

The Massachusetts
Undergraduate Journal of Economics

Undergraduate Economics Club
The University of Massachusetts Amherst

Volume 3
Fall 2015

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Preface

A Note from the Editorial Board

The Editorial Board of this year's edition of the Massachusetts Undergraduate Journal of Economics was comprised of Andre Gellerman, Andrew Furman, Parham Yousef Gorji, Marton Gal, and Dakota Firenze. The five of us would firstly like to thank all of the students from colleges and universities across Massachusetts for their time and effort in submitting great papers that varied in both scope and content. Given the quality of the papers submitted, attempting to choose from them proved to be a difficult task. Each paper that made it into the journal was ultimately chosen through a vote of collective support by the Editorial Board members. Once chosen, each paper was paired off with an Editor, who worked with the respective author to hone his or her paper to be ready for publishing. This year, we are publishing four unique and timely papers that demonstrate the depth and breadth of the economics discipline.

Our continued hope for MUJE is to carve a place for students

to meaningfully express their unique ideas through a medium created specifically for undergraduates, and to work with future editors to create the most academically rigorous journal possible.

We would also like to especially thank our Submissions Liaison Aaron Goslee, the UMass Economics Department, as well as recent and past alumni for their continued support.

Best regards,
Dakota Firenze, on behalf of the Editorial Board,
Massachusetts Undergraduate Journal of Economics 2014-15

A Note From the Submissions Liaison

Leonardo da Vinci wrote, “Fire destroys all sophistry, that is deceit; and maintains truth alone, that is gold.” I am pleased to join the editorial board in presenting these four papers, whose authors take out their tongs and put our most precious good, thought, through the fire. Exhibited here are a group of people who have spent considerable time in the pursuit of knowledge, who hold onto the belief that we can advance our understanding of the phenomena we experience and reach new conclusions that melt clouds and bring us to better summits. With exponentially growing vectors of distraction dinging about our periphery and an onslaught of proclaimed authorities with powerful backers and a knack for free associating important ideas populating an increasing number of sources, honing scientific methodology and cautiously applying these methods to a central hypothesis in the pursuit of truth is the ultimate act of faith.

With gratitude,
Aaron W. Goslee,
Submissions Liaison
and Head of Publication Working Group,
2014-2015

Chapter 1

**The Past, Present, and Future of Sanitation:
Where and Why We Should Give a Sh*t**
Jessica Kaliski, Amherst College ¹

1. Introduction

1a. No Toilet, No Bride

You consult astrologers about rahu-ketu (the alignment of sun and moon) before getting married. You should also look whether there is a toilet in your groom's home before you decide. Don't get married in a house where there is no toilet (Malm, 2012).

–Minister for Rural Development, Jaairam Ramesh

In 2005, local authorities established a massive media cam-

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paigned to encourage the construction of toilets and to broadcast the importance of respecting the right of women to use latrines in privacy and security in Haryana, India. The campaign used radios, banners, and other advertising channels to disperse information, using phrases, such as, “no toilet, no bride” and “no loo, no I do,” to target families of marriage-age girls to demand that potential suitors’ families construct a latrine prior to marriage. The strikingly competitive marriage market in the Punjab region – with an average of 87 women for every 100 males (Stopnitzky, 2012) – made women scarce commodities and forced men to distinguish themselves amongst the competitive field. The campaign’s innovative approach effectively changed the cultural and social taboo associated with toilets, and with sanitation more broadly. Toilets became instrumental to the marriage market, and thus prompted a value of and demand for toilets amongst the families of marriage-age boys: “I will have to work hard to afford a toilet. We won’t get any bride if we don’t have one now. I won’t be offended when the woman I like asks for a toilet.” (Stopnitzky, 2012).

The “No Toilet, No Bride” campaign represents an exemplary model for the future of sanitation reforms. This campaign was marked by the strong presence and influence of local authorities, who effectively created a value of and demand for toilet construction and usage among residents in Haryana, India. The design did not simply provide toilets, but changed the community’s perception of toilets – from unnecessary to essential, and from a social taboo to a social norm.

Sanitation is a worldwide problem, and one with sometimes awkward and highly charged topics and words – from “public

defecation” to “feces” – that invoke political, cultural, religious, social, and economic issues. Solutions to ameliorate sanitary problems must be found through a holistic approach of the “politics of shit,” which examines the environmental, social, political, and historical dimensions of toilets. In addition, an approach must address how a community’s society and culture intersects with the institutions responsible for providing sanitation amenities or who might have contributed to, or exacerbated, the current sanitation crisis. This paper seeks to understand the interaction between supply and demand for toilets and ultimately forecast the way in which sanitation reforms should proceed in the future. Demand for toilet construction and usage falls within the realm of the user: individuals must decrease the value of “unsanitary” ways of defecation, and subsequently increase the value of and demand for toilets. Supply for toilet construction falls within the hands of institutions – public and private organizations – or within the hands of individuals. Following a holistic framework, I argue that the solution must include not only the construction of toilets, but also the reconstruction of behavioral and cultural norms. Communities must see both the individual and collective value of toilet construction and usage; and nationally, political regimes must reorient their goals to focus less on quantitative and short-term solutions, which solely address the physical installation of toilets, and more on sustainable solutions, which incorporate educational components to ensure long-term behavioral change and continual usage of the toilets.

Part 1 looks at the sanitation issue as a whole, to better understand the inter- and intra-country inequalities of poor sani-

tation amenities, as well as the interaction between public defecation and the environment on the quality of sanitation. Part 2 analyzes the role of demand in sanitation reforms. Taking an economic model of human behavior approach, I use Pattanayak et al.'s (2007) model of toilet adoption to obtain an individual's demand for toilet construction through utility maximization. This demand model will help illuminate ways in which demand for toilet construction and usage can be increased, paying heed to the interactions of culture, religion, and history, among others in toilet adoption. After an understanding of the demand side, Part 3 focuses on supply, and investigates the political and social limitations and constraints that can impede toilet adoption. Finally, Part 4 looks at past health reforms after wide-scale health epidemics to provide insights for future implementation of effective sanitation reforms.

1b. Sanitation: A Global Issue

The [Millennium Development Goals] MDGs were never meant to be a one-way street – something that rich countries do for the poor. Quite the contrary: our long-standing work for development in general has always been based on global solidarity – on a shared interest – on a powerful sense of community and linked fates in an interconnected world (United Nations).

–Secretary-General Ban Ki-moon, in his closing remarks to the MDG Summit, September 22, 2010

In September 2000, members of the United Nations (UN) adopted the United Nations Millennium Declaration. Through the Declaration, committed members agreed to a number of time-bound targets and goals – designed to ameliorate poverty, hunger, and disease, with a deadline of 2015. These goals have collectively been termed the Millennium Development Goals (MDGs). Beyond financial and physical support, the MDGs call for a collective, “global partnership,” to “help give voice to the hopes, aspirations, and vital needs of the world’s poorest and most voiceless people” (Sachs, 2005).

One of the goals (#7) of the MDGs is to ensure environmental sustainability. Target 7.C intends to “halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation,” with basic sanitation defined as “the proportion of population using an improved sanitation facility” (UNICEF, 2014a). Poor sanitation and the practice of public defecation can have a series of environmental, health, and economic ramifications on affected communities. The combination of poor sanitation, water, and hygiene leads to about 700,000 premature deaths annually, as well as the loss of approximately 443 million school days as a result of subsequent diseases (The World Bank, 2014). Missed school days can have long-term impacts on future economic productivity of both individuals and society collectively. In fact, economic losses from lack of access to sanitation or increased health system costs are estimated at US\$260 billion annually (The World Bank, 2013). Beyond a physical health concern, public defecation opens the door to sexual harassment and violence when women are forced to utilize open areas (The World Bank, 2014), and hence acts

as an inconvenience, threatens privacy, and increases embarrassment, among other discomforts (Mara et al., 2010). Since 51% of the world population did not have access to an improved sanitation facility in 1991, in order to meet the 2015 target, this proportion must be reduced to 25% by 2015 (World Health Organization & UNICEF, 2014). Although 1.9 billion people gained access to a latrine or other improved sanitation facility between 1990 and 2011 (WHO & UNICEF, 2014), if current trends persist, the MDG sanitation target will fall short by over half a billion people (WHO & UNICEF, 2014).

“Lack of improved sanitation,” according to The World Bank, includes defecation in the open – in a bush, field, or forest – or the use of a pit latrine without a slab, bucket toilets, hanging toilets/latrines, or toilets that “flush” untreated waste into the environment (The World Bank Group). “Proper sanitation,” therefore could consist of the use of a range of toilets: pit latrines with a slab, ecological toilets, or water-flush and pour-flush toilets. For the remainder of this paper, “toilets” will be used to refer to this broad range of “proper sanitation” equipment.

Although one billion people are without access to sanitation facilities, this subset of individuals is not evenly dispersed globally. Rather, it is a “rural and poverty-related phenomenon,” and is particularly concentrated in Southern Asia and sub-Saharan Africa (WHO & UNICEF, 2014). Among other reasons, these particular countries may face higher population concentrations, which put a strain on the availability and maintenance of public sanitation facilities, or contain a larger segment of poor individuals who are unable to afford proper sanitation amenities. In addition to inter-country variation, there is also intra-country

variation, with large disparities between rich and poor populations, as well as urban and rural populations. In many instances, the wealthiest 20% receive coverage before the poorest 20%, increasing the wealth gap to access (WHO & UNICEF, 2014). The urban-rural divide is also striking: 70% (902 million people) of those without access to an improved sanitation facility reside in rural areas (WHO & UNICEF, 2014). Although the poor-rich and urban-rural divides invoke the most significant disparities, inequalities also exist among gender, ethnicity, language, education, and religion.

1c. Public Defecation, the Environment, and Sanitation

The combination of poor sanitation facilities and open defecation is a concern for both environmental and human health. Edwin Chadwick first made the link between lack of sanitation and disease in the mid-19th century. Through examination of the poor living conditions, disease, and life expectancy of English and Welsh residents, and using statistics from the General Registration (Chadwick, 1842), Chadwick concluded,

The defective town cleansing fosters habits of the most abject degradation and tends to the demoralization of large numbers of human beings, who subsist by means of what they find amidst the noxious filth accumulated in neglected streets and bye-places (Chadwick, 1843).

Attributing disease to uncleanliness, Chadwick advocated for cleaning, draining, and ventilating as means to improve health. John Snow built upon Chadwick's claim by discovering the link between uncleanliness and human health. Snow, using the Broad Street Pump incident as an example, showed how sewage – specifically, a baby's diaper polluted with cholera – from a nearby cesspit contaminated the county's water source and thus infected anyone who drank the water from the pump (Summers, 1989). Water was identified as the source of transmission, exemplifying the effects of poor sanitation on human health via water-borne diseases.

Similar to the diaper that contaminated the water source in London, human excreta from public defecation can also generate environmental and human health concerns. One gram of fresh feces from an infected person can contain up to 10^6 viral pathogens, 10^6 - 10^8 bacterial pathogens, 10^4 protozoan cysts or oocysts, and 10 - 10^4 helminth eggs (Mara et al., 2010). Public defecation in open fields can lead to human contact with excreta via various water routes: contamination of fingers, field crops, food, flies, etc. (Cairncross & Valdmanis, 2006). This environmental-health link helps explain the environmental, health, and economic ramifications on affected communities noted above. Moreover, the World Health Organization reports about 600 million episodes of diarrhea and 400,000 childhood deaths a year due to contaminated water and lack of sanitation, with an estimated 80% of all diseases and one-third of all deaths in developing countries induced by consumption of contaminated water (Rajgire, 2013).

A relevant example is a study by Rajgire (2013) who looked

at the effect of open defecation practices on the chemical and bacteriological quality of water in open-defecation-free (ODF) and open-defecation-not-free (ODNF) villages in the Amravati District of India. In these villages, individuals used water from various sources, including open well, tube well, hand pump, and water supplied by Gram Panchayat (GP)² for drinking and domestic use. Using data from 138 villages, Rajgire's (2013) results show that feces contaminated 17% of the water samples from ODF villages, and 48% of the samples from ODNF villages. Using antibiotic resistance analysis, both the ODF and ODNF villages' water samples were shown to have a poor water quality index, and to contain thermotolerant coliform (TTC) and *E. coli* bacteria, both of which are indicators of fecal pollution (Rajgire, 2013). The presence of TTC and *E. coli*, as well as the results of other antibiotic resistance tests, provided evidence that open defecation was the source of pollution, as opposed to other potential channels, such as sewage and domestic waste.

Poor health due to inadequate sanitation is a byproduct of a complex human-environment cycle: public defecation in open fields enters and contaminates water sources, these polluted water sources interact with crops, food, flies, etc., and eventually transfer their contaminants to humans. This cycle can be broken through installation of adequate sanitation measures, such as latrines or toilets. However, construction is not enough; there must both be a demand for such facilities and the presence of a proper supply, so that the toilets that are installed are actually

²A GP is similar to a village council, and is the first unit in India's three-tier governmental system (the GP at the village level, the Tahsil at the block level, and the Zilla Panchayat at the district level).

used and continually maintained.

2. The Demand for Toilets

2a. Framework: A Theoretical Demand for Toilets

Jawaharlal Nehru (1889-1964), India's first prime minister, remarked, "The day every one of us gets a toilet to use, I shall know that our country has reached the pinnacle of progress" (Aswathy, 2014). Yet the presence of a toilet in of itself is not enough to ameliorate India's poor sanitation: the value of a toilet must be realized and appreciated so that when a toilet is constructed, it is actually used. Demand for toilets is reliant upon the value individuals place on toilets. To increase this value requires an understanding of the individual and the society – how sanitation is understood historically, culturally, and socially. It requires an awareness of what mechanisms can be implemented to decrease value for alternative forms of defecation, add value to sanitation and toilets, and thus increase the individual demand for toilet construction and usage.

To better understand what factors increase the construction and usage of toilets, I will take an economic approach by conceptualizing a theoretical demand for toilets. This framework will help elucidate the various factors that encourage toilet adoption and act as constraints, and therefore will shed light on how sanitation reforms can be reconstructed to emphasize the factors which encourage toilet usage and to help eliminate the con-

straining ones. I use the model of demand for toilets proposed by Pattanayak et al. (2007); however, I have renamed certain variables in Pattanayak et al.'s (2007) model for clarification by incorporating elements of Zivin and Neidell's (2013) health capital model.

Demand for toilets cannot be conceptualized in the exact same structure as other goods and services, which typically display diminishing marginal productivity: the first units generally have a significantly greater impact than the last few units. In contrast, in a community where the vast majority of individuals defecate publicly, an individual who constructs and uses a toilet will not experience a drastic increase in his/her health. Because public defecation impacts health via water, the individual that constructs and uses a toilet in the high-density public defecation community will still experience poor health through contaminated water, or by flies that transmit fecal matter to food and drinking water sources via his/her neighbor's public defecation practices (Pattanayak et al., 2007). Theoretically, there must be some threshold level at which the percentage of community members using toilets has a substantial effect on health. Once this threshold is reached and bypassed, all individuals – whether or not one owns and uses a toilet – will experience health improvements, with improvements continuously increasing in the number of adopters. Shuval et al. (1981) propose such a theory: in comparison to the straight-line relationship – each incremental sanitation improvement creates the same improvement in health status – or the hyperbolic relationship – each sanitation improvement increases health status at a diminishing rate – Shuval et al. (1981) propose the “S” curve for the

threshold-saturation theory – sanitation improvements have a drastic effect on health after a certain threshold, with health improvements negligible below the threshold and increasing at a diminishing rate above the threshold. Thus, the health of an individual depends upon the construction and usage of sanitation facilities by the entire community. In fact, Geruso and Spears (2014) in their study, “Sanitation and Health Externalities: Resolving the Muslim Mortality Paradox,” show that it is latrine use by neighbors, rather than the household’s own use of latrines, that is associated with the largest mortality gradient. Consequently, when deciding whether or not to construct and use a toilet, an (rational) individual will also consider the decisions of, or social pressure to install from others, such as the number of sanitation facilities already in use in the community, or the communal pressures from others to also install a facility.

The transition away from public defecation and towards the usage of latrines or toilets produces value through a series of physical and mental health benefits. It is these all-inclusive health benefits that subsequently increase individual value, utility, and happiness. Jenkins and Curtis (2005) use qualitative data from interviews with 40 heads of households in rural Benin to help elucidate these motives and reasons for latrine adoption. Their analysis reveals 11 distinct reasons for latrine adoption, which they divide into three categories: prestige-related, well-being, and situational. Broadly, I will classify these three categories as health benefits, using the World Health Organization’s loose definition of health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (World Health Organization, 2003).

