth rates. Sub-Saharan Africa is also an area with the potential to benefit considerably from mobile broadband use, given its aggressive subscriber growth in recent years. Second, this study addresses the causation dilemma by investigating the extent to which a causal inference can be made between mobile broadband and economic growth.

II. DATA

Macroeconomic data on GDP, population, savings, human capital and exports are derived using the Penn World Tables (Feenstra et al. 2015), covering 182 countries between 1992 and 2014. The Penn World Table is one of the more comparable and widely used cross

country data sources available. This sample of countries spans across 22 years of observations, segmented into low income countries (43 total) and countries within Sub-Saharan Africa. The key variable of interest is the measure of mobile cellular subscriptions (per 100 people). This has been obtained from the World Bank Telecommunication Development database, which is updated annually. Mobile cellular subscriptions are defined as subscriptions to public telephone services that provide access via n cellular technology, and applies to all voice communication cellular subscriptions. However, it excludes subscriptions through alternate methods such as USB modems, mobile radios, radio paging, and similar services.

The quality of data largely varies between countries as a result of differences in regulations and overall data coverage. This is a limitation in the data as many discrepancies exist within the Sub-Saharan African segment. Second, there are likely different economic implications from the use of laptops versus handhelds or smartphones, which cannot be disentangled in the data. Finally, there are identification issues regarding active users versus those who in theory are capable of using broadband, resulting in a slight overestimation bias.

Table 1 gives an overview of the descriptive statistics. GDPCAP is GDP per capita (measured in 2011 prices); MOBILE represents the number of mobile cellular subscriptions per 100 people. The expected sign for the Mobile variable is positive and significant. POP represents the year over year growth of population of country i at time t. The expected sign for population growth is negative, as we expect lower population growth to be related to higher GDP per capita. SAVINGS represents the amount of savings. I expect a positive coefficient here as higher savings rates in countries relate to higher GDP. HCAPITAL represents the human capital, measured using a human capital index, based on the average years of schooling and returns to education. Again, I ex-

pect HCAPITAL to have a positive impact on growth as. Lastly, EXPORTS represents the share of GDP made up of merchandise exports. Similarly, I expect a positive coefficient here.

Table 1: Descriptive Statistics for mobile broadband and economic growth in 2014

	Observations	Mean	Std. Dev.	Min	Max
GDPCAP	179	19,117.21	21,935.37	570.04	163,294.4
MOBILE	179	110.00	39.50	25.59	315.30
POP	179	39.84	145.12	0.03	1369.44
SAVINGS	179	0.25	0.25	0.04	3.08
HCAPITAL	143	2.59	0.69	1.19	3.73
EXPORTS	179	0.32	0.33	0.006	2.11

Notes: This table presents descriptive statistics for 2014 only and includes the full sample of 179 countries.

There is a remarkable amount of variation in mobile penetration across countries, which is not surprising given that the original sample includes both the developed and developing world. Before turning to the empirical strategy, we can identify some important correlations in the dataset. As seen in Figure 2, the correlation between broadband penetration and GDP per capita for our sample of countries in 2014 illustrates a clear positive trend between the two. This result is aligned with our existing theoretical understanding of the causal link that we are testing for.

Figure 1. Histogram of Mobile connections in Africa versus the full sample of countries

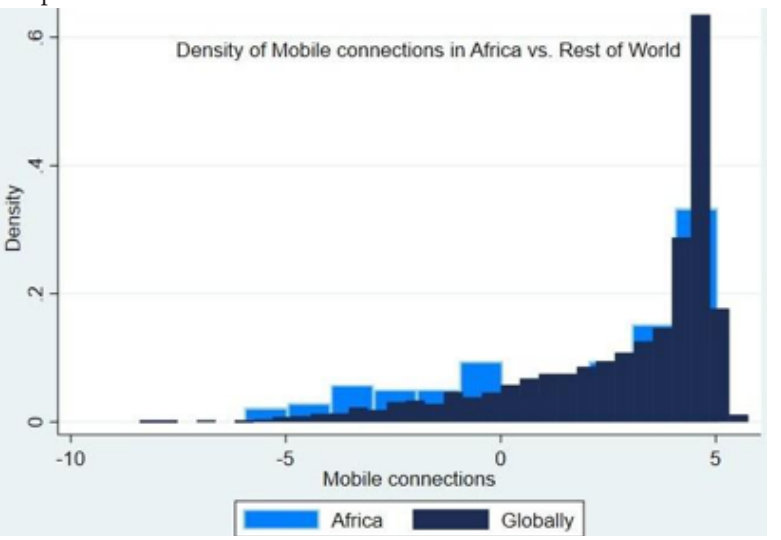
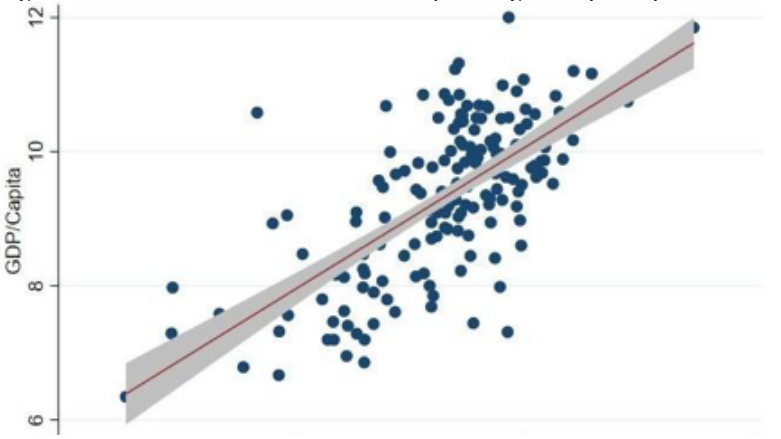


Figure 2. Mobile Connections and corresponding GDP per capita



III. EMPIRICAL STRATEGY

In order to evaluate the long run relationship between broadband and economic growth I use an endogenous growth model based on the seminal Mankiw, Romer, and Weil (1992) model. The estimation is extended to include the effects on growth; thus, a panel data approach is employed. A dynamic fixed effects panel data approach takes into account previous growth and country-specific effects.

A. Endogenous Growth Model

Traditional growth models are typically limited to analysis of a steady state equilibrium. As such, the focus of this model will not include transitional dynamics. However, from an empirical point of view, this strategy ensures we can find a steady-state relationship in the long run. I test the steady-state relationship as:

$$(1) \quad ln(GDPpercap_{i,t})^* = \beta o + \beta 1\,(lnMOBILE_{i,t})^* + \beta 2(lnMOBILE_{i,t})^{2*} + \beta 3(lnGPOP_{i,t})^* + \beta 4(lnSAVINGS_{i,t})^* + \beta 5\,(lnHCAPITAL_{i,t})^* + \beta 6\,(lnEXPORTS_{i,t})^* + \sum_{1993}^{2014}\delta_s(\Upsilon D)_s + \sum_{2}^{31}\gamma_j(CD)_j + e_{i,t})$$

Where:

$$(2) \quad GDPpercap_{i,t}^* = GDPpercap_{i,t} - \phi GDPpercap_{i,t}^{-1}$$

And the intercept:

$$(3) \quad \beta o = \beta o - \phi \beta o$$

Where each of the explanatory variables X:

$$(4) \quad X_{i,t}^* = X_{i,t} - \phi X_{i,t}^{-1}$$

Each of the explanatory variables are expressed, respectively, in their natural logarithm, with time and country indexes *i* and *t* included. Equation (1) considers GDP per capita (*GDPpercap*), mobile connections (*MOBILE*), a polynomial for the same term $(MOBILE)^2$, the year over year growth of population (*GPOP*), savings (*SAVINGS*), human capital (*HCAPITAL*), and exports (*EXPORTS*). The inclusion of a polynomial term allows us to incorporate non-linear effects which require time for adjustment for spillover effects from new technology (Holt & Jamison, 2009).

I also conduct several diagnostic tests to address potential issues related to outliers, heteroskedasticity, autocorrelation, and multicollinearity. I find that heteroskedasticity exists and must be controlled for in the regression. Collinearity diagnostics suggest that there exists mild, but unproblematic, correlation between variables with a mean VIF of 1.6. Moreover, when testing for autocorrelation I find that it is present, which is not surprising for time series data, and must be controlled for in our regression output. Finally, I omit 30 of the highest and lowest outliers to ensure results are not skewed.[1] Omitted countries have a wide range of characteristics and no meaningful pattern emerges among them. Given the number of panels included, this is to be expected.

IV. RESULTS

Table 2 presents generalized least square regression results of the model equation. A GLS approach allows controls for autocorrelation and heteroskedasticity with relative ease. The effect I am trying to capture is mainly related to the impact of higher levels of broadband connections on GDP per capita. I find that for a 10% increase in mobile broadband penetration there is a 0.15%

1. Outliers omitted include: Central African Republic, Myanmar, United Arab Emirates, Zimbabwe, China, Trinidad, Yemen, Ireland, Gabon, Sri Lanka, Burundi, Liberia, Mongolia, and D.R of the Congo

increase in GDP per capita. This is statistically significant at the 0.1% level. Further, the coefficient for mobile broadband holds a relatively constant magnitude before and after controlling for population, savings, human capital, and exports. Additionally, the polynomial term is statistically significant at the 1% level suggesting a nonlinear relationship. However, the evidence of an introduction effect from mobile broadband may be relatively small due to the coefficient magnitude. One possible explanation is that initial investments when mobile broadband is rolled out would be far lower than for fixed broadband.

Table 2: Regression results on GDP per capita from mobile investment in Africa

GDP	All Countries	Low-Income Countries	African Countries
MOBILE	0.0177***	0.259***	0.0150***
	(0.00120)	(0.00448)	(0.00414)
MOBILE2	0.00299***	0.00167*	0.00202**
	(0.000213)	(0.000738)	(0.000727)
GPOP	0.0115***	-0.0724***	-0.0272
	(0.00219)	(0.0157)	(0.0155)
SAVINGS	0.0515***	0.0346***	0.00181
	(0.00566)	(0.0104)	(0.0104)
HCAPITAL	0.473***	0.392**	0.215*
	(0.0391)	(0.142)	(0.0995)
EXPORTS	0.0197***	0.0527***	0.0355***
	(0.00375)	(0.00647)	(0.00729)
INTERCEPT	8.542***	6.189***	8.486***
	(0.0269)	(0.0794)	(0.0652)
Fixed Effects	Yes	Yes	Yes
N	2598	675	701
Countries	133	43	31

Standard errors in parenthesis
*p <0.05, **p <0.01, ***p<0.001

An important caveat of the results is the potential indirect effect not captured by the model. Many economists have asserted mobile broadband can affect economic growth both directly and indirectly, often times resulting in many intangible network effects. Put another way, mobile broadband can act as a prerequisite for subsequent core infrastructure developments in other parts of the economy. For example, Koutroumpis (2009) finds that broadband infrastructure can create spillover effects, including new employment, productivity gains, improved market efficiency, and financial inclusion. A favorable environment that promotes liberalized markets, open competition policies, higher-skilled human capital, and robust institutions often plays an important role in a country's ability to capitalize on existing infrastructure. Thus, results may be improved in future research by incorporating some of these variables into the regression model. Alternatively, subperiod analysis may serve as a useful tool to better study some of the individual dynamics which exist within countries and regions.

A. Testing for Causality

A major issue explored in the literature is whether the positive relationship between telecommunications and economic growth is from higher telecommunications investment leading to higher growth, or if countries with higher growth tend to deploy more telecommunications infrastructure. In order to test for causality, I conduct a cointegration test and a Granger causality test using lagged values of the MOBILE variable. If causation runs from mobile telecommunications to GDP growth then we should expect the coefficient of the lagged variable to be significant. In panel data an essential first step is to understand the stationary properties of each of the variables. In order to do this I use a unit root test as proposed by Im, Pesaran, and Shin (2003). The results find that MOBILE is non-stationary. The next step is to test

for a potential long run equilibrium between each of the variables. In order to do this I use the Kao (1999) test due to its popularity in other research. Under the null hypothesis, non-cointegration exists. The results are shown in Table 3. As we can see, the null hypothesis on non-cointegration can be rejected. These results strongly support the existence of a long-run relationship between mobile broadband and economic growth.

Table 3: Cointegration tests suggest there is at least a one way causal relationship

Cointegration Tests		
Ho: No cointegration Ha: All panels are cointegrated		
	Statistic	P-value
Modified Dickey-Fuller t	6.5901	0.00
Dickey – Fuller t	5.7759	0.00
Augmented Dickey-Fuller t	4.5225	0.00
Unadjusted modified Dickey-Fuller t	6.6703	0.00
Unadjusted Dickey-Fuller t	5.8881	0.00

Kao test for cointegration

Having confirmed the existence of cointegration, the next step is to test the causal relationship among the variable of interest. The results in Table 4 suggest that a Granger causal relationship exists between mobile broadband investment and economic growth. In the long run, this suggests that mobile broadband infrastructure increases the level of economic growth in Sub-Saharan Africa. This is an important insight for policymakers and governments alike in developing countries. Effective deployment of new mobile broadband infrastructure represents an empirically valid tool to improve economic well-being.

Table 4: Granger causality tests suggest mobile investment causes GDPpercap

Granger Causality Test		
Ho: Mobile does not Granger-cause GDP Ha: Mobile does Granger cause GDP for at least one panel	Lag order: 1	
	Statistic	P-value
W-bar	4.7451	0.00
Z-bar	24.5580	0.00
Z-bar tilde	19.4284	0.00

Dumitrescu & Hurlin (2012) Granger non-causality test

V. CONCLUSION

The results suggest that mobile broadband has a positive and significant impact on economic growth in Africa. Also, while establishing causality has been a major issue within the relevant literature, I address this issue and add to the existing knowledge by employing a Granger-causality test, which finds that there is positive long-run causality between mobile broadband and economic growth.

By the end of 2013, overall mobile penetration reached 66% in Africa. As the number of mobile broadband subscribers increases, the benefits within developing economies have the potential to rival and surpass those of developed economies. Further, the similar coefficients in our results suggest that we are nearing universal levels of the critical mass required for mobile broadband. This may also explain some of the variation in impact seen in Africa compared to other developing countries. However, whether this potential will be realized largely depends on the ability of policy makers and governments to recognize the opportunity at hand. In order to ensure favorable

conditions that maximize its effect, policy makers should identify the institutions and regulations that stimulate the economic impact of mobile broadband most effectively, as well as encourage public-private partnerships with telecommunications companies. Mobile broadband's utility grows as a greater proportion of the population uses it.

Several areas for future research may be fruitful. First, country level aggregate time series studies may be able to capture the differences among regions and disentangle some of the potential introduction effects. They can also better address the endogeneity issue arising from unobserved heterogeneity. Second, while the focus of this study has been limited to the impact of mobile broadband on economic growth, there is still much left unsaid about other effects such as employment, productivity, and other networks effects on different dimensions of mobile broadband.

Increasing Female Autonomy through Water Collection: Evidence from India

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ECON 494

ABSTRACT

Water collection in many parts of the world is a task that burdens the female population, taking away their ability to spend time on autonomous tasks such as labour market participation or education. This is due to the distance, time, and frequency that water collection entails. However, higher water collection times do not necessarily have to be a negative force on female autonomy as a whole. This paper utilizes an instrumental variable strategy from the Indian sample of the University of Pennsylvania's Survey of Status of Women and Fertility (SWAF) to detect the exact implication that water collection time has on female autonomy in terms of mobility and decision-making. My results indicate that while water collection does not lead to an increase in education or market participation (arguably the biggest drivers in increasing female autonomy), the ability to spend time away from home and have agency over tasks that can be conducted while collecting water, from buying food to visiting a friend, do increase as water collection times increase. As women leave their houses more frequently, this becomes a norm for the household and allows women to pursue other autonomous activities.

I. INTRODUCTION

The disparity between men and women in fundamental development areas such as health, education and employment is highly correlated with lower GDP. A great deal of literature proposes that these development indicators are linked to female autonomy and a woman's bargaining power within their marriage and household (Doss, 2013). Female autonomy is oppressed where patriarchal structures exist and which penalize autonomous behaviour for women; however, it also offers them provision and protection if they remain within its parameters (Kabeer, 1997). In addition to the moral claims for female empowerment, there are economic and societal motivators. Empirical evidence has demonstrated that increasing female autonomy produces other benefits, such as long-term reduction in fertility, higher child survival rates, and the allocation of resources in favour of children in the household (Anderson and Eswaran, 2009).

One well-researched driver of female autonomy is the time a woman has to participate in market-based work and attending school. Women spend a substantial amount of time on domestic tasks where they typically hold the primary responsibility. The time spent conducting these chores is directly related to infrastructure, which has been suggested to be a constraining factor on a woman's ability to participate in economic, educational and health related activities (Koolwal and Van de Walle, 2013). The relevant literature finds that the more time domestic tasks take, the less time women have to participate in potentially empowering activities. Water collection in particular has been unequally tasked to women and young girls and is "a ritual that [has] reinforced gender inequalities" (UNDP 2006, V). In an effort to further understand the implications of water access, this paper will answer the following question: How does water collection time, in minutes, affect female autonomy?

The empirical economic research around female autonomy has primarily focused on either adolescent girls or on particular aspects of female autonomy: economic empowerment, birth control choices or education. Research related to water access and female autonomy either lacks strong causal empirical strategies or contradicts other scholarly research on the subject matter. Given the importance of water in daily life and the potential policy implications for improving the lives of women, truly understanding the relationship between water and female autonomy is crucial. The results of this paper demonstrate that high water collection times can, in some ways, enhance female autonomy by creating a normalcy around wives leaving the house on a daily basis. This allows women to increase mobility and gain agency over how they spend their time.

The following section (II) further describes the relevant literature on this topic. Section III provides information regarding the data and summary statistics. Section IV explains the estimation strategy and Section V discusses the estimation results. Section VI concludes the paper.

II. LITERATURE REVIEW

II-1. The Facets of Female Autonomy and Water Access

Empowering women and increasing female autonomy within developing countries has been studied through a variety of lenses within the academic realm. Female autonomy is defined as 'the ability of women to make choices/decisions within the household relative to their husbands" (Anderson and Eswaran 2009, 179). By far the most researched facet of female autonomy is women's economic empowerment and how it affects a wife's bargaining power within a marriage. Studies in this area have demonstrated that female autonomy increases as more of a woman's income is earned rather than unearned, spe-

cifically income earned outside of husbands' farms (Anderson and Eswaran, 2009). Another aspect of female autonomy, reproductive empowerment, has been examined in relation to bargaining power with spouses. For example, a randomized control trial (RCT) in Zambia demonstrated that women who privately received contraceptive vouchers, specifically for easily concealable injections, were much more likely to hide use from their husbands to reach short-term fertility goals (Nava, Field, and Jean Lee, 2014). Finally, female autonomy has been proven to increase with education if their marital partners are more educated and thus more accepting of new family planning and gender norms regarding household decision-making (Hahn, Nuzhat and Yang, 2017). Ultimately, these three overarching facets of impact on female autonomy are all associated with bargaining power and their relationships with the males in their lives, typically their husband.

A significantly smaller theme within female autonomy comes from access to water infrastructure. The literature on water access has only been significantly considered for economic and educational empowerment through channels such as time allocation. Nonetheless, given the endogeneity of the three facets of female autonomy it is reasonable to suggest that water access and reproductive health decisions may also have a relationship. Bringing water back to the homestead is typically a chore carried out by the women and girls within the household and they are therefore the main group affected when considering the amount of time spent doing this chore (Nauges, 2017). Through an economic lens, a difficult to access water supply can affect women in that they are less likely to participate in the market-based economy due to the allocation of their time spent on chores (Koolwal and Walle 2013). Similarly, there have been concerns over how water access and distance and time spent on this activity affect female school attendance. Nagues (2017) has produced causal evidence from Ghana, using clusters and an

IV strategy, that shows that increased time spent on water hauling has a significant negative effect on the likelihood of girls attending school.

Most of the existing literature connects female autonomy to fertility decisions, education, and financial inclusion. However, there has been no empirical literature that directly relates water access, an external factor that can be improved through infrastructure policy, with female autonomy as a whole. This knowledge gap in female empowerment literature provides the basis for this paper, which aims to answer the research question of how water collection affects female autonomy.

This literature review is structured as follows: Section II-2 will focus on literature pertaining to female autonomy and economic empowerment. Section II-3 will examine female autonomy and fertility empowerment, specifically regarding contraceptive use. Section II-4 will emphasize female autonomy and education, while also referencing how education can encompass both economic and reproductive well-being for women, and finally Section II-5 will describe the existing literature around water access and how it connects to overarching themes of female autonomy. Section II-6 will summarize the literature.

II-2. Female Autonomy and Economic Inclusion

The economic perspective within female empowerment literature includes various angles such as bargaining power, financial inclusion, and decision making as well as access to employment, both in the market and at home. Kantor (2003) has demonstrated that home-based garment work for women in India is not a direct source of female empowerment within households. Kantor's results indicate that the level of income earned by garment workers is a "significant positive determinant of the probability of income control" (433). However, this is primarily due to the fact that women within the garment industry earn

low wages , and as income increases, women lose control over how they spend their own earned income (Kantor, 2003). Kantor as well as Anderson and Eswaran (2009) have utilized decision-making within the household as an outcome variable for female autonomy. Kantor focuses on decision-making that occurs alone or jointly and focuses on "atypical female" household decisions, which include buying and selling property, marriage of family members, and mobility of said female's family (437). Anderson and Eswaran (2009) use a similar approach but focus primarily on the purchases of goods, such as cooking oil, as proxies for various purchasing decisions, including household goods, self-grooming products, treats for children, and four variables to capture more expensive purchases such as children's clothes.

Both papers directly relate to the amount of bargaining power women have within their household, and how economic empowerment can increase this bargaining power. Anderson and Eswaran (2009) further reinforce Kantor's (2003) idea that income earned away from home is more empowering for women by focusing on wives' work conducted outside of their husband's farms. Anderson and Eswaran provide more vigorous results via a stronger empirical strategy with the use of instrumental variables (IVs), and a more robust sample of women since Kantor only samples women from the garment industry. It is important to note that both papers' decision-making questions focus primarily on purchasing power within the household and no other facets of female autonomy, such as who decides the method of birth control. Thus, his paper will examine similar decision-making outcome variables, but with respect to the aforementioned broader subsets within the definition of female autonomy.

II-3. Female Autonomy and Fertility

The key findings in the literature on sexual health and fertility in regards to female autonomy identify that

a woman's choice of contraceptives is directly related to the ability to conceal the birth control and have privacy from their husbands. Ashraf, Field and Lee (2014) identify a statistically significant difference between Zambian women who receive birth control vouchers in private versus women who receive the same voucher in the presence of their husbands. This indicates that women, when given the opportunity, will conceal contraceptive use from their husbands in fear that their husbands would not allow them to use the voucher. Hahn et al.'s (2018) paper focuses on the effect that a 1994 education subsidy in Bangladesh, the Female Secondary School Stipend Program (FSSSP), had on subsequent fertility rates. They find that while the subsidy had "little to no effect on the overall likelihood of using any contraceptive"(401), women who received more education because of the stipend were more likely to use observable contraception. Both papers identify a pattern within the sociology of women's fertility that indicates a relationship between contraception choice and female autonomy within a household. Ashraf, Field and Lee (2014) and Hahn et al. (2018) have more robust empirical strategies, with the former utilizing RCT data and an IV, and the latter using a difference-in-differences technique to compare girls within Bangladesh. Therefore there is a significant causal relationship between fertility and female autonomy within households, suggesting that women's fertility is a valid aspect of autonomy to consider for this paper.

II-4. Female Autonomy and Human Capital

Education is a difficult facet of female autonomy to pinpoint, as it internalizes the previous sections discussed. However, because it is endogenous to economic and reproductive empowerment, it is a crucial aspect to consider when analyzing a woman's decision-making and bargaining power within a household. Bandiera et al. (2015) identify, from a RCT in Uganda, the rewards of

teaching adolescent girls vocational skills for income-generation and life skills for informed choices about sexual health. They describe a significant success with their education program in Uganda, identifying mass increases in labour-market activities and decreases in early child-bearing, rape, and early marriage within a four year period of starting the program. A sister paper by Hahn, Nuzhat, and Yang (2017) to the previously mentioned FSSSP Bangladesh paper uses the FSSSP program to implement diff-in-diff and IV strategies to demonstrate how increased education changes marital partners later on in life. The change in marital partners includes a husband that is likely more educated and more accepting of reproductive rights, such as birth control and family planning (Hahn, Nuzhat, and Yang, 2017). While both papers provide strong empirical evidence of education affecting gender roles for contraception, they appear to differ when it comes to referencing education's effect on women's labour force participation. Bandiera et al. (2015) state that girls in the communities treated by their RCT saw a 72% increase in income-generating activities compared to girls in the control group. Hahn, Nuzhat, and Yang (2017), on the other hand, state that the effects of the FSSSP did "not increase the likelihood of [womens] own labour force participation nor their having of better occupations" (19). The difference here could be due to Bandiera et al.'s focus on self-employment as a key part of income-generation, but it is difficult to compare labour-market definitions between the two studies.

II-5. The Facets of Female Autonomy and Water Access

Koolwal and Walle's (2013) research directly pertains to water access as a potential infrastructural constraint for women participation in market-based employment. However, Koolwal and Walle find little empirical evidence that there is any relationship between water access and the likelihood of a woman participating in the la-

bour force. They conduct a cross-country experiment on the basis of "conditional exogeneity" by "exploiting the geographic differences in infrastructure placement and outcomes" (379). This is to account for the fact that water source placement, and people's proximity, is an endogenous variable to consider. Given this empirical strategy and lack of an exclusion restriction, Koolwal and Walle cannot claim any robust causal results. They do suggest that because of the "consistently weak" associations between water access and women's market work across several different countries, water access is not an important channel in this respect (402). However, this contradicts Ilahi and Grimard's (2000) paper, which investigates the relationship between water supply distances and women's allocation of time, particularly towards total work (farm based or market based) and leisure. Ilahi and Grimard (2000) use a relatively simple probit model to demonstrate a relationship between women's time allocation and water supply, stating that "improvements in water-supply infrastructure would lower the time women spend in all activities, with a substitution of water collection for income-generating activities". While neither paper produces an empirically sound causal strategy, they do produce polarizing results, indicating a need for further analysis to understand the relationship between water access and female autonomy as a whole.

Water access literature has also been examined in relation to female empowerment in terms of girls' educations. Nankhuni and Findeis (2004) present evidence from Malawi, investigating the broad effects of resource-collection work on children's schooling. By collecting the median values of child resources and using a logit model, they show that there is a "negative relationship between environmental degradation and children's education" (133). They also find that as the number of women in the household increases, the burden on children decreases, and school attendance increases. While

Nankhuni and Findeis do not present the most robust empirical strategy, their results are in line with the more causal findings from Nauges (2017) in Ghana. By clustering households according to GPS coordinates in order to solve the endogeneity problem of water source location relative to towns, Nauges uses an IV, age of the household head, to examine, more empirically, the relationship between the burden of water hauling by girls and women. The results of this paper primarily relate to girls' schooling; specifically, the conclusion that there are higher water hauling costs on girls' schooling, particularly if access to water takes longer than 20 minutes. While both papers demonstrate a negative relationship between education and water access, they focus on adolescent girls attending primary school rather than women's access to higher level education, and there is no mention of bargaining power or household decision-making.

II-6. Facets of Female Autonomy: Literature Summary

Relevant literature regarding female autonomy and empowerment can be divided into several different trajectories, but as can be seen from the papers above, there is a distinct relationship between the economic, reproductive, and educational rights of women. All three facets are imperative to understanding the root of female autonomy, as they are all endogenous to a woman being able to negotiate her own rights and make decisions within a household. However, because of the interrelated nature of these aspects and the difficulty of untangling cultural and social norms, identifying a relationship between an external and changeable factor such as access to water supply, which unequally burden women, is important in making real policy change for women empowerment in developing countries. This paper will uniquely contribute to the existing literature by encompassing all three facets of female autonomy through the use of decision-making and mobility binary dependent variables, focusing on

wives in India and the effect of access to water on female autonomy. This will be done by using a robust causal empirical IV strategy to identify the relationship between water access and the different proxies for female autonomy for women's economic, reproductive, and educational empowerment.

III. DATA

III-1. Data Description

The primary dataset used comes from the University of Pennsylvania's Survey of Status of Women and Fertility (SWAF). The researchers responsible for this dataset include Herbert L. Smith, Sharon J. Ghuman, Helen J. Lee and Karen Oppenheim Mason. SWAF contains data from five different South Asian countries including India, Malaysia, Pakistan, the Philippines, and Thailand. This entire research paper focuses on India due to the availability of community data. Pakistan and Thailand also have the Community datasets and the empirical methods used in this paper could be used for those countries as well. The data is entirely survey-based, aiming for a sample of 1600 wives; 800 each from Uttar Pradesh and Tamil Nadu. Within Uttar Pradesh, data was collected from the Pratapgarh district from November to December 1993, and from the Meerut district from December 1991 to January 1992. Within Tamil Nadu, data was collected from the Coimbatore district from October to November 1993 and from the Ramnathpuram district from November to December 1993. Survey data is organized into three datasets: (1)Eligible Respondent (ER) which includes information from the wives, (2)Husband and (3)Community data. The ER and Husband datasets are at the individual level and the Community level data is at the village level.

Husband and ER datasets are provided separately on the SWAF website and therefore need to be merged. This process is very simple and is described on the SWAF

website. Therefore I combined the two datasets with a 1:1 merge on Stata. The two datasets were matched with an identification (ID) number for each husband and ER couple. There were no unmatched variables after this process. With the combined husband and ER datasets, I then merged the Community dataset with a many-to-many merge on Stata using the village ID number. This merge is not as clean as the husband-to-wife merge and some village numbers do not match between the datasets resulting in 343 unmatched observations. However, there are still 2,446 observations and therefore the sample size is large enough that the unmatched variables should not cause any empirical problems. It is important to have the Community level dataset to control for village specific features and population. The rest of this data summary will be divided into three sections: Water Variables (treatment), Female Autonomy Variables (dependent variables), and controls.