According to the economic model of human behavior, an individual has a limited amount of time and resources, and within these constraints, an individual must determine his/her bundle of goods and services by making trade-offs between various goods and services. Assuming individuals take actions to maximize happiness (or utility), an individual will choose, and have a higher demand for, one particular good or service over another based on which one provides him/her with the most value. In order for there to be a demand for toilets, individuals must not only have a value for toilets, but also a relative preference to pay and use toilets in comparison to other means of defecating and to other ways in which that money could have been spent.

In a typical health model, an individual makes a series of trade-offs in order to maximize his/her own utility, with utility depending upon consumption of other goods and services (X), leisure (L), and health (H): $U(X, L, H)$. Under this simplified model, health decreases the number of days an individual is sick, and thus increases the number of days an individual can spend in leisure or spend in work and receive a wage to produce consumption goods. The effect of improved health in the labor and leisure market should encourage individuals to construct and use toilets, and thus increase the demand for such a good. Pattanayak et al.'s (2007) model additionally expands the role of toilets on human health beyond the labor market. Toilets themselves also directly contribute to utility. Pattanayak et al. (2007) refer to the utility derived from the toilet itself as a function of the averting behavior (a): $U(X, L, H, a)$. As mentioned above, construction and usage of toilets can indirectly improve physical health via improved environmental quality, and thus

increase the number of days an individual can work and receive a wage; but the very construction itself can also directly contribute to utility through improved “emotional” health. This “emotional” health can be classified in two categories: general mental health, such as feelings of comfort, convenience or privacy; and socially induced mental health. The second classification deserves greater clarification. In a community in which toilets are widely accepted, some individuals might pressure others to stop defecating publicly through mocking, social “walks of shame,” or social pressure. Or, if toilets are associated with an urban or modern lifestyle, construction and usage of a toilet might increase feelings of inclusion or self-confidence. Therefore, the toilet itself – and its construction and subsequent use – can contribute directly to individual utility by reducing feelings of shame or guilt, and increasing health through social inclusion. This utility is a component an individual gives value to and a component an individual might consider when making trade-offs among other goods and services. This indirect, “emotional” health utility derived from the construction and usage of toilets must be incorporated within the model of individual utility.

For clarity, I am going to walk through the derivation of Pattanayak et al.’s model (2007), which incorporates an individual’s utility maximization function to derive an individual’s willingness to construct and use a toilet. An individual’s health (H) will depend upon the community’s environmental quality (Q) and the individual’s averting behavior (a). Environmental quality (Q) might include both quality and quantity of water, among other factors. The extent of environmental quality (Q)

relies upon public policies (G) – which might include subsidies for latrine construction, or educational campaigns to elicit the benefits of toilet usage – as well as averting behavior by other community members (A) – the extent to which other members of the community construct and use toilets, which might be either a cost or benefit to an individual’s utility. The inclusion of averting behaviors by other community members (A) allows Pattanayak et al. (2007) to incorporate the externality public defecation exerts on other community members who are both using and not using toilets. Besides health (H) depending upon environmental quality (Q), health (H) also depends upon an individual’s averting behavior (a): the actions he/she takes towards the construction of toilets. Equation 1 expresses an individual’s utility function:

$$(1) \textit{Individual's Utility Function:} \\ U[X, L, H(a, Q\{G, A\}), a]$$

As noted above, Pattanayak et al.’s (2007) model uses the economic model of human behavior, concluding that an individual will try to maximize his/her utility, measured by consumption of other goods (X), time spent in leisure (L), physical health (H), and the result (an individual household toilet) of averting behavior (a). In order to determine which trade-offs to make as to maximize individual utility, an individual must take into considerations two constraints. The first is the health production function, which determines how “health inputs” (an individual household toilet) increase individual health and thus utility. The health production function is determined by the “health” obtained through the construction of the toilet itself

(a), how much time an individual invests in averting behavior through construction of the individual household toilet (C), and how much he/she spends on material inputs (M), which is based upon his/her knowledge (K) of which inputs to purchase or use (Equation 2):

$$(2) \text{ Individual's Health Production Function:}$$

$$f(a, C, M; K) = 0$$

The second constraint is an individual's budget constraint. This shows how much money an individual has that he/she can spend to increase utility. The amount of money is determined by how an individual allocates his/her time: an individual has a certain amount of time (T) that he/she can allocate to leisure (L), to time spent constructing an individual household toilet via individual averting behavior (C), and to sick days (H) which are determined by health. Thus, the total amount of money an individual can spend as to maximize his/her utility is the sum of exogenous income (E), earned income (a function of time spent working multiplied by wage, w), money spent on consumption of other goods (X), and materials invested in averting behavior through construction of an individual household toilet ($p * M$). This is shown in Equation 3:

$$(3) \text{ Budget Constraint:}$$

$$E + w(T - L - C - H) - X + p * M = 0$$

The budget constraint will help determine how an individual should spend his/her time – whether in the labor market or in leisure – as to maximize his/her utility. Equations 1-3 are combined below to display an individual's utility maximization

problem (Equation 4):

$$\text{Maximize } U[X, L, H(a, Q\{G, A\}), a]$$

(4) Subject to Constraints: Health Production Function:

$$f(a, C, M; K) = 0$$

$$\text{Budget Constraint: } E + w(T - L - C - H) - X + p * M = 0$$

The variable of interest is individual averting behavior (a), which will determine an individual's demand for toilet construction and usage. To find the optimal consumption of individual averting behavior (a), Pattanayak et al. (2007) use the above utility maximization and constraints to create a Lagrange Multiplier (Equation 5):

$$(5) \mathcal{L}_{(L, X, a, M, C, \lambda, \mu)} = U[X, L, H(a, QG, A), a] - \lambda f(a, C, M; K) + \mu [E + w(T - L - C - H) - X - p * M]$$

The variables of “ λ ” and “ μ ” represent the marginal utility gain from the health production function and the budget constraint respectively. To find the optimal amount of consumption of individual averting behavior (a), Pattanayak et al. (2007) take the first-order conditions for L, X, a, M, C, λ , and μ , and rearrange the equations as shown below:

$$\begin{pmatrix} \mathcal{L}_L \\ \mathcal{L}_X \\ \mathcal{L}_a \\ \mathcal{L}_M \\ \mathcal{L}_C \\ \mathcal{L}_\lambda \\ \mathcal{L}_\mu \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} U_L - \mu * w \\ U_x - \mu \\ U_a + U_H * H_a - \mu * f_a \\ -\lambda * f_M - \mu * p \\ -\lambda * f_C - \mu * w \\ f(a, C, M) \\ E + w(T - L - C - H) - X - p * M \end{pmatrix} \begin{pmatrix} a \\ b \\ c \\ d \\ e \\ f \\ g \end{pmatrix}$$

In order to understand the trade-offs (cost and benefits) of averting behavior (toilet construction), Pattanayak et al. (2007) re-write and recombine a number of the first-order condition equations. I will work through the steps Pattanayak et al. (2007) take. First, the authors re-write equation (c):

$$\begin{aligned} \mathcal{L}_a = 0 &= U_a + U_H * H_a - \lambda * f_a \\ \text{(6)} \quad U_a + U_H * H_a &= \lambda * f_a \end{aligned}$$

The left-hand side of the Equation 6 represents the marginal benefits of toilet construction and usage: U_a represents the utility (emotional health) one receives from the individual averting behavior itself (the individual household toilet), and $U_H * H_a$ represents the utility one receives from physical health. The right-hand side of the equation represents the cost of averting behavior (toilet construction). To better understand the right-hand side of the equation, Pattanayak et al. (2007) look at the factors which influence the averting behavior, namely the health production function – material inputs (M) and the time spent on averting behavior or construction of the toilet (C). Pattanayak et al. (2007) therefore re-write equations (d) – material inputs – and (e) – time spent constructing the toilet – and take the derivative of equation (f) – the health production function – with respect to individual averting behavior (a). This is shown in Equations 7-9 below:

$$\text{(7)} \quad f_M = \frac{-\mu * p}{\lambda}$$

$$\text{(8)} \quad f_C = \frac{-\mu * w}{\lambda}$$

$$\frac{d\mathcal{L}_a}{da} = 0 = f_a + f_C * a_C + f_M * a_M$$

$$(9) -f_a = f_C * a_C + f_M * a_M$$

Combining equations (7), (8), and (9) with equation (6) creates the optimal trade-off: an individual will demand a toilet up until the marginal benefits equal the marginal costs of toilet construction and usage.

$$-f_a = f_C * a_C + f_M * a_M$$

$$\text{Replace } f_a = (U_a + U_H * H_a) / \lambda$$

$$\text{Replace } f_M = \frac{-\mu * p}{\lambda} \text{ and } f_C = \frac{-\mu * w}{\lambda}$$

$$(10) \frac{U_a + U_H * H_a}{\mu} = w * a_C + p * a_M$$

Equation 10 shows than an individual will invest time and money to build and use a toilet when the marginal benefits of toilet construction and usage through the physical and emotional health benefits in monetary terms (the left-hand-side of Equation 10) equals the foregone wage one could have earned (time spent on construction of a toilet that could have been spent in the labor market, “ $w * a_C$ ”) and the cost of the materials for construction ($p * a_M$) which could have been spent elsewhere, such as on consumption goods (X) (the right-hand-side of Equation 10).

This optimal trade-off allows us to assess the various components involved in an individual’s demand for toilets. Moreover, this trade-off underscores the necessity of both demand-side and supply-side forces. For instance, if an individual does not recognize the benefits of toilet construction and usage, the individual’s left-hand side of Equation 10 ($[U_a + U_H * H_a] / \mu$) will be negligible. Consequently, even if toilets are supplied, the indi-

vidual will be unlikely to use the toilet. However, supply-side actions beyond the physical construction and availability of the toilets – such as making toilets more easily available or cheaper (the right-hand-side of the equation) – are also necessary for increasing individual demand. By understanding the relationship of these components, we can implement policy changes to try to alter individual demand, by increasing the benefits of toilet construction and usage – making individuals aware of the physical ($U_H * H_a$) and emotional health (U_a) advantages of toilets, and the importance of collective-action in increasing the environmental and health benefits of toilet construction and usage (changing demand) – and/or by altering demand through decreasing the costs of construction ($w * a_C + p * a_M$), by making toilets more easily available or cheaper through governmental programs or other welfare-improving interventions. However, to figure out which mechanisms will be the most influential for increasing demand will require an understanding of the specific traits of the community, such as the community’s values, religion or culture.

2b. Culture and the Value of Toilets

In order to increase the left-hand side components of Pattanayak et al.’s (2007) optimal trade-off, sanitation reforms should focus on education campaigns aimed at promoting the various “health” benefits of toilet construction, both physical health ($U_H * H_a$) – such as increased labor productivity – and “emotional” health (U_a) – such as privacy and security, or even as innovative as the “No Toilet, No Bride” campaign’s benefit of

marriage. However, emphasizing some benefits over others will be more effective in influencing and encouraging demand. Before understanding the direction of educational campaigns, we must first acknowledge that notions of sanitation, and thus of dirt and impurity, are entangled with culture, religion, and social norms: “building toilets without addressing common norms, attitudes and beliefs around latrine use is unlikely to reduce open defecation in rural India” (Diane Coffey; cited in Qadri, 2014). For instance, if Haryana – the location of the “No Toilet, No Bride” campaign – did not have a competitive marriage market or certain societal norms, the campaign would not have been effective in increasing toilet construction and usage.

Our understanding of human excreta is fundamentally understood and influenced within the realm of social science – social interactions among people determine what is contextually considered right and wrong (Warner): “There are no human societies where the act of excretion and its products are not subject to public and private arrangements, to expectations involving time and space, regularity and appropriateness” (Drangert & Nawab, 2011). Douglas (1966) analyzes the role of uncleanness in what she refers to as “primitive” religion, by asserting that the “fear, terror or dread in which [primitive religion] adherents live” can be “traced to beliefs in horrible disasters which overtake those who inadvertently cross some forbidden line or develop some impure condition” (Douglas, 1966). Consequently, notions of dirt are simply notions of disorder – disorder that “exists” and is created by “the eye of the beholder” (Douglas, 1966). Each community will therefore experience a unique notion of dirt and have a different stigma towards and

understanding of sanitation. This will necessitate different tactics to increase demand for toilet construction and usage in each community.

In fact, Diane Coffey (2014) attributes culture to be the main explanation for differences in public defecation practices. She uses evidence from a quantitative Sanitation Quality Use Access and Trends (SQUAT) survey, in which she, in conjunction with the Rice Institute, interviewed over 3,200 households in six north Indian states and the plains of Nepal. Coffey (2014) argues that poverty does not “force” people to defecate in the open due to the inability to access latrines or toilets. Specifically, she finds no correlation between gross domestic capital (GDP) per capita and the fraction of the population defecating in the open among 156 developing countries. In addition, 40% of households in the 13 districts of the SQUAT study who could afford a working latrine had at least one person who defecates in the open. Besides financial reasons, Coffey (2014) also dismisses lack of water as a factor contributing to public defecation, for only 3% of the surveyed individuals who defecate in the open mentioned lack of water as a reason for not using a latrine. In fact, 90% of Indians have “an improved water source,” as defined by the WHO-UNICEF Joint Monitoring Report (Coffey, 2014). Consequently, there must be a series of cultural factors that both encourage open defecation and discourage the use of affordable latrines. Coffey (2014) believes latrines are socially unacceptable in certain subpopulations of India due to religious reasons: latrines close to the home are considered ritually polluting, or individuals are reluctant to empty the pit (and its contents), and thus require unreasonably large (and expensive) pit sizes.

Such cultural factors have, and continue to have, a role in shaping access to and willingness to construct sanitation facilities in India.

Geruso and Spears (2014) build upon Diane Coffey's assertion that public defecation is inextricably influenced by a number of cultural factors. Their study attributes differences in child mortality rates between Hindus and Muslims to differences in public defecation rates. In fact, after controlling for education, wealth, family demographics, state trends, cohort effects, development expenditure, and village-level health services and infrastructure, the disparity between Hindu and Islamic mortality rates is still unexplained: by age five, mortality among Muslims is 18% lower than among Hindus (Bhalotra et al., 2010, study; cited in Geruso & Spears, 2014). An area in which Hindus and Muslims differ, however, is public defecation practices and toilet usage, with 67% of Hindu households, and 42% of Muslims defecating in the open (NHFS, 2005; cited in Geruso & Spears, 2014). In fact, even in households with functional latrines, Hindus are less likely to choose to use the latrines (Geruso & Spears, 2014). Although reasons for such differences are not well known, the rationale for such varying defecation rates has been attributed to a cultural difference: the Hindu caste system and its "ritual avoidance of excreta" and subsequent "[regulation of] its cleanup to the untouchables," the lowest class in the caste system (Geruso & Spears, 2014). This historic association – between human waste and the untouchables – "reinforces the norms in which sanitation problems are ignored by even upper caste Hindus" (Geruso & Spears, 2014). Consequently, differences in defecation practices are a symptom of historical,

religious, and cultural traditions that have both decreased the demand for latrines within individuals, and also prevented sanitation from being a priority within the upper castes, and hence political system.

Given the influence of culture on sanitation, Pattanayak et al.'s (2007) optimal trade-off shows two pathways that can increase the health benefits of toilet construction – physical health ($U_H * H_a$) and “emotional” health (U_a). Below are a few studies that try to tease out the health benefits of toilet construction. It should be noted, nonetheless, that these benefits are not necessarily universal or applicable to all populations.

Although John Snow made the link between public defecation and water-borne diseases in the mid-19th century, this classic fecal-oral transmission of disease is not always well known or considered to be a benefit to toilet usage by all individuals (Jenkins & Curtis, 2005). Jenkins and Curtis (2005), using interviews collected from 40 head-of-households in rural Benin, did find concerns of disease mentioned, such as intestinal worms, foot worms, diarrhea, cholera, and tuberculosis; however, respondents believed they were spread by smelling or seeing feces, rather than by fecal-oral transmission (Jenkins & Curtis, 2005). Usage of toilets, consequently, would not eliminate contact with feces' contaminants, and thus could not be seen as benefiting health within this population. In fact, numerous studies showcase the ineffectiveness of public health education in incentivizing demand (Coffey et al., 2014; Jenkins & Curtis, 2005; Pattanayak et al., 2007), and so even if education on germ theory and bacterial transmission were incorporated within sanitation campaigns, it would not necessarily encourage toilet adoption.