III-2. Summary Statistics: Water Access

Water access is the variable of interest for this paper, and Table I summarizes the key information on water access within the villages in India. Data for these variables comes from the ER portion of the survey data. The variable "Time to Return Water (Minutes)" is the treatment indicator and "Water Source" will be the instrumental variable (IV), which will be discussed in section four. The variable "Water Located Inside House (%)" was constructed by aggregating the outside and inside water sources. They are also individually shown in Table I. The variables to be included in the regression here are the treatment ("Time to Return Water (Minutes)") and the instrument ("Water Source").

Table I: Treatment Summary Statistics: Water and Water Access

Variable	Mean	Standard Deviation	Number of Observations*
Water Distance (Km)	0.08	0.38	1,908
Water: Need to boil and filter (%)	0.23	0.42	1,941
Time to Return Water (Minutes)	11.62	11.67	1,909
Water Located Inside House (%)	0.02	0.13	1,941
Water Source (%)			
Pipe inside house	0.02	0.13	1,941
Pipe outside house	0.1	0.3	1,941
Well	0.41	0.49	1,941
Rainwater	0	0.02	1,941
River, canal or lake	0.05	0.23	1,941
Hand pump	0.42	0.49	1,941

*Note: Differences in oberservation number are due to women who have water inside not answering questions pertaining to water access disatance and time.

In addition, to confirm that women in this sample are in fact the ones burdened with water collection, Table II shows that women, specifically wives in this sample, are unequally spending time collecting water from both the husband and wife's perspectives. Notably, daughters are the second most frequent water collectors from both the wife and husband perspective.

Table II: Share of Water Collection Chore

	Mean	Standard Deviation	Number of Observations
Who collects water the most: ER Response			
ER	0.71	0.45	1,329
Husband	0.06	0.24	1,329
Son	0.03	0.17	1,329
Daughter	0.10	0.30	1,329
Other Family Member	0.06	0.24	1,329
Paid Help	0.02	0.14	1,329
Who collects water the most: Husband Response			
ER	0.82	0.38	1,169
Husband	0.04	0.19	1,169
Son	0.02	0.14	1,169
Daughter	0.07	0.25	1,169
Other Family Member	0.03	0.18	1,169
Paid Help	0.003	0.06	1,169

*Note: * ER stands for Eligible Respondant, which refers to women (wives) interviewed who met the criteria set by SWAF.*

III-3. Summary Statistics: Female Autonomy

The dependent variable, female autonomy, will be measured in two ways. The first method will be through decision-making variables which will be calculated with dummy variables indicating the likelihood of the wife having the greatest say in various decisions within the

household. This includes economic choices (large household purchases, whether the ER can work outside the home), fertility choices (how many children to have, what type of birth control to use), education choices (where children should go to school, if the ER can pursue her own education), and other decisions regarding chores and household income expenditure. This is gauged by the SWAF survey questions that ask the ER and the husband who has the greatest say in various decisions. These dependent variables are analyzed in a robustness check in section V-3. Decision-making dependent variables are in Table III A and Table III B below.

Table III A : Female Autonomy- Dependent Variables (ER Response)

Variable*	Mean	Standard Deviation	Number of Observations
Greatest Say in Where Kids go to School			
ER	0.16	0.37	1,693
Husband	0.82	0.39	1,693
Say in how HH Income is Spent			
Yes	0.85	0.36	1,830
Who Decides Birth Control Method			
ER	0.11	0.32	763
Husband	0.04	0.21	763
ER & Husband Together	0.83	0.37	763
Greatest Say in Number of Children to Have			
ER	0.29	0.46	1,790
Husband	0.70	0.46	1,790
Greatest Say What Food to Buy			
ER	0.41	0.49	1,836
Husband	0.40	0.49	1,836
Greatest Say in Food to Prepare			
ER	0.79	0.41	1,842
Husband	0.03	0.16	1,842
Greatest Say in Buying Major HH goods			
ER	0.08	0.28	1,317
Husband	0.79	0.41	1,317
Greatest say if ER Can Work Outside Home			
ER	0.23	0.42	1,825
Husband	0.67	0.47	1,825
Greatest say in Wedding Gifts for Relatives			
ER	0.15	0.36	1,839
Husband	0.63	0.48	1,839
Greatest say in buy/sell Animals			
ER	0.08	0.28	1,466
Husband	0.68	0.47	1,466
Greatest say in buy/sell Jewelery			
ER	0.08	0.28	1,662
Husband	0.72	0.45	1,662

*Note: * ER stands for Eligible Respondant, which refers to women (wives) interviewed who met the criteria set by SWAF. Differences in observation numbers due to some respondants saying 'no one' for who has the greatest say. The total sample size of women is 1843. Some questions are any say vs having the greatest say which was divided between husbands and ER. HH stands for household.*

Table III B: Female Autonomy- Dependent Variables (ER Response)

Variable*	Mean	Standard Deviation	Number of Observations
Greatest say in Inviting Guests to Home			
ER	0.22	0.42	1,838
Husband	0.55	0.50	1,838
Greatest say in Punishing Children			
ER	0.58	0.49	1,700
Husband	0.38	0.48	1,700
Greatest say in Action when Child is Sick			
ER	0.38	0.48	1,703
Husband	0.54	0.50	1,703
Greatest say in Amount of Schooling for Children			
ER	0.11	0.32	1,691
Husband	0.85	0.36	1,691
Greatest say in who marries Children			
ER	0.19	0.39	1,667
Husband	0.71	0.46	1,667
Any Say in Who you Married			
Yes	0.20	0.40	1,726
Would Your Husband let you Improve your Education			
Yes	0.30	0.46	1,830

*Note: * ER stands for Eligible Respondant, which refers to women (wives) interviewed who met the criteria set by SWAF. Differences in observation numbers due to some respondants saying 'no one' for who has the greatest say. The total sample size of women is 1843. Some questions are any say vs having the greatest say which was divided between husbands and ER. HH stands for household.*

The second way that female autonomy is measured is through mobility variables. These are dummy variables that equal one if the wife does not have to ask permission from her husband to go to various locations. While it might seem counterintuitive that mobility variables are equal to one for a "No" response, the negative response here actually indicates more female autonomy, as not having to ask permission indicates a higher degree of freedom. The summary statistics of this measurement are shown below in Table IV.

Table IV: Female Autonomy- Mobility Dependent Variables (ER Response)

Variable*	Mean	Standard Deviation
Ask Permission to go to the Health Centre		
No	0.31	0.46
Ask Permission to go to the Temple		
No	0.21	0.41
Ask Permission to leave the House		
No	0.77	0.42
Ask Permission to go to the Market		
No	0.48	0.49
Ask Permission to go to the Fields		
No	0.21	0.41
Ask Permission to go to the Community Centre		
No	0.17	0.38
Ask Permission to go to the Fair		
No	0.12	0.33
Ask Permission to go to the next Village		
No	0.05	0.22
Ask Permission to go to a Friends House		
No	0.40	0.49

Note: Total number of observations for this sample is the same for all mobility questions: N=1,830.

III-4. Summary Statistics: Control Variables

This final section discusses the control variables used within the final estimation strategy. There are three different categories of controls: i. Baseline Controls (income, education, culture and religion, individual characteristics and village controls), ii. Marriage Controls (age at the time of marriage, and husband-wife relationship prior to wedding), iii. Women's Support Controls (whether or not the village has a women's support group). Summary Statistics for each of these control areas are included in Table V in panels A, B and C.

***Table V**: Various Control Variables*

Variable	Mean	Standard Deviation	Number of Observations
Panel A: Baseline Controls			
Income: Condition of House			1,920
Very Good	0.42	0.49	
So-So	0.44	0.49	
Dilapidated	0.12	0.33	
Education			
*ER: Formal Years of Schooling	2.64	3.37	1,830
ER Mother: Level of Schooling			1,830
None	0.84	0.36	
Primary School	0.11	0.31	
Middle School	0.02	0.15	
Secondary School	0.01	0.08	
ER Father: Level of Schooling			1,830
None	0.47	0.50	
Primary School	0.29	0.45	
Middle School	0.11	0.32	
Secondary School	0.04	0.20	
College or more	0.01	0.11	
**Husband: Formal Years of Schooling	5.56	4.59	1,649
Husband Mother: Level of Schooling			1,649
None	0.88	0.31	
Primary School	0.09	0.29	
Middle School	0.01	0.08	
Secondary School	0.002	0.05	
Husband Father: Level of Schooling			1,649
None	0.5	0.5	
Primary School	0.29	0.45	
Middle School	0.08	0.27	
Secondary School	0.03	0.16	
College or more	0.02	0.12	
Religion & Culture			
ER Religion			1,830
Hindu	0.48	0.49	
Muslim	0.52	0.49	
Husband Religion			1,830
Hindu	0.48	0.49	
Muslim	0.52	0.49	
ER: Cover Head in Front of Husband (Yes)	0.29	0.45	1,356
ER: Cover Head in Front of Outside Men (Yes)	0.98	0.13	
Individual Characteristics			
*ER Age	28.32	6.28	1,830
**Husband Age	34.01	7.66	1,649
***Total Number of Children	3.27	2.31	1,649
Village Characteristics			
Population	3458.1	4294.94	2,082
Number of Community Primary Schools	2.13	2.12	2,082
Community Telephone (=Yes)	0.77	0.42	2,082

*Note: The minimum number of years of school for an ER is 0 and the maximum is 15. Minimum ER Age is 15 and the maxiumum age is 39. **The minimum number of years of schooling for husbands is 0 and the maximum is 19. *** Total number of children minimum is 0 and the maximum is 12.

Table V: Various Control Variables Continued

Variable	Mean	Standard Deviation	Number of Observations
Panel B: Marriage Controls			
ER Worked that Year or Not (=Yes)	0.34	0.47	1,830
How Long ER Knew Husband Before Wedding			1,830
Wedding Day	0.68	0.47	
Less than a Month	0.01	0.12	
More than a Month, Less than a Year	0.01	0.11	
More than a Year	0.02	0.15	
Childhood	0.27	0.44	
Age ER Married Husband*	16.43	3.09	1,830
Panel C: Women Group Control			
Community Womens Group (=Yes)	0.30	0.46	2,082

*Note: Minimum age that ER married 5 and the maximum age is 29.

IV. ESTIMATION STRATEGY

Given that income, culture, and other omitted variables would impart a bias upon any causal variation that affects female autonomy directly, an instrumental variable (IV) strategy will be used to control for endogeneity of water access. In an effort to identify a causal relationship of water access time on female autonomy, this paper will use the variable "Water Source" as the IV which is a dummy variable for each possible type of water source. All controls are outlined in Section Three and standard errors are clustered at the village level. The first stage regression is as follows:

(1) $$watermini,v = \alpha + \beta watersource_i + \gamma X_{i,v} + s_{1,i,v}$$

In the first stage, water access in minutes ('watermin') is our dependent variable and will vary at both the individual 'i' and village level 'v' . Our instrument, water source ('watersource'), will vary at the individual level 'i' . 'X' is a vector for all controls outlined in Table V in panels A, B and C. In order to use an IV effectively, the instrument ('watersource') must directly affect the desired treatment variable ('watermin') without affecting our dependent variable ('femaleautonomy'). In other words, the exclusion restriction cannot be violated. I believe it is reasonable to assume there are no other channels for causality through which water source could affect female

autonomy, except through time spent on collecting water, which is the variable of interest. Other factors that would affect this relationship that are latent to water source and female autonomy are mostly due to location, specifically urban vs rural, and income, both of which are controlled for within the regression.

The first stage results can be found below in Table VI. Results are strong, especially with hand pumps, which is significant at the 1% level, and there is a high F-statistic of over 10%, suggesting that the IV is not weak.

Table VI: First Stage

Dependent Variable: Access to Water Source (In Minutes)	
Water Source:	
River	2.14
	[2.9]
Handpump	-5.68***
	[1.73]
Well	2.67*
	[1.44]
Number of Observations:	862
R-Squared:	0.45
F-stat:	60.84
Baseline Controls	Yes
Marriage Relation Controls	Yes
Women Support Controls	Yes

Note: p<0.01***, p<0.05**, p<0.1*

Before we continue to the second stage equation, it is a lso important to consider the reduced form, as seen in equation (2) below:

$$(2) \quad \text{femaleautonomy}_{i,v} = \alpha + \beta \text{watersource}_{i} + \gamma X_{i,v} + s_{o,i,v}$$

To further confirm that the exclusion restriction is not violated, it's important to ensure that the dependent variables that are significant in the reduced form are the same as the significant dependent variables in the second stage. We want to ensure that the channel of water source on

female autonomy is in fact water access time, and not a channel not being accounted for. The reduced form results can be seen below in Table VII, and match the results seen later in section V.

Table VII: Reduced Form.

Dependent Variables: (ER Only)	Treatment: Water Source
Greatest Say in buy/sell animals	-0.01
	[0.01]
Any Say in Choosing Husband	0.04*
	[0.02]
Greatest Say in Buying Major HH goods	-0.02**
	[0.01]
Greatest Say in if ER Can Work Outside Home	-0.01
	[0.01]
Greatest Say in buy/sell jewlery	-0.01
	[0.01]
Husband Let You Continue Education	0.001
	[0.01]
Say in how HH income is spent	0.003
	0.02
General Mobility (1=No)	**0.17*** **
	[0.04]
Greatest Say in Food to buy/prepare	**-0.06*** **
	[0.02]
Greatest Say in Fertility Decisions	0.05**
	[0.02]
Greatest Say in Relative/Friend Relations	-0.01
	[0.02]
Greatest Say in Parental Decisions	-0.03
	[0.04]
Baseline Controls	Yes
Marriage Relation Controls	Yes
Women Support Controls	Yes

Note: p<0.01***, p<0.05**, p<0.1*. For the two 1% signifigant variables, Mobility and Food, the R-squared is respectively 0.27 and 0.35. The number of observations is respectively 873 and 867.

Finally, the second stage regression will be as follows:

$$(3)\quad \text{femaleautonomy}_{i,v} = \alpha + \beta \text{watermin}_{i} + \gamma X_{i,v} + s_{2,i,v}$$

In the second stage, the binary dependent variable is female autonomy, varying at both the individual level 'i' and village level 'v'. This variable takes a value of one whenever the wife participates in female autonomous activities, such as decision-making or having mobility without asking permission. The independent variable, which

only varies at the individual level 'i', will be the estimated variable from our first stage regression, where the exogenous variation has been identified by the IV. Our vector variable will include the same controls for both regressions, and standard errors will still be clustered at the village level. All final results with this regression can be found in the following section.

V. ESTIMATION RESULTS

V-1. OLS Results

First, I examine naive OLS results with the same estimation outlined in regression (3), where the treatment has not been estimated through an IV regression. The results below in Table VIII have all decision and mobility dependent variables, as well as the controls outlined in section III. Dependent variables within a similar category have been indexed for simplicity.

Table VIII: OLS Regressions Water Access & Female Autonomy

	Treatment: Access to Water Source (In Minutes)			
Dependent Variable:	No Controls	Baseline Controls	Marital Relations	Women Community Group
Female Autonomy	(1)	(2)	(3)	(4)
Say in Household Income Spending	0.005***	0.002**	0.002**	**0.003****
	[0.0006]	[0.001]	[0.001]	[0.001]
Say in Food Bought and Prepared	0.025***	0.01***	0.01***	**0.01****
	[0.003]	[0.003]	[0.003]	[0.003]
Mobility	-0.076***	-0.025**	-0.025**	**-0.025****
	[0.01]	[0.01]	[0.01]	[0.01]
Say in Large Household Purchases	0.00006	0.001	0.001	0.001
	[0.00075]	[0.001]	[0.001]	[0.001]
Say in ER Working Outside the Hon	0.005***	-0.0004	-0.0004	-0.001
	[0.002]	[0.002]	[0.002]	[0.002]
Say in Parental Decisions	0.012***	0.008*	0.01*	0.01*
	[0.002]	[0.005]	[0.005]	[0.005]
Say in Fertility Decisions	0.00044	0.004	0.003	0.003
	[0.002]	[0.004]	[0.003]	[0.003]
Say in Buying/Selling Animals	0.002***	0.001	0.001	0.001
	[0.001]	[0.001]	[0.001]	[0.001]
Say in Buying/Selling Jewlery	0.00004	0.001*	0.0014**	0.001*
	[0.001]	[0.001]	[0.001]	[0.001]
Say in Inter-personal relations	0.012***	0.002	0.003	0.002
	[0.002]	[0.003]	[0.003]	[0.003]
Baseline Controls	No	Yes	Yes	Yes
Marriage Relation Controls	No	No	Yes	Yes
Women Support Controls	No	No	No	Yes

Notes: p<0.001***,p<0.05**,p<0.01*. All standard errors are clustered at the village level. Mobility, Food, Parental Decisions, Fertility and Interpersonal relations are all indexed variables.

Each column in the above table illustrates diminishing omitted variable bias as controls are progressively added. I will mostly be looking at variables that remain statistically significant with the highest amount of controls as indicated in column (4). Here we see that a say in household income expenditure, food bought and prepared, and mobility have the highest significance. Mobility is included even though it stays significant only at the 10% level due to the fact that this variable is indexed with several independent mobility variables. The significance of mobility variables is therefore slightly diluted as some are not significant while others are significant at the 1% level. The independent mobility variables that are driving the significance here include not having to ask permission to leave the house, go to the market and go to a friend's house. This can also be said for the food bought and prepared variables, where the significance is being driven by say in food bought, not food prepared.

The OLS regressions are primarily used to give some indication of which dependent variables have some relationship with water access, even at the most basic level. It will serve as a comparison for the IV strategy discussed in section V-2.

V-2. IV RESULTS

The IV regression results are shown below in Table IX.

Table IX: IV Regression

Dependent Variable Female Autonomy	Treatment: Water Access in Minutes Coefficients	Number of Observations	R^2
Say in Household Income Spending	-0.001 [0.008]	862	0.14
Say in Food Bought and Prepared	**0.03*** ** [0.004]	856	0.32
Mobility	**-0.07*** ** [0.015]	862	0.23
Say in Large Household Purchases	0.003 [0.002]	622	0.11
Say in ER Working Outside the Home	0.005 [0.003]	852	0.11
Say in Parental Decisions	0.008 [0.013]	768	0.14
Say in Buying/Selling Animals	0.003 [0.003]	691	0.11
Say in Buying/Selling Jewlery	-0.001 [0.002]	790	0.08
Say in Inter-personal Relations	0.01* [0.006]	862	0.16
Say in Choosing a Husband	-0.01 [0.009]	827	0.17
Say in Fertility Decisions	-0.04** [0.018]	361	--
Allowed to Continue Education	-0.002 [0.004]	862	0.11

*Note: All standard errors are clustered at the village level. Baseline controls include: education, cultural, religion, individual (demographic) and village specfic controls. P<0.01 ***, p<0.05**, p,0.1**

The most significant results here (at the 1% level) are in line with the OLS results in Table VIII and the reduced form results in Table VII. Since the two significant dependent variables, Food and Mobility, are indexes, Table X below gives the individual variables within the index so one can see what is driving these persistent significant results.

Table X: *IV Regressions (No Index)*

Dependent Variable: Female Autonomy (ER Response Only)	Treatment: Access to Water Source (In Minutes) IV Regression: Water Source Type	Observations	R^2
Food Index			
Greatest Say in Food Bought	**0.02*** ** [0.004]	856	0.35
Greatest Say in Food Prepared	0.003 [0.004]	862	0.19
*Mobility Index**			
Ask Permission to go to the Health Centre	0.004 [0.005]	862	0.18
Ask Permission to go to the Temple	0.0015 [0.004]	862	0.11
Ask Permission to leave the House	**0.01*** ** [0.002]	862	0.23
Ask Permission to go the Market	**0.03*** ** [0.003]	862	0.34
Ask Permission to go to the Community Centre	-0.001 [0.002]	862	0.08
Ask Permission to go to a Friends House	**0.02*** ** [0.004]	862	0.34
Ask Permission to go to a Fair	0.002 [0.002]	862	0.1
Ask Permission to go to the next Village	-0.001 [0.002]	862	0.11

*Note: Income, Education, Culture, Religion, Indnvidual and Village Control's are on. Standard Errors are clustered at the village level. *Mobility variables =1 if No.*

As can be seen in Table X, the significant variables within the Food and Mobility index variables are (1) Greatest Say in Food Bought, (2) Permission to Leave the House, (3) Permission to go to the Market and (4) Permission to go to a Friend's House. What is interesting to note is that each of the significant variables has a positive coefficient, and these variables fit into one of two categories, either a) doing something that a wife would be expected to do anyways or b) doing something that would be considered a leisure activity. The economic implications of these results will be further discussed in Section VI.

V-3. Robustness Checks

To ensure that the statistical significance found in Section V-2 holds, the following robustness checks were conducted to verify that the coefficients are valid. The first robustness check targets the decision-making dependent variable. The majority of this analysis uses questions from within the SWAF survey which asked the ER who, from her perspective, had the greatest say in various decisions. However, there was another question within the survey with similar wording which verified whether the ER had any say in each decision. If the effect of water access on the decision-making portion of female autonomy is only for women who have the greatest say rather than any say at all, then this would weaken the argument that water access has any causal implication on female autonomy. To test this, I ran the same IV regression as equation (3) but now with only the decision-making female autonomy dependent variables and using a new subset which allows for a broader range of possibility for wives to have any say rather than just the greatest say in decisions around the house. The results can be found below in Table XI.

Table XI: Robustness Check I

Dependent Variable Female Autonomy: Decision-Making*	Treatment: Water Access in Minutes Coefficients	Number of Observations	R^2
Say in Food Bought	**0.02*** ** [0.005]	760	0.37
Say in Food Prepared	-0.0005 [0.002]	760	0.11
Say in Large Household Purchases	**0.01*** ** [0.004]	622	0.11
Say in ER Working Outside the Home	0.004 [0.004]	760	0.13
Say in Parental Decisions	0.003 [0.02]	760	0.11
Say in Buying/Selling Animals	0.002 [0.004]	760	0.15
Say in Buying/Selling Jewlery	**0.01** ** [0.006]	760	0.06
Say in Inter-personal Relations	**0.012** ** [0.004]	862	0.16
Say in Number of Children to Have	0.003 [0.005]	760	0.1

*Note: *The same variables are indexed with the exception of Food variables given the individual signifigance of this variable. Dependent variables where the response was 'Yes or No' were not included in this check. All standard errors are clustered at the village level. Baseline controls include: education, cultural, religion, individual (demographic) and village specfic controls. p<0.01 ***, p<0.05**, p< 0.1**

Having a broader range of ER decision variables allows more of these variables to become significant, but most importantly, say in food bought remains significant at the 1% level. While the other variables do tie in to the economic implications to be discussed in Section VI, this paper will only discuss the say in food bought due to its robustness and relatively higher R-squared compared to the other significant dependent variables in this check.

The second robustness check targets mobility related dependent variables. Similar to the first robustness check, the SWAF survey had a similar but slightly different question relating to mobility asking whether an ER could go to various places alone. This implication is important as the economic significance discussed in Section VI will be related to women spending time alone. Therefore, the same variables from the original IV regression in Section V-2 should be significant, in addition to others that match the economic implications to be discussed. This check is not suggesting that the two mobility variables are explaining the same channels, but rather that they explain similar channels relevant to the overarching explanation of the relationship between water access and female autono-

my more generally. The robustness check for the Going Somewhere Alone mobility variables can be found below in Table XII.

Table XII: Robustness Check II

Dependent Variable Female Autonomy: Moblity (Alone)*	Treatment: Water Access in Minutes Coefficients	Number of Observations	R^2
Permission to go the Market Alone	0.02*** [0.01]	760	0.3
Permission to go to the Health Centre Alone	0.001 [0.005]	760	0.17
Permission to go to the Fields Alone	0.001 [0.005]	760	0.18
Permission to go to the Community Centre Alone	-0.01* [0.006]	760	0.13
Permission to go to a Friends House Alone	0.001** [0.005]	760	0.26
Permission to go to a Fair Alone	-0.008* [0.004]	760	0.1
Permission to go to the next Village Alone	-0.007*** [0.003]	760	0.12
Permission to go to the Temple Alone	0.03 [0.02]	760	0.2

*Note: *These mobility variables are of a slightly different nature as now (=1) is Yes, as going somewhere alone signifies more female autonomy. Note that some variables did not have a 'alone' mobility variable equavalent. All standard errors are clustered at the village level. Baseline controls include: education, cultural, religion, individual (demographic) and village specific controls. p<0.01 ***, p<0.05**, p< 0.1*.*

Unfortunately, there are no Going Somewhere Alone variables for some of the significant variables that I would like to test, such as Permission to Leave the House. From Table XII, one can see that in addition to the two significant mobility variables from Table X, going to the Fair, the Community Centre, and the Next Village have also become significant. What is interesting in this check is that the three new significant variables all have negative coefficients, while the persisting significant variables still retain their positive coefficients. This will be further analyzed in Section VI.

VI. CONCLUSION

The IV regression in Tables IX and X suggest that as the time to access a water source (in minutes) increases, the likelihood of a wife having a say in the food being bought increases, and women become less likely (recall that the mobility variable equals one if the response is 'no') to ask for permission to Leave the House, Go to the Market or to Go to a Friend's House. The effect on per-

mission to Leave the House is rather intuitive, as it makes sense that as a wife spends less time at home and more time out getting water, it would be more commonplace within the household for her to be gone, making it less likely that she would need to ask permission at all. This relates to other significant variables because if the wife is already more likely to leave the house, she may be able to conduct other activities while collecting water, such as visiting the market or stopping at a friend's house. This hypothesis is further justified when looking at the Buying Food decision variable as it is specifically buying food and not preparing food that is significant; buying food would occur outside the house, while preparing food would likely happen within the house. This paper is not suggesting that spending large portions of time collecting water directly increases female autonomy, rather, it is suggesting that women who spend more time outside of the house are increasingly able to have more autonomy over how they spend their time thus increasing their overall agency. Water collection merely supplies an outlet for women to leave the house without permission to conduct activities that she may otherwise not have the opportunity to participate in.

To test the notion that spending time alone or having choices over how a woman spends her time may be an important aspect to consider for female autonomy; the second robustness check in Table XII further explains of the importance of being alone. Here we see that the likelihood of going to the market or a friend's house alone increases as water collection time increases. This supports the results previously discussed, as an increase in water access time not only increases a women's likelihood of not having to ask permission, but also whether she goes alone or not. This, again, is intuitive, as collecting water is a task a woman would primarily do alone, so activities that increase with water access time should increase from both a permission-needed and going alone perspective.

An interesting result of this robustness test comes from the newly significant mobility variables, including if a woman has to ask permission to go alone to the Community Centre, Fair or the Next Village. All three of these dependent variables were not significant when only general permission was being tested, but become significant when examining permission specifically to go to these same places alone. However, all three of these variables have negative coefficients, indicating that as water access time increases, the likelihood of going to the community centre, the fair, or the next village alone decreases. This indicates that increasing water access time only enables women to have more autonomy in activities that are chores she would regularly do alone , such as buying food or going to the market, or that could be done while completing said individual chores, perhaps indicating that she goes to a friend's house while on her way to collect water, but activities that cannot be completed simultaneously follow similar patterns that other water access literature have suggested: increasing water collection time takes away women's time spent doing other autonomous activities, such as pursuing education or earning an income.

Therefore, this paper finds that time spent collecting water can have positive effects on female autonomy, but it is probably not the main factor that policy makers should focus on when trying to increase female autonomy as a whole. Finding ways in which women can leave their house more frequently may provide them with overall higher levels of autonomy, by participating in activities or chores that provide them with agency in their decision-making and more mobility within their lives. This research contributes to the literature by offering an empirically causal interpretation on how time spent on water collection can increase a woman's autonomy. While most of the literature has established that women may spend less time earning money or attending school, there has been little to no literature analyzing how spending

time doing chores outside of the household may help increase their autonomy. This is important because policies that aim to help women by reducing their time-consuming chores outside of the home could actually reduce female autonomy instead of increasing it. The results of this paper can be further tested by analyzing the SWAF datasets from Thailand and Pakistan, which consist of similar datasets and variables used in this empirical method.

Does Breastfeeding Suck? Exploring the Effects of Breastfeeding on Long-Run GDP Growth

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ECON 490

ABSTRACT

This research paper aims to find an association between exclusive and non-exclusive breastfeeding rates and long-run GDP per capita growth. Data is collected from various sources, including UNICEF, the WHO, and the Penn World Tables. Using a fixed-effects generalized least squares model, I run several regressions to test all countries within the available data, including OECD and non-oil producing countries. I find evidence of a relationship between non-exclusive breastfeeding and GDP growth. The analysis for exclusive breastfeeding yields statistically insignificant results for all but OECD countries.

I. INTRODUCTION

The saying 'breast is best' has arisen from the knowledge that breast milk contains essential nutrients that powdered infant formula lacks, and as such, breastfeeding is considered to be a better alternative than its substitutes (Martin, Ling and Blackburn, 2016). However, despite the favourable position of breastfeeding, global breastfeeding rates remain surprisingly low. The Global Breastfeeding Collective's 2017 scorecard shows that only 22 countries, out of the 129 with available data, meet the 70% goal of early breastfeeding initiation rates among infants, and only 23 countries meet the 60% goal of infants below than 6 months being exclusively breastfed. These findings are startling given that investing in breastfeeding has been found to generate high economic returns (WHO&UNICEF, 2017). One study finds that implementing a national breastfeeding program yields a return of 139% on the initial investment, most of which lies not in savings to the healthcare system, but in the cognitive losses averted (Hajeebhoy et al., 2016). In other words, breastfeeding may prevent forgetfulness, concentration difficulties and other reductions in cognitive functions. Bhandari et al. (2016) find that cognitive losses caused by suboptimal breastfeeding rates contribute to large gross national income (GNI) losses. The findings from these studies, and others examined in the literature review below, raise the question of whether or not breastfeeding is related to long-run economic growth. A deeper understanding of its effects on human capital investment and, in turn, GDP, is needed. This paper addresses this knowledge gap by exploring the relationship between exclusive and non-exclusive breastfeeding and economic growth.

The format of the paper is as follows. Section II reviews the current literature on breastfeeding and its health related, cognitive, and long-run outcomes. Section III describes the data used to conduct the research. Sec-

tion IV provides an economic model of breastfeeding and economic growth, using the model of long-run growth accounting, and discusses the results. Section V concludes.

II. EXISTING LITERATURE

The relevant scholarly literature on the effects of breastfeeding is centred around two subjects: individual impacts and country-wide impacts. The narrower approach is concentrated on childhood and adolescent intelligence, health, adult earnings, and educational attainment, while the broader approach studies the economic impact of cognitive losses associated with suboptimal breastfeeding rates.

Research has found mostly positive income effects from being breastfed as an infant. Cesur et al. (2017) use the National Longitudinal Study of Adolescent Health (Add Health) database to examine whether breastfeeding has a measurable effect on wages. Using the ordinary least squares method, the researchers found that every additional month of infant breastfeeding is correlated with an increase in their wages as adults by 0.5-0.7%, with the strongest effect being for those who were breastfed between 6 and 12 months. When various controls were added to the regression, family fixed effects being one of them, the coefficients measuring the effects of breastfeeding not only decreased, but were no longer statistically significant. Similarly, a 30-year Brazilian cohort study reveals that having been breastfed as an infant is associated with an increase in earnings, IQ test scores, and educational attainment later in life (Barros et al., 2015). These results existed after controlling for parental education, household assets, and genomic ancestry. By tracking individual respondents for 30 years, researchers were able to study the long term effects of breastfeeding on income, educational achievement, and intelligence. The research results revealed that children breastfed for more than 12

months increased their adult IQ scores by 3.76%, years of schooling by 0.91%, and earned a mean income of $1429 Reals.

The studies conducted on infant and young adult intelligence offer varied results in regard to the overall effect that breastfeeding may have. Rees and Sabia (2009) run a fixed-effects model on sibling data to determine the impact of breastfeeding on educational attainment. Controlling for family fixed-effects, they find a positive and statistically significant relationship between the duration of breastfeeding and high school achievement, as well as an increased probability of college attendance. Furthermore, each additional month of breastfeeding led to a 0.19% increase in GPA and raised the probability of attending college by 0.14% (pg. 53, 56-7). Evenhouse and Reilly (2005) discover that controlling for sibling bias reduces the effects of breastfeeding on intelligence and health variables, removing the significance of all but one coefficient - the Peabody Picture Vocabulary Test (PVT) scores, a measure of cognitive ability. Breastfeeding duration is positively associated with a 0.016% increase in PVT scores, and having ever been breastfed is associated with a 1.68% increase in PVT scores. The researchers note, however, that based off of these results, the benefits of breastfeeding that have commonly been touted have likely been exaggerated. These studies suggest that the effects of breastfeeding are strong but that the differences between breastfeeding and its alternatives are not so large so as to make a difference in child health and cognitive outcomes.

The results found by Rothstein (2013), who uses weighted least squares followed by propensity score matching to test three data sets, the National Longitudinal Survey of Youth (NLSY), the Early Childhood Longitudinal Study (ECLS), and the Panel Study of Income Dynamics Child Development Supplement (PSID), are contrary to the implications of previous studies. This study measures

the effect of breastfeeding duration on reading and math scores, and its findings indicate that results vary depending on the database used. Results from the NLSY sibling sample suggest that the optimal breastfeeding duration is more than six months for reading test scores and less than one month for math. Both coefficients are positively related to breastfeeding, with reading scores increasing by 0.105% and math by 0.101%. When mother fixed-effects are accounted for, the coefficients are no longer statistically significant. ECLS result coefficients are also all positively related to breastfeeding duration. Coefficient magnitudes increase as breastfeeding duration increases, the largest effect being at more than six months, with reading scores increasing by 0.148% and math scores by 0.116% (pg. 925). The PSID data analysis provides similar results with applied problem scores. In another study, Bas et al. (2013) find no clear link between breastfeeding duration and completion of secondary education across the five low and middle-income countries that were investigated, as opposed to within-country results, which does find strong evidence in favour of breastfeeding.

While studies that examine the short-term effects of breastfeeding in early childhood on future outcomes in children and adolescents have yet to come to a general consensus, investigations on its global economic impacts have reached a more definitive verdict. Hajeebhoy et al. (2016) examine the DHS and WHO data of seven countries in Southeast Asia to determine the consequences of suboptimal breastfeeding rates. A cost-benefit analysis of Vietnam's national breastfeeding strategy is also carried out to ascertain whether investments in such programs that promote breastfeeding have a positive or negative net benefit. Researchers estimate the cognitive losses associated with low breastfeeding rates for each country in terms of dollars, GNI percentage, and healthcare costs. The results indicates a strong presence of cognitive losses in all countries with suboptimal breastfeeding rates, as

well as high associated healthcare costs. Cognitive losses, as measured in GNI percentage, also vary widely as a result of breastfeeding rates. Therefore, countries with high cognitive losses such as Thailand with a GNI loss of 0.54%, are found to have lower breastfeeding rates. Countries with the highest breastfeeding rates in this study all had the lowest GNI losses with an average of 0.056%. Vietnam's cost-benefit analysis indicates a 139% return on investment, with the costs of its breastfeeding program at $30.3 million while benefits reached $72.14 million, demonstrating that investment in programs to increase breastfeeding rates are worthwhile not simply because of healthcare savings, but also due to the value of averted cognitive losses associated with the benefits of breastfeeding.

Insufficient breastfeeding affects not only mothers and children, but also national economic performance with a strong influence. Moreover, high negative economic costs as a consequence of low breastfeeding rates do exist, and investing to increase those rates has shown strong potential positive economic impacts. Bhandari et al. (2016), using data from a 2015 meta-analysis, estimate the global economic and cognitive losses associated with suboptimal breastfeeding rates, where cognitive losses are measured using IQ scores and economic costs utilize GNI percentages. In spite of the sample criteria being so broad so as to include children receiving any combination of breastmilk and breast milk alternatives, it is found that there are severe GNI losses throughout all 7 geographic regions included in the study. The Middle East and North Africa experience the largest GNI loss, at 0.97%, followed by Eastern Europe and central Asia at 0.75%. In dollar amounts, this results in losses of $11.8 billion and $17.6 billion, respectively. In its own category are the high-income countries which experience a GNI loss of 0.54%, equating to $231.4 billion; by far the largest loss in dollars amounts. Low breastfeeding rates relative to large

population sizes, such as those observed in high-income countries can then be associated with relatively large cognitive losses, as measured in economic costs. It can be expected that countries which have dedicated funds to promote breastfeeding and have implemented national breastfeeding policies are likely to experience large economic gains in the future. The latter two studies calculate the economic costs that substandard breastfeeding rates may have. This paper attempts to look at a gap that exists in the literature that addresses specific types of breastfeeding measures to determine whether there are potential long-run economic advantages that may be gained from higher breastfeeding rates.

III. DATA DISCUSSION

The data used for this paper is collected from several sources, including the World Bank (WB, 2015), the United Nations (UN, 2011), the United Nations International Children's Emergency Fund (UNICEF, 2016), the Organization of Economic Co-operation and Development (OECD, 2015), and the WHO (2015), in combination with Penn World Table 9.0 to measure the effects of breastfeeding on long-run economic growth (Feenstra, Inklaar, and Timmer, 2015). I use two variables to conduct my research. The first is the percentage of infants who were exclusively breastfed for 0-6 months, and the second is the percentage of infants who were non-exclusively breastfed for 0-6 months. Non-exclusive breastfeeding is defined as infants receiving breastmilk in combination with other liquids and solids, while exclusive breastfeeding involves infants receiving only breastmilk, without any other breastmilk complements or substitutes, with the exception of rehydration solution, vitamins, minerals or medicines (WHO, 2019). The databases gather the available data from Demographic Health Surveys, Multiple Indicator Cluster Surveys, or national health surveys.

Data on breastfeeding is usually scarce and collecting it may not be seen as a priority. As made evident by an examination of the WB and the WHO datasets, certain databanks have overlooked certain years while others have chosen to include them. Therefore, drawing from multiple sources is necessary to ensure that the results are as representative as possible. Additionally, data on my variables of interest from several high-income countries is not included. To address this issue, data is gathered from the OECD and the UN, as well as from national statistics bureaus such as the Centre for Disease Control for the United States (CDC, 2015), Statistics Canada for Canada (Gionet, 2015), Socialstyrelsen for Sweden (2015), the Department of Health for Australia (Australian Institute of Health, 2016), and the Ministry of Health for New Zealand (2016).

Before I attempt to estimate the effect of breastfeeding on long-run economic growth, it is necessary to first understand the variables that will be used. Gross domestic capital, GDP, is used to measure GDP per capita. The savings (SAVINGS), exports (EXPORTS), human capital (SCHOOL), and population growth (POP) rates are all collected from the Penn World Data Tables. The only two variables that are manipulated are GDP and POP. GDP is taken from each country's real GDP at constant 2011 prices in US millions and is divided by population size, also in millions. POP is calculated by taking the difference between a country's population from one year to the next and adding 0.05, which is a combination of the depreciation rate and the technological growth rate (Mankiw, Romer, and Weil, 1992). SAVINGS measures the share of gross capital formation, and EXPORTS is the share of merchandise exports. eBFD and neBFD are exclusive and non-exclusive breastfeeding rates, respectively. Based on the Solow growth model (SGM), which states that increasing population growth rates leads to a lower capital-labour ratio, GDP and POP are expected

to be negatively related to each other. SAVINGS, as explained by the SGM, measures physical capital investment and is expected to have a positive relationship with GDP. EXPORTS is also positively related to GDP through direct and indirect investments in the economy. SCHOOL is defined as the years of schooling and the returns from such schooling (Barro and Lee, 2013). Mankiw, Romer, and Weil (1992) find that human capital, as measured by years of schooling and returns on education, positively affects economic growth because it increases the productivity of labour. Table 1 provides a summary of statistics of the variables used to analyze exclusive breastfeeding rates for all years of the available data, as the number of observations for each year were extremely low and would likely not provide a representative sample of the data.

Table 1: Summary Statistics for Exclusive Breastfeeding

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
GDP	1836	16648.56	19925.65	364.297	163294.4
eBFD	647	29.42	19.67	0.3	99
POP	1818	-2.74	0.21	-4.098	-1.54
SAVINGS	1836	0.225	0.127	-0.43	3.07
SCHOOL	1499	2.42	0.7	1.04	3.73
EXPORTS	1836	0.28	0.29	-0.37	2.138

Table 2 below displays the summary statistics for non-exclusive breastfeeding for all years. Like eBFD, the number of observations per year is quite low, especially after removing outliers. Of note is the number of observations for neBFD, which is different from the observation size for eBFD, further emphasizing that the data analyzed for both measures come from separate datasets. Comparing the mean for eBFD and neBFD reveals that non-exclusive breastfeeding is practiced with more frequency than exclusive breastfeeding by all the countries

within this sample. Both measures of breastfeeding are expected to be positively related to economic growth because of their contributions to human capital.

Table 2: Summary Statistics for Non-Exclusive Breastfeeding

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
GDP	813	14410.62	12609.28	443.02	82883.9
neBFD	813	42.09	25.28	0	97.8
POP	811	-2.91	0.22	-3.647	-2.4
SAVINGS	813	0.196	0.083	-0.0019	0.47
SCHOOL	690	2.81	0.59	1.117	3.72
EXPORTS	813	0.25	0.217	0.0000238	1.27

As mentioned in the previous paragraphs, the data on breastfeeding is not always available for each country. This is evident when looking at the observations for breastfeeding in Table 1 and comparing them to the larger number of observations in Table 2. The lack of data for most high-income countries may potentially hinder the explanatory power of the results of this paper. When I attempted to examine the data of certain OECD countries, I was unable to do so because certain OECD countries simply do not record breastfeeding statistics. It is also important to note that all of the studies utilized in the databases are self-reported, which will inevitably affect the accuracy of this paper's results as they rely on the memory and transparency of the individual responder.

IV. RESULTS

A. Empirical Approach

The empirical approaches for exclusive and non-exclusive infant breastfeeding rates for infants that are 0 to 6 months, respectively, are provided. A primary concern is the data's susceptibility to serial correlation

and heteroskedasticity, which occurs when the variances of the variables used are not constant. To address this problem, I use a fixed-effects generalized least squares model. The resulting equation for exclusive breastfeeding is,

$$(1)\quad (lnGDP_{i,t})^* = \beta_0^* + \beta_1(lneBFD_{i,t})^* + \beta_2((lneBFD_{i,t})^2)^* + \beta_3(lnPOP_{i,t})^* + \beta_4(lnSAVINGS_{i,t})^* + \beta_5(lnSCHOOL_{i,t})^* + \beta_6(lnEXPORTS_{i,t})^* + \sum_{1987}^{2014}\delta_s(YD)_s + \sum_{2}^{179}\sigma_j(CD)_j + \varepsilon_{i,t}$$

and for non-exclusive breastfeeding,

$$(2)\quad (lnGDP_{i,t})^* = \beta_0^* + \beta_1(lnneBFD_{i,t})^* + \beta_2((lnneBFD_{i,t})^2)^* + \beta_3(lnPOP_{i,t})^* + \beta_4(lnSAVINGS_{i,t})^* + \beta_5(lnSCHOOL_{i,t})^* + \beta_6(lnEXPORTS_{i,t})^* + \sum_{1977}^{2014}\delta_s(YD)_s + \sum_{2}^{101}\sigma_j(CD)_j + \varepsilon_{i,t}$$

such that,

$$GDP_{i,t}^* = GDP_{i,t} - \rho GDP_{i,t-1}$$
$$\beta_0^* = \beta_0 - \rho\beta_0$$
$$X_{i,t}^* = X_{i,t} - \rho X_{i,t-1}$$

where X is any explanatory variable within the GLS equation and where X is any explanatory variable within the GLS equation and where ρ corrects for the presence of serial correlation. i is the country observation, t is the year observation, and eBFD and neBFD are exclusive and non-exclusive breastfeeding rates from 0-6 months, respectively. YD is the year dummy and δ is its slope coefficient. YD ranges from 1986 to 2014 for exclusive breastfeeding, and the years 1976 to 2014 for non-exclusive breastfeeding. CD is the country dummy with σ as its slope coefficient. Equation (1) has 179 countries in its dataset and equation (2) has 101. β0 denotes the equations' intercept point, the remaining βs each represent

slope coefficients. I include squared terms to determine whether or not a non-linear relationship exists between both types of breastfeeding and GDP per capita.

B. Post-Regression Tests

The following section refers to both breastfeeding variables as both yielded the same results[1,2]. I test whether a random or fixed effects model is more appropriate in order to determine if the errors in the sample are correlated with the independent variables. In order to do so, I complete a Hausman Test which finds that a fixed effects model is the more suitable model. I then test for serial correlation by performing a Wald test and examining the errors to determine if they correlate with one another. Results from this test indicate that a clear correlation between the error terms exists. I also test to see if all coefficients are equal to zero and whether the year dummy is appropriate for the model, confirming the previous results from the Hausman test, that a fixed effects model is needed and that a year dummy is best suited for this model. A modified Wald test is done to verify if the variance of the errors is constant. The test reveals a strong presence of heteroskedasticity, and further proves that a GLS model is the appropriate corrective measure. Finally, a test on the collinearity of the independent variables is ran, which returns a VIF value of less than 10, signifying that multicollinearity is not present within this model.

C. Results

C.1 Exclusive Breastfeeding Rates

Table 3 shows the GLS regression results for exclusive breastfeeding rates. In each column, the change

1. The following outliers for non-exclusive breastfeeding were excluded from the analysis: Armenia (1992), Côte d'Ivoire (2000), Democratic Republic of Congo (2007), Egypt (2005, 2014), Liberia (2007, 2013), Madagascar (2009), Maldives (2009), Norway (2006), United States (2011), Swaziland (2007), Tajikistan (1995, 1996), Turkey (1998, 2003), Zambia (2014), Zimbabwe (2006, 2009, 2011).

2. The following outliers for exclusive breastfeeding were excluded from the analysis: Democratic Republic of Congo (2007), Egypt (2000), Iran (2000), Kuwait (1996), Lesotho (1996), Liberia (2007), Maldives (2009), Qatar

in effect based on the addition of an explanatory variable is measured. eBFD is negative and statistically significant in column 1 of the analysis. However, the subsequent coefficients for eBFD become positive and are statistically indistinguishable from zero as a result of the squared coefficient for breastfeeding, $eBFD^3$, being included in the regression.

eBFD also increases significantly, from -0.3 to 0.09, when the squared measure is included in the analysis and experiences no sizeable changes in coefficient value after column 2. eBFD2 is negative and statistically significant throughout, demonstrating that the associated relationship is non-linear.

Table 3: Exclusive Breastfeeding Regression Results

GDP	(1)	(2)	(3)	(4)	(5)	(6)
eBFD	-0.361***	0.0930	0.0513	0.0116	0.00633	0.0658
	(0.169)	(0.0318)	(0.0939)	(0.0836)	(0.0492)	(0.0354)
$eBFD^2$		-0.0878**	-0.0591***	-0.0575***	-0.0420***	-0.0436***
		(0.0297)	(0.0176)	(0.0158)	(0.00932)	(0.00769)
POP			-4.586***	-3.840***	-0.305**	-0.325**
			(0.128)	(0.124)	(0.106)	(0.108)
SAVINGS				0.640***	0.368***	0.307***
				(0.0510)	(0.0415)	(0.0373)
SCHOOL					2.926***	2.487***
					(0.0544)	(0.0648)
EXPORTS						0.270***
						(0.0195)
INTERCEPT	9.552***	8.992***	-3.261***	0.0978	7.131***	7.816***
	(0.260)	(0.339)	(0.410)	(0.448)	(0.324)	(0.308)
N	550	550	550	550	550	550

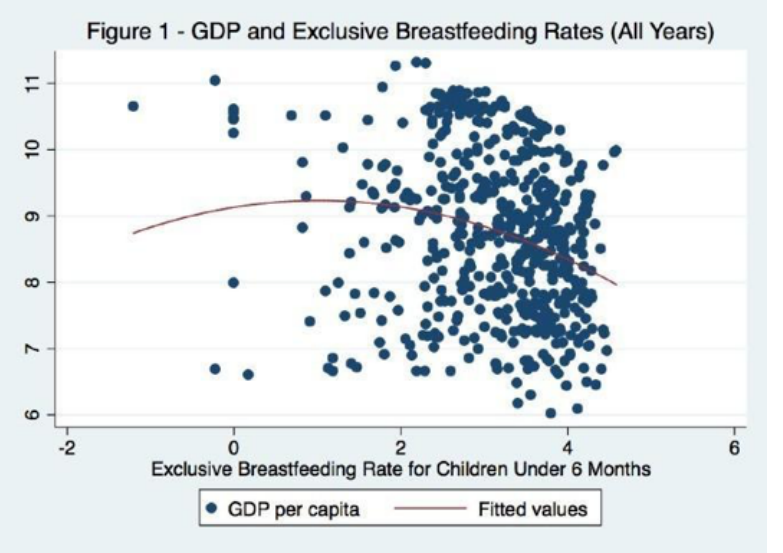
Standard errors in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001

From column 4 to 5 of Table 3, POP experiences a significant drop as the measure of human capital, SCHOOL, is added on; however, it remains negative throughout the analysis. SCHOOL's coefficient is quite large and does

3. The following outliers for exclusive breastfeeding were excluded from the analysis: Democratic Republic of Congo (2007), Egypt (2000), Iran (2000), Kuwait (1996), Lesotho (1996), Liberia (2007), Maldives (2009), Qatar

not decrease markedly from column 5 to 6. All additional coefficients in this particular analysis remain statistically significant and relate to GDP according to the predictions that were made in section III.

Figure 1 shows the non-linear relationship between exclusive breastfeeding and long-run economic growth. This specific approach does not reveal a statistically significant relationship between exclusive breastfeeding and GDP growth, and I recommend further testing in order to properly examine the extent of the relationship between eBFD and GDP growth.



C.2 Non-Exclusive Breastfeeding Rates

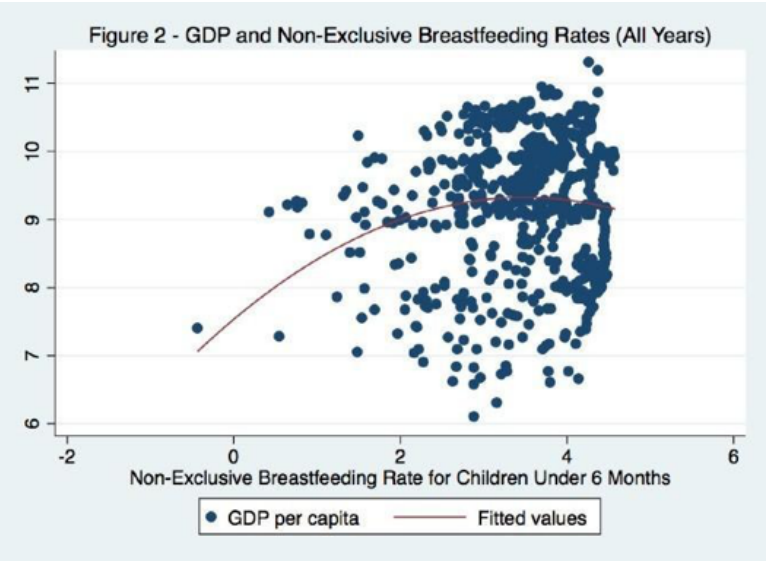
The regression results for non-exclusive breastfeeding are described in Table 4 below. The non-exclusive breastfeeding coefficient, neBFD, is positive for the entire analysis and has a statistically significant relationship with GDP. From column 1 to 2, neBFD increases significantly and, in the subsequent columns, decreases, though the final coefficient is still larger than that of column 1. In the final regression, a 1% increase in neBFD leads to a 0.408% increase in GDP. neBFD2 is negative and sta-

tistically significant for the entire analysis. The squared measure decreases in size as each new variable enters into the regression. Similar to eBFD this indicates that the relationship between GDP and non-exclusive breastfeeding is non-linear, as shown in figure 2. POP is no longer significant in columns 5 and 6 and contains the only two coefficient values that are not statistically significant throughout this regression analysis. SAVINGS and SCHOOL do not experience any large changes and in column 6 the coefficients are at 0.57 and 2.45, respectively. While POP is positive, it is also statistically insignificant, and therefore the coefficient results for the neBFD variables relate to GDP as predicted in section III. Analyses of both measures of breastfeeding would likely improve from running multiple regressions on lagged population variables of more than 20 years as the effects of having been breastfed as an infant are likely not realized until the infants enter the workforce as adults.

Table 4: Non-Exclusive Breastfeeding Regression Results

GDP	(1)	(2)	(3)	(4)	(5)	(6)
neBFD	0.212***	0.953***	0.733***	0.754***	0.503***	0.408***
	(0.0254)	(0.154)	(0.126)	(0.0914)	(0.0966)	(0.0704)
neBFD^2		-0.125***	-0.113***	-0.0879***	-0.0832***	-0.0698***
		(0.0255)	(0.0210)	(0.0152)	(0.0156)	(0.0112)
POP			-1.678***	-1.270***	-0.0164	0.0344
			(0.111)	(0.0960)	(0.0686)	(0.0596)
SAVINGS				1.116***	0.805***	0.577***
				(0.0440)	(0.0369)	(0.0276)
SCHOOL					2.890***	2.245***
					(0.0673)	(0.0622)
REPORTS					2.890***	0.373***
					(0.0673)	(0.0161)
INTERCEPT	9.249***	8.163***	3.740***	5.709***	6.962***	8.200***
	(0.822)	(0.870)	(0.928)	(0.559)	(0.382)	(0.322)
N	653	653	653	653	653	653

Standard errors in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001



C.3 Results Comparison

The regression results for both measures of breastfeeding are shown in Table 5. Columns 1 and 4 contain results from all available countries and columns 2 and 5 from OECD countries, which are, in both datasets, generally the countries with the highest GDP per capita. Columns 3 and 6 display the results from non-oil producing countries. SAVINGS in column 2, and POP in columns 4 and 6, are the only coefficients, apart from eBFD, that are not statistically significant. In column 5 POP is statistically significant at 1.75.

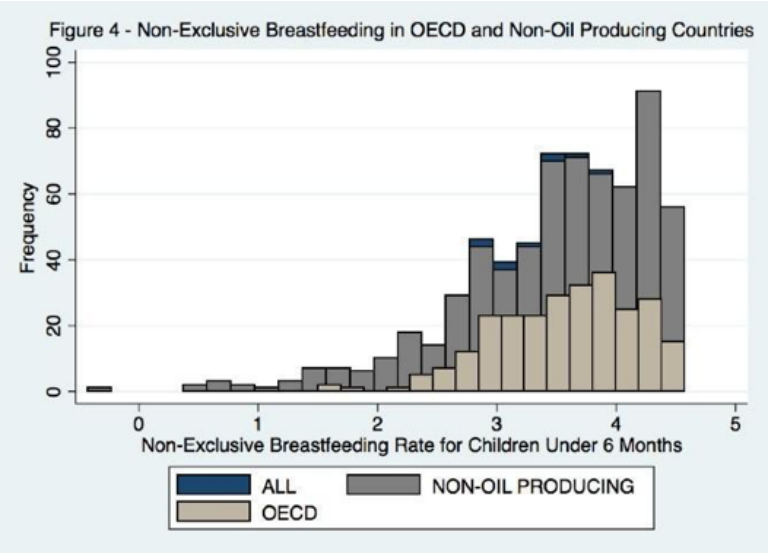
Table 5: The Effect of Exclusive and Non-Exclusive Breastfeeding (6 months) on GDP Growth

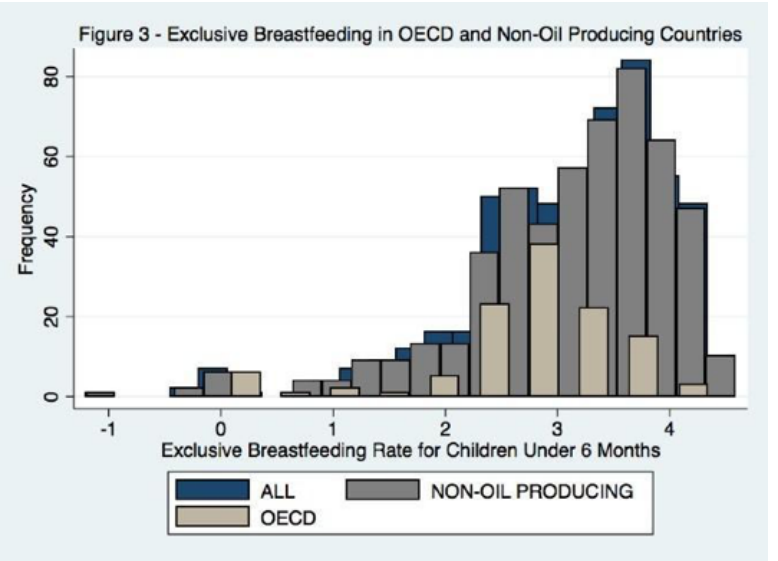
	Exclusive Breastfeeding			Non-Exclusive Breastfeeding		
GDP	All Countries (1)	OECD Countries (2)	Non-Oil Countries (3)	All Countries (4)	OECD Countries (5)	Non-Oil Countries (6)
BFD	0.0658	0.181***	0.00777	0.408***	0.390*	0.379***
	(0.0354)	(0.0525)	(0.0398)	(0.0704)	(0.155)	(0.0692)
BFD2	-0.0436***	-0.0686***	-0.0317***	-0.0698***	-0.0685**	-0.0654***
	(0.00769)	(0.0123)	(0.00830)	(0.0112)	(0.0229)	(0.0111)
POP	-0.325**	0.811***	-0.371***	0.0344	1.753***	-0.000924
	(0.108)	(0.0980)	(0.102)	(0.0596)	(0.107)	(0.0598)
SAVINGS	0.307***	0.0102	0.341***	0.577***	0.368***	0.592***
	(0.0373)	(0.0758)	(0.0389)	(0.0276)	(0.0698)	(0.0282)
SCHOOL	2.487***	1.760***	2.574***	2.245***	0.386**	2.292***
	(0.0648)	(0.147)	(0.0642)	(0.0622)	(0.148)	(0.0642)
EXPORTS	0.270***	0.144***	0.231***	0.373***	0.172***	0.361***
	(0.0195)	(0.0304)	(0.0204)	(0.0161)	(0.0314)	(0.0162)
INTERCEPT	7.816***	10.88***	7.660***	8.20***	14.60***	8.092***
	(0.308)	(0.526)	(0.301)	(0.322)	(0.412)	(0.319)
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	550	116	522	653	262	644
Countries	179	35	166	101	25	97

Standard errors in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001

Figures 3 and 4 demonstrate the logged frequency distributions of each measure of breastfeeding by comparing all countries to OECD and non-oil producing countries. All countries and non-oil producing countries are left-skewed in both graphs and have distinguishably higher frequencies than OECD countries. OECD countries do not have frequencies higher than 40, and the mean exclusive breastfeeding rate is also notably low compared with the other two groups. The distribution for non-oil producing countries in both figures is extremely similar to that of all countries in that they have similar frequencies and are both left-skewed, indicating that oil- producing countries do not greatly affect global breastfeeding rates. In Figure 4, the similarities in frequencies and distribu-

tions for non-oil producing countries and all countries is also likely explained by the fact that there are only four oil-producing countries in the non-exclusive breastfeeding dataset.