Given the present public perception regarding physical health benefits ($U_H * H_a$) associated with toilet installation, more emphasis of sanitation campaigns should be placed on the “emotional” health benefits (U_a) (Jenkins & Curtis, 2015)

One “emotional” health benefit found in multiple studies is related to prestige. To many individuals, toilet construction and usage was seen as a gateway [to] “achieving a good life” (Jenkins & Curtis, 2005). According to studies conducted in rural Benin (Jenkins & Curtis, 2005) and India (O’Reilly & Louis, 2014), travel to urban areas and exposure to urban, or Western, lifestyles – through government jobs, education, and marketing of commercial produce – transformed one’s perception of public defecation. Awareness of other lifestyles that did not involve public defecation forced individuals to question their current practices and ultimately see public defecation as a symbol of embarrassment and a barrier towards an elevated lifestyle and status. Defecating in the open became seen as a backwards ideal, and usage of toilets was seen as a modern or luxurious activity (Jenkins & Curtis, 2005). A study conducted by O’Reilly and Louis (2014) drew upon interviews with members in India and found similar results regarding the influences of urban lifestyles. Employment in the public sector introduced rural residents to urban areas: “When we went to Shimla or Rampur, we saw toilets. This influenced people to build toilets” (male interviewee; cited in O’Rielly & Louis, 2014). Or, after children were sent to study in Shimla and exposed to modern toilets, they instilled in their family a drive to transition away from public defecation, and to rather construct toilets to be at an equal standard with the Shimla environment: “Since my children are studying

in Shimla, we also think it’s nice to have a dry pit toilet when I have people coming over to my house” (interviewee; cited in O’Reilly & Louis, 2014).

Similar reports were detailed in interviews in rural Benin. After men left the village, either for work or to obtain money for marriage, their outlook on public defecation changed. Having become accustomed to defecating in latrines, defecating in the open became seen as an impediment to feeling “good,” “settled,” or “complete” or as a hindrance from achieving the “good life” (Jenkins & Curtis, 2005). Interviewees began to see their practices, in comparison to others’, as improper and undesirable. Additionally, the use of latrines, over public defecation, became equated with the royal status: avoidance of public defecation and emulation of latrine use was an attempt to aspire towards a royal status of the local Fon ethnic group:

It was explained that a Fon king, his sons, and sometimes his wives, should never be seen outside the walls of the palace except for very special occasions. The royal family never defecated in the open, using pits covered with wood boards dug in discreet parts of the palace compound (Jenkins & Curtis, 2005).

Such exposure to the benefits of toilets had ripple effects within communities: individuals began to pressure others in the community to transition away from public defecation and construct toilets. A daughter-in-law from West Bengal noted the pressure she felt to be “civilized” and thereby build a toilet: “When everyone started to be clean, the environment started to

be clean and civilized. Then we built a toilet. When everyone started building toilets we felt embarrassed [because we did not have one]" (O’Rielly & Louis, 2014). Increased demand for toilets came from the outside and the inside, with both influences having similar effects by decreasing the desire to defecate publicly, and increasing the value of and demand for toilets.

However, prestige-related drives might not be the only effective mobilization technique to increase demand for toilets among the entire population. Jenkins and Curtis (2005) found that all 24 interviewees that noted prestige drives were males. Females’ drives for toilets, in contrast, were centered on well-being, specifically for convenience, comfort, and privacy: “People were defecating in the bushes or hidden places. We explained that you have women in your family. If someone suddenly appears while the women are shitting, what will happen then?” (male interviewee; cited in O’Rielly & Louis, 2014). In fact, the value of privacy that toilets bestow is becoming ever more prevalent, as more violence against women during open defecation is broadcasted in public news. In May 2014, two girls from Uttar Pradesh, India were raped and hung from a tree while walking to a field to defecate. “When we step out of the house we are scared. And we have to go in the mornings, in the evenings, and when we cannot stop ourselves, at times we go in the afternoons as well. . . And there are no bathrooms. We don’t have any kind of facility. We have to go out” (Guddo Devi, cousin of the two killed girls; cited in Qadri, 2014). Many studies have cited similar findings: women must wait until nightfall to defecate in the open in order to protect their modesty (Coffey et al., 2014; Hueso & Bell, 2013; Jenkins & Curtis, 2005). In comparison

to public defecation, toilets ensure that a woman would be able to keep her modesty and privacy during defecation (increasing the left-hand-side of Equation 10), thus decreasing demand for public defecation and increasing demand for toilets.³

Nevertheless, the different health benefits of toilet construction and usage might differ on a number of dimensions – gender, age, geographic location, religion, and societal norms, among others. Thus, there is not one universal or correct way to increase the emotional and physical health benefits of Pattanayak et al.’s (2007) demand for toilets model. Rather, solutions will vary at the country, state, community, and even individual level.

3. Supply of Toilets

3a. It’s Not All About Demand

Demand for toilets among individuals is not the whole part of the story. Supply and demand are both necessary. Figure 1.1 is a simplified supply and demand model.

In order for the quantity of toilets to increase, supply could increase (Figure 1.1.b), demand could increase (Figure 1.1.c), or there could be a combination of both mechanisms. In the

³However, the individuals who have the ability to obtain a subsidy and/or construct the toilets are primarily men. Consequently, even if demand for toilets is present among females, they might be unable – politically, socially, or physically – to construct a toilet. Therefore, many campaigns, such as the “No Toilet, No Bride” campaign, are designed to develop demand for toilets among the male population.

“ideal” situation, all individuals would be supplied with a toilet. As described earlier, if every individual does not have a demand for toilets, despite the presence of the supply or amount of toilets available, this “ideal” will not be reached. Since a demand curve is the aggregate of all individual demand curves, if a large portion of individuals does not have a demand for toilets, the aggregate demand curve would decrease (a leftward shift of the demand curve in Figure 1.1.a). Additionally, demand could increase (a rightward shift of the demand curve; Figure 1.1.c) by altering the components of Equation 10: using educational campaigns to outline the physical and health benefits of toilet construction. In contrast, supply could increase (a rightward shift of the supply curve; Figure 1.1.b) through direct construction of toilets or by reducing the costs of construction through subsidies or other welfare programs.

Consequently both supply and demand factors are required for toilet construction: “the degree to which a target population is prone, resistant, or unable to adopt a new behavior derives from the presence or absence of: self-interest (motivation), opportunity, and ability to voluntarily adopt the new behavior” (Rothschild, 1999; cited in Jenkins & Scott, 2007). Self-interest can be conceptualized within the demand-side factors, which impact the demand curve; whereas opportunity and the ability to voluntarily adopt falls within supply-side factors, which can either impact the demand or supply curve. Without adequate supply and/or demand, the “ideal” scenario of 100% toilet coverage will be infeasible, if not impossible, to accomplish.

3b. The Role of Supply

The responsibility to provide sanitation usually falls within the hands of the government. The United Nations annual report on water and sanitation examined the policies for WASH programs in 94 countries (WHO, 2012). Although two-thirds of the countries recognized drinking water and sanitation as a universal human right in national legislation, and more than 80% reported national policies in place for drinking water and sanitation, the majority of the programs remained stagnated within written political agreements, with little action taken on the ground (WHO, 2012). For instance, less than one-third of the countries surveyed had national WASH plans that were fully implemented, funded, and regularly reviewed (WHO, 2012). Such stagnation might be a byproduct of supply side constraints: a particular political structure that either limits the ability of those most affected by poor sanitation to voice their concerns or have political sway; or, one that is plagued by governmental fragmentation and corruption, or a short-term outlook and an exclusive focus upon number of toilets installed. In many situations which experienced ineffective sanitation reforms, there was a disconnect between the individuals involved in the planning process and their engagement with the community. Consequently, supply side constraints either hindered the construction of sanitation facilities (a decrease in the supply curve), or failed to create effective educational campaigns to encourage toilet adoption (a decrease in the demand curve).

The political system, working within the confines of a particular social and cultural framework, controls which individu-

als' voices are heard, and consequently which programs achieve more funding. Hueso and Bell (2013) assert that the failure of India's Total Sanitation Campaign (TSC) might be in part due to the uneven representation of individuals in the government. Poor sanitation facilities, in comparison to other issues, predominately affect the lower class, a group that receives little sway politically. Many government officials and engineers in charge of TSC projects are consequently more likely to "[neglect] sanitation in favour of more stimulating and costly water projects" (Hueso & Bell, 2013). Because their reelection depends on the quantifiable success of their actions, governmental officials will choose programs that are most popular among the groups that have the greatest political influence. Thus, sanitation receives little attention.⁴ In fact, the persistent neglect of certain segments of the population can create distrust between the government and its civilians, leaving the population resistant even in the presence of governmental support. In Africa, for example, the lackluster efforts of the government to improve public services diminished trust in governmental institutions and created unresponsiveness among governmental beneficiaries towards community-based programs (Mugumya, 2013; cited in Davis, 2014).

⁴As argued in another paper by Kaliski (2015), the reason sanitation receives little attention in India can be better understood through a political ecology framework. Such a framework provides an analysis of how India's environment and its political, social, and religious history interacts with and mutually constitutes one another. Thus, current sanitation reforms in India are a byproduct of India's colonization by Great Britain, history of environmentalism and the caste system, and the effects of these factors on other facets of society – from politics to education to employment.

With a profusion of governments not prioritizing sanitation reforms, many are poorly executed due to an understaffed or unqualified government staff, insufficient funding, and poor monitoring. In fact, 80% of the countries reported in the UN’s annual survey reported that the government’s current levels of financing are insufficient to reach targets for drinking water and sanitation (WHO, 2012). Haiti’s National Directorate for Potable Water and Sanitation (DINEPA), for example, although designed to construct sustainable water and sanitation facilities for all citizens, is plagued by governmental inefficiencies. Davis (2014) cites Bliss and Fisher (2013) who ascribe DINEPA’s focus on crisis management, as opposed to long-term sustainability, as well as an uncompetitive governmental salary, to have prevented DINEPA from obtaining a strong and skilled managerial workforce. The focus on short-term solutions also disregards efforts for maintenance. Even in municipal schools that have toilets, lack of funding from public institutions for maintenance leaves toilets broken and unusable (a leftward shift of the supply curve in Figure 1.1): “If the toilet stops working they just lock the door and no one does anything. . . So basically [things fail because of] lack of municipal support” (US-based interviewee, 2013; cited in Davis, 2014). Similarly, the inability to collect, analyze, or update information of sanitation deficiencies by governmental institutions stymies proper distribution of funds to the most needed areas and inaccurately records the level of sanitation improvement: “The Rural Water Information System (SIAR) in Honduras, for example, performed reasonably well until external funding stopped and all data rapidly became outdated” (Smits, Uytewaal, & Sturzenegger, 2013; cited in Davis,

2014).

Similar to DINEPA's poor leadership, Hueso and Bell (2013) criticize the Government of India's incompetent staff in regards to the country's Total Sanitation Campaign (TSC). Although the TSC proclaimed to be a community-led, people-centered, demand-driven, and incentive-based program, Hueso and Bell (2013) call into question the program's assertion due to its lackluster results. Hueso and Bell (2013) argue that TSC's main failures are found within its governmental system, which proved unsuccessful at creating a bottom-up approach, or effectively increasing demand (Figure 1.1.c). Government officers leading TSC were over-worked and under-paid, and lacked awareness and understanding of the participatory development methods the TSC was supposed to conduct. Moreover, because this was a government-led program, officers knew they would be evaluated on short-term, quantitative measures. As a result, although focus was directed on distributing funds and installing toilets, thus increasing the supply curve (Figure 1.1.b), supply was not met with an adequate demand for toilets and improper construction prevented long-term sustainability of the toilets (Hueso & Bell, 2013). Consequently, the TSC was characterized by a quick fix approach that was technologically focused, had a short-term outlook, and quantitatively based.

Government and other institutions must restructure how sanitation is prioritized and how governmental reforms are implemented. Institutions must not only supply the physical toilets (increase the supply curve), but also implement educational reforms – to highlight the physical and emotional health benefits of toilet usage – and subsidy and welfare programs – to decrease

the cost of construction (increase the demand curve). Sanitation reforms must improve data collection, ensure long-term sustainability and maintenance, and shift attention towards results that do not quantify how many toilets are installed, but rather how many toilets are used over time and the measures of health – physical and emotional – such installation brings. Within the government itself, actions must be reoriented to favor all populations – regardless of class, religion, race, gender, etc. – and must work to recreate trust between government and its beneficiaries.

4. The Past and the Future: Lessons from Past Health Reforms

Both supply and demand are crucial for achieving positive and effective sanitation reforms. To achieve Goal 7 of the MDGs, to “halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation” (United Nations, 2014), two aspects of sanitation reforms must be amended. First, reforms must understand the current values of the target communities, and in particular the historical, cultural, and religious perceptions of sanitation. Reforms must utilize this knowledge to decrease the value of current defecation practices, and activate a new value – new emotional and physical health benefits – for toilets and consequently a demand for toilet construction and usage. Second, institutions, particularly the government, must prioritize sanitation so that it is delivered efficiently and equally to the public. This change will require a restruc-

turing of the governmental institution itself, in, for example, improving economic conditions and land availability for certain segments of the population, listening to and addressing the needs of all segments of the population, and altering how governmental representatives' accomplishments are recorded and rewarded.

An examination of past health reforms can help to illuminate the challenges of improving public health, assess various methods employed to ameliorate health crises for both the short- and long-term, and can act as a platform by which to compare and contrast the current sanitation reform efforts. The Rockefeller Foundation's creation of the Rockefeller Sanitary Commission (RSC) for Eradication of Hookworm Disease highlights the role of awareness, care, and education in eliminating the disease; the New York Health Department during the 1918 Influenza epidemic showcases a successful community-involved campaign that drastically reduced mortality rates in New York, compared to other high-density cities in the United States; and the relatively recent Chinese anti-spitting campaign, enacted leading up to the Beijing Olympics, shows the effectiveness of a strategy that more stringently monopolized social pressure. All three examples created successful outcomes, for the programs were executed within a transparent and community-oriented framework that adequately supplied the physical necessities to improve health, and also created an educational or public platform that produced a demand for individual behavioral change.

In 1910, the Rockefeller Sanitary Commission for the Eradication of Hookworm Disease was established to eliminate hookworm throughout the country – a disease that was estimated

to have infected 40% of the population by the beginning of the century (The Rockefeller Foundation, 2014). RSC’s success was grounded in its decentralized and community-involved campaign: “if the infection is to be stamped out, the States in which it exists must assume the responsibility” (Elman et al., 2014). RSC used a three-step approach – a survey to map the prevalence of the disease; mobile dispensaries to treat infected patients; and education campaigns that used illustrated lectures and demonstrations. This approach proved “not only [to] dramatically [reduce] the disease, but [to also create] a culture of public health” (The Rockefeller Foundation, 2014). Additionally, the RSC, in conjunction with each state’s board of health, formed health networks with local doctors and health boards (The Rockefeller Foundation, 2014). These relationships proved instrumental, especially given the role of state and county schools to encourage public participation in the RSC campaign. Additionally, localized doctors and health boards provided locations for testing and treatment, and in some localities, hookworm screening was mandated as a condition for school attendance (The Rockefeller Foundation, 2014).

However, many communities did not initially welcome RSC’s approach. RSC’s biggest problem was convincing a skeptical public about the spread of hookworm, especially when its side-effects – weakness, gastric distress, dizziness, headache, coughing, and breathing problems – could be associated with a number of other common diseases (Elman et al., 2014). The RSC Administration saw hookworm as a disease spread by soil pollution, and thus initially focused its campaign on improving unsanitary conditions. However, many Southern residents, un-

like the RSC's belief of germ theory, were proponents of miasma theory: the belief that diseases are caused by the presence of miasma, a form of vapor composed of suspended particles of decaying matter that emit a putrid smell in the air (London Science Museum). Therefore, these individuals did not see hookworm's symptoms as a "sickness" or open privies and unsanitary conditions as "risks" (Elman et al., 2014). Consequently, the RSC's original program took a germ-theory-oriented approach, centering its prevention solely on hookworm treatment and on surveying the presence and quality of local sanitary facilities (Elman et al., 2014). However, because many physicians and lay public disagreed or misunderstood the RSC's claim to the cause of hookworm, the RSC's attempts remained unsuccessful. In 1910, only 16% of practicing physicians in the nine Southern states participating in the RSC's campaign treated patients for hookworm (Elman et al., 2014). And even when physicians offered treatment, the RSC found that out of the 42,946 positive cases in 1910, only 14,400 were treated, with the remainder of the patients refusing treatment (Elman et al., 2014).