As shown in table 5 the squared coefficients for eBFD and neBFD remain negative for the entire analysis,

indicating that the relationship between the variables of interest and GDP is non-linear. The effect of non-exclusive breastfeeding on GDP growth is greater than that of exclusive breastfeeding in all instances, likely because this type of feeding is practiced more frequently than exclusive breastfeeding, as shown in the differences in means in section III. The reason for the diminishing nature of the relationship between breastfeeding and economic growth may lie in breastfeeding being a form of human capital investment. Breastfeeding is associated with increased cognitive function and improved educational attainment in infants and young adults. Better cognitive scores, in turn, positively affect human capital (Lynn and Meisenberg, 2013). Human capital investments, specifically educational attainment, have decreasing returns because each additional year invested in school generates fewer benefits than the year before it (Trostel, 2004). Initial investments in education yield the largest economic gains, while subsequent investments, particularly at higher educational levels, have diminishing returns. Breastfeeding, then, may exhibit the same behaviour as human capital investments in education, potentially through the role it plays in increasing academic performance. An initial investment in increasing breastfeeding rates has a high economic return in the form of GDP per capita growth, however subsequent investments, particularly when the overall breastfeeding rate is high, will have diminishing returns. These are clear investments in human capital and, thus, lead to an increase in the economic growth rate. eBFD has the largest and only statistically significant coefficient when calculated using OECD countries such that a 1% increase leads to GDP growth of 0.181%. OECD countries also have the largest coefficient compared to non-oil producing countries when examining neBFD. The results for columns 2 and 5 make intuitive sense given that OECD countries have lower breastfeeding rates, both exclusive and non-exclusive, relative to non-oil producing coun-

tries. Non-oil producing countries have exclusive and non-exclusive breastfeeding rates of 30.68% and 41.98%, respectively, whereas OECD countries have their rates at 21.19% and 41.93%. This indicates, as per diminishing returns to human capital, that if they were to increase breastfeeding rates, they may experience greater economic gains compared to countries with already high levels of breastfeeding.

V. CONCLUSION

Through the finding of a positive statistically significant effect of non-exclusive breastfeeding on long-run economic growth, this paper opens the doors to a new path for future research to take. The regression analyses reveal a small association between GDP and exclusive breastfeeding rates for high-income countries, and a strong relationship between non-exclusive breastfeeding and GDP. The final regression for neBFD shows a 1% increase in non-exclusive breastfeeding leads to a 0.408% increase in GDP. As the results have shown, the potential economic returns for non-exclusive breastfeeding are all consistently higher than for exclusive breastfeeding. The analysis for eBFD yields statistically insignificant results for all but the OECD countries; the reason for this may be because the average exclusive breastfeeding rate for OECD countries is around 9% less than that of non-oil producing countries, thus leading to much larger potential gains in GDP per capita. The original hypothesis of this paper was that breastfeeding, in particular exclusive breastfeeding, is a form of human capital investment which positively affects economic growth. However, I find evidence of GDP per capita gains only in OECD countries and, more significantly, large economic returns associated with non-exclusive breastfeeding rates.

The positive relationship between breastfeeding and economic growth carries with it large implications.

The summary of statistics reveals that, globally, exclusive breastfeeding rates are currently at 29%, even when the Global Breastfeeding Collective's goal is set at 60% (WHO&UNICEF, 2017). This paper suggests that, where possible, countries should shift away from the promotion of exclusive breastfeeding towards investing in maternal and infant health education for the purpose of increasing non-exclusive breastfeeding. The World Health Assembly (WHA) (2014) currently has five goals in place to increase exclusive breastfeeding; (i) providing hospital and (ii) community support, (iii) controlling the promotion of breastmilk substitutes such that there is no spread of misinformation, (iv) enacting mandatory paid 6-month maternity leave, and (v) training in infant feeding practices. Where water quality is poor, exclusive breastfeeding remains the best option for infants, but the WHA goals are still highly applicable to non-exclusive breastfeeding whenever implementation is feasible.

While this paper has suggested that there may be a relationship between breastfeeding and economic growth, it has not indicated the cause of this relationship. Therefore, further research should focus on determining the nature and mechanism of any causal relationship that is uncovered. Furthermore, for more representative results, future research should also use a larger dataset with multiple breastfeeding measures analyzed consistently across all available countries. For the purposes of improving policies, establishing whether or not breastfeeding is a proxy measure for other health indicators would also prove advantageous. Finally, as breastfeeding policies move toward increasing the promotion of non-exclusive breastfeeding, the GDP effects that such policies will eventually have is something that is also worth exploring.

II

HONOUR'S THESIS

Social Ties, Institutions, and Indian Entrepreneurs: The Role of Caste and Community Networks on Business Incomes in India

Peter Ki

ECON 499

ABSTRACT

This thesis seeks to investigate the role of caste and community networks with key professionals on Indian business incomes. Second-round data from the India Human Development Survey (IHDS) indicates that connections between entrepreneurs and politicians in rural areas have positive effects on log business income, and connections between entrepreneurs and government or political party officials have a positive effect in urban areas. A negative effect is also found for urban entrepreneurs connected to other government workers. Using the same data to proxy for how well connected an entrepreneur is through the number of professional connections, it is suggested that being better connected to caste and community networks increases business income. However, these results are somewhat diminished in the presence of strong financial institutions, which this thesis tests for using different financial inclusion indices and the number of savings accounts owned in a district from the dataset. Finally, robustness checks and instrumental variables cautiously suggest that caste and community networks have some causal role on business incomes in India.

I. INTRODUCTION

Business is an integral source of income and employment opportunities. For an entrepreneur, scaling up a business requires not only physical capital but also capital involving individuals, specifically human and social capital. Human capital consists of the education, skills, and innovation of an entrepreneur and workers, which are important to a firm's success as a whole. The second, less-studied form is social capital, which involves the relationships an entrepreneur possesses in relation to a firm. In India, where caste, religion, and informal networks have a strong sway on people's lives, business can be impacted by such factors.

Considering these aspects, I intend to investigate the following research question: Do caste and community networks increase business incomes in India? Although India is improving its financial institutions and government structures to address inequality within its population, concerns of corruption, caste sectarianism, and political favouritism still persist. Thus, this thesis aims to contribute to the social capital literature, specifically relating to entrepreneurs, and analyze whether caste and community ties to professionals have an impact on business performance.

To perform this exercise, I use data from the India Human Development Surveys, which contain relevant questions of social capital, which will examine a household's connections to family, caste, and community networks, and entrepreneurial business across the country. Linear regressions with a host of demographic and business controls suggest that caste and community connections to professionals such as politicians, government officers, and political party officials offer a positive boost for business performance. Interestingly, being connected to other government workers is associated with a business income penalty for urban entrepreneurs. Even more

intriguing is the fact that these results vary in significance and magnitude based on caste and religion. For example, Scheduled Castes and Scheduled Tribes[1] do not receive the same benefits as other Hindu castes do with these social connections. When considering the overall network, a larger network of professionals leads to higher income boosts as well where this thesis finds the magnitude of its effect to be larger in urban settings.

As an additional exercise, I also investigate whether stronger financial institutions can reduce the effect of caste networks on business income. These financial institutions are represented by financial inclusion indicators. Using three different proxy types for the strength of financial institutions, the results lend support to the institutions hypothesis where stronger institutions dampen effects of caste networks and connections to political professionals.

Finally, I assess the validity of "inner" networks as opposed to "outer" networks beyond the family, caste, and community. Both panel data and an instrumental variables approach, which reduces the threat of reverse causality, provide evidence that politicians and a caste network can play a causal role on business incomes.

II. BACKGROUND AND INSTITUTIONAL FRAMEWORK

Defining Social Capital

To sociologists, economic transactions are situated in social and cultural contexts that go beyond neoclassical interpretations (Portes, 2010). Thus, it is understandable that social capital was first conceived by sociologists and political scientists who focused on social interactions and power. The modern version of the term was defined in the late 1980s by James Coleman (1988, 1990) and Robert Putnam (1993a, b). Their definitions describe social

1. Scheduled Castes and Scheduled Tribes are characterized as social groups in India that occupy the lowest social status in the caste hierarchy.

relationships that are created by informal organizations; Putnam observes group formations between equals while Coleman focuses on hierarchical arrangements (Hayami, 2008). Durlauf and Fafchamps (2005) find that a large amount of literature on social capital is vague. They conclude that social scientists define the term through key ideas including informal ways of associating, positive externalities for belonging in a group, and trust occurring from such networks. It can then be inferred that there is some positive benefit to being socially connected.

There is criticism that the concept of social capital lacks analytical precision and is exclusionary to concepts of inequality (Fine, 2010). It is therefore necessary to avoid assuming that the term is all-encompassing, while recognizing its intersection with other social structures. For this thesis, Lin (2001) offers an appropriate definition of social capital "as the resources embedded in social networks accessed and used by actors for actions" (p. 25). I use Lin's (2001) definition to define social capital as social networks and ties while emphasizing informal arrangements. A key assumption must be made that a positive effect would indicate the use of a key professional connection. This distinction is important as I intend to deliberately separate trust and formal institutions from the definition.

The Significance of Social Capital on Business

According to Westlund and Bolton (2003), social capital can be viewed as productive capital that generates positive externalities, but negative social capital is also a possibility. They state that an established business may have strong customer and supplier networks that exclude others in the market from gaining access to resources. The authors also state that this form of capital is both consumed and invested in, affecting producer surplus either directly or indirectly. Focusing on the latter, they

theorize that social capital affects transaction costs by reducing information, search, and contract costs, through increased trust.

In this thesis, certain "inner" network links can reduce transaction costs and increase economic benefits. For instance, ties to a government bureaucrat may reduce the transaction costs of creating a relevant legal entity for a business. In another case, ties to a politician may provide personal favours to a business, especially when corruption is a systemic problem.

Caste Networks in India

Translating social capital into the Indian context means acknowledging another social structure that must be carefully interpreted: caste. According to Desai and Dubey (2012), caste is hierarchical, exclusive, and exploitative by nature, creating social stratification that affects opportunity structures. Their study finds that although there are improving signs in the 21st century, caste still correlates with education status, consumption patterns, and social networks; in other words, the lower the caste, the worse the outcomes in socioeconomic terms.

Vanneman, Noon, Sen, Desai, & Shariff (2006a) also find that the hierarchy of Hindu caste corresponds to the strength in social ties to doctors, educators, and government workers, while Muslims do especially poorly in all indicators. Yet they make an important distinction for urban dwellers where Dalits and Adivasis[2], the lowest castes and tribes, surprisingly have greater social ties than higher castes. The authors suppose that social equalization in urban areas and government reservation programs explain the result of these higher outcomes.

These stronger ties hint at a broader phenomenon of caste networks that Munshi (2016) finds relevant to providing all sorts of economic support to affiliated members in India, whether in the form of loans,

2. Scheduled Castes (SC) and Scheduled Tribes (ST)

insurance, or new economic opportunities. He argues that such associations also enable social mobility through mutual support, but only within a community and not necessarily across; exclusion is emphasized in this case.

Munshi (2016) concludes that such arrangements are inferior to efficient markets and solid institutions. Meanwhile, Fafchamps (2006) claims that the effectiveness of social capital depends on a country's formal institutions and development; it may indicate the failure of such institutions as well. However, even though social capital could be a substitute, Fafchamps (2006) also states the possibility of social capital being a complement to formal institutions as well.

Indian Business Performance by Caste

Although Munshi has focused on the potential of a social group to improve economic outcomes for its members, context should be provided on how each subgroup performs in the business sector. This understanding is necessary as the effects of social capital vary by caste.

Iyer, Khanna, and Varshney (2013) analyze the Economic Censuses to find that SCSTs in 2005 remain underrepresented in private business ownership and employment generation. In contrast, the private business ownership shares of OBCs (Other Backward Castes)[3] have risen significantly to match their population share. They also argue that only a modest increase in these indicators have prevailed for these groups since 1990. The authors find that SCST firms are characteristically smaller, employ less outside labour, have less access to financial institutions, and are more likely to be in the informal sector.

Dehejia and Panagariya (2012) appear to reach similar conclusions as Iyer et al. (2013) do concerning ownership, gross value added (GVA), and employment for SCST firms between 2001-2002 and 2006-2007. Although they

3. OBCs are considered to be higher in the caste hierarchy than SCSTs

find that such groups possess below-average productivity, the authors diverge in their assertion that SCST firms are not falling behind in economic growth. They also find that OBC firms have grown significantly in contrast to FC (forward caste)[4] firms that have declined in their GVA share.

So far, it has been theorized that extensive ties to caste networks can be useful for Indian businesses through reducing transaction costs and offering new economic opportunities, such as employment and better access to consumers and suppliers. In the larger economic sphere, caste networks are exclusive and are inferior to strong, formal institutions that promote equality rather than discrimination by caste. Furthermore, Indian business incomes may differ based on the type of caste and environment that an entrepreneur is involved in.

Literature Review on Social Capital's Impact

As previously mentioned, social capital is broadly defined, even within economics. Thus, this review will focus on networks as the key independent variable of economic outcomes.

Social networks have been studied in relation to various economic indicators. Individual welfare is one significant topic in the literature where academics have observed some positive effects of networks and associations on overall household welfare (Adepoju and Oni, 2012), migrant income and employment dynamics (Dang, 2015), and access to microfinance (Akram and Routray, 2013).

In the business context, networks are also positively significant but not in all cases. Studies on African trading firms support the positive effects of networks. Fafchamps and Minten (2002) find that Madagascan agricultural traders who are better connected to other traders, have positive effects on firm productivity—channels of trust and information-sharing are suggested. However,

4. FCs are considered to be higher in the caste hierarchy than OBCs

Egbert (2009) suggests there is a negative side to social networks as personal favours from family, friends, or other community members can act as a constraint.

These two sides of social networks are acknowledged by Kuépié, Tenikue, and Walther's (2016) study on traders' profits and social networks in West African border regions. The authors find that the most-connected traders have greater monthly profit; connections to one important person give 144% more profit, and each additional connection yields a 46% profit boost. Connections to senior civil servants give a positive effect on profits as well as police officers (despite a non-statistical significance), but a religious figure penalizes profits with significance. Kuépié et al.'s work lays a good foundation for this thesis through the methodology of constructing social network variables for business income regressions and offers potential solutions to endogeneity.

The unique Indian social context must also be acknowledged. Caste adds another layer to social capital, where Anderson (2011) finds higher income outcomes for low-caste households living in low-caste dominant villages. Her research on low-caste and high-caste villages reveals the same outcome for agricultural yields, proposing that markets for groundwater irrigation are more efficient when a more homogenous caste composition is present.

An even more nuanced approach to social networks and caste in India has been conducted by Johny, Wichmann, and Swallow (2017). Their study in the Indian state of Kerala reveals a common trend: diversifying a household's social network with other households creates a positive effect on income diversification. Furthermore, the authors find that social stratification in villages negatively correlates with income diversification. Both papers suggest that social ties in India are more productive when individuals are in the same association but not beyond an "inner" network.

In addition to networks and caste, institutions

must be acknowledged. Danis, De Clercq, and Petricevic (2011) empirically test the relationship between social networks and new business activity, finding that the effect of informal relations is stronger for new enterprises in developing countries than in developed ones. In both cases, higher associations correlate with more new business activity. The authors assert a substitution effect between social networks and weak institutions, which I will later test for.

III. ECONOMIC FRAMEWORK FOR SOCIAL CAPITAL AND BUSINESS INCOMES

It is apparent that caste impacts how well a business owner does in India, and yet, in the same vein, caste creates access to social capital that enables economic mobility. Furthermore, there are additional concerns on how well business owners of other religions fare outside of the caste system. This begs the question: how does the impact of networks on business performance vary by caste and religion? It also begs the question of whether such effects are dampened in the presence of strong, formal institutions. Do such networks matter at all for Indian entrepreneurs? How well do non-Hindu individuals fare in these economic activities?

Inspired by the literature on caste networks, my hypothesis is that connections to certain prominent professionals in an entrepreneur's own caste or community leads to a greater return of business income. Furthermore, I also hypothesize that having more of these professionals within an entrepreneur's network increases business income as well.

This thesis seeks to understand the social mechanics of business in India. My work builds on Deshpande and Sharma's (2016) paper addressing the impact of caste differences on entrepreneurial income. Their own work finds that SCST firms perform significantly worse than

non-SCST firms, where a mean decomposition reveals that at least 20% of the caste gap is unexplained.

I expand on their findings by addressing the potential role of community networks between different castes, religions, and income. The strength of these networks is proxied by social ties to key professionals, including doctors, educators, politicians, government workers, and the police or military, as well as indicators of obtaining loans from relatives and community credit groups. Deshpande and Sharma (2016) also use membership in caste associations and connections to village committees, which I use as indicators as well.

In addition to this investigation, I address whether stronger financial institutions would diminish the effect of these informal networks on business income. Based on the literature, my hypothesis is that stronger institutions diminish the effect of informal ties on business performance. If there is a strong and stable financial base that offers equal access to financing schemes, it is reasonable to assume that these formal institutions would prevail over the more divisive schemes of caste networks, a second-best alternative.

IV. DATA SOURCES AND DESCRIPTIONS

Main Data

The main data used is the India Human Development Survey (IHDS) and IHDS-II micro datasets (both household and individual) in the second round, along with surveys conducted by the University of Maryland and the National Council of Applied Economic Research in New Delhi. This survey asks a broad range of socioeconomic questions including business income, types of assets owned, education, and social ties to professionals. According to the data guide, the second-round sample spans 33 states and union territories, 384 districts, 1,420 villages and 1,042 urban neighbourhoods. A closer inspection of

the dataset yields only 373 districts, but the 33 states and union territories are present as expected.

This first round was conducted in 2004-2005 (with 41,554 households) and the second round was conducted in 2011-2012 (n = 42,152). An 83% re-interview rate was achieved and a merging of the two rounds yields 40,018 observations. 6,911 households were only surveyed in round 1, 2,134 households were only surveyed in round 2, and 5,397 households were split households from round 1 that are included in the merge. It should be noted that only second-round data is used for the main analysis while the first-round data is reserved for robustness checks of explanatory variables.

The main outcome variable uses log nonfarm business income reported for a household in the second round. Although it is possible for a single household to own multiple businesses, this analysis restricts itself to the first business that a household respondent reports in the survey. Given that a log transformation is required for business income, 39 observations with negative or zero incomes are labelled as missing, leading to a total of 8,747 entrepreneurs that report a positive business income.

It is also possible to use gross receipts instead of the reported net income since there is extensive information on expenses for a nonfarm business. However, Deshpande and Sharma (2016) find that some businesses only report the net income and not the individual components. The authors also find that there are methodological concerns of unpaid family labour affecting net business income calculations in the first round. Being unable to distinguish between hired and unpaid family labour prevents a true calculation of net income. Given that the authors choose to use the reported net income figures, along with the complication of manually calculating them, this analysis also accepts the decision to use reported net business income.

For the main independent variables, there are 11

indicators that ask households if they are personal acquaintances with a certain professional within their relatives, caste, or community. These professionals include doctors, other health workers, teachers/principals, other school workers, government service officers and above, other government employees, elected politicians excluding village panchayats, political party officials, police inspectors and above, other police workers, and the military. Along with these "inner" variables, there are equivalent indicators that ask if households know any professionals outside of their caste and/or community.

Using the same controls as Deshpande and Sharma (2016), many of the demographic controls involve education, marital status, age, sex, asset ownership, and so forth. Business specific controls are also included that identify the business industry type[5] along with membership in certain groups that could affect business (Appendix 1), the log of the number of hours or days put into the business, the number of workers, and the location of the business. Additional dummy variables used in this analysis are finer distinctions of the urban-rural divide, defined as four groups (metro urban, other urban, more-developed village, and less-developed village) and five caste-religion groups (Brahmin/Forward Castes, Other Backwards Castes, Scheduled Castes/Scheduled Tribes, Muslims, and Christians/Sikhs/Jains).

Although the analysis is mainly conducted on the household level, a few controls are found in the individuals' dataset that are merged accordingly. This information includes data on who a primary decision-maker of a business is, as well as an entrepreneur's sex, education, and marital status. The information on household members working in the business involves the number of workers,

5. This thesis will not include business industry types in the results, but for clarification, the INDUSTRY variable has been collapsed into 9 separate categorical dummies: agriculture/hunting/gathering, mining/mining services, manufacturing/repair capital goods, utilities, construction, retail/service, transportation/storage/communication, professional services (banking/legal/renting/etc.), and government-related work.

the number of work hours committed per day, and the number of workdays per year. Totals are calculated by individual in each household for the labour-related data and incorporated into the household dataset.

Additional Data

For the testing of the institutions hypothesis, two additional pieces of data are used as different proxies for institutional development. The first data piece is a measurement of financial inclusion for Indian states by Ambarkhane, Singh, and Venkataramani (2016). The authors calculate indices for both financial inclusion and comprehensive financial inclusion that involve a drag factor of the population growth rate. These indices account for various aspects of financial and banking services based on dimensions of supply, demand, and infrastructure. Both the financial inclusion index (FII) and the comprehensive financial inclusion index (CFII) have a total of 21 states listed and are meant to be assessed for the 2011 year.

The second data piece is the CRISIL Inclusix Index by CRISIL which has its own calculations of financial inclusion at the district level. This index calculates financial inclusion based on three parameters of branch penetration, deposit penetration, and credit penetration. The actual data is included in the data files of the India Map of Financial Inclusion by MIX's Finclusion Lab, but information is also available on documents of the CRISIL Inclusix reports. Because there are less districts reported in the IHDS surveys than in the CRISIL Inclusix index, the total of 373 districts are used. This index also uses assessments for the 2011 year.

For instrumental variables, the 2011 Census Data of India which contains information on the proportion of Muslims for all 373 districts identified in the dataset is also included. A correlation test is done with a placebo proportion of Muslims in the dataset to determine whether other group proportions can be obtained from

the IHDS and finds a reasonably high correlation which will be addressed in the next section.

V. ESTIMATION STRATEGY

Main Estimation Analysis

The first three preliminary regressions conform to ordinary least squares (OLS) to investigate the effect of caste and community social ties, represented in equation (1):

$$(1) \qquad Log\Upsilon_i = \alpha + \beta_j X_{ij} + \delta x_{it} Dx_{it} + \varepsilon_{id}$$

where Y represents log business income, X_{ij} represents the independent variables of key "inner" networks (where j denotes one of the eleven social ties variables), Dx_{it} represents demographic/business controls (where t denotes multiple controls used), and ε_{id} represents the clustered error term at the district level (denoted by d). A positive coefficient from network variables would suggest a percentage boost in income for a social connection while a negative coefficient would suggest a penalty in being connected to a professional. Standard errors are also clustered at the district level for all regressions unless otherwise stated.

Borrowing from Deshpande and Sharma (2016), I first conduct an OLS regression on all eleven social indicators with only age, transformed age (age squared divided by 100), marital status, education, asset ownership, and urban dummies as controls (along with caste/religion groupings). I then conduct a second regression that includes the rest of the demographic and business controls. The third regression restricts the sample size to states that have at least 50 entrepreneurs in the dataset, reducing the number of state and union territories to 23.

For the last two preliminary regressions, a slight modification is made to equation (1):

$$(2) \qquad Log\Upsilon_i = \alpha + \beta_j X_{ij} + \delta x_{it} Dx_{it} + \gamma_r + \varepsilon_{id}$$

$$(3) \qquad Log\Upsilon_i = \alpha + \beta_j X_{ij} + \delta x_{it} Dx_{it} + \gamma_s + \varepsilon_{id}$$

Equation 2 denotes Specification 4 where γ_r denotes fixed regional effects by Arun, Annim, and Arun[6] (2015) while Equation 3 denotes Specification 5 where γ_s represents fixed state effects. For instrumental variable estimations, this fourth regression includes the above-mentioned regional dummies. The fifth regression replaces these regional dummies with state fixed effects. These regressions will provide an illustration of how robust these social indicators are as additional restrictions are added.

Given India's context of a large rural-urban social divide, this thesis will investigate how the independent variables will differ between the two settings. Furthermore, with even clearer institutional differences between caste and religion, the rural and urban groups are further divided into the following subgroups: Brahmins-Forward Castes (BFC), Other Backwards Castes (OBC), Scheduled Castes-Scheduled Tribes (SCST), and Muslims (Muslim)—Christians, Sikhs, and Jains are the omitted subgroup. An analysis of these groups provides a far more nuanced picture of how caste and community networks impact entrepreneurs, instead of assuming that the mean results apply equally to a diverse sample. As an additional investigation, interaction terms between group dummies and key indicators will be used in later regressions.

Adding an additional dimension of business income, I use Deshpande and Sharma's (2016) technique of conducting quantile regressions for the overall sample and the urban-rural divide, expressed by a slight modification of equation (3):

6. The regional dummies are the following: North, BIMARU, South, East, and Other, where the excluded group will always be North. See Arun, Annim, and Arun (2015) for the exact states used for each regional grouping.

$$(4) \qquad Log\Upsilon_i = \alpha + \beta_j X_{ij} + \delta x_{it} Dx_{it} + \gamma_s + \varepsilon_b$$

Note that the error term is now bootstrapped to 100 replications for quantile regressions as done by the authors. Based on their findings, it is reasonable to assume that the social indicator variables may vary depending on how prosperous a business is. The effect by caste networks may vary by income, suggesting that richer businesses may benefit more from certain connections than others Thus, quantile regressions are performed at the 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentiles.

To measure for the general connectedness of an entrepreneur, the eleven social variables are also aggregated into a basic index, which modifies equation (3) once again:

$$(5) \qquad Log\Upsilon_i = \alpha + \beta X_i + \delta x_{it} Dx_{it} + \gamma_s + \varepsilon_{id}$$

where X_i becomes a single index. The intuition is that a higher index value indicates that an entrepreneur has more connections, which implies that a business owner has better caste or community networks. This exercise is done to see if a general index of caste networks has any explanatory power for an entrepreneur's business income. The index is assessed along urban-rural divide and subgroup lines.

Institutions Hypothesis

To evaluate this hypothesis, I use three different types of proxies for financial institutions and interact a proxy with either a key social indicator or the general index. The first proxy type, which involves two variables, uses the financial inclusion indices by Ambarkhane et al. (2016). These indices are assessed in the usual parameters of subgroups and the urban-rural divide. Since the indices differ by state and the proxy variable is omitted

upon regressing, I remove state fixed effects and evaluate the interactions terms both with fixed regional effects by Specification 4.

The regressions employed for this proxy also conform to ordinary least squares (OLS) in equations (3) and (4) but includes a single interaction that vary by state:

$$(6) \quad Log\Upsilon_i = \alpha + \beta_j X_{ij} + \beta 2\gamma 2_s + \phi\gamma 2_s X_{ie} + \delta x_{it} Dx_{it} + \gamma_r + \varepsilon_{id}$$

$$(7) \quad Log\Upsilon_i = \alpha + \beta X_i + \beta 2\gamma 2_s + \phi\gamma 2_s X_i + \delta x_{it} Dx_{it} + \gamma_r + \varepsilon_{id}$$

where $\gamma 2_s$ represents the FII and CFII terms to be interacted with either a single explanatory social variable (denoted by subscript e) in equation (6) or a single basic index in equation (7). Note that state fixed effects are replaced with regional effects.

The second proxy type uses the CRISIL Inclusix Index by district, which will be assessed in the same way as the first proxy, with the reintroduction of state fixed effects. The second index variable is divided by 100 to obtain a range between 0 and 1. The third proxy type uses a dummy variable from the dataset that indicates whether a household has invested in banks savings or a current account in the last five years. The intuition is that the strength of financial institutions can be approximated by the proportion of those with bank savings at the district level. By this logic, a higher savings index would indicate stronger financial institutions.

Empirically, this third proxy is constructed from all round 2 observations by calculating the mean of those that have invested in a savings account by district. The regression equations follow as such:

$$(8) \quad Log\Upsilon_i = \alpha + \beta_j X_{ij} + \beta 2\gamma 2_d + \phi\gamma 2_d X_{ie} + \delta x_{it} Dx_{it} + \gamma_s + \varepsilon_{id}$$

$$(9) \quad Log\Upsilon_i = \alpha + \beta X_i + \beta 2\gamma 2_d + \phi\gamma 2_d X_i + \delta x_{it} Dx_{it} + \gamma_s + \varepsilon_{id}$$

where $\gamma 2_d$ represents the CRISIL and SAVINGS terms (varying by district) to be interacted with either a single explanatory social variable (denoted by subscript e) in equation (8) or a single basic index in equation (9). Note that state fixed effects are reintroduced.

For all proxies, a negative interaction term with either a key social indicator or a basic index confirms the institutions hypothesis. If an informal network effect exists, then the presence of stronger financial institutions should diminish that effect. In addition, there is an expectation that the sign of any network variable does not change with the introduction of an interaction term. A sudden change of a sign would cast doubt on whether the institutions hypothesis is confirmed using a certain specification and its parameters.

Robustness Checks and Determining Causality

As an additional robustness check, one empirical strategy assesses whether the "inner" (i.e. relatives, caste, and community) portion of network effects is valid. It is assumed that having community or caste networks are useful for a business as a potential source of social capital. Thus, to test for the validity of this assumption, I conduct a placebo test and use equation (3) to regress for social ties outside of such a social arrangement since the IHDS-II data distinguishes between caste and "outer" networks. If "outer" networks have a weak or inconclusive coefficient, then it correctly proves the assumption that community or caste networks are helpful. Empirically, this technique involves putting both "inner" and "outer" social variables together in a regression as well as using "outer" social variables on their own.

The main challenge of this thesis is to assert a causal relationship between informal caste and community networks and business income in India. Although I do not argue that all eleven indicators of social ties have a causal effect on the dependent variable, there is at least

one worth investigating along with the basic index itself. Thus, a few techniques will be employed to determine whether a causal relationship exists from networks to income.

The first technique involves using round one observations to construct a variable of past business income. This exercise is useful because it is possible to use panel data in the first round and connect them to entrepreneurs in the second round. Checking whether future network variables have any explanatory power on past business performance, the possibility of reverse causality is diminished if the relationship is not statistically significant. It should be noted that the number of observations is reduced to approximately half when conducting this causality test. Equation (3) will still be employed for this exercise.

The second technique involves using an instrumental-variables approach to prove causality, which conforms to two-stage least squares regressions. For the four proportion instruments with no clustered errors,

(10) $$X_i = \alpha + \beta 1_k Z_{ik} + \delta x_i Dx_i + \gamma_r + \varepsilon_i$$

(11) $$Log\Upsilon_i = \alpha + \beta 2 X_i + \delta x_i Dx_i + \gamma_r + \varepsilon_i$$

where Υ_i represents log business income, Z_{ik} represents four different instruments for proportions of BFCs, OBCs, SCSTs, and Muslims by district (differing by the subscript k), X_i represents either the basic social index or the "inner" politician tie, Dx_i represents demographic/business controls, and γ_r represents fixed regional effects differing by r.

For the same regression equation with clustered errors at the district level,

(12) $$X_i = \alpha + \beta 1_k Z_{ik} + \delta x_i Dx_i + \gamma_r + \varepsilon_{id}$$

$$(13) \qquad Log\Upsilon_i = \alpha + \beta 2X_i + \delta x_i Dx_i + \gamma_r + \varepsilon_i$$

where the only difference lies in the error term, clustered by district with the subscript d.

Since there is a concern for reverse causality or network ties being correlated with omitted variables, an instrument would isolate a portion of network ties that has an idiosyncratic variance while being uncorrelated to omitted terms. To successfully execute this technique, an instrument must fulfill the three criteria of exogeneity, excludability, and strength. If an instrument is successful in passing all these expectations, then there is much greater assurance that a causal relationship exists.

One type of instrument is used to assess the role of caste and community ties. This instrument type uses the proportion of BFC, OBC, SCST, and MUSLIM groups by district as an appropriate indicator for "inner" networks and ties. For exogeneity and excludability concerns, it is assumed that having a greater proportion of an individual's group in a district would increase the probability that the individual is better connected to key professionals within their caste or community. The mechanism involved would be increasing the pool of one group to have more professionals in that caste or community. In addition, there is little chance that a greater proportion of an entrepreneur's group would necessarily increase business income.

To gain a more accurate representation of religious proportions, I use India's 2011 Census data and input the proportion of Muslims that reside in a district to construct the instrument for Muslim entrepreneurs. Given the difficulty of finding similar data on the proportion of BFC, OBC, and SCST groups by district, I use the round 2 dataset itself to receive the proportions of certain caste groups by district. Although there are concerns that there are too few observations by district to make a reasonable guess on true proportions, a correlation test between

Census data on Muslims and proportions taken directly from the second-round dataset yields a figure of 82.39%. This higher correlation leads to the conclusion that group proportions for Hindu castes can also be reasonably inferred from the second-round dataset.

VI. RESULTS

Summary Statistics

Table 1.1 lists the mean business income and social ties reported by entrepreneurs in the whole sample while Table 1.2 reports summary statistics for all controls besides industry types and state fixed effects. On average, an Indian entrepreneur makes 104,966.5 Indian Rupees per year and indicates social ties with approximately two key professionals. Investigating the social ties themselves, teachers or principals have the highest acquaintance rate of 36.21% within the sample while elected politicians have the lowest acquaintance rate of 7.32%.

In Appendix 1, business income and the basic social index are decomposed into subgroups and the urban-rural divide. It is hardly surprising to find that urban entrepreneurs in India earn 1.89 times more income than their rural counterparts while having a slightly higher index boost of 0.37. Furthermore, amongst the Hindu castes, the hierarchy of the social structure is reflected in both income and indices with higher figures correlating with higher caste. An interesting exception is found within the urban SCST group where the average index is higher than their urban OBC counterparts. This finding suggests either less caste discrimination in urban areas or a stronger network of SCST groups in this setting. Meanwhile, Muslim entrepreneurs appear to have the greatest similarity with OBC groups concerning their own income and index.

Overall, entrepreneurs in the sample are overwhelmingly male (88.41%) and married (87.31%) with an

average education span of 7.70 years. The average business also employs 1.47 workers, puts in approximately 8.69 hours per day, and commits to 332.45 days of work a year. There is an even split between rural and urban businesses and close to half these businesses locate their businesses at a fixed workplace (44.52%). Interestingly, not many of these entrepreneurs are affiliated with professional organizations such as business or development groups. It is also worth mentioning that the distribution of entrepreneurs by subgroup is as expected from the general population trend, with BFCs at 26.00%, OBCs at 36.15%, SCSTs at 18.40%, and Muslims at 16.18%.

To observe differences in the urban and rural settings, Tables 1.3 and 1.4 provide summary statistics along these respective parameters. It is unsurprising that the mean income is 1.89 times higher in the urban setting than the rural one. However, what is of more interest is whether key social ties variables are evenly balanced in the government and political sectors. In the government sectors, government officers are better known by urban entrepreneurs (13.0%) than their rural counterparts (8.7%), and the same goes for other government workers (19.1% in the urban setting versus 14.2% in the rural setting). Much more balance is found with elected politicians at a rate of 7% for both settings when rounding to the nearest percent while political party officials differ more (11.4% in the urban setting versus 8.0% in the rural setting). This evidence suggests that urban entrepreneurs have more connections in these key sectors.

Main Regression Results

Table 2 presents the regressions results of "inner" social ties from the whole sample of entrepreneurs. Each specification denoted by an S indicates more restrictions and controls as the results move further to the right. As a reminder, S1 is considered a baseline regression with basic controls, S2 includes the rest of the controls indicated in

Table 2 (as well as business industry dummy variables), S3 excludes states with less than 50 entrepreneurs in the dataset, S4 includes regional effects, and S5 replaces regional effects with state fixed effects. It should be noted again that for subgroup controls, the omitted subgroup for this regression is the Christian/Sikh/Jain group, while the remaining BFC, OBC, SCST, and Muslim dummy variables are put in place.

From the health sector, the effect of connections to doctors on business incomes gradually loses significance and magnitude while the opposite is the case for other health professionals. The education sector, along with government officers, other police workers, and the military, have even less impressive results with barely any significance indicated for these variables. The more interesting results are found within the political sector where being connected to elected politicians and political party officials suggest a higher income boost of 13.8% and 10.1%, respectively. Police inspectors also provide a very stable and positive result with a percentage increase of 12.3% at the 1% significance level.

A surprising outcome is found with other government employees: if an entrepreneur is connected to such a professional, their business would expect a decrease of 7.97% in income. The coefficient becomes more significant as additional controls and restrictions are added in. This result contradicts the initial logic that being connected to a government worker or bureaucrat would reduce transaction costs for entrepreneurs formalizing their businesses.

Table 3 uses quantile regression methods to analyze how social ties affect businesses with log incomes at the 10th, 25th, 50th, 75th, and 90th percentiles. The results suggest that elected politicians and doctors grow in importance as business incomes increase. This trend is the same for political party officials except that they lose significance at the 90th percentile. A reverse trend

is somewhat found where poorer businesses have better effects from other health professionals.

Tables 4.1 and 5.1 investigate how these "inner" social ties fare between urban and rural settings as well as along subgroup lines, using the S5 specification[7]. In Table 4.1, both governmental and political sectors have the most significant effects on business income. Although other government employees maintain a strong negative effect as expected, government officer connections are correlated with an 18.4% premium. When decomposing this effect, it is the BFC group that drives the result with an even higher premium that is expected of 30.3%. Political party officials are also correlated with a strong 18.1% premium in business income where OBC and Muslim groups drive this particular result.

Considering the SCST group, it seems that neither government officer ties nor political party official ties offer any significance for these entrepreneurs. The only effect that seems to hold promise for SCST business owners are ties to police inspectors. The 32.3% income boost associated with these professionals is somewhat plausible to either the power or decreased discrimination that exists for these individuals in an urban setting.

In Table 5.1, elected politicians have the most sway out of any other social tie in the rural setting. Discouragingly, SCST entrepreneurs do not see a significant effect by this key professional, but the remaining BFC, OBC, and Muslim groups receive higher business incomes of 38.7%, 26.9%, and 51.8% respectively. Concerning other social ties that have significance, other health professionals indicate a 12.2% boost driven by OBC and SCST groups. Inspectors also have a more meaningful output that are largely driven by BFC entrepreneurs. Finally, some unusual results are found with a penalty by other school workers on BFC enterprises and even stranger results with other police workers. The latter group provides

7. It should be noted that all subsequent regressions will conform to S5 and its associated controls in Appendix 2 unless otherwise stated.

significant, negative effects on business income for Muslim and SCST entrepreneurs but provide positive effects for OBCs.

To observe how these key social ties vary in relation to production inputs and other similar variables, Tables 4.2 and 5.2 conduct four regressions in the following manner for urban and rural settings (using state effects and only keeping states with over 50 entrepreneurs for all regressions). P1 uses no controls of S1, P2 uses the controls from S1 including the male dummy variable, P3 includes controls for production input, industry type, and household assets, and P4 uses all S2 controls, which includes the remaining social capital and association controls.

Table 4.2 finds that in the urban setting, government officers from P2 to P3 lose 3% magnitude but remain significant at the 1% level. An opposite pattern is found for political party officials where the magnitude from the same switch in parameters leads to a small boost of 1.6%. Interestingly, police inspectors immediately lose significance when moving from P2 to P3, where a 15.3% effect at the 1% significance level is lost once production-related controls are added.

In the rural setting, Table 5.2 finds that for elected politicians, including production- related inputs from P2 to P3 increases the significance level from 10% to 1% while the effect becomes larger by 4.5%. The magnitude jumps even higher by another 2.3% when including the remaining social capital variables. When observing the P2 to P3 shift for police inspectors, significance increases from 10% to 5% with a very small boost in magnitude. What is more intriguing is that the magnitude of the effect is highest when no controls are used.

Table 6 addresses the basic social index, which adds up all the social ties variables into a single variable and divides it by the usual parameters of urban-rural settings and subgroup lines. In the urban setting, a 4.19%

boost to business income is accrued for each key professional in the relatives/caste/community sphere that an entrepreneur is connected to. In order of greater magnitude and significance from the highest to the lowest, the social index is applicable to urban BFCs, OBCs, and Muslims. SCSTs seem to have no benefit from this arrangement as their coefficient is very close to zero. Meanwhile, in the rural setting, the social index is also significant to a lesser extent (2.78%) where it seems to only affect OBCs.

Institutions Hypothesis

The first proxy type of the Financial Inclusion Index (FII) and the Comprehensive Financial Inclusion Index (CFII) are interacted with the basic index to determine whether a higher index would net a negative interaction term with general caste and community networks. Given the fact that Stata omits both indices when including state fixed effects, S4 is used instead with regional fixed effects. Table 7.1 and 7.2 uses both FII and CFII indices to observe how the basic index fares at the urban level. The results are inconclusive at the overall level but remarkably, the SCST group gains 10% significance for the index and its interaction with the expected negative sign. The interaction term becomes stronger when observing the CFII interaction effect.

Appendix 3.1 and 3.2 analyzes these effects at the rural level with inconclusive results besides an unusual positive interaction for BFC entrepreneurs and an expected negative sign for Muslims. However, this interaction term for BFCs ought to be interpreted with caution, given a negative basic index sign with no significance. For rural Muslims, a weak confirmation of the institutions hypothesis holds with the correct signs but large standard errors for the index.

From Table 7.2, this notion implies that urban SCST entrepreneurs with more connections may receive a higher income boost of 8.07% for every connection

they possess. However, if they live in a state where the CFII is higher, then their overall index boost is drastically reduced and even more so if additional connections are present. For instance, with one connection and a CFII of 0.3, an SCST entrepreneur loses 13.83% from the interaction term. A CFII of 0.5 would increase this penalty to 23.05%. If two connections are present with the CFII ranking of 0.5, an index boost would be substantially reduced by 46.10%.

Given the significance of politicians at the rural level, this thesis pays careful attention to these effects for the institutions hypothesis. In general, any treatment of specific social ties variables will always include all other social ties unless specified otherwise. Appendix 4 shows the results of using the FII on rural politicians, but a more conclusive result is found in Table 8 when using the CFII. At the rural level, an entrepreneur is expected to gain a boost of 56.1% but its interaction term with the CFII indicates a substantial penalty on income. For instance, having a CFII state rating of even 0.2 would net a penalty of 35.54% for a rural entrepreneur.

Decomposing the result by subgroup lines yields inconclusive results with very large standard errors for the interaction term. An effort was made to see if any others results appear for government officers at the urban level. Appendix 6 reveals that the results are inconclusive for the interaction terms. Similarly, an attempt was made to see if urban political party officials have an effect on urban entrepreneurs, but the results in Appendix 7 are also inconclusive with large standard errors.

Although the institutions hypothesis is somewhat satisfied at the state level, it is worth investigating how this effect plays out at the district level, which decreases the geographic size of interest but increases the variation of institutions within India. The second proxy type of the CRISIL Inclusix Index (CRISIL) does this, allowing regressions to conform to S5 again. For the basic social in-

dex, Appendices 8 and 9 observe how this effect fares at the urban-rural divide. The interaction terms have standard errors that are too large to draw any useful conclusions.

However, when considering how this result plays out for rural politicians, there is slightly more hope in using the CRISIL index at the district level. At the overall level, Table 9 shows that the interaction term has no significance, but a p-value of 11.9 is retained, which fails the 10% significance test by a small margin. Along with a significant effect of 55% of being connected to a politician, a negative effect of 68.2% is illustrated in this regression. Despite being a slightly weaker result, Table 9 gives more assurance that the benefits accrued from informal ties with a politician are reduced in the presence of stronger financial inclusion indicators at the district level.

Appendix 10 attempts to observe whether government officers and political party officials offer similar conclusions to rural politicians. The interaction terms provide significance with positive signs, but these should be interpreted with caution, as the dummy variables of the interacted terms for social ties are negative and insignificant. Thus, there are little conclusions to be drawn about this specification as well for the urban setting.

The final proxy type also utilizes district-level variation and determines the proportion of households from the second-round IHDS that invested in bank savings in the last five years. Observing how these results play out with the basic index, Table 10 gives assurances that BFC entrepreneurs lend even further support to the institutions hypothesis. Although BFC enterprises enjoy a 15.3% increase for each professional connection within a caste or community, a 100% bank savings rate within their district would reduce the informal effect by 15.3%. An overall impression of urban business owners finds weak support for the institutions hypothesis, with an 11.3 p-value that barely fails 10% significance. To better illustrate this no-

tion, a 100% bank savings rate in a district would reduce the basic index's premium by 6.35%.

It is worth mentioning this unintuitive result found for urban SCSTs in Table 10. The basic index presents itself as significantly negative with the interaction term flipped to a significantly positive outcome. It may be that the very strong negative effect from being connected to a government employee may drive this unusual result, but this result certainly leads to more questions on the validity of the institutions hypothesis in this channel.

Appendix 11 performs the same exercise as Table 10 except in the rural setting. Although a negative sign of the interaction term is provided for the whole rural sample, the standard errors are too large to draw any significant conclusions. In fact, all coefficients in this appendix, besides the constants, have standard errors that are too large for precise interpretations.

With support of the institutions hypothesis on rural politicians, Table 11 focuses on using interaction terms with a political party official in the urban setting. The results lend support to the hypothesis with a significantly negative term for being connected to this key professional. Although no conclusions can be drawn from the subgroup regressions, the overall trend is to receive a 48% penalty if an entrepreneur lives in a district with a 100% savings rate.

Robustness and Causality

Since this thesis ponders the question of caste or community networks affecting business performance in India, it is worth investigating whether the "caste or community" portion of this research question. Table 12 performs the same regressions as Tables 2 (using only S5), 3, and 4, except all social ties variables are replaced with "outer" social ties variables where an entrepreneur indicates connections with an outside professional. It would be inappropriate to conclude that the "inner" check is

100% confirmed, but the results indicate much weaker significance of the coefficients. Furthermore, Appendix 12 reveals an intriguing picture of entrepreneurs having more connections with "outer" professionals than "inner" ones, even though standard deviations are somewhat higher for the former.

Political party officials have the most significance in the overall and urban regressions, but the effects of 7.04% and 8.11% are somewhat smaller in magnitude than the 10.1% and 18.1% outcomes with their "inner" counterparts. Government officers in the "outer" sphere also appear to have some weaker significance but smaller than the "inner" counterpart by 9.74%. It is interesting to note the coefficients that are not significant. The politician variable in the rural setting suggests that politicians beyond the caste and community sphere do not matter as much to entrepreneurs as immediate connections.

Appendices 13 and 14 decompose urban and rural regressions of "outer" social variables by subgroup lines, suggesting strong, positive effects of police inspectors by urban SCSTs and rural BFCs. Strong, positive effects for categories of interest are also found for political party officials and other government workers on urban Muslims along with other police workers on urban SCSTs. Interestingly, some substantial negative effects are found with the military on rural BFCs and Muslims.

Appendix 15 observes regressions for putting all social ties variables for the whole sample as well as the urban-rural divide. Evidently, for "inner" social ties variables, the expected effects of government officers, other government workers, politicians, and political party officials are still significant in their respective settings. No significance is found for outer social ties with the same key professionals, which gives support to the power of "inner" ties.

Causality is a significant issue to address, so this thesis takes advantage of panel data to test for whether

second-round social ties variables affect first-round business income. Since approximately half the observations are lost in this exercise, the interpretation of the following results should be taken with greater caution. Table 13 performs regressions for the whole sample and with the urban-rural divide on the usual eleven social ties variables. The results indicate that significance is found for doctors and the military, but the other nine social ties are insignificant.

Table 14 replaces the social ties with the basic index to find a more concerning result of significance for the overall sample and 10% significance for the urban setting. However, the urban counterpart for present income has a higher magnitude and is strongly significant at the 0.1% level. The basic index test in the rural setting remains insignificant and offers a more credible argument against reverse causality.

Instrumental Variables

The second technique of using instrumental variables is also executed to investigate the causal effect of caste and community networks on business income. For all IV regressions, Specification 4 is used, and comparisons are made between having no robust standard errors and standard errors clustered at the district level. The set of instruments used involve the proportion of Muslims at the district level collected from the 2011 Indian Census, along with the proportions of BFC, OBC, and SCST at the district level, calculated for all round-two observations in the dataset. Given a correlation of 82.39% between the Census proportion and the dataset proportion of Muslims, an inference can be made that the dataset can reasonably predict the true proportions of all other Hindu castes at the district level.

Table 15 observes the causal nature of the basic social index for all entrepreneurs in the sample, instrumenting the basic index for the four instruments of group

proportions. The basic index increases substantially in magnitude to 19.0%, and with no robust standard errors, an F statistic of 31.882 indicates that the instruments are strong. However, the overidentification test rejects the null hypothesis that the instruments are valid, which leads to a more doubtful conclusion on their usefulness. With the clustered specification, the opposite problem occurs where the overidentification test does not reject the null hypothesis but an F statistic of 6.253 suggests that the instruments are weak.

VII. DISCUSSION

This thesis does not intend to interpret all caste and community network variables (e.g. doctors, teachers, etc.), as the economic justification on why some of them are positively significant is ambiguous at best. However, the more important connections are indicated by those in the political and government sectors, which I will focus my analysis on.

As shown in the main analyses of social ties variables, politicians and political party officials matter for Indian entrepreneurs. This result is particularly evident for politicians in the rural areas but unfortunately, SCSTs seem to lose out on this benefit, which adds to their discrimination. Overall, this finding is unsurprising, given the fact that politicians in the rural areas of India have significantly more influence in their constituencies and can offer substantial benefits to connected entrepreneurs. It is also likely that elements of favouritism and corruption are manifested from such relationships, given the assumption that institutions are weaker and informal networks stronger in rural settings.

Interestingly, in the urban setting, it is government officers and political party officials that matter a great deal more than politicians. Perhaps in this setting, the influence of politicians themselves is significantly reduced,

but the economic power that political party officials and government officers hold in urban centres matter more for business owners. In general, it is reasonable to assume that having affiliations with government or political professionals would gain some economic benefits through informal caste and community networks.

Additional concerns are addressed on whether these specific ties hold significance on their own or whether they are simply part of the same, general institution. Summary statistics between urban and rural settings suggest that the two types of entrepreneurs have similar means in knowing an elected politician. However, for the remaining political and government professionals, urban entrepreneurs have a higher proportion of connections (by around 3- 4%). Thus, politicians seem to matter on their own since the proportion of ties is balanced. As for government officers and political party officials, doubts would arise if there was a significant difference in their proportions between the two settings. However, the low difference illustrated in the summary statistics gives some support that these professionals also matter on their own.

There is the additional question of whether these connections are effective without the presence of production input controls (i.e. do they matter in the production process itself?). The urban setting suggests government officers and political party officials are both useful for production inputs. The only difference is the magnitude of their effects: while government officers seem to have more sway in the production process, political party officials matter more after controlling for production-related inputs (i.e. they give extra benefits after production). Interestingly, in the rural setting, politicians provide a much stronger and more significant effect after controlling for production-related inputs but less so without such controls. This result suggests that the production process benefits less from a rural politician connection.

When using all eleven "inner" social variables to

create a basic index, the results find that such an index is statistically significant in the urban setting while being somewhat weaker in the rural setting. These results posit that being generally well connected to caste or community networks can lead to an increase in the economic opportunities and benefits that a business can accrue. Unfortunately, SCSTs still do not have significant results with being better connected, which leads to the mixed conclusion that despite their greater connectivity, the economic incentives do not exist in informal networks for their businesses. Meanwhile, the rural setting weakens the index's power since only OBCs seem to have some benefit from general connections.

Although this thesis has found stronger, positive effects of "inner" ties to government or political workers, one exception stands out: other government workers. Particularly in the urban areas, there is a strong and significant negative effect that decreases an Indian entrepreneur's income. Despite this thesis arguing for a causal effect of caste or community ties on business income, it makes even more sense to consider the reverse causality channel of business income impacting ties to a government worker.

Suppose that an Indian business is struggling with earning an income. It is then plausible to believe that an entrepreneur would appeal for assistance or be assigned help by government workers to improve the business. In other words, the income penalty associated with this professional can be explained by struggling businesses who select or are selected into this tie.

An alternative theory would suggest that the mechanisms of formalizing a business by government is so cumbersome that business income is negatively impacted as a result. This theory suggests that the cost of joining the formal sector is too great due to bureaucracy or high costs of joining the formal sector, which is famously described by De Soto (2001) in *The Mystery of Capital*. In

general, it lends support to the idea that when institutions fail, joining such an establishment is a far worse outcome than simply subscribing to informal networks for financing or supporting an entrepreneur's business.

Conveniently, the institutions hypothesis is thoroughly investigated in this thesis to observe whether stronger financial institutions would mitigate the second-best alternative to exclusionary caste and community networks. In a general sense, with the basic index, the institutions hypothesis seems to hold for the savings proxy within the urban areas where the index has more power and is driven by urban BFCs. Urban SCSTs suddenly gain some significance with the basic index and FII/CFII interactions in Tables 7.1 and 7.2, which adds another potential subgroup to support the institutions hypothesis. In other words, some urban businesses may be better off using stable, financial institutions instead of second-best informal networks to scale their business when institutions are stronger and more inclusive.

Specific to groups, there is some confirmation of the institutions hypothesis when analyzing political party officials and the savings proxy in the urban setting. In the rural setting, the politician effect is substantially reduced in the presence of a stronger CFII rating and stronger district institutions by the CRISIL index to a lesser extent. It supposes the argument that caste or community political connections seem to matter less in India for businesses when stronger banking and financial services are available to everyone in a non-discriminatory fashion.

Of course, with any data analysis, there is the possibility of unusual results, and such a result is found with urban SCSTs in Table 10. Significance is found in a negative basic index and a positive interaction term, suggesting that urban SCSTs who are better connected are subject to a business income penalty that is mitigated by stronger financial institutions. This claim should be taken with great caution, given the fact that in Table 6.2 the

basic index is hardly significant but shows a negative sign for this subgroup.

Although the results are promising that caste and community networks can impact Indian business incomes, there is still the issue of whether the "inner" portion of networks is valid and whether the results are truly causal. For the former concern, Table 12 replaces the eleven social ties variables with "outer" counterparts to lend greater support that caste and community networks matter more for Indian entrepreneurs than professionals beyond these spheres. Although some significance is found for political party officials and government officers in rural settings, Appendix 15 suggests that these effects disappear while the "inner" effects remain significant. Further regressions of "outer" effects on subgroups are listed in the Appendices section but such discussion is beyond the scope of this thesis.

For the issue of reverse causality, there is a bit of concern since significance is found in Table 14 for the basic index for the whole sample on a basic index and to a lesser extent in urban settings. However, individually, Table 13 suggests that the key government and political categories of social ties do not have any significance on past income. These conclusions give cautious support that reverse causality does not contaminate some social variables of interest.

A more powerful exercise is to consider the instrumental variables techniques on the basic index and a key variable of politicians. For the proportions instruments, in general, being well-connected to caste or community networks may somewhat suggest causality on business income, with the magnitude of the connections increasing. However, this statement should be interpreted carefully given doubts on the instrument type's validity and strength.

Combined with the previous tests of using past business income, there is cautious support of politicians

causally impacting Indian business incomes, and not the other way around. Within the Indian context, this conclusion is not too difficult to believe, since elements of political favouritism are still a cause for concern in the country.

Limitations

There are some limitations that may cast doubts on the interpretation of my results. For instance, the design of the survey question on knowing a key professional is limiting, since there is no follow-up data on the frequency of connections and quality of interactions. A reasonably large assumption is made in this thesis that being acquaintances with someone implies active use of the relationship that may benefit a business.

Another limitation is the issue of omitted variables that still may affect the results of this empirical work. In other words, there may be certain confounders that can bias the regressions performed for social ties variables. In addition, the sample may still be too diverse to account for every possible covariate that affects Indian businesses. To overcome these concerns, it would be useful to gain additional characteristics on the nature of the business and its associated entrepreneurs. It would also be helpful to have more information on the nature of social relationships and its potential intersections to an enterprise.

A final limitation draws on the fact that not every social variable can be truly proven to have a causal effect. Especially with the IV method, it is incredibly difficult to conceive eleven separate instruments when even conceiving one is already a challenge. As previously stated, this thesis does not attempt to prove a causal effect on all indicators but rather focuses on a few key variables of interest such as the basic social index and ties to politicians that fit the institutional context of India.

VIII. CONCLUSION

This thesis attempts to answer the question of whether caste and community networks increase business incomes in India. By performing OLS regressions on a sample of entrepreneurs across India, there is a general trend that being better connected to professionals within caste and community networks increases business income. This result is stronger in the urban areas. Connections to politicians matter a great deal for rural entrepreneurs, while government officers and political party officials matter for their urban counterparts. These effects also vary along caste or religious lines. Furthermore, other government workers appear to provide a significant negative effect on business income for urban entrepreneurs.

The institutions hypothesis is cautiously confirmed using three different proxy types for financial institution, as evidenced by weaker informal network effects on politicians in the rural setting and the basic social index for urban entrepreneurs. These results suggest that in the presence of stronger and more inclusive institutions, the second-best economic incentives provided by caste networks and politicians are reduced for entrepreneurs in India.

Finally, a series of robustness checks are performed to determine whether such "inner" network ties are truly "inner" and whether they have a causal role. There is evidence that these "inner" networks are far more important than "outer" ones, especially in the context of individual social ties. Both panel data and instrumental variables are used to mitigate the risk associated with reverse causality on at least the basic index and ties to politicians.

Given the results of this thesis, caste networks in India still play a significant role on business. However, in the presence of stronger financial institutions, the importance of these informal social networks is diminished for

some entrepreneurs. If more Indian districts equalized their access to finance and opportunities for entrepreneurship, there is a possibility that more efficient development would occur. Since this thesis does not evaluate the positive benefits to stronger financial institutions, future research should focus on how such instances would benefit entrepreneurs. In addition, future research would also benefit from creating a testable, causal chain between institutions, entrepreneurship, and development.

III

REFERENCES AND APPENDICES

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I. PAPERS

II. HONOURS THESIS

Let's Talk About Sex: Unmet Need for Contraceptives and Long-Run Economic Growth

Kat Gallant

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A. REFERENCES

Acemoglu, Daron and Johnson, Simon. 2007. "Disease and Development: The Effect of Life Expectancy on Economic Growth" Journal of Political Economy 115 (6): 925–985.

Ahmed, S., QF Li, L. Liu, and AO Tsui. 2012. "Maternal deaths averted by contraceptive use: an analysis of 172 counties." Lancet 380 (9837): 111-125.

Bailey, Martha J. 2006. "More power to the pill: The impact of contraceptive freedom on women's life cycle labor supply." The Quarterly Journal of Economics 121 (1): 289-320

Bailey, Martha, Brad Hershbein, and Amalia Miller. 2012. "The opt-in revolution? Contraception and the gender gap in wages." American Economic Journal: Applied Economics 4 (3): 225-254.

Becker, Gary S. "Investment in Human Capital: Rates of Return" In Human Capita: A Theoretical and Empirical Analysis with Special Reference to Education, edited by Gary S. Becker, 59-160. 3rd Ed. Chicago: The University of Chicago Press, 1994.

Barro, Robert J. and Jong-Wha Lee. 2013. "A New Data Set of Educational Attainment in The World, 1950-2010." Journal of Development Economics 104: 184–198.

Bell, Suzanne O., and David Bishai. 2017. "Unmet need and sex: investigating the role of coital frequency in fertility control." Studies In Family Planning 48 (1): 39-53.