The RSC's initial campaign was not attuned to the general public's concerns and values, and thus its efforts were minimal and ineffective. Rather than focusing on visual inspection of residents and anecdotal reports from local physicians and teachers, the RSC administration restructured its strategy by conducting local prevalence surveys of microscopic examinations through sampling small segments of the community (Elman et al., 2014). In comparison to visual inspections, the RSC found that the public accepted and was receptive to screening, particularly through dispensaries (Elman et al., 2014). These dis-

dispensaries were localized – supervised by state directors – and were one-stop shops, incorporating screening and treatment, as well as education about hookworm (Elman et al., 2014). More importantly, focus was given to providing scientific and visual “proof” of the worms and disease: “the public looked at hookworms in pictures and especially through microscopes” (Elman et al., 2014). As Elman et al. (2014) write, “And so, a highly visible, community-based public health demonstration model, not the medical practice model that encouraged local physicians to provide diagnosis and treatment, elicited community participation motivating behavioral change.” The RSC realized it was the combination of a decentralized system in conjunction with public education that was embraced by the general public. The public saw value in preventing the spread of hookworm and thus demanded such dispensaries. The ability to generate public demand for these health measures would be paramount in the national effort to eradicate hookworm.

The RSC was a nationwide initiative, however such a national campaign is not always implemented during disease outbreaks in the United States. During the 1918 Influenza outbreak, various states took different measures to combat the disease, with the states that implemented stronger initiatives – especially ones that incorporated effective educational components – achieving lower mortality rates. New York City, in comparison to other large cities, such as Boston and Philadelphia, did not experience as drastic effects of the 1918 Influenza on mortality (Aimone, 2010). While Boston and Philadelphia’s death rates were 6.5 and 7.3 per 1,000 individuals, respectively, following the influenza, New York City’s was only 4.7 per 1,000

(Aimone, 2010). A significant portion of this contrast can be attributed to the NYC's Department of Health (DoH), which helped to contain the epidemic, through both regulations and educational campaigns.

New York's regulations, although mandated centrally, were characterized by a system of transparency and decentralization. Before rules and regulations were centrally sanctioned, the DoH attempted to hear the concerns of the lay public, and particularly the impacted stakeholders. For example, in an attempt to decrease public transit congestion during the morning and afternoon commute, the DoH proposed to amend the Sanitary Code to create a mandatory timetable, which would regulate the opening and closing hours of business. However, before the rule was sanctioned, the DoH met with individuals that would be affected by the mandate, namely representatives of NYC's business community, to explain the logistics of the rule and justify the necessity for such mandate. Communication with stakeholders did not cease there: Health Commissioner Royal S. Copeland responded to complaints from businesses and manufacturers, and negotiated new opening and closing hours (Aimone, 2010). The Board of Health, the official body that took over regulation of the 1918 epidemic from the Department of Health, also made considerable efforts to spread administrative responsibilities in a decentralized fashion. Each borough's sanitary superintendents and assistant superintendents were given the responsibility and "the power to regulate, order and '...remove, abate, suspend, alter or otherwise improve' places that sell, store, or serve food and drink with the same authority as if their orders were issued by the Board of Health" (Aimone, 2010). New York's reform

efforts eliminated a top-down approach by incorporating both the needs and diversity of opinions of New York residents into public health regulations.

Beyond regulation, the large portion of the Board of Health's funds and energies went towards health education materials. The educational campaign tried to educate the public on the effects of the influenza by attempting to curb the spread of the disease through changing social norms, by picturing behaviors that contributed to the influenza's spread as "filthy habits." By September 24, 1918, just months after the influenza was reported in NYC, a minimum of 10,000 posters had been placed around NYC in railway stations, elevated train platforms, streetcars, store windows, police precincts, hotels, and other public areas (Aimone, 2010). Educational material pictured the practices that would negatively impact health as disgusting and uncivilized. As noted by Peal et al. (2010), "[enabling] a change in behavior" is a vital component of "software" techniques. In an attempt to prevent the spread of influenza, and with the germ theory belief that spitting was the main route for transmission, the Department of Health issued an anti-spitting campaign. Similar to the anti-spitting campaign initiated 20 years earlier by former Health Commissioner Herman Biggs, the 1918 campaign was also based on education, moral persuasion, and police enforcement (Aimone, 2010). Spitting was described as "dangerous, indecent, and against the Law," and violators were fined or arrested if caught spitting (Aimone, 2010). Spitting was categorized as a backwardness activity, associated with uncleanliness and an activity that should be avoided.

However, Copeland did not expect his campaign to change

the behaviors of the entire population: he targeted his educational campaign at the population most susceptible to the influenza and most likely to be influenced by indoctrination. He argued that the city's school system could do a better job at keeping students healthy than their families could do by allowing students to be constantly monitored and educated about the influenza, and attendance at school would allow students to be constantly educated about the influenza (Aimone, 2010). Teachers had to inspect students daily and were given permission to authorize home visits regarding potentially sick children (Aimone, 2010).

The anti-spitting campaign incorporated in the NYC's DoH's efforts is not a lost practice. Leading up to the Beijing Olympics, the Chinese Government's no-spitting campaign received much publicity internationally. More broadly, the Chinese government sought to reshape and remold Chinese social norms and local habits. The main concern, however, was not necessarily the worry of communicable disease through spitting, but was more to avoid international embarrassment: "So as Beijing is building new sports stadiums, subways lines, futuristic skyscrapers and public parks for the Games, city leaders are also trying to rebuild Beijingers" (Yardley, 2007). Many Chinese officials see these practices – public spitting, public cursing, and littering, among others – as "stubborn diseases that stain the image of the capital city" (Zi Huayun; cited in Yardley, 2007). In an attempt to curb these "stubborn diseases," the Chinese Government used similar tactics as the RSC and New York's Department of Health. The government used fear, moral, and monetary persuasion: people caught spitting in the public be-

fore the Olympics could face fines up to 50 yuan (Yardley, 2007); as well as educational, community-involved initiatives: Chinese individuals were encouraged to stand in line, as opposed to cutting the line, at subway stops, post offices, and other public places on official Queuing Day, which takes place once every month (Fong, 2007).

20th and 21st century public health campaigns – inside and outside the U.S. and on both a local and national scale – highlight the importance of health reforms that offer more than technical solutions. Rather, these campaigns have strong supply – centralized governmental bodies within a transparent, collaborative, long-term, and community-led framework – which properly distribute the physical supply of health facilities and create demand for public health changes – through educational campaigns that institute behavioral and social changes. These mechanisms work to increase the utility a community acquires through participating in health treatments, as to increase the value of and demand for such treatment, so that supply and demand are adequately fulfilled.

5. Concluding Remarks and Beyond

The provision of sanitation is still less than ideal in rural areas because people tend not to see toilets as essential, a perception influenced by the absence of appropriate technology, by inadequate infrastructure and by gaps in governance (Arghyam, 2005).

To work, sanitation campaigns cannot be a quick fix, tech-

nological solution. Rather they must engage with the cultural, social, historical, and political disposition of the community, state, nation, and even globe. The solutions, therefore, must be creative, innovative and influential: to increase individual demand requires attention to collective factors. They must pay heed to the drives of the particular community and the institutional constraints imbedded in the community, and will need to utilize roundabout techniques and incentives to awaken the drives for toilet construction and usage.

The “No Toilet, No Bride” campaign was an excellent example of a sanitation reform, instituted by local government authorities, which effectively incorporated sustainable, long-term behavioral changes to permanently increase the value of and demand for toilets. However, the presence of strong governmental institutions and support might be a requirement too large to achieve. Consequently, private institutions, such as non-profit or non-governmental organizations, may be needed to fill this void.

UNICEF, through its Poo2Loo campaign in India, marks another example. It has initiated strategies that target a specific population group, children, who have the “potential to be very effective change agents” (Rahman, 2013). In order to increase the perceived value of toilets, UNICEF has incorporated engaging social media content, as well as provided children with the responsibility for hygienic practices and a sense of leadership and onus. Mr. Poo, a character invented to encourage children to use the toilet and prompt mothers not to dispose of dirty diapers in the open in India, is the centerpiece of the Poo2Loo Initiative. Mr. Poo stars in an educational video, accompa-

nied by a song – “first thing in the morning, what do I see? I pile of shit staring at me” (Yallop, 2014) – and his message is conveyed through various social media platforms: YouTube, Twitter (#poo2loo), Facebook, and its very own website. In fact, Poo2Loo released a smartphone app that allows users to report sightings of human feces, which are subsequently plotted, on maps of Indian cities (Yallop, 2014).

We are also seeing markets for toilets emerge. Funded by the Stone Family Foundation and the Bill & Melinda Gates Foundation, iDE created the Sanitation Marketing Scale Up (SMSU) project in Cambodia that utilized such a market-based approach. “Essential to a functioning market is a functioning supply chain that makes desired products or services available when the customer wants to purchase them” (McKinlay, 2014). Because the supply chain for toilets is easily broken in many developing countries, iDE places humans at the center of the design process to better understand the community, reasons for deficiencies in the supply chain, and ultimately possible business solutions. Another organization, Sanergy, has developed a similar business plan, by selling its Fresh Life Toilets (FLT) to local micro-entrepreneurs in Nairobi. These local franchisees can then charge community members for usage of the FLTs, and can make up to \$40 per week. In addition to the FLTs, the local residents receive training, access to financing, ongoing operation and marketing support, and daily waste collection service. Individuals are incentivized to participate in the market for not only does it provide them with a source of income, but also a new lifestyle via improved sanitation for themselves and for other community members. Since its inception in 2013,

Sanergy has opened 415 Fresh Life Toilets, provided 500 jobs, and has given nearly 200,000 people access to affordable, clean sanitation (Saleh, 2014).

The direction of future sanitation campaigns must be tailored to the specific community at hand and incorporate unique mechanisms that change behaviors. As UNICEF (2014b) proclaims, using the toilet must be seen in a positive light: we must “take the poo to the loo” and have a “poo party.” Using a toilet must have external benefits, values, and rewards – the reward of being a leader in maintaining sanitation facilities of a local school; or having a financial stake in the provision of toilet usage through micro-financing. Future sanitation reforms must utilize other unique mechanisms that strike a chord for the particular idiosyncrasies of the target community. For instance, because human excreta is organic matter, which produces greenhouse gases, once decomposed, proper and safe disposal of human excreta could be linked to carbon credits: every “ton” of human excreta disposed through a toilet or latrine, which alters the decomposition in such a way as to reduce greenhouse gas production, could be equated to a certain number of “credits” (Kumar, 2010). Moreover, in order to encourage demand for toilet usage among the male population – the ones who typically lack demand – educational information could be reoriented to show the link between public defecation and contamination of water sources or agricultural production, and its effect on income. Finally, UNICEF’s Poo2Loo campaign, in addition to invoking emotions of disgust and embarrassment with respect to the vast quantities of feces on the streets, could advertise associations of toilet usage to Western or modernized lifestyles.

Private institutions can aid public institutions in their efforts to combat the sanitation crisis. Specifically, public institutions can provide the financial means for other organizations to provide on-the-site support or improved data collection and monitoring.

Karti Subramanian (Amherst '07) in his TED-x talk two years ago (2013) advised listeners to ask big questions, for “asking better questions is the real innovation.” In order to solve the sanitation crisis, we must continue to ask and answer big questions. We cannot focus solely on restructuring the supply or demand side using traditional, standardized, technology-oriented methods. But rather, we must challenge ourselves, and ask what innovative mechanisms and techniques we can use to incentivize toilet construction and usage. We must think outside the box, be creative and flexible, and ultimately be revolutionary in order to not only reach the Millennium Development Goal by its 2015 deadline, but to also ultimately ensure that every person has access to basic sanitation.

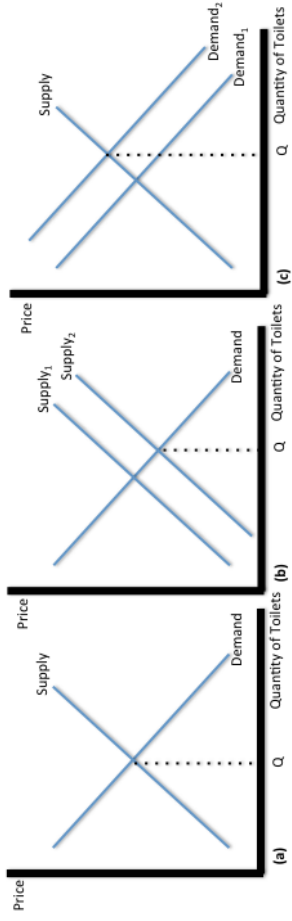


Figure 1.1: Supply and demand model; (a) Simplified supply and demand model; (b) increase in supply; and (c) increase in demand.

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Chapter 2

Income Inequality and Financial Market Participation: Rural and Urban China Yidan Jin, Smith College ¹

Abstract

Based on 2013 China Household finance Survey data, this study examines: first, the labor income gaps between rural and urban individuals in China, and second, the financial market participation of Chinese households in investment products and loans. It applies an extended model of the gap decomposition method among rural and urban dwellers to study the determinants of individual labor income inequality. The decomposition results support the hypoth-

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esis that the difference occurs because of gaps in human capital measured by education and occupation. At the household level, the Chinese financial market participation rate is found to be determined by household income, household size, sufficient knowledge of financial products, and the availability and convenience of financial services. This study confirms rural-urban inequality that urban households have a higher rate of participation in financial markets. Household income, available and convenient financial services, and sufficient knowledge of financial products positively affect financial market participation in China. This paper contributes to the existing literature by using the China Household Finance Survey data to study the rural-urban inequality of both income and wealth in China.

1. Introduction

China's economy has grown significantly during the past decades since the economic reform in 1978, driven by increasing exports and investment. At the same time, dramatic growth had also increased structural and trade imbalances, which are related to income inequality (Zhu and Wan, 2012). The issue of income inequality has been widely discussed because lower income groups are not able to afford consumption, which is related to the engines of economic growth—exports and investments. Among various dimensions of income inequality, such as race and gender,

the rural-urban gap in China is one of the largest in the world and would be even greater if differences in standard of living, welfare benefits, and infrastructure were taken into consideration (Wang and Piesse, 2010).

China's financial market has been developing since the economic reform and liberalization. A variety of financial products are available in China's market, including stocks, securities investment funds, bonds, and commodity futures (China's Financial Markets: An Insider's Guide to How the Markets Work, 2006, p.2). Household investment outcomes are playing an increasingly critical role in household wealth accumulation (Zhen, 2013) and households' behaviors in the financial market affect asset pricing and consequently determine market efficiency (DeLong et. al, 1990; Dumas, Kurshev, & Uppal, 2009). In this context, participation of households in financial markets has implications in maintaining households' wealth accumulation and in decreasing rural-urban wealth inequality.

The main purpose of this paper is to examine two topics: 1) rural-urban inequality in individual labor income, and 2) determinants of household financial market participation in investment products and loans. First, the paper focuses on highlighting the determinants of individual labor income by analyzing demographic factors and human capital. The rural-urban inequality in human capital explains most of the rural-urban labor income difference. This study also shows that there is a rural-urban gap in financial market participation and concludes that household income and availability of financial resources positively influence financial market participation. Then this study justifies the political recommendation to decrease rural-urban

income inequality and wealth inequality through discussing and adjusting factors of the inequality.

The paper beyond the current section is organized as follows: section 2 establishes a review of the literature and theory; section 3 introduces the data and the demographic characteristics of the target population; section 4 introduces the methodology; and section 5 and 6 presents the results and the conclusions.

2. Review of literature and theory

2.1 Individual labor income study

In 2009, urban residents earned 2.33 times more than those in rural areas, while the income of rural residents in coastal provinces tripled from 1989 to 2004. Since the 1980s, income inequality in China has risen at a faster pace than in the United States. From 1980 to 2012, China's Gini coefficient increased from 0.30 to 0.55, surpassing the U.S. coefficient of 0.45 (Xie and Zhou, 2014).

Compared with other occupations, the overall level of farmers' income in China is low. Rural individuals have lower labor income because farming is more concentrated in rural areas. Yusuf and Saich (2008) explain that the size of the rural-urban income gap is influenced by the integration of rural-urban labor markets. They suggest that rural industrialization and rural enterprises have important roles in increasing rural labor income and minimizing the gap (p.50). Lee (2013) also points out that the income inequality for urban households in China is mainly

related to the coastal provinces with relatively higher return to capital, capital intensity, and thus capital income in the state sector. Similarly, Xia et al. (2013) demonstrate that urban wage inequality is affected by the changes in wage structure and employment share of the state sector. Besides the effect of the labor market's structure and employment share, Sicular et al. (2005) demonstrate that differences in educational characteristics between rural and urban areas contribute substantially to the gap. Zhu and Wan (2012) also confirm the rural-urban income inequality and suggest that government interventions can target rural-urban disparity through rapid urbanization, and tackle regional inequality by developing financial markets and ensuring progressive allocation of fiscal resources.