Bongaarts, John. 2008. "Fertility Transitions in Developing Countries: Progress of Stagnation?" Studies in Family Planning, 39(2): 105-110.

Ela, Elizabeth J., and Kamie Budnick. 2017. "Non-heterosexuality, relationships, and young women's contraceptive behavior." Demography 54 (3): 887-909.

Falk, Candace, Stephen Charles Cole, Sally Thomas. 1995. Emma Goldman: A guide to her life and documentary sources. Alexandria, VA, USA: Chadqyck-Healey.

Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer. 2015. "The Next Generation of the Penn World Table." American Economic Review 105 (10): 3150-3182

Fitzenberger, Bernd, Katrin Sommerfeld, and Susanne Steffes. 2013. "Causal effects on employment after first birth — A dynamic treatment approach." Labour Economics 25: 49-62.

Galor, Oded. 2005. "From Stagnation to Growth: Unified Growth Theory" in Handbook of Economic Growth, edited by Edited by Philippe Aghion and Steven N. Durlauf, 171-293: Elsevier B.V.

Galor, Oded, and David N. Weil. 2000. "Population, Technology, and Growth: From Malthusian stagnation to the demographic transition and beyond." The American Economic Review, 90 (4): 806-828.

Goldin, Claudia, and Lawrence F. Katz. 2002. "The power of the pill: Oral contraceptives and women's career and marriage decisions." Journal of Political Economy 110 (4): 730-70.

Greenwood, Jeremy, and Nezih Guner. 2010. "Social change: the sexual revolution." International Economic Review 51 (4): 893-923.

Johnson-Hanks, Jennifer. 2007. "Natural Intentions: Fertility decline in the African Demographic and Health Surveys" American Journal of Sociology, 112 (4): 1008-1043.

Mankiw, N. Gregory, David Romer, and David N. Weil. 1992. "A Contribution to the Empirics of Economic Growth." The Quarterly Journal of Economics 107(2): 407–437.

Miller, Grant. 2010. "Contraception as development? New evidence from family planning in Colombia." The Economic Journal 120 (545): 709-36.

Moultrie, Tom A., Takudzwa S. Sayi, and Ian M. Timæus. 2012. "Birth intercals, postponement, and fertility decline in Africa: A new type of transition?" Population Studies 66(3): 241-58.

Sedgh, Gilda, and Rubina Hussain. 2014. "Reasons for contraceptive nonuse among women having unmet need for contraception in developing countries." Studies in Family Planning 45 (2): 151-69.

Sedgh, Gilda, Susheela Singh, and Rubina Hussain. 2014. "Intended and unintended pregnancies worldwide in 2012 and recent trends." Studies in Family Planning 45 (3): 301-314.

Staff, Jeremy, and Jeylan T. Mortimer. 2012. "Explaining the motherhood wage penalty during the early occupational career." Demography 49 (1) (02): 1-21.

Troske, Kenneth R., and Alexandru Voicu. 2013. "The effect of the timing and spacing of births on the level of labor market involvement of married women." Empirical Economics 45 (1) (08): 483-521.

United Nations. 2015. "World Fertility Patterns 2015 Data Booklet" Department of Economic and Social Affairs, Population Division (ST/ESA/ SER.A/370)

United Nations. 2017. "Tracking global progress in family planning" Department of Economic and Social Affairs, December. http://www.un.org/en/development/desa/population/publications/pdf/popfacts/PopFacts_2017-11.pdf

World Bank. 2016. "Unmet need for contraceptives (% of women ages 15-49)" https://data.worldbank.org/indicator/SP.UWT.TFRT. Accessed January 7, 2018.

World Health Organization. 2017. "Countries need to do what works to improve contraceptive access, provision and choice for women and girls" http://www.who.int/reproductivehealth/topics/family_planning/contraceptive-access-women-and-girls/en/

Mobile Broadband Investment on Economic Growth: Evidence from Africa

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A. REFERENCES

Briscoe, B., A. Odlyzko, and B. Tilly. 2006. "Metcalfe's Law Is Wrong - Communications Networks Increase in Value as They Add Members-but by How Much?" IEEE Spectrum 43 (7): 34–39.

Castaldo, Angelo, Alessandro Fiorini, and Bernardo Maggi. 2018. "Measuring (in a Time of Crisis) the Impact of Broadband Connections on Economic Growth: An OECD Panel Analysis." Applied Economics 50 (8): 838–54.

Datta, Anusua, and Sumit Agarwal. 2004. "Telecommunications and Economic Growth: A Panel Data Approach." Applied Economics 36 (15): 1649–54.

Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2015), "The Next Generation of the Penn World Table" American Economic Review, 105(10), 3150-3182

Holt, Lynne, and Mark Jamison. 2009. "Broadband and Contributions to Economic Growth: Lessons from the US Experience." Telecommunications Policy 33 (10): 575–81.

Im, Kyung So, M. Hashem Pesaran, and Yongcheol Shin. 2003. "Testing for Unit Roots in Heterogeneous Panels." Journal of Econometrics 115 (1): 53–74.

International Telecommunication Union, World Telecommunication/ICT Development Report and database.

Katz, Raul, and Pantelis Koutroumpis. 2012. "The Economic Impact of Telecommunications in Senegal (*)." Communications & Strategies; Montpellier, no. 86 (Second Quarter): 21-42,220.

Koutroumpis, Pantelis. 2009. "The Economic Impact of Broadband on Growth: A Simultaneous Approach." Telecommunications Policy 33 (9): 471–85.

Mankiw, N. Gregory, David Romer, and David N. Weil. 1992. "A Contribution to the Empirics of Economic Growth." The Quarterly Journal of Economics 107 (2)

Pradhan, Rudra P., Girijasankar Mallik, and Tapan P. Bagchi. 2018. "Information Communication Technology (ICT) Infrastructure and Economic Growth: A Causality Evinced by Cross-Country Panel Data." IIMB Management Review 30 (1): 91–103.

Qiang, Christine Zhen-Wei, and Carlo M Rossotto. 2009. "Economic Impacts of Broadband." Information and Communications for Development, 16.

Thompson, Herbert G., and Christopher Garbacz. 2011. "Economic Impacts of Mobile versus Fixed Broadband." Telecommunications Policy 35 (11): 999–1009.

Yousefi, Ayoub. 2011. "The Impact of Information and Communication Technology on Economic Growth: Evidence from Developed and Developing Countries." Economics of Innovation and New Technology 20 (6): 581–96.

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Increasing Female Autonomy through Water Collection: Evidence From India

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A. REFERENCES

Anderson, Siwan, and Mukesh Eswaren. 2009. What determines female autonomy? Evidence from Bangladesh. Journal of Development Economics 90(2): 179-91

Ashraf, Nava, Erica Field, and Jean Lee. 2014. Household bargaining and excess fertility: An experimental study in Zambia. The American Economic Review 104 (7): 2210-37

Bandiera, Oriana, Niklas Buehren, Robin Burgess, Markus Goldstein, Selim Guelsci, Imran Rasul and Munshi Sulaiman. 2015. Women's Empowerment in Action: Evidence from a Randomized Control Trial in Africa. Working Paper.

Doss, & World Bank e-Library. 2013. Intra-household Bargaining and Resource Allocation in Developing Countries. World Bank Working Paper.

Hahn, Youjin, Asadul Islam, Kanti Nuzhat, Russell Smyth and Hee-Seung Yang. 2018. Education, Marriage, and Fertility: Long-Term Evidence from a Female Stipend Program in Bangladesh. Economic Development and Cultural Change 66(2): 383-415.

Hahn, Youjin, Kanti Nuzhat, and Hee-Seung Yang. 2017. The effect of female education on marital matches and child health in Bangladesh. Journal of Population Economics. 1-22.

Ilari, Nadeem, and Franque Grimard. 2000. Public Infrastructure and Private Costs: Water Supply and Time Allocation of Women in Rural Pakistan. Economic Development and Cultural Change 49 (1): 45-75.

Kantor, Paula. 2003. Women's Empowerment Through Home-based Work: Evidence from India. Development and Change 34: 425-445.

Koolwal, Gayatri and Dominique Van de Walle. 2013. Access to Water, Women's Work and Child Outcomes. Economic Development and Cultural Change 61 (2): 369-405.

Nankhuni, Flora J., and Jill L. Findeis. 2004. Natural resource-collection work and children's schooling in Malawi. Agricultural Economics 31 (2): 123-34.

Nauges, Céline. 2017. Water hauling and girls' school attendance: Some new evidence from Ghana. Environmental and Resource Economics 66(1): 65-88.

United Nations Development Programme. 2006. Human Development Report, Beyond Scarcity: Power, Poverty and the global water crisis. Available from http://www.undp.org/content/dam/undp/library/corporate/HDR/2006%20Global%20HDR/HDR-2006-Beyond%20scarcity-Power-poverty-and-the-global-water-crisis.pdf

Does Breastfeeding Suck? Exploring the Effects of Breastfeeding on Long-Run GDP Growth

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A. REFERENCES

Australian Institute of Health. 2016. "Australian Health." https://www.aihw.gov.au/reports-statistics/health-welfare-overview/australias-health/data

Bahl, Rajiv, Aluisio Barros, Giovanny França, Susan Horton, Julia Krasevec, Simon Murch, Nigel C. Rollins, Mari J. Sankar, Cesar Victora, Neff Walker. 2016. "Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect." The Lancet 387 (10017): 475-490.

Barro, Robert J. and Jong-Wha Lee. 2013. "A New Data Set of Educational Attainment in The World, 1950-2010." Journal of Development Economics 104: 184–198.

Barros, Fernando C., Denise P. Gigante, Helen Gonçalves, Bernardo L. Horta, Christian L. de Mola, Ricardo T. Pinheiro, Lu-

ciana Quevedo, Cesar G. Victora. 2015. "Association between breastfeeding and intelligence, educational attainment, and income at 30 years of age: A prospective birth cohort study from brazil." The Lancet Global Health 3 (4): e199-205.

Bhandari, Nita, Nemat Hajeebhoy, Susan Horton, Chessa K. Lutter, Jose C. Martines, Ellen G. Piwaz, Linda M. Richter, Nigel C. Rollins, Cesar G. Victora. 2016. "Why invest, and what it will take to improve breastfeeding." The Lancet 387 (10017): 491-504.

Borra, Cristina, Maria Iacovou, Almudena Sevilla. 2012. "The effect of breastfeeding on children's cognitive and non cognitive development." Labour Economics 19 (4): 496-515.

Centre for Disease Control and Prevention. 2015. "Breastfeeding Report Card." https:// www.cdc.gov/breastfeeding/data/reportcard.htm .

Cesur, Resul, Joseph J. Sabia, Inas Rashad Kelly, Muzhe Yang. 2017. "The effect of breastfeeding on young adult wages: new evidence from add health." Review of Economics of the Household 15 (1): 25-51.

Evenhouse, Eirik, Siobhan Reilly. 2005. "Improved estimates of the benefits of breastfeeding using sibling comparisons to reduce selection bias." Health Services Research 6 (40): 1781-1801.

Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer. 2015. "The next generation of the Penn World Table." American Economic Review 105 (10): 3150-3182.

Foster, Michael E., and Jade M. Jenkins. 2014. "The Effects of Breastfeeding Exclusivity on Early Childhood Outcomes." American Journal of Public Health 104 (1): 128-135.

Gionet, Linda. 2015. "Breastfeeding Trends in Canada." Statistics Canada. https:// www.statcan.gc.ca/pub/82-624-x/2013001/article/11879-eng.htm.

Godfrey, Jodi R., Ruth A. Lawrence. 2010. "Toward Optimal Health: The Maternal Benefits of Breastfeeding." Journal of Women's Health 19 (9): 1597-1602.

Hajeebhoy, Nemat, Susan Horton, Roger Mathisen, Linh Thi Hong Phan, Pipit Pitriyan, Christiane Rudert, Adiatma Yudistira Manogar Siregar, Dylan Walters. 2016. "The cost of not breastfeeding in Southeast Asia." Health and Policy Planning 31 (8):
1107-1116.

Jones, Garett, W. Joel Schneider. 2006. "Intelligence, human capital, and economic growth: A Bayesian Averaging of Classical Estimates (BACE) approach." Journal of Economic Growth 11 (1): 71-93.

Lynn, Richard, Gerhard Meisenberg. 2013. "Cognitive Human Capital and Economic Growth: Defining the Causal Paths." The Journal of Social, Political, and Economic Studies 38 (1): 16-54.

Mankiw, N. Gregory, David Romer, David N. Weil. 1992. "A Contribution to the Empirics of Economic Growth." The Quarterly Journal of Economics 107 (2): 407-437.

Martin, Camilia R., Pei-Ra Ling, George L. Blackburn. 2016. "Review of Infant Feeding: Key Features of Breast Milk and Infant Formula." Nutrients 279 (8): 1-11.

New Zealand Ministry of Health. 2016. "Breastfeeding." https://www.health.govt.nz/our-work/ life-stages/breastfeeding.
Nothnagle, Melissa, Eleanor B. Schwarz. 2015. "The Maternal Health Benefits of Breastfeeding." American Family Physician No. 91 (9): 603-604.

Organization for Economic Co-operation and Development. 2015. "OECD Family Database." http://www.oecd.org/els/family/database.html.

Rees, Daniel I., Joseph J. Sabia. 2009. "The effect of breast feeding on educational attainment: evidence from sibling data." Journal of Human Capital 1 (3): 43-72.

Rothstein, Donna S. 2013. "Breastfeeding and children's early cognitive outcomes." Review of Economics and Statistics 95 (3): 919-931.

Socialstyrelsen. 2015. "Statistics and Data." http://www.socialstyrelsen.se/statistics

Trostel, Philip A. 2004. "Returns to scale in producing human capital from schooling." Oxford Economic Papers 56 (2004): 461-484.

United Nations. 2011. "Exclusive breastfeeding rate." http://data.un.org/Data.aspx? d=SOWC&f=inID%3A92.

United Nations International Children's Emergency Fund. 2016. "Adopting optimal feeding practices is fundamental to a child's survival, growth and development, but too few children benefit." https://data.unicef.org/topic/nutrition/infant-and-young-child-feeding/.

United Nations International Children's Emergency Fund. 2016. "Failing to breastfeed costs the global economy around US$302 billion every year." https:www.unicef.org.uk/baby-friendly/lancet-increasing-breastfeeding-worldwide- prevent-800000-child-deaths- every-year/.

World Bank. 2015. "Exclusive breastfeeding (% of children under 6 months)" https:// data.worldbank.org/indicator/SH.STA.BFED.ZS?locations=CV.

World Health Assembly. 2014. "WHA Global Nutrition Targets 2025: Breastfeeding Policy Brief." http://www.who.int/nutrition/topics/globaltargets_breastfeeding_policybrief.pdf

World Health Organization. 2019. "Exclusive breastfeeding for optimal growth, development and health of infants." https://www.who.int/elena/titles/exclusive_breastfeeding/en/.

World Health Organization. 2015. "Exclusive breastfeeding under 6 months Data by country." http://apps.who.int/gho/data/view.main.NUT1730.

World Health Organization and the United Nations International Children's Emergency Fund. 2017. "Global Breastfeeding Scorecard, 2017." http://www.who.int/ nutrition/publications/infantfeeding/global-bf-scorecard-2017.pdf.

World Health Organization Regional Office for Europe. 2015. "European Health Indicator Gateway." https://gateway.euro.who.int/en/hfa-explorer/.

Social Ties, Institutions, and Indian Entrepreneurs: the Role of Caste and Community Networks on Business Incomes in India

Peter Ki

ECON 499

A. REFERENCES

1. Data Sources Obtained

Ambarkhane, D., Singh, A. S., & Venkataramani, B. (2016). Measuring financial inclusion of Indian states. International Journal of Rural Management, 12(1), 72-100.

Census Organization of India. (2011). Census 2011 [Website housing data points]. Available from https://www.census2011.co.in/religion.php.

MIX and CRISIL. (2013). India map of financial inclusion [Data file including the CRISIL Inclusix Index]. Available from http://maps.mixmarket.org/india/.

The University of Maryland and the National Council of Applied Economic Research, New Delhi. (2004-2005/2011-2012). India human development survey [Website housing data files]. Available from http://ihds.umd.edu/.

2. Bibliography

Adepoju, A. A., & Oni, O. A. (2012). Investigating endogeneity effects of social capital on household welfare in Nigeria: A control function approach. Quarterly Journal of International Agriculture, 51(1), 73-96.

Akram, S., & Kumar Routray, J. (2013). Investigating causal relationship between social capital and microfinance: Implications for rural development. International Journal of Social Economics, 40(9), 760-776.

Ambarkhane, D., Singh, A. S., & Venkataramani, B. (2016). Measuring financial inclusion of Indian states. International Journal of Rural Management, 12(1), 72-100.

Anderson, S. (2011). Caste as an impediment to trade. American Economic Journal: Applied Economics, 3(1), 239-263.

Arun, S., Annim, S., & Arun, T. (2016). Do all networks 'work'? the mediating role of social networks on consumption expenditure in India. Sociology, 50(3), 522-541.

Coleman, J.S. (1988). Social capital in the creation of human capital. American Journal of Sociology, 94(Supplement), S95–120.

Coleman, J.S. (1990). Foundations of social theory (Cambridge, MA: Harvard University Press).

Dang, D. A. (2015). Social networks and employment performances: evidence from rural–urban migration in Vietnam.

Danis, W. M., De Clercq, D., & Petricevic, O. (2011). Are social networks more important for new business activity in emerging than developed economies? an empirical extension. International Business Review, 20(4), 394-408.

De Soto, H. (2001). The mystery of capital. Finance and Development, 38(1), 29-33.

Dehejia, R., & Panagariya, A. (2012). Entrepreneurship in services and the socially disadvantaged in India. Reforms and Economic Transformation in India (253-278). Oxford University Press

Desai, S., & Dubey, A. (2011). Caste in 21st century India: Competing narratives. Economic and Political Weekly, 46(11), 40-49.

Deshpande, A., & Sharma, S. (2016). Disadvantage and discrimination in self-employment: Caste gaps in earnings in Indian small businesses. Small Business Economics, 46(2), 325-346.

Durlauf, S. N., & Fafchamps, M. (2005). Social capital. Handbook of Economic Growth (Vol. 1, 1639-1699). Elsevier.

Egbert, H. (2009). Business success through social networks? A comment on social networks and business success. The American Journal of Economics and Sociology, 68(3), 665-677.

Fafchamps, M. (2006). Development and social capital. The Journal of Development Studies, 42(7), 1180-1198.

Fafchamps, M., & Minten, B. (2002). Returns to social network capital among traders. Oxford Economic Papers, 54(2), 173-206.

Fine, B. (2010). Theories of social capital: Researchers behaving badly. London: Pluto Press.

Hayami, Y. (2009). Social capital, human capital and the community mechanism: Toward a conceptual framework for economists. The Journal of Development Studies, 45(1), 96-123.

Iyer, L., Khanna, T., & Varshney, A. (2013). Caste and entrepreneurship in India. Economic and political weekly, 48(6), 52-60.

Johny, J., Wichmann, B., & Swallow, B. M. (2017). Characterizing social networks and their effects on income diversification in rural Kerala, India. World Development, 94, 375-392.

Kuépié, M., Tenikue, M., & Walther, O. J. (2016). Social networks and small business performance in west African border regions. Oxford Development Studies, 44(2), 202-219.

Lin, N. (2001). Social capital. Cambridge: Cambridge University Press.

Munshi, K. (2016). Caste networks in the modern Indian economy. Development in India (13- 37). Springer India.

Portes, A. (2010). Economic sociology: A systematic inquiry. Princeton, N.J: Princeton University Press.

Putnam, R.D. (1993a). Making democracy work: civic traditions in modern Italy (Princeton: Princeton University Press).
Putnam, R.D. (1993b.) The prosperous community: social capital and public life. American Prospect, 4(March), 11–18.

Vanneman, R., Noon, J., Sen, M., Desai, S., & Shariff, A. (2006a). Social networks in India: caste, tribe, and religious variations. In Annual meetings of the Population Association of America, Los Angeles, CA.

Vanneman, R., Desai, S., & Noon, J. (2006b). Social capital in India: networks, organizations, and confidence. In Annual Meeting of the American Sociological Association. Montreal.

Westlund, H., & Bolton, R. (2003). Local social capital and entrepreneurship. Small Business Economics, 21(2), 77-113.

B. APPENDICES

B.1. APPENDICES

Appendix 1: Mean Business Incomes and Social Indices by Urban-Rural Subgroups

	Urban Income	Rural Income	Urban Index	Rural Index
All (including Christians/ Sikhs/Jains)	135987.3 (5135.785)	71774.1 (2558.995)	2.083221 (.0365505)	1.714896 (.0341755)
Brahmin/Forward Castes	189040.5 (14174.12)	87804.32 (5462.884)	2.761803 (.0729513)	2.352804 (.0866526)
Other Backwards Castes	114587.3 (5372.384)	71437.96 (4264.493)	1.640523 (.0575483)	1.465645 (.0471155)
Scheduled Castes/ Scheduled Tribes	85238.92 (5286.323)	47654.11 (2920.811)	1.907716 (.0949774)	1.445975 (.0700746)
Muslims	104528.5 (5978.061)	74571.16 (7404.374)	1.740828 (.0730164)	1.815693 (.0969653)

Standard Errors are in parentheses

Appendix 2: Full Controls of Table 2 Besides Fixed Effects

	(S1) LOG_INC	(S2) LOG_INC	(S3) LOG_INC	(S4) LOG_INC	(S5) LOG_INC
BFC	-0.229* (0.0967)	-0.0509 (0.0791)	-0.0514 (0.0804)	-0.0340 (0.0799)	-0.0866 (0.0747)
OBC	-0.355*** (0.0996)	-0.0801 (0.0801)	-0.0782 (0.0814)	-0.0380 (0.0813)	-0.0846 (0.0744)
SCST	-0.584*** (0.0971)	-0.164* (0.0820)	-0.181* (0.0824)	-0.165* (0.0832)	-0.201* (0.0780)
MUSLIM	-0.251* (0.101)	-0.0130 (0.0830)	-0.00645 (0.0845)	0.0219 (0.0851)	-0.0153 (0.0821)
AGE	0.0268*** (0.00583)	0.0208*** (0.00543)	0.0205*** (0.00554)	0.0218*** (0.00549)	0.0221*** (0.00543)
TRANS_AGE	-0.0253*** (0.00614)	-0.0228*** (0.00578)	-0.0224*** (0.00591)	-0.0234*** (0.00586)	-0.0238*** (0.00578)
MARRIED	0.265*** (0.0385)	-0.00143 (0.0352)	-0.00115 (0.0347)	-0.00207 (0.0349)	-0.00542 (0.0350)
EDUCATION	0.0491*** (0.00297)	0.00673* (0.00283)	0.00613* (0.00285)	0.00620* (0.00282)	0.00612* (0.00281)
URBAN METRO	0.786*** (0.0969)	0.254** (0.0902)	0.271** (0.0892)	0.321** (0.102)	0.270** (0.0900)
URBAN OTHER	0.625*** (0.0493)	0.112** (0.0403)	0.111** (0.0405)	0.132** (0.0399)	0.0868* (0.0407)
MORE- DEVELOPED VILLAGE	0.189*** (0.0513)	-0.0266 (0.0413)	-0.0266 (0.0416)	-0.00386 (0.0432)	-0.0202 (0.0431)

FIXED WORKPLACE		0.286*** (0.0295)	0.284*** (0.0288)	0.279*** (0.0291)	0.269*** (0.0296)
MOBILE WORKPLACE		0.294*** (0.0378)	0.295*** (0.0381)	0.290*** (0.0384)	0.299*** (0.0378)
ASSETS		0.0687*** (0.00289)	0.0686*** (0.00290)	0.0678*** (0.00285)	0.0702*** (0.00280)
WORKERS		-0.150*** (0.0223)	-0.148*** (0.0223)	-0.153*** (0.0222)	-0.141*** (0.0223)
MALE		0.505*** (0.0398)	0.517*** (0.0401)	0.504*** (0.0399)	0.496*** (0.0407)
LOG WORKHOURS		0.234*** (0.0310)	0.232*** (0.0311)	0.237*** (0.0302)	0.221*** (0.0304)
LOG WORKDAYS		0.440*** (0.0308)	0.444*** (0.0310)	0.440*** (0.0310)	0.443*** (0.0306)
UNION/BUSINESS/ PROFESSIONAL MEMBER		0.0712 (0.0519)	0.0417 (0.0499)	0.0437 (0.0513)	0.0468 (0.0499)
CREDIT/SAVINGS GROUP MEMBER		-0.126** (0.0442)	-0.124** (0.0442)	-0.0597 (0.0478)	-0.0394 (0.0495)
CASTE ASSOCIATION MEMBER		-0.0377 (0.0543)	-0.0494 (0.0534)	-0.00474 (0.0544)	-0.00558 (0.0528)
NGO/ DEVELOPMENT GROUP MEMBER		0.0909 (0.132)	0.0128 (0.120)	0.0276 (0.118)	0.0676 (0.115)
AGRI/MILK/ OTHER COOP MEMBER		-0.114^ (0.0626)	-0.110^ (0.0640)	-0.0729 (0.0687)	-0.0235 (0.0688)
PANCHAYAT MEMBER/ OFFICIAL IN HH		-0.0359 (0.0566)	-0.0395 (0.0580)	-0.0477 (0.0582)	-0.0557 (0.0597)
BIMARU				-0.0769 (0.0543)	
SOUTH				-0.239*** (0.0601)	
EAST				-0.114^ (0.0586)	
OTHER				-0.115 (0.165)	
Constant	9.383*** (0.168)	5.788*** (0.236)	5.756*** (0.238)	5.841*** (0.243)	5.824*** (0.270)
N	8674	7567	7352	7352	7352
adj. R^2	0.212	0.431	0.433	0.437	0.447

Standard errors in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Appendix 3: Summary Statistics for Institutions Proxies

	Mean	Standard Dev.	Min	Max
FII	.2873611	.1066246	.12939	.60341
CFII	.1693499	.1032625	.0539	.5637
CRISIL	.4311512	.1668359	.151	.962
SAVINGS	.5935737	.2164019	.0183486	1
N	8119			

Appendix 4.1: FII Interactions with the Basic Index at the Rural Level

	(ALL) LOG_INC	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUSLIM) LOG_INC
BASIC INDEX	0.0399 (0.0263)	-0.0496 (0.0482)	0.0347 (0.0403)	0.0386 (0.0722)	0.0912 (0.0661)
FII	0.523 (0.371)	-0.205 (0.585)	0.270 (0.534)	1.411^ (0.773)	1.799^ (1.059)
FII*BASIND	-0.0224 (0.0899)	0.265^ (0.145)	0.0987 (0.146)	-0.104 (0.250)	-0.319 (0.210)
Constant	5.256*** (0.369)	5.846*** (0.630)	5.270*** (0.480)	4.546*** (0.530)	5.883*** (0.954)
N	3586	733	1536	768	455
adj. R^2	0.388	0.350	0.392	0.398	0.313

Standard errors in parentheses and clustered at the district level. Specification 4 is used.
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Appendix 4.2: CFII Interactions with the Basic Index at the Rural Level

	(ALL) LOG_INC	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUSLIM) LOG_INC
BASIC INDEX	0.0370* (0.0175)	-0.0308 (0.0319)	0.0441 (0.0270)	0.0501 (0.0548)	0.0571 (0.0437)
CFII	0.289 (0.341)	-0.543 (0.629)	-0.364 (0.464)	1.727^ (0.895)	2.123* (1.065)
CFII*BASIND	-0.0210 (0.0914)	0.338* (0.138)	0.110 (0.158)	-0.247 (0.308)	-0.350^ (0.197)
Constant	5.365*** (0.350)	5.852*** (0.612)	5.392*** (0.458)	4.670*** (0.502)	6.056*** (0.912)
N	3586	733	1536	768	455
adj. R^2	0.388	0.351	0.392	0.398	0.315

Standard errors in parentheses and clustered at the district level. Specification 4 is used.
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Appendix 5: Rural Politicians and FII

	(ALL) LOG_INC	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUSLIM) LOG_INC
Elected Politicians	0.724** (0.248)	0.520 (0.512)	0.315 (0.452)	0.392 (0.461)	1.402* (0.624)
FII	0.607 (0.343)	0.788 (0.440)	0.518 (0.488)	1.161 (0.741)	1.294 (0.885)
FII*Polit.	-1.580 (0.841)	-0.415 (1.742)	-0.171 (1.422)	-0.870 (1.376)	-3.702 (2.438)
Constant	5.272*** (0.359)	5.671*** (0.657)	5.179*** (0.461)	4.704*** (0.537)	5.903*** (0.941)
N	3586	733	1536	768	455
adj. R^2	0.392	0.356	0.394	0.403	0.329

Standard errors in parentheses and clustered at the district level. Specification 4 is used.
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Appendix 6: Urban Government Officers and FII

	(ALL) LOG_INC	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUSLIM) LOG_INC
Gov. Officer	0.117 (0.148)	0.242 (0.312)	0.153 (0.269)	0.771 (0.511)	-0.348 (0.319)
FII	-0.552 (0.359)	-0.459 (0.676)	-0.661 (0.522)	0.240 (0.760)	-0.708 (0.540)
FII*Govoff.	0.248 (0.460)	0.0641 (0.944)	-0.350 (0.854)	-1.767 (1.902)	1.191 (0.832)
Constant	6.478*** (0.402)	5.711*** (0.874)	6.579*** (0.574)	4.525*** (0.922)	6.620*** (0.667)
N	3562	1122	1113	478	710
adj. R^2	0.378	0.334	0.368	0.359	0.363

Standard errors in parentheses and clustered at the district level. Specification 4 is used.
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Appendix 7: Urban Political Party Officials and FII