An important contribution of this study is that it draws from a well-censored sample of widely distributed respondents in China. It uses a decomposition method that is often used in gender income inequality studies to quantitatively analyze determinants of rural-urban income inequality.

2.2 Household financial market participation study

The rural-urban inequality in financial market participation is an indicator of rural-urban wealth inequality. According to a 2013 study on Chinese Household Finance, the Chinese household financial market participation rate is low and informal financial sectors are very active. Rural households are more active in participating in informal financial sectors (China Household Finance Survey Report, 2013). While the formal (bank) financing is often claimed to be the main engine for economic

growth (Ayyagari, Demirgüç-Kunt and Maksimovic 2010), informal financing accounts for about 28% of the total borrowing in China (Li and Hsu 2009). Formal financial services such as loans and insurance are absent in rural areas (Wang & Moll, 2010) and the demand for insurance in rural areas is constrained by the lack of insurance knowledge, compared with urban China. As a means of wealth accumulation, rural-urban inequality in household financial market participation would exacerbate the imbalance of rural-urban economic development. The absence of financial and insurance markets can also lead to highly variable household income and persistent poverty (Dercon and Christensen, 2011; Jensen, 2000; Rosenzweig and Wolpin, 1993).

Many studies have discussed the determinants of financial market participation such as the ownership of stocks and bonds. Household income, gender, marital status, education, financial literacy, and culture all influence the participation rate. Income is crucial to the financial market participation. Grinblatt, Keloharju, and Linnainmaa (2011) suggest that household income and education are all key contributors to financial market participation. Education is found to have a strong positive effect on households' stock ownership (Haliassos & Bertaut, 1995). Cole and Shastry (2009) report a remarkable 7% to 8% increase in the probability of financial market participation with only one additional year of schooling. Van Rooij, Lusardi, and Alessie (2011) find that those with low literacy are much less likely to invest in stocks. Nguyen (2006) finds household financial activity in Vietnam is determined by household size and agricultural work rather than distance to the nearest bank branch.

This paper contributes to the analysis of Chinese financial

market participation and aims to determine how to increase wealth accumulation through participating in formal financial markets. It also gives particular predicted probabilities of households holding investment products and loans.

3. Data

This paper obtained the data from the China Household Finance Survey (hereafter CHFS), a nationally representative survey in China conducted by the Survey and Research Center for China Household Finance² from 2011 to 2013. It examines detailed information about household finances and assets including non-financial assets, financial assets and other household assets. It collects demographic data and labor income on an individual basis as well as financial market participation of households. The non-response rate was 11.6% (16.5% in cities and 3.2% in rural areas relatively), which is lower than that of other finance surveys conducted in China in the past, such as the Survey of Consumer Finance in 2010. It was conducted by face-to face interviews with 29,324 individuals in 8,438 households³ covering 29 provinces and 1,048 communities.

²The Survey and Research Center for China Household Finance is based at Southwestern University of Finance and Economics.

³Respondents of individual and household data sets are same but the head of family answers household survey.

3.1 Individual labor income study

This study uses individual data set from the CHFS, excludes unemployed and retired individuals, and uses a subset of respondents who reported being employed at the time of the survey, reported their annual labor income (or being imputed⁴ by CHFS), and were no younger than 16 years old. Self-employed workers, freelancers, and farmers are included in the analysis as the salary gap of these occupations is an essential determinant of the urban-rural gap in annual labor income. The analytic sample of N=7,074 is derived from list-wide deletion of respondents who had missing values on individual labor income or any one of the demographic variables of age, marital status, gender, education levels, occupation types and living in an urban area. Table 4.1 shows the basic demographic data for relevant variables.

Respondents' annual labor income is in RMB. The individual labor income contains income they gain from their first job and second job if applicable. Marital status has three levels: single, married or living with a partner, separated or divorced or widowed. We examine human capital, measured by education level and occupation types. The CHFS uses nine rank ordered degrees to represent education levels of respondents: never attended school, primary school, junior high, high school,

⁴In order to solve the problem of missing data, some important variables are imputed by the CHFS, this paper will use actual individual income as well as imputed individual income as dependent variables. The imputed variable of individual income is 34.10% in a sample size of 7,079 in this study.

secondary/vocational school⁵, college/vocational⁶, undergraduate degree, Master's degree, and PhD degree. According to the average education level in mainland China and the nine year compulsory education system which requires people to finish their junior high school education, this study uses simplified variables to represent the educational achievement of respondents: below primary school or primary school education, junior high school education, senior high education, and four-year college degree or above. We also use a simplified classification of occupation: farmers, self-employed or freelance workers, and employed by other parties, including government agencies, public institutions, military, NGOs, private enterprises, and others. The annual salary difference between occupations, especially between farmers and employees of formal enterprises, has an impact on the urban-rural labor income inequality since farmers earn far less than employees in China.

In general, the average annual individual labor income of urban residents is much higher than that of rural residents. The average annual labor income in rural areas is only 62.51% of that in cities. Table 4.1 shows us the general level of wage inequality in rural and urban areas in China. Rural and urban residents do not have a large age gap, but rural residents tend to be younger than urban residents. Men constitute a larger percentage of the total population in rural areas than cities because farming

⁵Secondary/vocational schools refers to the same level of education as high school but graduates will go to work directly rather than going to universities in China.

⁶College/vocational refers to two or three years of college education but does not offer bachelor's degrees to graduates.

requires heavy physical labor and rural areas have the tradition of a preference for sons. Married people and people living with a partner make up the major part of the respondents of our sample, but the rural area has a larger single percentage.

It is interesting to note that there is a big difference in human capital, measured by education and occupation. As expected, urban residents have higher education in general compared with rural residents. Especially the percentage of lowest education level in rural areas is more than twice of that in urban area. Moreover, the percentage of respondents with a four-year college degree or above is much lower in rural areas than in cities, which implies that higher education is not balanced. Higher education and the nine-year compulsory education system is not universal and promoted all around China. Since the percentage of farmers is not significant in our sample, farming has the smallest percentage in both cities and rural areas. However, farming is more common in rural areas.

3.2 Household financial market participation study

The CHFS provide information on household characteristics including household sizes, subjective attitude toward finance, non-financial assets, financial assets, income, and expenditures. Because this paper studies the difference between household financial market participation in rural and urban areas, it will focus on three main financial activities: investment products holdings, formal loans holdings, and informal loans holdings. After excluding respondents who do not report having any of the variables: holding investment products, holding formal, infor-

mal loans and responding to questions about demographic categories, the sample size for investment products analysis is 7,343 households and 8,050 households for having loans.

This study also examines holding investment products, having formal loans, informal loans, annual household income (RMB), household size, using credit cards, using any formal sources of information from media (newspapers, magazines, television, radio, and Internet⁷), owning non-financial assets (land, real estate, and vehicles), and interest in economics, politics, and social topics. We also include a variable that measures the patience of respondents and financial knowledge about interest rates and returns to make long-term financial plans.

This paper studies investment products holdings including owning stocks, bonds, mutual funds, derivatives, or wealth management products⁸ by analyzing categories such as no available or convenient financial service⁹, thinking the market is bad¹⁰, insufficient knowledge of investment products¹¹, and respondents' investment attitudes. The above variables are represented as dummies: they will be counted as "1" if respondents answered

⁷SMS is counted as an informal source since people in china often use SMS as interpersonal communication.

⁸financial products do not include deposits, funds bonds, equities, derivatives, business assets, real estate, and personal property. It includes those offered by banks, brokers, or trust.

⁹Including too far away from the security company, do not know where to open an account, cumbersome procedures, and limited financial resource.

¹⁰Including too risky, returns are too slow, lost money previously, and term is too long.

¹¹Including do not know how to open an account, lack relevant knowledge, never heard of them, and afraid of being cheated.

“yes” and “o” otherwise, except investment attitude which has four levels: above average risk and return, average risk and return, below average risk and return, and not willing to answer or do not know¹².

To study Chinese households’ loan holdings, this paper counts having loans from a formal bank as formal loans and borrowing from relatives, friends and colleagues, informal financial organization, and others as informal loans. Insufficient knowledge of loans or inconvenience of application is counted as 1 if respondents choose “do not know how to apply”, “do not have confidence the loan would be granted at all”, or “the application process is too troublesome”.

Table 2.2 displays demographic statistics of household financial market participation, showing the large rural-urban difference in the average and medium annual household income. Indeed, the urban average annual household income is more than twice of that of rural households. Rural households have higher average household size than urban households, which could be explained by higher demand of agricultural labor and relatively flexible one child policy in rural areas. For women who had a second child, those whose first child had been a daughter were often officially permitted to have a second child under the reformed family planning policy in rural China (Hesketh, Li, and Zhu 2005). Moreover, rural households have much higher agricultural work participation than expected. Respondents to this survey have a high percentage of owning non-financial assets in-

¹²The precise wording of the question can be found in the Appendix: CHFS survey Part 1 A4012.

cluding land, real estate, and vehicles, but the rural-urban gap is not remarkable. Rural households usually own land as non-financial assets, having a higher percentage than urban households in this category.

The difference of subjective attitude toward finance is not significant between rural and urban areas. Urban respondents have a higher rate of using “any formal sources of information from media”. Both groups of respondents have a low percentage (less than 10%) in the category “only using informal sources”. Compared with rural respondents, urban households are more impatient in financial investment, whereas rural respondents are more willing to wait for higher return.

Urban residents have an overwhelmingly higher rate of having investment products (14.03% compared with 1.87% of rural households) and express that the stocks and bonds market is bad for investment. Rural households show a large percentage in reflecting insufficient knowledge of investment products. However, the availability and convenience of investment services are not significantly different between rural and urban areas as well as investment attitude, but most respondents accept below-average risk and return.

The rate of having formal loans is 15.2% and the rate of having informal loans is 33.12%. These numbers are not high in general, probably because not all respondents are in need of loans. Ma and Yi (2010) states that the average saving rate has been rising over time, so that the aggregate marginal propensity to save exceeds 50% in the 2000s. High savings imply that people have sufficient funds and do not often need loans. However, the informal loan rate has a large gap between rural and urban

regions: the percentage of having informal loans in rural areas is 1.5 times that of cities.

4. Methodology

4.1 Individual labor income study

In this section, we employ 1) Duncan's D-index of dissimilarity, 2) OLS regression, and 3) regression decomposition methods to examine determinants of rural-urban labor income inequality.

We first use Duncan's D-index of dissimilarity (Duncan and Duncan, 1955) to measure the compositional differences among categorical factors (marital status, gender, education levels, and occupation types) and the mean differences between rural and urban areas among continuous factors (labor income and age). This index is a measurement of social segregation, sensitive to changes in population distribution (Social research update, 2000). It is calculated as $D = \frac{1}{2} \sum_j | \frac{u_j}{U} - \frac{r_j}{R} |$, where U is the total number of the urban residents, u_j is the number of urban residents in the j -th group, R is the total number of the rural residents, and r_j is the number of rural residents in the j -th group. The D-index can be interpreted as the percentage of urban (or rural) who need to switch groups before urban and rural distributions become equal.

Secondly, as described below, an OLS regression model as shown in equation (1) is developed to examine the associations of the logarithm of annual individual labor income (Y) with age, gender, education levels, marital status, occupation types and

urban residency.

$$(1) \ln(Y) = \beta_0 + \beta_1 age + \beta_2 age^2 + \beta_3 male + \beta_4 education + \beta_5 marital + \beta_6 occupation + \beta_7 urban$$

To examine how much rural-urban differences in the means of each independent variable explain the average labor income gap, we apply an OLS regression model which eliminates “ $\beta_7 urban$ ” separately on urban and rural laborers as shown in the equation (2).

$$(2) \ln(Y) = \beta_0 + \beta_1 age + \beta_2 age^2 + \beta_3 male + \beta_4 education + \beta_5 marital + \beta_6 occupation$$

The decomposition method is similar to those of Chang and England (2011), who show a precise amount of gender wage gap that is explained by discrimination in industrialized East Asia. It was developed from an extended model of the Oaxaca decomposition method (1973). Kim and Shirahase (2014) use the same method in testing cross-national differences in income distribution between males and females.

As Chang and England (2011) have pointed out, coefficients of regression for separated groups tell us the rate of return to a unit change in the variable. Oaxaca (1973) and Jones and Kelley (1984) argue that coefficients of separated groups (urban and rural) equally evaluate how much differences in the means of each independent variable explain the average labor income gap. Therefore, we present the results of the percentage explained by independent variables by using both urban and rural

coefficients. Using rural coefficients, we examine how different the average \ln labor income of rural respondents would be if rural people retained their rate of return to the factor but moved to the urban group. The equation is given as follows:

$$\begin{aligned} \text{\% of gap explained using urban slope} = \\ \frac{(\text{urban mean-rural mean}) * \text{urban coefficient}}{\text{difference between urban and rural mean of } (\ln \text{ income})} \end{aligned}$$

$$\begin{aligned} \text{\% of gap explained using rural slope} = \\ \frac{(\text{urban mean-rural mean}) * \text{rural coefficient}}{\text{difference between urban and rural mean of } (\ln \text{ income})} \end{aligned}$$

The percent of \ln income gap explained by the mean difference in each independent variable is achieved by taking the product of the independent variable's mean difference and its coefficient, which is then divided by the mean difference between urban and rural in \ln labor income (Dummy factors such as education are explained by the sum of mean differences on all the dummies). They show the percent of the \ln labor income gap that is explained by mean differences in each explanatory variable, with two estimates provided- one using urban and one using rural coefficients.

4.2 Household financial market participation survey

We employ 1) Duncan's D-index of dissimilarity and 2) logistic regression models to examine determinants of household financial

market participation. Using Duncan's D-index of dissimilarity, we measure the mean difference between rural and urban areas to measure continuous factors (income and household size) and the compositional difference among categorical factors (all other variables).

The logistic regression model – equation (3) – assesses the associations of holding investment products with annual household income, household size, financial knowledge and patience of respondents, investment attitude, urban residency, having a credit card, being interested in economics, politics, and social topics, having non-financial assets, having no available or convenient financial service, thinking the market is bad, and having insufficient knowledge of investment products as described in the data section. p represents the probability of having investment products:

$$(3) \ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 HHI + \beta_2 urban + \beta_3 formal + \beta_4 cc + \beta_5 patience + \beta_6 nfa + \beta_7 size + \beta_8 serv + \beta_9 topics + \beta_{10} badmarket + \beta_{11} insufficientknlg + \beta_{12} investmentattitude$$

Another logistic regression model – equation (4) – estimates the association of having formal loans from banks with all independent variables, including annual household income, household size, financial knowledge and patience of respondents, urban residency, having a credit card, being interested in economics, politics, and social topics, having non-financial assets, having insufficient knowledge of loans or inconvenient application process. The CHFS combines questions of knowledge of loans and the convenience of loan services together so these two

aspects are considered as one dummy variable reflecting the level of understanding and the service of loans. p is the probability of having formal loans:

$$(4) \ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 HHI + \beta_2 urban + \beta_3 formal + \beta_4 cc + \beta_5 patience + \beta_6 nfa + \beta_7 size + \beta_8 topics + \beta_9 serv\&knlg$$

The above expression is also applied to informal loans, where p represents the probability of having informal loans.

5. Results

Results of individual labor income regression model and decomposition

The difference in the distributional disparity between urban and rural laborers varies in education levels and marital status as shown in Table 2.3.

The D-index for level of education is the highest among all variables, meaning that as many as 34.45% of rural laborers would need to change their educational degrees to achieve balance with the educational distribution of laborers in urban areas, or vice versa. Besides this highest compositional difference in education due to the unbalance of educational resources, there is also a relatively high level of rural-urban segregation in marital status when compared with gender and occupation. The D-index for marital status is 12.99%, showing that 12.99% of rural laborers would need to change the distribution of marital

status to have the same distribution as urban laborers. The demographic data of marital status in Table 4.1 shows that rural areas have a higher percentage of single people, but marital status is partially influenced by age. Older people would have higher percentage of being married or living with a partner. It can be shown that the mean difference of age is 2.74: rural residents are 2.74 years younger than urban residents on average. Therefore, the D-index of marital status is not influential or significant.

With this understanding of the differences in urban and rural attributes, we now consider the analysis of earnings. The urban-rural earning gap, measured by the urban-rural difference in the average logarithm of annual individual labor income, is 0.46. Urban residents earn RMB 12,037.65 (\$1,965.97) more than rural residents in China on average.

Table 2.4 presents the results of OLS regression – equation (1). The joint significance of age, gender, education and occupation were statistically significant with the overall F-test ($p < 0.0001$). However, marital status was not statistically significant. Holding other independent variables constant, older people had a higher annual labor income, which could be explained by increased working experience. Holding other factors constant, men earn 28.48% more than women in China, demonstrating a large gender gap in annual labor income.

Education levels have a significant effect on annual labor income: the annual labor income increases with higher education levels achieved. When comparing respondents who received a four-year college degree or above with people who only attended primary school or below, the OLS results show a college de-

gree or above is associated with 110.55% higher annual income than primary school, holding other factors constant. Occupation also illustrates the income difference between farmers, the self-employed and those employed by others. Among respondents, both the self-employed and those employed by others earn over 100% more than farmers in China, controlling for other variables.

Table 2.5 refers to the amount of the urban-rural gap caused by the urban-rural difference in each independent variable. The results of decomposition show that overall, 78.96% of the annual labor income gap can be explained by using urban coefficients; 72.06% of the gap can be explained using rural coefficients. The difference of using urban and rural coefficients is small. Among all independent variables, education contributes more than 50% of the annual labor income gap, followed by occupation and age. The main difference in education is that 19% of rural respondents are graduates of four-year college or above, while only 5% of rural respondents are. Meanwhile, the coefficient of this factor is the highest, representing strong influence on annual labor income and then on rural-urban income gap.

5.2 Results of household financial market participation

The index of dissimilarity is reported in Table 2.3. Among all categories, the difference in household subjective attitude toward finance (such as sources of information, patience, and interests) is not significant from the result of Duncan's D-index of dissimilarity. Together with having credit cards and non-

financial assets, they are all below 10%. The high index of dissimilarity appears in the knowledge of investment products, indicating that 19.89% of rural workers would need to change to “have sufficient knowledge of investment products” in order to achieve balance with the distribution of household workers, and vice versa. Besides their prominent compositional difference, lack of knowledge of loans and inconvenience of loan application also stands out among all categories. And 17.95% of rural workers would need to change their opinions toward the market in order to be balanced with the distribution of urban households (vice versa). There are rural urban differences in owning investment products and informal loans. Rural has higher household sizes and lower household income, representing a higher financial pressure to maintain daily expenditure.

Table 2.6 reports the results of the logistic model – equation (3) – of holding investment products. Annual household income, living in urban areas, household size, having a credit card, being interested in economic topics, having no available service, and having insufficient knowledge of investment products are statistically significant. The Chi-square test of investment attitude also shows investment attitude’s statistical significance.

In general, the odds ratio of holding investment products increases with household income, living in urban areas, having a credit card, and being interested in economics, politics and social topics. Conversely, larger household size, not having available or convenient financial service, having insufficient knowledge of investment products decreases the log of odds. Meanwhile, using formal sources of information, having non-financial assets, and investing above average risk and return is positively

associated with the log of odds, but they are not statistically significant.

Indeed, holding other variables constant, living in urban areas results in 379.1% increase in the odds of having investment products. A 1% increase in household income is associated with a 0.5% increase in the odds of having investment products, controlling for others. This confirms that urban households with higher household income tend to have a larger probability in owning investment products than rural households with lower household income. We can also conclude that households responding that they have no available or convenient financial service are associated with a 52.7% decrease in the odds of having investment products and insufficient knowledge with a 51.0% decrease in the odds, controlling for other variables. These results verify that financial knowledge and available financial service influences the financial market participation rate in terms of investment products.

The following hypothetical cases show how our model predicts the probability of having investment products taking into account living in urban areas, annual household income, insufficient knowledge and the availability of service:

Case 1: Rural and urban households: The predicted probability of having investment products for urban households with medium household income RMB 26,900 (\$4,393.27), average household size 3.52 people (N=7,347) and all other reference variables is 5.04%. With other variables constant, a rural household with average income only has a 1.52% probability of having investment products.

Case 2: Different levels of annual income for urban house-

holds: The predicted probability of having investment products for urban households with 75% percentile annual income (RMB 50,200 (\$8,198.60)), average household size 3.52 people, and all other reference variables is 10.32% (higher than 5.04%).

Case 3: Comparison of having and not having available and convenient financial services for urban households: The predicted probability of having investment products for urban households with medium household income, average household size 3.52 people, reflecting no available and convenient financial services, and all other reference variables is 3.38% (lower than 5.04%).

Case 4: Comparison of sufficient and insufficient knowledge for urban households: The predicted probability of having investment products for urban households with medium household income, average household size 3.52 people, reflecting insufficient knowledge of investment products, and all other reference variables is 3.51% (lower than 5.04%).

Overall, the probability of holding investment products is low. Household income, available and convenient financial services, and financial knowledge are positively related to the probability. As a way to generate wealth, holding investment products demonstrates a large gap between urban and rural households.

Table 2.7 presents the results of logistic model of holding formal loans – equation (4). All independent variables are statistically significant except living in urban areas and formal sources of information. The overall test for financial knowledge and patience of respondents is also statistically significant at the 99.9% level of significance. It is surprising that living in urban

areas is not statistically significant, while it suggests no obvious difference in urban and rural households in having formal loans from banks. As expected, the household income is influential in determining the probability of having formal loans. Holding other variables constant, a 1% increase in annual household income increases the odds of having formal loans from banks by 3%. Increasing household sizes increases the potential of having formal loans from banks: one unit increase in household size is associated with an 11.7% increase in the odds of having formal loans, controlling for other variables. Meanwhile, having non-financial assets increases the odds ratio by 689%, which is extremely high. However, it can be argued that households apply for loan mainly in order to purchase non-financial assets such as real equity, land, and vehicles.

Table 2.8 presents the results of the logistic model of having informal loans – equation (4). From Table 2.8, annual household income, living in urban areas, household size, having non-financial assets, and insufficient knowledge of loans or inconvenience of application processes are statistically significant. Especially, living in urban areas reduces the odds ratio by 19.74%, controlling for other variables. Increasing household income by 1% will reduce the odds ratio of having informal loans by 0.082%, holding other variables unchanged. These results confirm the rural-urban gap in holding informal loans and demonstrate that higher household income reduces rate of informal loans. The results are compatible with Nguyen (2007) who argues household size determines financial activities in rural Vietnam. However all three cases of financial activities shows financial services influence financial activities, indicating a difference be-

tween China and Vietnam.

Here are comparisons of the probability of different hypothetical cases for holdings of informal loans:

Case 1: Rural and urban households: The predicted probability of having informal loans for rural households with medium household income RMB 30,000 (\$4,899.56), average household size 3.49 people and all other reference variables is 21.37%. With other variables constant, a urban household with medium income only has a probability of having informal loans 17.90% (less than 21.37%)

Case 2: Different levels of annual income for urban households: The predicted probability of having informal loans for urban households with 75% percentile annual income (RMB 55884.18 (\$9,126.93)), average household size 3.49 people, and all other reference variables is 17.17%. The difference in household income is not as obvious as expected, but increasing household income is negatively related to informal loans.

Case 3: Comparison of having insufficient knowledge of loans and inconvenience of application process for urban households: The predicted probability of having informal loans for urban households with medium household income, average household size, reflecting insufficient knowledge of loans and inconvenience of application process for urban households, and all other reference variables is 49.38% (more than 17.90%). Compared with households with knowledge of loans and convenience of application process, these households usually turn to informal loans as alternatives.

In general, households have a high rate of participating in informal loan markets. Rural households more likely have infor-

mal loans than urban households. Improving financial knowledge and convenience of formal loan's service can largely reduce the probability and alleviate the situation.

6. Conclusion and policy recommendation

Our models and decomposition are able to explain portions of income and wealth inequality between rural and urban China. The D-index of individual laborers shows that the largest gap in rural and urban areas is education distribution. Higher education highly increases individual labor income while participating in agricultural works reduces labor income when compared with other occupations. The study confirms on the basis of individual data about labor income that education and occupation contribute more to the individual labor income gap between rural and urban areas, revealing that human capital should be a crucial target in policy making.

The household data reveals a rural-urban difference in holding investment products and informal loans but the difference in formal loans participation rate is not significant for rural and urban households. The overall participation rate in the formal financial market is low but informal loans markets are active in China. Household income is positively and significantly related to the participation rate. This result confirms a previous study which shows income is an indicator of financial market participation. The availability and convenience of financial services and

sufficiency of knowledge also improve the participation rate.

Turning to the policy implications of these findings, we concentrate on those areas where human capital would be a central consideration, such as education and occupation. Improving education in rural areas to raise the rate of higher education would minimize the education gap and then target the individual labor gap. Because income inequality between agricultural workers and other laborers is still remarkable, subsidizing and improving farmers' income can be highly effective in dealing with income inequality.

The high difference between rural and urban financial market participation rates implies that developing rural financial services, simplifying registration and application processes, and promoting financial knowledge about investment products and loans could increase financial market participation, help households accumulate wealth, and alleviate rural-urban wealth inequality.

Our result directs more attention to the importance of human capital to explain the rural-urban variation. However, for individual income study, further research is necessary to identify other potential reasons in determining the individual labor income gap or to use more detailed categories than those used here to interpret the remaining unexplained portion of the income gap. Since the decomposition method is based on OLS regression, another future improvement that could be done is to design a decomposition method for logistic regression in order to explain the wealth inequality.

Appendix

1. The precise wording of the survey question can be found on the website of China Finance Household Survey:
<http://www.chfsdata.org/intro-14.html>

Table 2.1: Individual labor income demographic statistics (N=7,074)

^a

| | Total | Urban | Rural |
|---|---------------|-----------|-----------|
| Average annual individual labor income (RMB) | 28,343.38 | 32,110.89 | 20073.24 |
| Medium annual individual labor income (RMB) | 19,572.42 | 22,180.00 | 14,400.00 |
| Average logarithm of annual individual labor income | 9.81 | 9.49 | |
| Average age | 38.47 | 39.32 | 36.58 |
| Median age | 38.00 | 39.00 | 36.00 |
| Average age square | 1,602.32 | 1,655.03 | 1,486.61 |
| | Percentage(%) | | |
| Gender | 61.04 | 58.62 | 66.35 |
| Female | 38.96 | 41.38 | 33.65 |
| Education | | | |
| Below or primary school | 14.05 | 9.28 | 24.53 |
| Junior high education | 33.83 | 27.82 | 47.02 |
| High school education | 37.26 | 43.64 | 23.26 |
| Four-year college degree or above | 14.86 | 19.26 | 5.19 |
| Marital Status | | | |
| Single | 17.50 | 13.44 | 26.42 |
| Married/living with a partner | 80.11 | 83.87 | 71.86 |
| Separated/divorced/widowed | 2.39 | 2.70 | 1.72 |
| Occupation | | | |
| Farming | 1.94 | 0.51 | 5.06 |
| Self-employed/freelance | 7.85 | 7.37 | 8.90 |
| Employed by others | 90.22 | 92.12 | 86.04 |

^aFor categorical factors, index of dissimilarity is calculated in the way in the footnote as indicated in the paper; it is the mean difference for continuous factors

Table 2.2: Household financial market participation demographic statistics (N=8,050 unless otherwise indicated)

| | Total | Urban | Rural |
|--|-----------|----------------|-----------|
| Average annual household income (RMB) | 53,379.77 | 69,000.13 | 33,801.43 |
| Median annual household income (RMB) | 30,000.00 | 38,029.75 | 18,200.00 |
| Average logarithm of annual household income | 10.12 | 10.40 | 9.67 |
| Average household size | 3.49 | 3.24 | 3.89 |
| | | Percentage (%) | |
| Having non-financial assets ^a | 93.86 | 90.98 | 98.43 |
| Having a credit card | 5.54 | 7.29 | 2.76 |
| Using any formal sources of information | 94.62 | 96.78 | 91.20 |
| Interested in economics, politics, and social topics | 77.43 | 81.24 | 71.40 |
| Financial knowledge and patience of respondents | | | |
| Inpatient | 69.63 | 72.36 | 65.30 |
| Patient | 29.33 | 26.69 | 33.52 |
| Do not know and not willing to answer | 1.04 | 0.95 | 1.19 |
| Loans | | | |
| Having formal loans ^b | 15.20 | 16.11 | 13.77 |
| Having informal loans ^c | 33.12 | 27.52 | 41.98 |
| Insufficient knowledge of loans or inconvenience of application process ^d | 18.29 | 12.79 | 27.00 |
| Investment products (N=7,343) | | | |
| Having investment products ^e | 8.98 | 14.03 | 1.87 |
| No available or convenient services ^f | 52.44 | 52.56 | 52.28 |
| Respondents think the market is bad ^g | 22.15 | 29.60 | 11.64 |
| Insufficient knowledge of investment products ^h | 66.03 | 57.77 | 77.66 |
| Investment attitude | | | |
| Above average risk and return | 11.79 | 12.40 | 10.92 |
| Average risk and return | 24.32 | 25.66 | 22.40 |
| Below average risk and return | 62.43 | 60.68 | 64.91 |
| Not willing to answer / don't know | 1.47 | 1.26 | 1.77 |

^aIncluding land, real estate, and vehicles

^bHaving loans from a formal bank

^cBorrowing from relatives, friends and colleague, informal financial organization, and others

^dIncluding do not know how to apply, do not have confidence the loan would be granted at all, or the application process is too troublesome

^eIncluding owning a stock account, bonds, mutual funds, derivatives, and wealth management products

^fIncluding too far away from the security company; do not know where to open an account, cumbersome procedures, and limited financial resource

^gIncluding too risky, returns are too slow, lost money previously, and term is too long

^hIncluding don't know how to open an account, lack relevant knowledge, never heard of them, and afraid of being cheated

Table 2.3: Index of dissimilarity – comparing the compositional difference by urban and rural areas

| | |
|---|-----------|
| Individual laborers (N=7,074) | |
| Age | 2.74 |
| Age square | 168.43 |
| Annual individual labor income | 12,037.65 |
| Logarithm of annual individual labor income | 0.46 |
| Education | 34.45% |
| Marital status | 12.99% |
| Gender | 7.73% |
| Occupation | 6.08% |
| Households (N=8,050 unless otherwise indicated) | |
| Annual household income | 35,198.70 |
| Logarithm of annual household income | 0.72 |
| Household size | 0.65 |
| Formal sources of information | 5.57% |
| Having a credit card | 4.53% |
| Interested in economics, politics, and social topics | 9.84% |
| Financial knowledge and patience of respondents | 7.06% |
| Having non-financial assets | 7.44% |
| Loans | |
| Having formal loans | 2.02% |
| Having informal loans | 14.47% |
| Insufficient knowledge of loans or inconvenience of application process | 14.21% |
| Investment products (N=7,343) | |
| Having investment products | 12.16% |
| No available or convenient services | 0.28% |
| Respondents think the market is bad | 17.95% |
| Insufficient knowledge of investment products | 19.89% |
| Investment attitude | 2.62% |

^aFor categorical factors, index of dissimilarity is calculated in the way in the footnote as indicated in the paper; it is the mean difference for continuous factors.