	(ALL) LOG_INC	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUSLIM) LOG_INC
Political Party Official	0.0974 (0.191)	0.221 (0.329)	0.253 (0.299)	-0.0905 (0.462)	0.0198 (0.318)
FII	-0.551 (0.363)	-0.416 (0.660)	-0.711 (0.521)	0.0567 (0.762)	-0.574 (0.493)
FII*PPO	0.336 (0.510)	-0.293 (0.928)	0.00646 (0.883)	0.887 (1.404)	0.567 (0.825)
Constant	6.477*** (0.402)	5.700*** (0.872)	6.582*** (0.572)	4.536*** (0.920)	6.477*** (0.402)
N	3562	1122	1113	478	3562

adj. R^2	0.378	0.334	0.368	0.358	0.378

Standard errors in parentheses and clustered at the district level. Specification 4 is used.
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Appendix 8: Urban CRISIL Index and the Basic Index

	(ALL) LOG_INC	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUSLIM) LOG_INC
BASIC	0.0149	0.0438	0.0388	0.00611	0.0235
	(0.0243)	(0.0338)	(0.0467)	(0.0651)	(0.0522)
CRISIL	0.158	0.337	0.500	-0.137	-0.0793
	(0.297)	(0.346)	(0.414)	(0.744)	(0.438)
CRI*BASIND	0.0603	0.0343	0.0244	-0.0342	0.0265
	(0.0491)	(0.0684)	(0.102)	(0.118)	(0.114)
Constant	6.386***	4.504***	6.806***	5.548***	6.020***
	(0.363)	(0.779)	(0.657)	(0.956)	(0.806)
N	3739	1172	1161	524	735
adj. R^2	0.386	0.358	0.380	0.340	0.361

Standard errors are in parentheses and clustered at the district level.
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Appendix 9: Rural CRISIL Index and the Basic Index

	(ALL) LOG_INC	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUSLIM) LOG_INC
BASIC INDEX	0.0365	-0.0175	0.0274	0.0407	0.0254
	(0.0237)	(0.0471)	(0.0435)	(0.0646)	(0.0635)
CRISIL	-0.293	-0.00992	-0.212	0.00234	-0.134
	(0.253)	(0.429)	(0.390)	(0.530)	(0.718)
CRI*BASIND	-0.0218	0.0978	0.0588	-0.0417	-0.108
	(0.0554)	(0.101)	(0.105)	(0.150)	(0.159)
Constant	5.535***	5.568***	5.658***	3.484***	5.435***
	(0.340)	(1.036)	(0.508)	(0.954)	(0.810)
N	3613	739	1546	779	455
adj. R^2	0.397	0.351	0.411	0.413	0.344

Standard errors are in parentheses and clustered at the district level.
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Appendix 10 : Urban Gov. Officers and Political Party Officials with the CRISIL Index

	(Gov Off) LOG_INC	(Poli Off.) LOG_INC
CRISIL	0.185	0.212
	(0.260)	(0.265)
Gov. Officer	-0.199	0.176**
	(0.160)	(0.0647)

CRI*GovOff	0.807* (0.328)	-
Political Party Official	0.180** (0.0654)	-0.146 (0.176)
CRI*PPO	-	0.750* (0.352)
Constant	6.393*** (0.365)	6.403*** (0.373)
N	3739	3739
adj. R^2	0.391	0.390

Standard errors in parentheses and clustered at the district level.
* p < 0.05, ** p < 0.01, *** p < 0.001

Appendix 11: Savings and the Basic Index at the Rural Level

	(ALL) LOG_INC	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUSLIM) LOG_INC
BASIC INDEX	0.0468 (0.0301)	0.0120 (0.0455)	0.0476 (0.0565)	0.0126 (0.0607)	0.0710 (0.0614)
SAVINGS	0.0285 (0.151)	0.187 (0.300)	-0.0756 (0.223)	0.473 (0.348)	-0.212 (0.379)
SAV*BASIND	-0.0321 (0.0471)	0.0202 (0.0657)	0.00429 (0.0922)	0.0120 (0.0964)	-0.173 (0.122)
Constant	5.685*** (0.349)	5.679*** (0.988)	5.608*** (0.455)	3.168** (0.959)	6.814*** (0.765)
N	3608	739	1544	779	453
adj. R^2	0.397	0.351	0.411	0.416	0.356

Standard errors are in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Appendix 12: Summary Statistics on Outer Social Ties

	Mean	S.D.	Min	Max
Doctor Ties	.4641204	.4987399	0	1
Other Health Prof. Ties	.3538194	.4781817	0	1
Teachers/Principal Ties	.5033565	.5000177	0	1
Other School Worker Ties	.3726852	.4835473	0	1
Gov. Officer Ties	.1703704	.3759796	0	1
Other Gov. Worker Ties	.2378472	.4257897	0	1
Elected Politician Ties	.1634259	.3697752	0	1

Political Party Official Ties	.1627315	.3691419	0	1
Inspector Ties	.1158565	.3200713	0	1
Other Police Ties	.2429398	.4288838	0	1
Military Ties	.1461806	.3533076	0	1
BASIC INDEX	2.933333	2.835082	0	11
N	8640			

Appendix 13: Subgroup Decomposition of Outer Ties in the Urban Setting

	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUSLIM) LOG_INC
Doctor Ties OUTER	0.128^ (0.0661)	0.0659 (0.0589)	0.0810 (0.112)	-0.0155 (0.0767)
Other Health Prof. Ties OUTER	0.00514 (0.0647)	0.0222 (0.0734)	-0.0498 (0.0924)	-0.0148 (0.0740)
Teachers/ Principal Ties OUTER	-0.0339 (0.0738)	-0.0133 (0.0636)	-0.0559 (0.0821)	-0.0212 (0.0828)
Other School Worker Ties OUTER	-0.0256 (0.0668)	0.0523 (0.0843)	-0.0195 (0.0950)	0.0107 (0.0728)
Government Officer Ties OUTER	0.169^ (0.0895)	0.134 (0.0893)	-0.0807 (0.131)	-0.112 (0.112)
Other Govt. Ties. OUTER	-0.117 (0.0851)	0.00172 (0.0718)	-0.209 (0.138)	-0.0493 (0.103)
Politician Ties OUTER	0.156^ (0.0922)	-0.123 (0.0922)	0.0392 (0.143)	0.232^ (0.124)
Political Party Officer Ties OUTER	-0.0975 (0.0860)	0.125 (0.0977)	0.153 (0.155)	0.278** (0.0871)
Inspector Ties OUTER	0.115 (0.107)	0.0505 (0.0988)	0.157 (0.176)	0.0164 (0.130)
Other Police Ties OUTER	0.0572 (0.0922)	-0.000205 (0.0763)	0.314* (0.133)	0.0806 (0.0908)
Military Ties OUTER	0.0702 (0.0922)	-0.0550 (0.0947)	-0.0267 (0.262)	0.0196 (0.148)
Constant	5.581*** (0.684)	7.103*** (0.551)	4.862*** (1.043)	5.869*** (0.808)
N	1167	1158	523	734
adj. R^2	0.353	0.369	0.349	0.369

Standard errors in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Appendix 14: Subgroup Decomposition of Outer Ties in Rural Areas

	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUSLIM) LOG_INC
Doctor Ties OUTER	0.0729	-0.0655	-0.0908	-0.160
	(0.0816)	(0.0635)	(0.0858)	(0.133)
Other Health Prof. Ties OUTER	0.114	0.109^	0.155	-0.0299
	(0.0873)	(0.0564)	(0.104)	(0.133)
Teachers/ Principal Ties OUTER	-0.00260	0.0671	-0.0563	0.0497
	(0.0900)	(0.0565)	(0.0854)	(0.139)
Other School Worker Ties OUTER	-0.0941	-0.0395	0.168*	0.0270
	(0.0939)	(0.0620)	(0.0850)	(0.139)
Government Officer Ties OUTER	0.0568	0.00570	0.0981	-0.0259
	(0.118)	(0.0891)	(0.165)	(0.206)
Other Govt. Ties. OUTER	-0.0356	-0.0146	-0.0263	0.306*
	(0.111)	(0.0680)	(0.112)	(0.148)
Politician Ties OUTER	-0.0775	0.0698	0.205	0.283^
	(0.103)	(0.0777)	(0.168)	(0.168)
Political Party Officer Ties OUTER	0.0123	0.107	-0.121	-0.0439
	(0.126)	(0.0830)	(0.125)	(0.173)
Inspector Ties OUTER	0.348**	0.155	-0.0691	-0.278
	(0.133)	(0.107)	(0.171)	(0.258)
Other Police Ties OUTER	0.200	0.0897	-0.121	0.170
	(0.124)	(0.0643)	(0.115)	(0.171)
Military Ties OUTER	-0.237*	-0.0444	0.0683	-0.658**
	(0.110)	(0.102)	(0.119)	(0.199)
Constant	5.990***	5.768***	5.719***	5.887***
	(0.975)	(0.436)	(0.499)	(0.819)
N	740	1540	777	453
adj. R^2	0.361	0.411	0.434	0.360

Standard errors in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Appendix 15: Outer and Inner Social Ties

	(All) LOG_INC	(Urban) LOG_INC	(Rural) LOG_INC
Doctor Ties INNER	0.0596^ (0.0307)	0.0502 (0.0411)	0.0451 (0.0458)
Other Health Prof. Ties INNER	0.0747* (0.0348)	0.0648 (0.0456)	0.0948^ (0.0529)
Teachers/ Principal Ties INNER	-0.00709 (0.0296)	-0.000245 (0.0385)	-0.0264 (0.0422)
Other School Worker Ties INNER	0.0144 (0.0324)	0.0541 (0.0408)	-0.0269 (0.0478)
Gov. Officer Ties INNER	0.0527 (0.0522)	0.168* (0.0669)	-0.118 (0.0726)
Other Govt. Ties. INNER	-0.0882* (0.0397)	-0.160*** (0.0448)	0.00980 (0.0674)
Politician Ties INNER	0.124* (0.0625)	0.00497 (0.0828)	0.261** (0.0839)
Political Party Officer Ties INNER	0.0799 (0.0543)	0.171* (0.0659)	-0.0383 (0.0872)
Inspector Ties INNER	0.109* (0.0525)	0.0978 (0.0657)	0.135 (0.0944)
Other Police Ties INNER	-0.0191 (0.0365)	-0.0105 (0.0500)	-0.0308 (0.0553)
Military Ties INNER	-0.0631 (0.0423)	-0.0430 (0.0567)	-0.0710 (0.0588)
Doctor Ties OUTER	-0.000645 (0.0283)	0.0432 (0.0365)	-0.0426 (0.0440)
Other Health Prof. Ties OUTER	0.0355 (0.0277)	0.00262 (0.0377)	0.0809^ (0.0415)
Teachers/ Principal Ties OUTER	-0.00451 (0.0285)	-0.00702 (0.0423)	0.00869 (0.0389)
Other School Worker Ties OUTER	0.0182 (0.0308)	-0.00402 (0.0457)	0.0457 (0.0427)
Gov. Officer Ties OUTER	0.0231 (0.0415)	0.0342 (0.0509)	0.0172 (0.0656)
Other Govt. Ties. OUTER	-0.0226 (0.0387)	-0.0426 (0.0560)	0.00127 (0.0512)

Politician Ties OUTER	0.0331 (0.0395)	0.0298 (0.0502)	0.0244 (0.0566)
Political Party Officer Ties OUTER	0.0529 (0.0363)	0.0443 (0.0468)	0.0434 (0.0585)
Inspector Ties OUTER	0.0444 (0.0529)	0.00452 (0.0729)	0.0689 (0.0787)
Other Police Ties OUTER	0.0743* (0.0339)	0.0730^ (0.0439)	0.0955^ (0.0545)
Military Ties OUTER	-0.0103 (0.0459)	0.0508 (0.0629)	-0.0761 (0.0655)
Constant	5.893*** (0.243)	6.264*** (0.372)	5.810*** (0.329)
N	7323	3723	3600
adj. R^2	0.448	0.389	0.403

Standard errors in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Appendix 16: Summary Statistics for Proportions

	Mean	S.D.	Min	Max
MUS_PROP	.1351391	.1483502	.0023	.9549
BFC_PROP	.2351469	.174544	0	.94111765
OBC_PROP	.3281769	.197281	0	.9545454
SCST_PROP	.2786592	.1536372	0	.9871795
N	8674			

Appendix 17: Controls of Table 15

1ST STAGE	(Normal) BASIC INDEX	(Cluster) BASIC INDEX	2ND STAGE	(OLS) LOG_ INC	(Normal) LOG_ INC	(Cluster) LOG_ INC
BFC	0.120 (0.143)	0.120 (0.176)		-0.0366 (0.0815)	-0.0777 (0.0666)	-0.0777 (0.0886)
OBC	-0.122 (0.142)	-0.122 (0.176)		-0.0421 (0.0823)	-0.0181 (0.0660)	-0.0181 (0.0883)
SCST	0.0827 (0.149)	0.0827 (0.186)		-0.169* (0.0845)	-0.185** (0.0693)	-0.185* (0.0909)
MUSLIM	0.0507 (0.150)	0.0507 (0.185)		0.0266 (0.0865)	-0.0157 (0.0704)	-0.0157 (0.0923)
AGE	0.0100 (0.0113)	0.0100 (0.0125)		0.0222*** (0.00551)	0.0208*** (0.00535)	0.0208*** (0.00585)
TRANS_ AGE	0.000330 (0.0120)	0.000330 (0.0134)		-0.0237*** (0.00588)	-0.0239*** (0.00565)	-0.0239*** (0.00614)
MAR-RIED	-0.0267 (0.0794)	-0.0267 (0.0760)		0.00176 (0.0351)	0.00773 (0.0376)	0.00773 (0.0378)

EDUC	0.0802***	0.0802***	0.00600*	-0.00615	-0.00615
	(0.00636)	(0.00719)	(0.00286)	(0.00455)	(0.00650)
URBAN METRO	-0.692***	-0.692*	0.338***	0.394***	0.394***
	(0.117)	(0.348)	(0.0985)	(0.0550)	(0.107)
URBAN OTHER	-0.596***	-0.596***	0.143***	0.229***	0.229***
	(0.0723)	(0.116)	(0.0399)	(0.0411)	(0.0561)
MORE- DEVELOPED VILLAGE	-0.355***	-0.355***	0.00161	0.0603	0.0603
	(0.0702)	(0.0971)	(0.0432)	(0.0369)	(0.0537)
FIXED WORKPLACE	0.0528	0.0528	0.284***	0.274***	0.274***
	(0.0599)	(0.0668)	(0.0290)	(0.0284)	(0.0303)
MOBILE WORKPLACE	-0.0312	-0.0312	0.291***	0.299***	0.299***
	(0.0734)	(0.0741)	(0.0387)	(0.0347)	(0.0413)
ASSETS	0.103***	0.103***	0.0673***	0.0523***	0.0523***
	(0.00564)	(0.00667)	(0.00284)	(0.00498)	(0.00763)
WORKERS	0.0215	0.0215	-0.152***	-0.154***	-0.154***
	(0.0378)	(0.0404)	(0.0223)	(0.0179)	(0.0234)
MALE	0.000863	0.000863	0.502***	0.499***	0.499***
	(0.0819)	(0.0852)	(0.0404)	(0.0387)	(0.0435)
LOG_ WKHRS	-0.0892^	-0.0892	0.236***	0.250***	0.250***
	(0.0501)	(0.0607)	(0.0304)	(0.0240)	(0.0328)
LOG_ WKDAY	-0.0933*	-0.0933*	0.439***	0.451***	0.451***
	(0.0449)	(0.0473)	(0.0310)	(0.0215)	(0.0326)
UNION/ BUS./ PROFESSIONAL MEMBER	0.844***	0.844***	0.0348	-0.106^	-0.106
	(0.0903)	(0.174)	(0.0518)	(0.0581)	(0.0874)
CREDIT/ SAVINGS GROUP MEMBER	0.0824	0.0824	-0.0675	-0.0841*	-0.0841
	(0.0801)	(0.0933)	(0.0485)	(0.0381)	(0.0530)
CASTE ASSOCIATION MEMBER	0.488***	0.488**	-0.00241	-0.0686	-0.0686
	(0.0872)	(0.152)	(0.0547)	(0.0452)	(0.0634)
NGO/ DEVELOPMENT GROUP MEMBER	-0.186	-0.186	0.0253	0.0659	0.0659
	(0.209)	(0.325)	(0.119)	(0.0994)	(0.116)
AGRI/ MILK/ OTHER COOP MEMBER	-0.00397	-0.00397	-0.0699	-0.0662	-0.0662
	(0.129)	(0.135)	(0.0678)	(0.0609)	(0.0729)
PANCHAYAT MEMBER/ OFFICIAL IN HH	0.985***	0.985***	-0.0311	-0.173*	-0.173^
	(0.115)	(0.162)	(0.0588)	(0.0675)	(0.0924)
BIMARU	0.513***	0.513**	-0.0663	-0.115**	-0.115^
	(0.0885)	(0.172)	(0.0551)	(0.0405)	(0.0648)

SOUTH	0.190*	0.190		-0.225***	-0.224***	-0.224***
	(0.0913)	(0.190)		(0.0599)	(0.0381)	(0.0652)
EAST	0.457***	0.457*		-0.106^	-0.156***	-0.156*
	(0.0932)	(0.202)		(0.0588)	(0.0441)	(0.0694)
OTHER	-0.416*	-0.416		-0.108	-0.0146	-0.0146
	(0.194)	(0.380)		(0.161)	(0.0929)	(0.159)
Constant	-0.330	-0.330		5.814***	5.860***	5.860***
	(0.415)	(0.512)		(0.243)	(0.177)	(0.254)
N	7352	7352	N	7352	7352	7352
adj. R^2	0.209	0.209	adj. R^2	0.435	0.372	0.372
			Under		126.044	19.022
					(0.0000)	(0.0008)
			Weak/F		31.882	6.253
			Over		13.976	4.113
					(0.0029)	(0.2495)

Standard errors in parentheses and clustered at the district level if indicated.
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001
P-values in parentheses for identification tests.

B.2. TABLES AND FIGURES

Table 1.1: Summary Statistics of Key Social Ties Variables

	Mean	Standard Deviation	Minimum	Maximum
Business Income (in INR)	104966.5	275639.1	80	1.14e+07
Doctor Ties	.2573685	.4372099	0	1
Other Health Prof. Ties	.2046687	.4034831	0	1
Teachers/Principal Ties	.3620608	.4806246	0	1
Other School Worker Ties	.2423957	.4285576	0	1
Gov. Officer Ties	.1091724	.3118737	0	1
Other Gov. Worker Ties	.1675312	.3734715	0	1
Elected Politician Ties	.0732139	.2605026	0	1
Political Party Official Ties	.0976185	.2968156	0	1
Inspector Ties	.0748644	.263188	0	1
Other Police Ties	.1763735	.3811601	0	1
Military Ties	.132398	.338943	0	1

Basic Index	1.904196	2.342549	0	11
N	8482			

Table 1.2: Summary Statistics of Controls

	Mean	Standard Deviation	Minimum	Maximum
Brahmin/Forward Castes*	.2599623	.4386395	0	1
Other Backwards Castes*	.3614714	.480455	0	1
SCST*	.1840368	.387537	0	1
Muslims*	.1617543	.368247	0	1
Age*	43.61577	12.71651	12	98
Transformed Age*	20.64026	11.894	1.44	96.04
Married*	.8731431	.3328322	0	1
Education*	7.696062	4.795653	0	16
Metro Urban*	.0956142	.2940788	0	1
Other Urban*	.4199481	.4935792	0	1
More-Developed Village*	.2597265	.4385103	0	1
Fixed Workplace**	.445178	.4970148	0	1
Mobile Workplace**	.22141	.4152204	0	1
Assets Owned**	18.30842	6.10712	0	33
Number of Workers**	1.471587	.8217975	0	7
Male**	.8841075	.3201148	0	1
Total Work Hours / Day**	8.694647	6.102968	0	60
Total Work Days / Year**	332.4473	236.4204	0	2070
Union/Business/Prof. Member**	.0891299	.284948	0	1
Credit Savings Group Member**	.1059892	.3078419	0	1
Caste Association Member**	.0873615	.2823807	0	1
Development/NGO Member**	.0150908	.1219213	0	1

Agricultural Co-op Member**	.0348974	.1835308	0	1
Panchayat Member in HH**	.0459797	.2094535	0	1
N	8482			

* = First Specification/Regression, ** = Second to Fifth Specification/Regression including First

Table 1.3: Full Summary Statistics in the Urban Setting

	Mean	S.D.	Min	Max
Business Income (in INR)	136054.9	345395	300	1.14e+07
Doctor Ties	.2995423	.45811	0	1
Other Health Prof. Ties	.2299771	.420866	0	1
Teachers/Principal Ties	.384897	.4866266	0	1
Other School Worker Ties	.2556064	.4362514	0	1
Gov. Officer Ties	.1299771	.3363167	0	1
Other Gov. Worker Ties	.1913043	.3933731	0	1
Elected Politician Ties	.0741419	.2620316	0	1
Political Party Official Ties	.1139588	.3177976	0	1
Inspector Ties	.0897025	.2857878	0	1
Other Police Ties	.1844394	.3878865	0	1
Military Ties	.1189931	.3238175	0	1
Basic Index	2.07254	2.43073	0	11
Brahmin/Forward Castes*	.3114416	.4631359	0	1
Other Backwards Castes*	.3084668	.4619133	0	1
SCST*	.1485126	.3556481	0	1
Muslims*	.1915332	.3935526	0	1
Age*	44.41213	12.30836	13	98
Transformed Age*	21.23898	11.67855	1.69	96.04
Married*	.8768879	.3286035	0	1
Education*	8.530206	4.706553	0	16
Metro Urban*	.1855835	.3888147	0	1

Other Urban*	.8144165	.3888147	0	1
More-Developed Village*	0	0	0	0
Fixed Workplace**	.5194508	.4996787	0	1
Mobile Workplace**	.2116705	.4085392	0	1
Assets Owned**	20.75858	5.07757	1	33
Number of Workers**	1.414645	.7797891	0	7
Male**	.8915332	.3110047	0	1
Total Work Hours / Day**	9.081922	6.417615	0	60
Total Work Days / Year**	347.2437	241.216	0	1990
Union/Business/Prof. Member**	.1189931	.3238175	0	1
Credit Savings Group Member**	.0913043	.2880744	0	1
Caste Association Member**	.0858124	.2801188	0	1
Development/NGO Member**	.016476	.1273115	0	1
Agricultural Co-op Member**	.0102975	.1009642	0	1
Panchayat Member in HH**	.0237986	.1524387	0	1
N	4370			

Table 1.4: Full Summary Statistics in the Rural Setting

	Mean	S.D.	Min	Max
Business Income (in INR)	71927.6	166843.1	80	3150000
Doctor Ties	.2125486	.4091606	0	1
Other Health Prof. Ties	.1777724	.3823675	0	1
Teachers/Principal Ties	.3377918	.4730147	0	1
Other School Worker Ties	.228356	.4198243	0	1
Gov. Officer Ties	.0870623	.2819606	0	1

Other Gov. Worker Ties	.1422665	.3493658	0	1
Elected Politician Ties	.0722276	.2588959	0	1
Political Party Official Ties	.0802529	.2717174	0	1
Inspector Ties	.0590953	.2358317	0	1
Other Police Ties	.1678016	.3737354	0	1
Military Ties	.146644	.3537937	0	1
Basic Index	1.711819	2.208182	0	11
Brahmin/Forward Castes*	.2052529	.4039354	0	1
Other Backwards Castes*	.4178016	.4932571	0	1
SCST*	.2217899	.415501	0	1
Muslims*	.130107	.336462	0	1
Age*	42.76946	13.08485	12	90
Transformed Age*	20.00398	12.08772	1.44	81
Married*	.8691634	.3372626	0	1
Education*	6.809582	4.730538	0	16
Metro Urban*	0	0	0	0
Other Urban*	.0007296	.027004	0	1
More-Developed Village*	.535749	.498781	0	1
Fixed Workplace**	.3662451	.4818362	0	1
Mobile Workplace**	.2317607	.4220083	0	1
Assets Owned**	15.70452	6.03162	0	31
Number of Workers**	1.532101	.8601792	0	7
Male**	.876216	.3293751	0	1
Total Work Hours / Day**	8.283074	5.721853	0	50
Total Work Days / Year**	316.7225	230.2039	0	2070
Union/Business/Prof. Member**	.057393	.2326203	0	1
Credit Savings Group Member**	.1215953	.3268576	0	1

Caste Association Member**	.0890078	.2847896	0	1
Development/ NGO Member**	.0136187	.1159158	0	1
Agricultural Co-op Member**	.0610409	.2394344	0	1
Panchayat Member in HH**	.0695525	.2544223	0	1
N	4112			

Table 2: Preliminary Regressions with More Restrictive Specifications

	(S1) LOG_INC	(S2) LOG_INC	(S3) LOG_INC	(S4) LOG_INC	(S5) LOG_INC
Doctor	0.148***	0.0713*	0.0823*	0.0696*	0.0562^
	(0.0378)	(0.0326)	(0.0325)	(0.0328)	(0.0307)
Other Health Professional	0.0746^	0.0961**	0.0895*	0.0979**	0.0923**
	(0.0392)	(0.0352)	(0.0352)	(0.0353)	(0.0339)
Teacher/ Principal	0.0255	-0.00350	0.00357	-0.00312	-0.00806
	(0.0342)	(0.0297)	(0.0298)	(0.0295)	(0.0294)
Other School Worker	0.0884*	0.0439	0.0387	0.0374	0.0356
	(0.0390)	(0.0330)	(0.0326)	(0.0323)	(0.0315)
Gov. Officer	0.0608	0.0377	0.0500	0.0608	0.0666
	(0.0564)	(0.0512)	(0.0523)	(0.0520)	(0.0521)
Other Gov. Employee	-0.0245	-0.0513	-0.0930*	-0.0773^	-0.0797*
	(0.0463)	(0.0414)	(0.0400)	(0.0408)	(0.0394)
Elected Politician	0.136*	0.125*	0.125*	0.138*	0.138*
	(0.0683)	(0.0572)	(0.0589)	(0.0585)	(0.0605)
Political Party Official	0.0984^	0.102^	0.109*	0.116*	0.101^
	(0.0537)	(0.0532)	(0.0539)	(0.0548)	(0.0544)
Inspector	0.142**	0.121*	0.132**	0.123*	0.123**
	(0.0481)	(0.0480)	(0.0480)	(0.0480)	(0.0474)
Other Police	0.0613	0.0169	0.0147	0.0178	0.00616
	(0.0382)	(0.0372)	(0.0373)	(0.0370)	(0.0364)
Military	0.0804^	-0.0129	-0.0118	-0.0470	-0.0513
	(0.0443)	(0.0378)	(0.0375)	(0.0386)	(0.0375)
Constant	9.383***	5.788***	5.756***	5.841***	5.824***
	(0.168)	(0.236)	(0.238)	(0.243)	(0.270)
N	8674	7567	7352	7352	7352
adj. R^2	0.212	0.431	0.433	0.437	0.447

Standard errors are in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 3: Quantile Regressions of the Preliminary Regressions

	(10%) LOG_INC	(25%) LOG_INC	(50%) LOG_INC	(75%) LOG_INC	(90%) LOG_INC
Doctor	-0.00580	0.00178	0.0138	0.115**	0.146*
	(0.0560)	(0.0309)	(0.0317)	(0.0386)	(0.0590)
Other Health Professional	0.139*	0.0964*	0.111**	0.0378	0.0872
	(0.0669)	(0.0400)	(0.0387)	(0.0391)	(0.0596)
Teacher/ Principal	0.00726	0.0134	0.000203	-0.0410	-0.0321
	(0.0482)	(0.0325)	(0.0271)	(0.0306)	(0.0439)
Other School Worker	0.0202	0.0166	0.0375	0.0943**	0.0427
	(0.0583)	(0.0377)	(0.0339)	(0.0349)	(0.0621)
Gov. Officer	-0.0509	-0.00695	0.0846	0.0667	0.122
	(0.0795)	(0.0559)	(0.0518)	(0.0534)	(0.0843)
Other Gov. Employee	-0.0477	-0.101^	-0.0551	-0.0151	-0.0508
	(0.0652)	(0.0546)	(0.0495)	(0.0436)	(0.0663)
Elected Politician	-0.000225	0.112^	0.104	0.167**	0.237*
	(0.102)	(0.0663)	(0.0678)	(0.0587)	(0.109)
Political Party Official	0.102	0.0619	0.115*	0.123**	0.0810
	(0.0716)	(0.0574)	(0.0554)	(0.0452)	(0.0848)
Inspector	0.0905	0.188**	0.0848^	0.0515	0.232^
	(0.0947)	(0.0676)	(0.0495)	(0.0562)	(0.130)
Other Police	0.0239	0.0110	-0.0257	0.000898	-0.0307
	(0.0626)	(0.0479)	(0.0389)	(0.0367)	(0.0511)
Military	-0.182*	-0.0850^	-0.0457	-0.0289	-0.0111
	(0.0743)	(0.0502)	(0.0427)	(0.0440)	(0.0656)
Constant	2.747***	4.201***	5.877***	7.303***	8.584***
	(0.350)	(0.287)	(0.258)	(0.300)	(0.315)
N	7352	7352	7352	7352	7352
Pseudo R^2	0.3157	0.2986	0.2703	0.2584	0.2628

Quantile standard errors in parentheses and are bootstrapped to 100 replications. Controls are included in S5 of Appendix 2 and state fixed effects are also included
^ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.1: Urban Regressions and Subgroups