Table 2.4: OLS regression results of annual individual labor income-equation (1) (N=7,074)

| | Coefficient | Std. Error | Overall Significance Test |
|----------------|--|----------------------------------|---|
| Age | 0.051*** | 0.006 | F (2, 7062) = 45.64 |
| Age square | -0.0000632*** | 0.000 | Prob > F = 0.0000 |
| Urban | Rural (reference) Urban | 0.162*** | F (1, 7062) = 43.64 Prob > F = 0.0000 |
| Gender | Female (reference) Male | 0.285*** | F (1, 7062) = 173.72 Prob > F = 0.0000 |
| Education | Below or primary school (reference) Junior high education High school education Four-year college degree or above | 0.139*** 0.468*** 1.105*** | 0.034 0.035 0.042 |
| Marital Status | Single (reference) Married/living with a partner Separated/divorced/widowed | 0.049 -0.058 | 0.037 0.077 |
| Occupation | Farming (reference) Self-employed/freelance Employed by others | 1.263*** 1.334*** | 0.084 0.077 |
| Intercept | | 6.859*** | 0.138 |

F-test for joint significance
 Adjusted R-squared = 0.2339
 ****p<0.0001
 ***p<0.01
 **p<0.05

Table 2.5: Detailed decomposition of rural-urban inequality in annual individual labor income-equation (2) (N=7,074)

| Independent variables | Mean | | Rural-urban gap ^a | | Urban Coefficients | | % of gap explained using urban coefficients ^b | | Rural Coefficients | | % of gap explained using rural coefficients ^c | |
|---------------------------------------|----------|----------|------------------------------|------------|--------------------|-------|--|-------|--------------------|-------|--|---------|
| | Urban | Rural | Urban | Rural | Urban | Rural | Urban | Rural | Urban | Rural | Urban | Rural |
| Total % explained by mean differences | | | | | | | | | | | | |
| | | | | | text(0),7896 | | | | 0.7206 | | | |
| Age | | | | | | | | | | | | |
| Age | 39.33 | 36.59 | 2.74 | 0.05*** | | | | | 0.0523 | | 0.039** | 0.2300 |
| Age square | 1.655103 | 1.486161 | 0.16842 | -0.0006*** | | | | | -0.2464 | | -0.0015*** | -0.1777 |
| Gender | | | | | | | | | | | | |
| Male | 0.59 | 0.66 | -0.08 | 0.255*** | | | | | -0.0429 | | -0.0600 | -0.0600 |
| Education | | | | | | | | | | | | |
| Junior high education | 0.28 | 0.25 | 0.03 | 0.195*** | | | | | 0.0139 | | 0.08 | 0.0057 |
| High school education | 0.44 | 0.23 | 0.20 | 0.539*** | | | | | 0.2568 | | 0.315*** | 0.1378 |
| Four-year college degree or above | 0.19 | 0.05 | 0.14 | 1.103*** | | | | | 0.3352 | | 1.44*** | 0.4376 |
| Marital Status | | | | | | | | | | | | |
| Married/living with a partner | 0.84 | 0.72 | 0.12 | 0.027 | | | | | 0.0070 | | 0.088 | 0.0228 |
| Separated/divorced/widowed | 0.03 | 0.02 | 0.01 | -0.055 | | | | | -0.0012 | | -0.179 | -0.0039 |
| Occupation | | | | | | | | | | | | |
| Self-employed/freelance | 0.07 | 0.09 | -0.02 | 1.355*** | | | | | -0.0503 | | 1.208*** | -0.0391 |
| Employed by others | 0.92 | 0.96 | 0.06 | 1.629*** | | | | | 0.2142 | | 1.273*** | 0.0164 |

Urban adjusted R-squared = 0.1784; rural adjusted R-squared = 0.2528

+ P<0.1

***p<0.0001

^aUrban-rural gap = urban mean-rural mean

^bCalculated by dividing [urban-rural gap*urban slope] by total difference between urban and rural mean of (ln labor income).

^cCalculated by dividing [urban-rural gap*rural slope] by total difference between urban and rural mean of (ln labor income).

Table 2.6: Logistic regression results of having investment products-equation (3) (N=7,347)

| | Coefficient | Std. Error | Odds Ratio | Overall Significance Test |
|--|-------------|------------|------------|--------------------------------------|
| Logarithm of annual household income | 0.549*** | 0.046 | 1.095*** | |
| Urban | 1.567*** | 0.149 | 4.791*** | |
| Household size | -0.132*** | 0.034 | 0.876*** | |
| Products or assets | | | | |
| Having a credit card | 0.805** | 0.128 | 2.237*** | |
| Having non-financial assets | 0.499 | 0.201 | 1.646 | |
| Financial service factor | -0.750*** | 0.099 | 0.473*** | |
| No available or convenient services | 0.343 | 0.339 | 1.721 | |
| Using formal sources of information | 0.359*** | 0.129 | 1.428** | |
| Interested in economics, politics, and social topics | | | | |
| Financial knowledge and patience of respondents | | | | |
| Impatient (reference) | | | | |
| Patient | -0.150 | 0.102 | 0.853 | chi2(2) = 2.49 Prob > chi2 = 0.2973 |
| Do not know and not willing to answer | -0.027 | 0.542 | 0.973 | |
| Respondents think the market is bad | 0.062 | 0.098 | 1.064 | |
| Insufficient knowledge of investment products | -0.713** | 0.096 | 0.490*** | |
| Investment attitude | | | | |
| Above average risk and return | 0.243 | 0.132 | 1.276 | chi2(3) = 36.49 Prob > chi2 = 0.0000 |
| Average risk and return (reference) | -0.407*** | 0.102 | 0.666 | |
| Below average risk and return | -1.971 | 1.020 | 0.139 | |
| Not willing to answer/ Don't know | | | | |
| Intercept | -0.109*** | 0.633 | 0.00011*** | |

Chi-square tests for joint significance

Psuedo R²=0.2061

***p<0.0001

**p<0.01

*p<0.05

Note: Reference groups: Living in rural areas; Not using formal sources of information; Having no credit card; Not interested in Economics, politics, and social topics; Impatient; Having no non-financial assets; Having available or convenient service; Having sufficient knowledge of stocks or bonds; Thinking the market is not bad; Average risk and return

Table 2.7: Logistic regression results of holdings of formal loans from banks-equation (4) (N=8,050)

| | Coefficient | Std. Error | Odds Ratio | Overall Significance Test |
|---|-------------|------------|-------------|--------------------------------------|
| Logarithm of annual household income | 0.306*** | 0.029 | 1.033*** | |
| Urban | -0.037 | 0.073 | 0.964 | |
| Household size | 0.110*** | 0.021 | 1.117*** | |
| Having a credit card | 0.573*** | 0.115 | 1.773*** | |
| Having non-financial assets | 2.067*** | 0.309 | 7.890*** | |
| Using formal sources of information | 0.005 | 0.163 | 1.004 | |
| Interested in economics, politics, and social topics | 0.282** | 0.05 | 1.320** | |
| Financial knowledge and patience of respondents | | | | |
| Financial knowledge and service factor | | | | |
| Impatient (reference) | | | | |
| Patient | -0.257*** | 0.073 | 0.773*** | chi2(2) = 15.69 Prob > chi2 = 0.0004 |
| Do not know and not willing to answer | -0.022* | 0.068 | 0.308* | |
| Insufficient knowledge of loans or inconvenience of application process | -0.055*** | 0.009 | 0.4955*** | |
| Intercept | -7.346*** | 0.442 | 0.000651*** | |

Chi-square tests for joint significance

Psuedo R²=0.0623

***p<0.0001

**p<0.01

*p<0.05

Note: Reference groups: Living in rural areas; Not using any formal sources of information; Having no credit card; Not interested in Economics, politics, and social topics; Impatient

Table 2.8: Logistic regression results of holdings of informal loans-equation (4) (N=8,050)

| | Coefficient | Std. Error | Odds Ratio | Overall Significance Test |
|--|-------------|------------|------------|---------------------------|
| Logarithm of annual household income | -0.082*** | 0.020 | 0.999*** | |
| Urban | -0.230*** | 0.056 | 0.803*** | |
| Household size | 0.260*** | 0.017 | 1.297*** | |
| Products or assets | | | | |
| Having a credit card | 0.008 | 0.115 | 1.008 | |
| Having non-financial assets | 0.594*** | 0.137 | 1.811*** | |
| Using formal sources of information | -0.201 | 0.113 | 0.818 | |
| Interested in economics, politics, and social topics | 0.049 | 0.063 | 1.050 | |
| Financial knowledge and patience of respondents | | | | |
| Financial knowledge and patience of respondents | | | | |
| Impatient (reference) | | | | |
| Patient | -0.116 | 0.057 | 0.891 | |
| Do not know and not willing to answer | -0.361 | 0.263 | 0.697 | |
| Insufficient knowledge of laws or inconvenience of application process | 1.498*** | 0.063 | 4.471*** | |
| Intercept | -1.365*** | 0.246 | 0.255*** | |

$\chi^2(2) = 5.72$ Prob > $\chi^2 = 0.0573$

Chi-square tests for joint significance

Psuedo R² = 0.1111

***p < 0.0001

**p < 0.01

*p < 0.05

Note: Reference groups: Living in rural areas; Not using any formal sources of information; Having no credit card; Not interested in Economics, politics, and social topics; Impatient

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Chapter 3

The Developing Economy of Technology and E-Governance in Moldova: A Comparative Case Study to Estonia and Analysis of Geopolitical Relations on Moldova's Move into the 21st Century

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¹

Abstract

Moldova is a small, developing country embedded in the heart of Eastern Europe. During 2011, it partnered with the World Bank to initiate the Governance eTransformation Project, a program designed to promote economic growth by moving government

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and the services it provides to citizens online in hopes of decreasing government corruption via electronic transparency. Inspiration for this approach to development is likely to have come from Estonia, another former Soviet republic and country with a small population, who initiated a very similar program in the mid 1990s to transfer its government, society and livelihood to the Internet. This paper discusses the potential of e-governance as a suitable component for Moldova's complex structural development by looking at both the precedent set by Estonia, and the progress made in Moldova to date, as well as comparing theoretical ideas such as the central role of the state, Big Push Theory, and spill over effects on economic growth. By examining factors that had, and still, contribute to Moldova's industrializing process, notably its foreign relations with the East and West, it becomes apparent that Moldova's present course may finally lead to economic growth 23 years after independence. Now, Moldova is dependent on leaders to remain vigilant and think carefully before continuing forward, especially in regard to future trade agreements. Thirty years ago, such an approach in Moldova taken by the World Bank would never have occurred. A revelation in the way international economic entities approach development has taken place as these new programs now address the roots of economic problems entangled in the need for social and governmental reforms. Additionally, this paper will

discuss overarching themes involved in the transition to e-governance, including what it means in terms of dependence on the Internet, ideological jurisdiction from the West, and the potential problems that may be caused if the Internet was to become a privatized good.

The study of development economics is a continually evolving field as it can be argued that there is no one 'correct' approach to country industrialization and development. Over the last 30 years, the International Monetary Fund (IMF) structural adjustment programs of the 1980s adopted a uniform, neoliberal approach to development, notably implementing extensive measures of privatization. In 2010 however, the IMF created the Poverty Reduction and Growth Facilitation (PRGF) program, allowing specialized routes to development based on the needs of individual countries. This revolutionary change in the intellectual fabric of international economic entities, including the IMF and World Bank, has opened the door to alternative approaches to development, with wider scopes for incorporating social and governmental changes alongside restructuring of the economy. Rather than relying on methods that approach development solely from an economic standpoint based on GDP growth, economic entities are now examining means to address risk factors that impact growth outside the economy. However, it is crucial for all players involved in making financial recommendations to these newly industrialized nations to realize that economic growth does not inclusively represent the entire picture of development because factors such as healthcare systems,

government corruption, and tax reform are crucial points that can affect GDP. This diversification of thought is key in addressing the root of development issues, such as the case of government corruption in Moldova. Recognizing that economic productivity is a dependent factor contingent on social well-being is of the utmost importance when discussing potential policy solutions for the future.

1. Paths to Development – an overview and the case of Estonia

In 2011, the World Bank partnered with Moldovan entities to initiate a new approach for modernization and development nationwide. Governance eTransformation Project is intended to spur economic growth and financial self-sufficiency in this small country torn between East and West by essentially moving all government online subsequently increasing the extent of government's accessibility and services to citizens. This novel and innovative approach was undertaken by another post-Soviet country, Estonia, whose successful path to development has resulted in its current membership to the exclusive Organization for Economic Cooperation and Development (OECD). Moldova hopes to replicate this success and spur economic growth by moving its society online. One pre-requisite for Moldova's transformation is to address generalized government corruption. In hopes of exposing and decreasing government corruption through online transparency, government officials will be held accountable

to the people. Moldova is not alone in its attempts to move its society online. Certain aspects of government e-transformation have been undertaken in other developing countries (notably the Philippines, Chile and India) in an attempt to decrease corruption as well. However, the comparison of Moldova to Estonia is particularly relevant because each obtained independence from the Soviet Union in 1991 and is classified within the same developing region of Eastern Europe (Ndou, 2004).

To appreciate why the replication of e-governance development may be well suited for Moldova, it is important to understand the details of Estonia's progress. Parallels can be drawn between these two case studies in that both nations have small populations, limited land, and lack of precious natural resources. Prior to e-governance implementation, each country started out with nearly equivalent GDP, around \$3 billion. Today the GDPs of Estonia and Moldova are respectively \$24.5 billion and \$7.9 billion. A question arises as to why Estonia has grown at a more rapid rate, relative to Moldova, despite their similarities and initial equivalence. Estonia's experience in many circumstances was different from Moldova's, markedly through population and government composition, labor force capability specialization and how it proceeded with political and economic structuring after gaining independence in 1991.

Toomas Hendrik Ilves, former Estonian Minister on Foreign Affairs and current Estonian President, shared with the BBC how he was inspired to initiate the Estonian government transformation in 1996 from a neo-Marxist book that explained Marx's reserve army of labor theory, which claims that as more firms modernize, the less overall labor is required to create a

highly functioning economy (Mansel, 2013). Ilves realized that to increase the country's rate of overall success, it was necessary to utilize the small labor force as a catalyst to shift towards technology. According to *The Economist*, Estonia laid the foundation for the e-transformation in 1992 when Prime Minister Mart Laar (1992-1994, 1999-2002) (Eesti Pank, 2014), and "his young government (average age: 35) gave Estonia a flat income-tax, free trade, sound money and privatisation. . . the country's young ministers put their faith in the internet" (A.A.K., 2013, p.2). Additionally, "A nationwide project to equip classrooms with computers followed and by 1998 all schools were online. In 2000. . . the government declared internet access to be a human right"; Ilves puts forth the view that "Estonia's success is not so much about ditching legacy technology as it is about shedding 'legacy thinking' " (A.A.K., 2013, p.3).

Estonia's clean break from Soviet oversight resulted in a new Estonian constitution by 1992, a system of privatization used to re-distribute national assets and to re-introduce the Estonian national currency the Kroon. These are all points that differentiate the Moldovan and Estonian experiences. After independence in 1991, Estonia embarked on a path to modernization by embracing the technological culture that was booming throughout the 1990s. Moldova, on the other hand, fell into disarray after independence, witnessing an ethnic power struggle that ravaged the country causing many of its Russian, Ukrainian and Romanian ethnic minorities to leave the country (Lewis, 2004). Unable to agree on a future path for Moldova due to an ethnically and socio-economically fragmented society, the country relied on the former structure of government

and law used under Soviet rule. Moldova's economy faced further hardship when the province of Transnistria, an area where the majority of Moldova's industrial sector for production was based, seceded. An additional dimension to the overall struggle was the fear of Romanian dominance that had existed prior to Soviet rule. As this paper explores the complex development history of Moldova, along with the relevance of how foreign relations with Romania still hinder Moldova's progress, we will see this emerge as an issue that will need to be addressed before development can move forward (Lewis, 2004, p.47-49).

In 1994, Moldova's slightly revised version of the Soviet Code on Penal Procedure still ruled as law and prevented any progressive measures from being passed, such as President Lucinschi's attempt to establish an anti-corruption agency that was declared unconstitutional by the Moldovan Constitutional Court (Karatnycky, Motyl, & Graybow, 1999). This was detrimental to Moldova's progress as it continually looked to the past for a way to move forward instead of creating a new path and breaking free of prior dominant rule by other countries, such as Romania or the Soviet Union. Old repressive barriers prevented the leaders from agreeing on a new path forward, as they had never previously had the freedom to choose an independent direction for their own country. The appeal for Moldova's new government to rely on and revise what they were familiar with before independence was tempting to the "old" ruling elite resulting in further isolation of ethnic minorities and a disenfranchised younger generation that desired change. The country remained unchanged with a small, elite ruling class and a populous that was not ideologically invested in, or allowed to actively partici-

pate in, Moldova's future due to control mechanisms persisting from unchecked corruption.