	(ALL) LOG_INC	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUS.) LOG_INC
Doctor	0.0507	0.0387	0.0519	-0.0832	-0.0254
	(0.0408)	(0.0672)	(0.0758)	(0.113)	(0.0783)
Other Health Professional	0.0754^	0.133^	0.0433	0.0783	0.0817
	(0.0454)	(0.0792)	(0.0720)	(0.124)	(0.101)
Teacher/ Principal	0.00192	0.0268	0.0871	-0.0403	-0.102^
	(0.0376)	(0.0616)	(0.0630)	(0.0966)	(0.0603)
Other School Worker	0.0618	0.00548	0.0982	0.0788	0.121
	(0.0388)	(0.0678)	(0.0657)	(0.119)	(0.0870)

Gov. Officer	0.184**	0.303*	0.0252	0.244	-0.0160
	(0.0655)	(0.118)	(0.0895)	(0.192)	(0.132)
Other Gov. Employee	-0.157***	-0.201*	-0.126^	-0.400**	-0.121
	(0.0428)	(0.0850)	(0.0747)	(0.124)	(0.115)
Elected Politician	0.0295	0.0842	0.161	-0.202	0.337^
	(0.0819)	(0.143)	(0.153)	(0.178)	(0.180)
Political Party Official	0.181**	0.0741	0.192^	0.163	0.216*
	(0.0649)	(0.109)	(0.107)	(0.138)	(0.102)
Inspector	0.0964	0.0910	0.0497	0.323*	0.00609
	(0.0599)	(0.0834)	(0.123)	(0.141)	(0.152)
Other Police	0.0111	0.106	-0.0157	-0.00409	-0.00471
	(0.0492)	(0.0785)	(0.0923)	(0.129)	(0.106)
Military	-0.0121	0.00477	0.0225	-0.172	0.154
	(0.0496)	(0.0724)	(0.0947)	(0.127)	(0.162)
Constant	6.440***	4.367***	6.997***	5.421***	6.113***
	(0.361)	(0.730)	(0.663)	(0.936)	(0.807)
N	3739	1172	1161	524	735
adj. R^2	0.389	0.361	0.380	0.354	0.370

Standard errors are in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 4.2: Urban Regressions and Production Inputs

	(P1) LOG_INC	(P2) LOG_INC	(P3) LOG_INC	(P4) LOG_INC
Doctor	0.235***	0.140**	0.0528	0.0507
	(0.0519)	(0.0468)	(0.0408)	(0.0408)
Other Health Professional	0.0658	0.0641	0.0754^	0.0754^
	(0.0481)	(0.0456)	(0.0455)	(0.0454)
Teacher/Principal	0.113**	0.0541	0.00547	0.00192
	(0.0432)	(0.0388)	(0.0379)	(0.0376)
Other School Worker	0.106*	0.0676	0.0562	0.0618
	(0.0452)	(0.0449)	(0.0392)	(0.0388)
Gov. Officer	0.285***	0.207**	0.187**	0.184**
	(0.0752)	(0.0690)	(0.0653)	(0.0655)
Other Gov. Employee	-0.0870	-0.121*	-0.159***	-0.157***
	(0.0529)	(0.0486)	(0.0441)	(0.0428)
Elected Politician	0.0000430	0.0454	0.0338	0.0295
	(0.0967)	(0.0847)	(0.0799)	(0.0819)
Political Party Official	0.191**	0.164**	0.180**	0.181**
	(0.0702)	(0.0605)	(0.0649)	(0.0649)
Inspector	0.187**	0.153**	0.0919	0.0964
	(0.0598)	(0.0566)	(0.0594)	(0.0599)
Other Police	0.0312	0.0431	0.00635	0.0111
	(0.0501)	(0.0478)	(0.0480)	(0.0492)
Military	-0.0203	-0.00529	-0.00899	-0.0121
	(0.0637)	(0.0564)	(0.0495)	(0.0496)

Constant	11.07*** (0.113)	9.159*** (0.202)	6.303*** (0.371)	6.440*** (0.361)
N	4329	4323	3747	3739
adj. R^2	0.111	0.233	0.389	0.389

Standard errors are in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 5.1: Rural Regressions and Subgroups

	(ALL) LOG_INC	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUS.) LOG_INC
Doctor	0.0366 (0.0459)	-0.0870 (0.0906)	0.0847 (0.0769)	0.153 (0.110)	-0.00422 (0.0972)
Other Health Professional	0.122* (0.0512)	0.0368 (0.106)	0.140^ (0.0769)	0.228^ (0.127)	0.170 (0.133)
Teacher/ Principal	-0.0244 (0.0419)	0.122 (0.105)	-0.000621 (0.0600)	-0.173 (0.108)	-0.116 (0.130)
Other School Worker	0.0147 (0.0458)	-0.241** (0.0912)	0.0683 (0.0875)	0.0882 (0.0879)	0.0902 (0.120)
Gov. Officer	-0.104 (0.0728)	-0.0316 (0.115)	-0.210^ (0.121)	-0.172 (0.189)	-0.271 (0.311)
Other Gov. Worker	0.0242 (0.0657)	0.0445 (0.124)	-0.0564 (0.111)	0.158 (0.136)	-0.00739 (0.187)
Elected Politician	0.260** (0.0805)	0.387** (0.143)	0.269* (0.111)	0.161 (0.172)	0.518* (0.229)
Political Party Official	-0.0123 (0.0884)	-0.0825 (0.154)	0.0556 (0.132)	0.271 (0.189)	-0.184 (0.205)
Inspector	0.171* (0.0857)	0.280^ (0.156)	0.0809 (0.142)	0.0734 (0.186)	0.347 (0.291)
Other Police	0.00361 (0.0543)	0.192* (0.0931)	0.0554 (0.0948)	-0.232* (0.0963)	-0.501* (0.207)
Military	-0.0870 (0.0554)	-0.139 (0.0926)	0.0852 (0.0851)	-0.0811 (0.108)	-0.383 (0.277)
Constant	5.441*** (0.334)	5.588*** (0.977)	5.508*** (0.418)	3.398*** (0.937)	6.384*** (0.759)
N	3613	739	1546	779	455
adj. R^2	0.400	0.361	0.414	0.425	0.371

Standard errors are in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 5.2: Rural Regressions and Production Inputs

	(P1) LOG_INC	(P2) LOG_INC	(P3) LOG_INC	(P4) LOG_INC
Doctor	0.203*** (0.0584)	0.145** (0.0546)	0.0484 (0.0454)	0.0366 (0.0459)

Other Health Professional	0.171**	0.115^	0.125*	0.122*
	(0.0651)	(0.0596)	(0.0505)	(0.0512)
Teacher/Principal	0.0594	0.0100	-0.0305	-0.0244
	(0.0511)	(0.0483)	(0.0421)	(0.0419)
Other School Worker	0.147**	0.0965^	0.0216	0.0147
	(0.0529)	(0.0523)	(0.0454)	(0.0458)
Gov. Officer	0.0657	-0.0259	-0.107	-0.104
	(0.0791)	(0.0744)	(0.0730)	(0.0728)
Other Gov. Worker	0.0396	0.0313	0.0182	0.0242
	(0.0753)	(0.0684)	(0.0655)	(0.0657)
Elected Politician	0.166	0.192^	0.237**	0.260**
	(0.106)	(0.107)	(0.0865)	(0.0805)
Political Party Official	0.120	0.0993	0.0113	-0.0123
	(0.0998)	(0.0995)	(0.0921)	(0.0884)
Inspector	0.228*	0.166^	0.171*	0.171*
	(0.0948)	(0.0911)	(0.0853)	(0.0857)
Other Police	0.0212	0.0309	0.00368	0.00361
	(0.0564)	(0.0551)	(0.0543)	(0.0543)
Military	0.0679	0.0118	-0.0894	-0.0870
	(0.0632)	(0.0576)	(0.0551)	(0.0554)
Constant	11.65***	9.838***	5.658***	5.441***
	(0.0524)	(0.270)	(0.324)	(0.334)
N	4098	4092	3642	3613
adj. R^2	0.108	0.200	0.402	0.400

Standard errors are in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 6.1: Basic Social Index

	(All) LOG_INC	(Urban) LOG_INC	(Rural) LOG_INC
BASIC INDEX	0.0362***	0.0419***	0.0278**
	(0.00678)	(0.00863)	(0.00935)
Constant	5.797***	6.397***	5.446***
	(0.274)	(0.354)	(0.324)
N	7352	3739	3613
adj. R^2	0.445	0.385	0.397

Standard errors are in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 6. 2: Basic Index and Urban Subgroups

	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUSLIM) LOG_INC
BASIC INDEX	0.0575***	0.0481**	-0.00936	0.0356^
	(0.0115)	(0.0156)	(0.0225)	(0.0189)

Constant	4.653*** (0.733)	7.030*** (0.658)	5.500*** (0.926)	5.968*** (0.787)
N	1172	1161	524	735
adj. R^2	0.357	0.379	0.342	0.363

Standard errors are in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 6.3: Basic Index and Rural Subgroups

	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUSLIM) LOG_INC
BASIC INDEX	0.0236 (0.0181)	0.0505** (0.0154)	0.0228 (0.0226)	-0.0126 (0.0310)
Constant	5.676*** (0.966)	5.572*** (0.434)	3.438*** (0.949)	6.634*** (0.754)
N	739	1546	779	455
adj. R^2	0.352	0.412	0.414	0.346

Standard errors are in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 7.1: Urban Basic Index and FII

	(ALL) LOG_INC	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUSLIM) LOG_INC
BASIC INDEX	0.0497* (0.0223)	0.0910* (0.0392)	0.0694^ (0.0414)	0.107^ (0.0569)	-0.0341 (0.0501)
FII	-0.410 (0.391)	-0.228 (0.658)	-0.572 (0.608)	1.139 (0.754)	-0.811 (0.681)
FII*BASIND	0.00271 (0.0718)	-0.0744 (0.124)	-0.0414 (0.148)	-0.364^ (0.186)	0.232 (0.148)
Constant	6.279*** (0.383)	5.666*** (0.832)	6.576*** (0.569)	4.199*** (0.908)	6.744*** (0.680)
N	3562	1122	1113	478	710
adj. R^2	0.373	0.331	0.368	0.351	0.355

Standard errors are in parentheses and clustered at the district level. Specification 4 is used.
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 7.2: Urban Basic Index and CFII

	(ALL) LOG_INC	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUSLIM) LOG_INC
BASIC INDEX	0.0501** (0.0150)	0.0937*** (0.0248)	0.0537^ (0.0302)	0.0807^ (0.0410)	-0.00483 (0.0328)
CFII	-0.551 (0.415)	-0.420 (0.691)	-0.638 (0.652)	0.772 (0.866)	-0.806 (0.676)
CFII*BASIND	0.00378 (0.0710)	-0.138 (0.114)	0.0173 (0.179)	-0.461* (0.210)	0.213 (0.134)

Constant	6.243*** (0.379)	5.674*** (0.794)	6.491*** (0.565)	4.470*** (0.887)	6.613*** (0.674)
N	3562	1122	1113	478	710
adj. R2	0.374	0.333	0.368	0.351	0.355

Standard errors are in parentheses and clustered at the district level. Specification 4 is used.
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 8: Rural Politicians and CFII

	(ALL) LOG_INC	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUSLIM) LOG_INC
Elected Politician	0.561*** (0.153)	0.343 (0.312)	0.367 (0.291)	0.237 (0.312)	1.027* (0.408)
CFII	0.410 (0.316)	0.679 (0.460)	-0.0349 (0.414)	1.158 (0.936)	1.331^ (0.791)
CFII*Polit.	-1.777* (0.820)	0.351 (1.721)	-0.685 (1.458)	-0.640 (1.322)	-4.065 (2.925)
Constant	5.529*** (0.348)	5.470*** (1.082)	5.567*** (0.489)	3.442*** (0.965)	5.597*** (0.820)
N	3586	733	1536	768	455
adj. R^2	0.391	0.356	0.394	0.402	0.330

Standard errors are in parentheses and clustered at the district level. Specification 4 is used.
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 9: Rural Politicians and the CRISIL Index

	(ALL) LOG_INC	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUSLIM) LOG_INC
Elected Politician	0.550** (0.190)	0.848* (0.343)	0.332 (0.338)	0.0672 (0.517)	-0.663 (0.751)
CRISIL	-0.287 (0.255)	0.302 (0.445)	-0.108 (0.380)	-0.149 (0.489)	-0.790 (0.555)
CRI*Polit.	-0.682 (0.436)	-1.231 (0.945)	-0.144 (0.702)	0.199 (1.055)	3.589^ (2.067)
Constant	5.529*** (0.348)	5.470*** (1.082)	5.567*** (0.489)	3.442*** (0.965)	5.597*** (0.820)
N	3613	739	1546	779	455
adj. R^2	0.401	0.361	0.413	0.423	0.374

Standard errors are in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 10: Savings Proxy with the Basic Index in the Urban Setting

	(ALL) LOG_INC	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUSLIM) LOG_INC
BASIC INDEX	0.0804** (0.0264)	0.153*** (0.0340)	0.0560 (0.0409)	-0.169* (0.0837)	0.0667 (0.0651)

SAVINGS	0.275^	0.776***	0.215	-0.398	0.107
	(0.155)	(0.221)	(0.232)	(0.289)	(0.363)
SAV*BASIND	-0.0635	-0.153**	-0.0105	0.231*	-0.0518
	(0.0399)	(0.0488)	(0.0637)	(0.112)	(0.108)
Constant	6.238***	5.309***	6.882***	5.750***	6.196***
	(0.381)	(0.650)	(0.561)	(0.947)	(0.886)
N	3732	1168	1158	524	735
adj. R^2	0.388	0.368	0.381	0.348	0.361

Standard errors are in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 11: Savings Proxy with Political Party Official in the Urban Setting

	(ALL) LOG_INC	(BFC) LOG_INC	(OBC) LOG_INC	(SCST) LOG_INC	(MUSLIM) LOG_INC
Political Party Off.	0.472**	0.429	0.511	0.0332	0.705^
	(0.176)	(0.276)	(0.321)	(0.442)	(0.373)
SAVINGS	0.222^	0.405^	0.222	-0.0477	0.211
	(0.133)	(0.217)	(0.193)	(0.270)	(0.278)
SAV*PPO	-0.480^	-0.549	-0.609	0.209	-0.788
	(0.282)	(0.363)	(0.525)	(0.675)	(0.591)
Constant	6.238***	5.805***	7.019***	5.451***	5.901***
	(0.373)	(0.727)	(0.557)	(0.947)	(0.839)
N	3732	1168	1158	524	735
adj. R^2	0.392	0.368	0.382	0.351	0.371

Standard errors are in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 12: Outer Ties Placebo Test

	(All) LOG_INC	(Urban) LOG_INC	(Rural) LOG_INC
Doctor Ties OUTER	0.00250	0.0499	-0.0420
	(0.0288)	(0.0370)	(0.0441)
Other Health Prof. Ties OUTER	0.0476^	0.0145	0.0957*
	(0.0285)	(0.0388)	(0.0416)
Teachers/ Principal Ties OUTER	-0.00668	-0.0114	0.00585
	(0.0281)	(0.0417)	(0.0391)
Other School Worker Ties OUTER	0.0238	0.0141	0.0348
	(0.0307)	(0.0450)	(0.0414)
Government Officer Ties OUTER	0.0530	0.0866^	-0.00668
	(0.0411)	(0.0503)	(0.0662)
Other Govt. Ties. OUTER	-0.0448	-0.0803	0.00560
	(0.0385)	(0.0537)	(0.0507)

Politician Ties OUTER	0.0517 (0.0386)	0.0371 (0.0510)	0.0645 (0.0543)
Political Party Officer Ties OUTER	0.0704^ (0.0368)	0.0811^ (0.0460)	0.0375 (0.0600)
Inspector Ties OUTER	0.0912^ (0.0491)	0.0542 (0.0686)	0.114 (0.0710)
Other Police Ties OUTER	0.0658^ (0.0342)	0.0565 (0.0457)	0.0917^ (0.0539)
Military Ties OUTER	-0.0319 (0.0406)	0.0443 (0.0559)	-0.114^ (0.0604)
Constant	5.747*** (0.285)	6.419*** (0.352)	5.784*** (0.335)
N	7332	3728	3604
adj. R^2	0.445	0.382	0.401

Standard errors in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 13: Past Income Test for Social Ties

	(All) LOG_INC2	(Urban) LOG_INC2	(Rural) LOG_INC2
Doctor Ties	0.110* (0.0453)	0.0951^ (0.0516)	0.126 (0.0803)
Other Health Prof. Ties	-0.0379 (0.0525)	-0.00362 (0.0578)	-0.119 (0.0929)
Teachers/ Principal Ties	0.0540 (0.0431)	0.0616 (0.0547)	0.0373 (0.0668)
Other School Worker Ties	0.0435 (0.0433)	0.0317 (0.0555)	0.0843 (0.0713)
Officer Ties	-0.0163 (0.0601)	-0.0224 (0.0699)	-0.0207 (0.122)
Other Govt. Ties.	0.0145 (0.0566)	0.0265 (0.0691)	-0.0349 (0.0953)
Politician Ties	0.0220 (0.0670)	0.0380 (0.0801)	-0.00893 (0.116)
Political Party Officer Ties	0.0134 (0.0696)	0.00449 (0.0829)	0.00370 (0.122)
Inspector Ties	0.0724 (0.0693)	0.0144 (0.0715)	0.184 (0.143)
Other Police Ties	-0.0650 (0.0523)	-0.0171 (0.0656)	-0.108 (0.0793)
Military Ties	-0.0536 (0.0571)	-0.114^ (0.0646)	0.0382 (0.0917)
Constant	7.849*** (0.349)	7.670*** (0.390)	7.380*** (0.398)

N	3731	2086	1645
adj. R^2	0.362	0.286	0.263

Standard errors in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 14: Basic Index and Past Income

	(All) LOG_INC2	(Urban) LOG_INC2	(Rural) LOG_INC2
BASIC INDEX	0.0178*	0.0175^	0.0170
	(0.00821)	(0.00923)	(0.0136)
Constant	7.819***	7.623***	7.384***
	(0.352)	(0.389)	(0.397)
N	3731	2086	1645
adj. R^2	0.362	0.286	0.263

Standard errors in parentheses and clustered at the district level
^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 15: Instrumenting Basic Index with All Proportions (Specification 4)

1ST STAGE	(Normal) BASIC INDEX	(Cluster) BASIC INDEX	2ND STAGE	(OLS) LOG_ INC	(Normal) LOG_ INC	(Cluster) LOG_ INC
BASIC INDEX	-	-		0.0415***	0.190***	0.190**
				(0.00669)	(0.0418)	(0.0719)
BFC Proportion	0.857***	0.857^		-	-	-
	(0.237)	(0.500)				
OBC Proportion	-0.591*	-0.591		-	-	-
	(0.234)	(0.448)				
SCST Proportion	-0.526*	-0.526		-	-	-
	(0.250)	(0.484)				
Muslim Proportion	1.140***	1.140*		-	-	-
	(0.241)	(0.511)				
Constant	-0.330	-0.330		5.814***	5.860***	5.860***
	(0.415)	(0.512)		(0.243)	(0.177)	(0.254)
N	7352	7352	N	7352	7352	7352
adj. R^2	0.209	0.209	adj. R^2	0.435	0.372	0.372
			Under		126.044	19.022
					(0.0000)	(0.0008)
			Weak/F		31.882	6.253
			Over		13.976	4.113
					(0.0029)	(0.2495)

Standard errors in parentheses: ^ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001
P-values in parentheses for identification tests. Columns with Cluster have clustered standard errors by district.

Authors

KAT GALLANT

ECONOMICS

Kat Gallant graduated from the University of British Columbia in 2018 with a major in Economics, and is currently pursuing her Master's of Public Policy at Simon Fraser University. Strongly influenced by feminist economics, she incorporates intersectional feminist theory into her work to evaluate the relationships between public policy and minority groups' and women's socioeconomic outcomes. Her particular interest in this area of research was reinforced by UBC economics professor Dr. Marina Adshade, who Kat had the pleasure of learning from throughout her degree. In the future, Kat hopes to work in the field of social policy and is particularly interested in sustainable community development.

JACK JEFFERSON

ECONOMICS

Jack recently joined a venture capital firm and works closely with entrepreneurs building the next generation of enterprise companies. Prior to this, he worked in strategy consulting where he advised clients on delivering transformations at scale across core customer experiences, including sales, service, and credit. He holds a B.A. in Economics from The University of British Columbia, where he was a Trek Scholar. At UBC, he served as the Editor-in-Chief of the Journal of Political Science, Managing Director of the Strategy Consulting Initiative and Director of the UBC Pacific Venture Capital Conference. Jack originally grew up in Uganda, Africa and spends his free time voraciously reading and being outdoors as much as he can.

PETER KI

ECONOMICS

Peter Ki is a current MA in International Affairs student at Carleton University where his field is focused on International Development Policy. He graduated in 2018 from the University of British Columbia with a BA in Honours Economics and International Relations. With interests in development and business, Peter has explored how entrepreneurship can be an asset for developing countries. For his future endeavors, Peter will pursue co-op work with the government on cost estimation and he intends to graduate for the 2020 year.

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INTERNATIONAL ECONOMMICS

Sarah is a 2019 graduate of the Bachelor's of International Economics program. She is interested in development economics and how econometric research can be impactfully applied to meaningful policy. She has worked for a community development organization in rural BC, as a data scientist for the Social Good Fellowship with the City of Surrey, and most recently in policy development with TransLink.

MICHELLE ZAPIOLA

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Michelle Zapiola is a fourth year student at the University of British Columbia. Next spring, Michelle will receive her B.A. in Economics and International Relations. Her time at UBC has greatly expanded her focus on sustainable development. Michelle currently sits on two non-profit boards, Mount Pleasant Family Centre Society and Village Vancouver Transition Society, organizations which centre on family and community development.

IONA Team

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Mina is a fourth year student pursuing a major in economics and minor in commerce. Mina's aim with IONA is to provide a platform for the incredible work and voices of economics students at UBC, both through the print journal and the Exchange series. Particularly interested in how corporate social responsibility can play a larger role in sustainable economic development, Mina would like to work in the fashion industry upon graduation and support efforts for economic development as a lifelong project.

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Kavya is a fourth year student pursuing a major in Economics and a minor in Sociology. Her primary interest is in welfare economics and understanding how different players in the economy benefit from various government policies. She plans on pursuing a graduate degree in Economics or Business Administration after graduation.

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MinJu is in her last year of pursuing a Bachelor of International Economics degree. She is particularly interested in international trade and developmental economics. Through her work with the journal, she hopes to expand her knowledge of empirical economic research in various aspects of international economics. Upon graduation, she hopes to start a career in Logistics/ Supply Chain and Operations.

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Maham is a 4th year International Relations student, pursuing a minor in Economics as well. She is an international student from Pakistan. Maham intends to work in international development or policymaking fields until pursuing graduate school in a similar field. She is passionate about research and writing and wants to bring ease in academic content for it to be accessible for everyone.

CHRISTINE WU

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Christine is a fourth year student pursuing a major in Economics. She became interested in economics during high school, after a service trip to rural India exposed intra-country inequalities. Her primary interests are in econometrics and microeconomics. After graduation, she plans to work for a few years before pursuing a graduate degree.

SENIOR EDITORS

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Mikhael is a fourth-year student pursuing a combined major in Economics and Mathematics. He hails from Washington, D.C., where he witnessed inequality and other social issues first-hand. Mikhael sees economics as a mode of thought which can be used to understand and correct the world's patterns and problems. Some specific areas of interest include inequality, automation, and unemployment. After graduating, Mikhael hopes to pursue graduate studies and travel the world.

RAGINI JAIN

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Ragini is a third year Bachelor of International Economics student who is passionate about development economics, specifically the links between women and development, and development in her native country, India. After graduation, she plans to follow this interest by pursuing a Masters in Economics.

LIAM ROBERTSON

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Liam is a fourth year International Economics student from Calgary, Alberta. He is interested in all things related to international trade, and is particularly fascinated by international taxation practices and regulations. Liam intends to attend law school after graduation, and is working toward a career in emerging markets.

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Erin is a fourth year student with a major in Political Science and a minor in Economics student. She is primarily interested in the topics of international political economy, environmental economics and international trade policy. Upon completion of her undergraduate degree, she aspires to go to graduate school for International Affairs with a specialization in Economic Policy.

JUNIOR EDITORS

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Hana is a fourth year economics student minoring in urban studies. She is deeply interested in urban and real estate economics, and hopes to work toward building more sustainable and equitable cities. Hana has a background in journalism and media studies, and believes strongly in the importance of great storytelling.

JACEK KNUDSON

Bachelor of International Economics

Jacek Knudson is a third year Bachelor of International Economics student, with a planned minor in Political Science. He is most passionate about public policy, but is also interested in commerce and finance. After graduation, Jacek hopes to continue his education by going to law school.

CHAE RIN YANG

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Chae is in her third year pursuing a major in International Relations with a minor in economics. She is particularly interested in the macroeconomics in international finance, particularly in offshore project financing. After graduation, Chae wishes to pursue an MA in financial regulation.

FELIPE GROSSO

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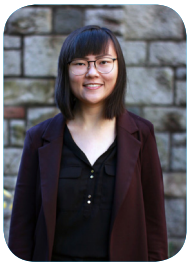
Felipe is a second year student pursuing a combined major in Economics and Philosophy with a minor in Math. He is most passionate about the link between economics and education. Specifically, he wants to explore new ways of thinking about educational systems to decrease educational inequality in his home in Puerto Rico. After graduation, Felipe plans to pursue a Phd in Econ to develop the skills to research this relationship further. In his free time, Felipe likes spending time with friends and reading The Economist.

RACHEL LEE

Bachelor of International Economics



Rachel is a first year Bachelor of International Economics student who is passionate about financial economics. One area of interest for her is exploring the balance a society must have between economic equity and efficiency. She joined the IONA Journal of Economics to combine her writing and editing skills with her career endeavours, and to discover the multi-faceted field of economics.

YUKI KINOSHITA

Bachelor of International Economics

Yuki is a first year international economics student from Washington D.C.. He is intrigued by the fields of environmental and behavioral economics and is keen on understanding the balance between the private and public sector in achieving economic success. He hopes to expand his horizons by pursuing an MBA or a career in a foreign country.

JUNIOR EDITORS

THEA UDWADIA

Bachelor of Arts - Double Major in Economics and International Relations

Thea is a third year student studying Economics and International Relations. She is particularly interested in developmental economics and global economic history. She loves writing and research, and upon graduating hopes to incorporate this into her career in journalism or law.

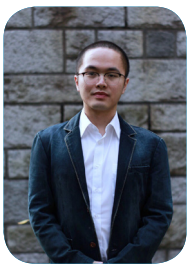
IA MANTECÓN GARCÍA

Bachelor of Arts - Major in Economics and Minor in Political Science

Ia is a third year student pursuing a major in Economics and a minor in Political Science. Growing up in Mexico, Ia witnessed firsthand the social consequences of institutional weakness and the shortcomings of weak institutions in bringing about economic development. The feedback loop between political and economic institutions is, in part, what inspired her undergraduate choices. Ia is especially interested in developmental economics, international trade and Latin American politics.

AIBO WANG

Bachelor of Arts - Combined Major in Economics and Mathematics



Aibo (John) Wang is a third-year combined major in mathematics and economics student. His primary interest is in microeconomics and game theory. He is also passionate about how economic ideas affects individuals' decision-making in everyday life. After graduation, he is planning on obtaining a graduate degree which is related to either economics or mathematics.

ISHA TRIVEDI

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Isha is a first year Bachelor of International Economics student from Southern California. She is primarily interested in corporate development, political and behavioral economics, and urban design. With experience in hospitality management and the nonprofit sector, she is keen to keep learning about various industries. After completing her degree, she plans to work, travel, pursue graduate studies, and continue advocating for the Oxford comma.

AKASH SATPUTE

Bachelor of International Economics

Akash is a first year Bachelor of International Economics student, who is ardent about International trade and behavioral economics. Growing up in 4 different countries, he experienced a stark contrast between the standard of living of a developing country and developed country first hand. This ignited his interest in economics, which has now evolved into a desire to explore the interaction between developmental economics and international trade. Akash is also passionate about entrepreneurship and plans to pursue a start-up after graduating.

MANIKA MARWAH

Bachelor of International Economics

Manika is a third year International Student from New Delhi India. She is interested in gaining exposure to all fields of Economics, with a particular affinity for labour and behavioural Economics. After graduation, she plans to work a few years in the finance sector, before pursuing a masters in Business Administration.

SARA CORTES

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Sara is in her fourth year of economics with a minor in international relations. She is particularly interested in the application of economics in the fields of marketing and technology. Sara joined this journal because of her commitment to giving those who are interested in economic research a low barrier means to publish their hard work. After graduation she intends to pursue her passion in global marketing and communications.

SHARON HUI

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Sharon is a fourth year student pursuing a major in Economics and minor in Commerce. With deep interest in welfare economics, Sharon is interested in learning how government policies impact individuals and the economy. Upon graduation, Sharon hopes to work in the banking industry.

CHRISTIAN WONG

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Christian is a fourth year undergraduate student pursuing an Economics major and Commerce minor. Whilst passionate about economic development and policy making in his home country Peru, Christian seeks to contribute with economic and decision-making analysis in the private sector after graduation.

ANJAY SEABROOK

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Anjay is a third year student pursuing a major in Political Sciences and a minor in Economics. His primary interest is the intersection between politics and economics and how the two disciplines come together to shape the world we live in. After graduation from UBC he hopes to pursue a law degree abroad.

ODMAA BAYARTSOGT

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Odmaa Bayartsogt is a 2nd year BIE student.
What she loves most about studying for Econ is that it has taught her to view world issues differently than before. In her spare time she enjoys reading about economic history as well as interesting theories about the future.

ANNA GIULIA MURGIA

Bachelor of Arts - Major in Honours Economics

Anna Giulia is a third year economics student and she developed a keen interest in international economics after having lived in the UK, France and Italy. Now that she is at UBC she wants to further study environmental economics to better understand its implications for sustainable development. After graduation, she plans on pursuing a graduate degree in economics.