Meanwhile Estonia, whose new constitution formed a democratic parliamentary republic in 1992, began the process of privatization based on a voucher system shortly after independence. The Estonian voucher system allowed control to be limited solely to Estonian citizens, who could exchange their vouchers for shares "in companies or investment funds, [and] use them to buy the housing in which they live, purchase land, or buy bonds from the Compensation Fund. This privatization program combats the notions that divestiture only benefits "foreigners, local elite, and the politically well-connected" (Karatnycky et al., 1999, p.253-254). However, when Moldova privatized, it used a vastly different voucher system and progressed at a much slower rate. "Most of the state-owned monopolies are scheduled for break-up and privatization, but this has yet to occur" as of nearly 10 years after independence (Karatnycky et al, 1999, p.421). Following a path of privatization similar to the Czech Republic, the Moldovan government issued National Patrimonial bonds to Moldovan citizens based on the number of years they had worked in the economy. Although "some 90 percent of Moldovans ultimately participated in the program and about half of state assets were sold," most went to select corporations with ties to the government rather than to the people (Karatnycky et al., 1999, p. 417). Venality riveted throughout the process resulting with "Ceslav Ciobanu, the Privatization Minister, [being] forced to resign in June 1997 over a privatization scandal" (Karatnycky et al., 1999, p.417). Moldova, plagued by continual bouts of corruption in every aspect of gov-

ernment needed to devise a new path to development before all of their youthful population fled the country in search of jobs elsewhere. By 1997, Moldova had regressed to an even more precarious state when the “budget deficit was 7.7% of GDP . . . an increase from the initial target of 4.5%.” One major reason for this has been the “reluctance of Parliament. . . to penalize politically powerful firms who are delinquent on their tax payments,” leading to the IMF and World Bank to suspend their structural adjustment loan agreements (Karatnycky et al., 1999, p.418). In comparison, Estonia at the same time had a 52.3% increase in banking deposits as confidence grew around their banking and monetary system that was isolated from the political sphere. This factor, which Moldova did not possess, led investors to fear lack of returns on their investments based on speculation of political corruption influencing the financial sector of the country (Karatnycky et al., 1999). Another major reason cited for the flourishing Estonian economy was the re-introduction of its national currency prior to Soviet rule.

After gaining independence both Moldova and Estonia reinstated their previous national currencies, the Leu and the Kroon, approaching the re-introduction from two very different perspectives. Estonia chose to fix the Kroon to the German Deutsche Mark, which “curbed inflation, promoted reorientation towards European markets, and supported long-term economic recovery and growth” (Karatnycky et al., 1999, p.255). With the Kroon’s successful launch by 1993, the Bank of Estonia began to liberalize domestic holdings of foreign currency, the public’s confidence in the banking system grew exponentially, and this “was instrumental in enabling the country to stabilize

its economy well before other former Soviet republics” (Karatnycky et al., 1999, p.255). Comparatively, Moldova chose the route of a floating exchange rate for their currency. Although the exchange rate remained relatively stable throughout 1994, by 1997 depreciation became evident with the Leu reaching an all time low of 4.68 Leu per US dollar by 1998 (Karatnycky et al., 1999, p.419). Today the exchange rate has depreciated further to reach 15 Leu per US dollar in 2014, as a nominal value discounting inflation (XE Currency Exchange, 2014). Along with the re-introduction of the Leu in 1993 (OANDA Corporation, 2014), the National Bank of Moldova (NBM) was reformed in 1991(Advameg Inc., 2014) to be independent, however, compared to Estonia, the “banking sector is considered generally sound but... undercapitalized” (Karatnycky et al., 1999, p.419).

2. Technology and Politics in Moldova

“It’s sort of obnoxious to say, ‘Do what we did’, says current Estonian President Ilves, but he submits that Estonia’s success... is about shedding ‘legacy thinking’ ” (A.A.K., 2013, p.3). Is Estonia’s path to development replicable in Moldova? Has Moldova reached a stage where implementation of a technological society is feasible or where modifications of Estonia’s experience could be a success? To create a clearer picture of why the World Bank has endorsed the Governance e-Transformation Project, it is important to recognize how far Moldova has come over the past 23 years. Much of the data necessary to compare the countries after independence had not been recorded

throughout the early 1990s. However, with a report released by the United Nations (UN) in 2002 on the shift towards knowledge based economies in Eastern Europe, a relevant insight is offered on where both Moldova and Estonia stood 10 years after Soviet rule. The UN developed a formula for measuring a country's readiness to modernize called the Global Knowledge-Based Economy Index (GKEI). The GKEI factors in technology (TGKEI), public institutions (PGKEI) and the macroeconomic environment (MGKEI) in order to assess a country's ability to adapt to an economy and society rooted in technology. The formula consists of $[GKEI = A*TGKEI + B*PGKEI + C*MGKEI]$ (United Nations, 2002).

According to the GKEI Estonia scored 0.160 and was ranked 4th, just below the US (with a score of 1.0), Slovenia (0.214) and Russia (0.164). Moldova on the other hand, was ranked last out of the 28 countries surveyed with a score of only 0.0151 (United Nations, 2002, p. 60). How to measure qualitative data and quantify abstract factors contributing to a country's readiness to assume a technological economy, such as the computations made to derive the GKEI, will always be seen as controversial because there is not a direct numerical approach for measuring a country's knowledge or adaptiveness, just as there is no way to measure the exact utility or happiness of consumers, they are subjective values.

If Moldova ranked so poorly 13 years ago, has there been enough time to improve to a level capable of adopting an online government, or even an online society? In 2001, Moldova fell short of Estonia in the amount of total Internet hosts (by $\sim 96\%$), the total amount of Internet users (by $\sim 86\%$), the esti-

mated number of PCs (by $\sim 72\%$) and the number of government websites (by $\sim 88\%$) (United Nations, 2002, p.20-21). As shown in Table 4.1, the rate of Internet use has been consistently greater in Estonia than in Moldova, throughout the twenty-first century. Several of these staggering differences could be due not only to Moldova's loss of Transnistria, the production powerhouse province, but also "another major problem is that the intelligence service and police have been known to monitor Moldovans electronically, especially government opponents" therefore inciting fear and distrust between the citizens and their government (Karatnycky et al., 1999, p.414). By increasing transparency through moving the government and services it provides to citizens online the money invested in Research and Development (R&D) can be closely watched, investing in focal areas of production that are key to the resources and capabilities available.

Due to Moldova's turbulent beginning after independence, large sectors of the population including an outpouring of Moldova's youth left the country in search of stability and prosperity elsewhere. Over the span of the following years this has had a significant impact on Moldova's future because the young population was not there to pursue reform or develop new ideas to shift away from Soviet precedents. "Well over 500,000 Moldovans had left the country in search of employment. Disproportionately young, educated, and disaffected with economic conditions, the migrants could have been expected to vote in favor of reformist parties had they remained in Moldova," the consequence being that in 2001 the Communist Party was re-elected based on a platform of anti-reform (Crowther, 2004, p.43). If the

government and remaining population, composed largely of impoverished and elderly people, have been unwilling to embrace change related to the rapidly evolving era of the 21st century is there hope for reform now? If Moldova does modernize, will the young population that fled shortly after independence be enticed to come back to the country if they believe they can build a prosperous future in Moldova? Since the initiation of the Governance eTransformation Project in 2011, scheduled for completion by 2016, the World Bank's 2014 implementation status reported moderate satisfaction with the progress thus far. Public support increased from 53% in 2011 to 65% in 2014, with an end target goal of 70% by 2016 and this speaks to the hope that Moldova is on a track towards institutional change and economic growth (World Bank, 2014).

3. Transition to Technology and Economic Growth?

Having established the success story of Estonia, the following segment of this paper will attempt to theoretically establish and link the idea of decreased government corruption via on-line transparency as a potential route to development for small, emerging economies. As Estonian President Ilves mentioned, computerization will increase a country's functional size and make a technological leap especially advantageous to countries with finite amounts of resources or small populations, such as Moldova, who as of 2013 recorded having 3.559 million citizens

(World Bank, 2014). Re-creating the homegrown comprehensive technological capability of Estonia is a different matter, so laying the groundwork for change was essential. Shortly after gaining independence Estonia implemented a nation wide program called “TigerLeap” or “ProgeTiger” in 1996, introducing computer programming as part of the primary school curriculum starting at age 7 and continuing with this training throughout the student’s educational experience. The result ten years later was a country that had moved to an online society, becoming a competitive force in the technological product market with a “tech-savvy” innovative work force capable of creating and selling the program Kazaa that evolved into Skype, a live video and audio computer software application, that is valued at \$8.5 billion (A.A.K., 2013, p.1). So, what if a country does not have the same high-tech capability specialization that Estonia cultivated, would another newly formed online society have any chance of replicating Estonia’s success? Economist Paul Romer offers a theory of economic development based on the idea of increasing returns to scale that can inspire countries to be hopeful due to the idea of spill over effects. The main argument behind this idea is that methods making specific sectors of the economy prosperous will be adopted by other sectors to increase their productivity proportionally. Optimally, these positive growth factors not only have effects on the domestic economy, the international impacts can also be profound by integrating new modes of technological production into the structure of industrializing economies. This picture may not be as rosy as it appears. Often times emerging, industrializing countries, while not having to develop the technology themselves, must pay exorbitant

prices for software or machinery that is not applicable to the situation or already outdated by the time it is put into place. Perhaps Moldova will be spared this no-win scenario and not have to face the same fate as a result of having partnered with the World Bank. Countries that partner with international economic entities receive guidance and a fostering of their economy protected from volatile markets by their partnership. To assist with the high tech transition, Moldova may be provided with an advantageous opportunity to implement the latest technology, enabling them to compete at the same level as their already industrialized neighbors, such as Romania.

A controversial topic among many development economists is the extent of the role government should play throughout the industrializing process. Undeniably, in Moldova's case this question has an urgency that must be addressed due to the government's central role in the reform project. Recognizing the functional role the state plays in the economy is key to understanding the Big Push Theory of development, which is instrumental in demonstrating why the e-government transition has the potential to set Moldova on the path for progress. The Big Push Theory confronts the problem of coordination failure that often becomes an obstacle to many developing nations and can be explained by a scenario of competition in the marketplace. For example, as an individual firm, one stands to gain the most if one invests simultaneously with firms from other sectors of the economy, alternately this also poses a risk. What if only one firm invests? The single invested firm will suffer a loss while the other non-invested firms neither gain nor lose profits, and to avoid this potential loss, firms are hesitant to invest, leaving

the economy to stagnate at the status quo. Big Push Theory promotes the idea that government oversight can supersede the coordination failure by having the ability to oversee all sectors of the economy simultaneously. In some cases, sectors of the economy are nationalized, and once under government control, can all move forward in step with one another, producing economic growth. Under e-governance, all business transactions will be made public and citizens will have the capability to see how the economy is progressing by tracking different sectors online. Allocating the resources available into a single location could prove beneficial to strategizing how and where to invest. Estonians promote the strength of e-government to open development planning for the public and to use the limited resources of people and industry available to the best of the country's ability (Government of Estonia, 2014).

4. Future Challenges for Moldova

Even with Moldova's e-government transition, this small Eastern European country remains torn between East and West. With these two competitive forces vying for future trade agreements, Moldova faces difficult decisions in the future that will define its path to development, either bringing it closer to Russia or the European Union (EU). Recent events in Ukraine have intensified negotiations Moldova is currently pursuing with the EU under the watchful eye of Russia, who would not like to have the former satellite country move towards the West so quickly. Authors of the book 'Moldova and the EU' anticipated

Moldova's foreign relations with Romania as a sticking point in the progress made to integrate Moldova into the EU. Romania, who had assumed the role of a colonial imperial power to Moldova prior to Soviet rule, became a member of the EU in 2004 and is viewed as Moldova's closest tie to the West. Petru Clej and Alexandru Cantir, two authors of 'Moldova and the EU', insightfully stated "the dilemma in which the country is entangled: move closer to Russia, jeopardizing links with Romania and the Moldovans' common identity and to some extent links with the West, or 'doing a Baltic' and cutting links with Moscow, which in the past has proved to be much easier said than done" (Clej & Cantir, 2004, p.62). Each side has pros and cons for Moldova, with Russia offering large capital inflows and serving as Moldova's main trade partner throughout history, as well as the fact that Moldova relies on Russia to supply them with fuel, so cutting ties with the past will prove difficult. On the other hand, the EU offers a path towards democratic integration with relevant examples of other former Soviet republics that are now prosperous in the global economy. An additional benefit of opening trade relations with the EU is there are more countries to trade with in the European market, opposed to solely Russia. Recently, in 2013 the EU and Moldova signed the Association Agreement aiming "to deepen political and economic relations between Moldova and the EU, and to gradually integrate Moldova into the EU Internal Market – the largest single market in the world" by reforming areas including public governance, economic recovery and growth, consumer protection, and industrial and social development (EU External Action Service, 2013, p.1). With an emphasis on democracy, the new

trade agreement proposes the “opening of markets through the progressive removal of customs tariffs and quotas, and by the extensive harmonisation of laws, norms and regulations in various trade-related sectors” (EU External Action Service, 2013, p.2). The initiation of free trade by eliminating tariffs and quotas has served as a stumbling block to many developing countries that are not yet ready to compete in the global economy with established, industrialized entities. Moldova should consider the negative impacts free trade brings to less industrialized countries in the time before they are able to compete at a profitable level.

With a history of corruption and a declining or stagnant economy, the impact of free trade could be devastating to Moldova’s infant technological sector, having only been in existence since 2011. Although optimism runs high that the e-Government Transformation project will strengthen the technological sector while coordinating the economy to grow as a whole, country leaders and ministers should be leery of the profits promised by free trade. According to the European Commission on Trade (2014), 45.4% of Moldova’s trade takes place with the EU, 25.5% with Russia and 11.8% with Ukraine. In light of Ukraine’s ongoing civil war and Russia’s decline under economic sanctions resulting in a continually depreciating Ruble, Moldova is under international pressure to choose a side.

During November 2014, as Moldovans went to the polls to elect a new government, Europe’s focus turned to see the result. Pro-EU candidates pushed ahead, overtaking pro-Russian advocates in a country whose loyalty was equally divided. Statistics released from *euronews* indicated “with nearly 80% of votes

counted, the three pro-EU parties had around 44% while the opposition had around 40%” (Euronews, 2014, p.1). *The New York Times* also released an article on December 1, 2014 announcing that the top three pro-EU parties won enough seats in the Moldovan parliament to gain control (New York Times, 2014). It was inevitable that at some point Moldova would need to choose between the two sides dueling for a role as Moldova’s benefactor and recent events in Ukraine could be a contributing factor to the speed at which Moldova is gaining momentum to join the EU. Moldova’s association with the World Bank for the Governance eTransformation Project in 2011 could be viewed as a Westward invitation, with developed countries from Europe and North America jointly financing the \$23 million e-transformation (World Bank, 2012). To a certain extent the involvement of the World Bank could arguably be viewed as a form of ideological imperialism. Since post-1945, the West has been a strong advocate of democracy, stipulating democratic reforms as conditions for loan agreements. Although there has been a shift away from this type of conditionality attached to loans, democratic alignment is still of crucial importance when entering into agreements with Western institutions. This is a problem Estonia never encountered. Estonia did make a clear decision between East and West as it created a democratic parliamentary republic in 1992 forming a government by choice, not influenced by outward forces. An Estonian ‘how to’ website has generated a list of “do’s and dont’s” for countries that are considering an e-transformation and two of the dont’s include “Try to force everyone to use a centralized database or system, which won’t meet their needs and will be seen as a burden

rather than a benefit” and not to “waste millions contracting large, slow development projects that result in inflexible systems” (Government of Estonia, 2014, p.2). The M-cloud that Moldova is creating may be susceptible to crashes or hacking, as it appears that all services the government offers to its citizens are centrally located rather than each sector of the government possessing its own electronic location. Potentially, this could lead to a future risk that Moldova may experience harsh consequences from in terms of a hindrance on the benefits that the e-transformation promises (Center for Electronic Governance, 2014). However some of do’s on the list have already been implemented by Moldova, such as “be[ing] a smart purchaser, buying the most appropriate systems developed by the private sector” and “find[ing] systems that are already working, allowing for faster implementation” (Government of Estonia, 2014, p.2).

5. Conclusions

This paper has discussed the complex route to development Moldova has undertaken since its independence from the Soviet Union in 1991. At the time of independence, the country faced escalating, almost insurmountable, hurdles to achieving self-determination. A social power struggle occurred when ethnic fragmentation resulted from the outpouring of its Russian, Ukrainian and Romanian minorities and the industrialized sector of its economy suffered as the province of Transnistria seceded. Moreover, Moldovan youth, having lost faith in a prosperous future, migrated from their homeland to seek opportuni-

ties elsewhere. Among what remained intact, remnants of Soviet rule were resurrected as Moldova looked to the past for a way forward.

While events unfolded in Moldova, Estonia was also being transformed after achieving independence. By 1992 Estonia officially emerged on the world stage as a democratic parliamentary republic, and four years later initiated a nuanced approach to development by moving its entire society and livelihood online. Fifteen years later, in 2011, hoping to replicate Estonia's success Moldova embarked on a similar path to development with monetary aid from the World Bank. The result of this partnership will not be a nation with a burgeoning economy like Estonia but one that is, by the end of the Governance eTransformation, \$23 million in debt (World Bank, 2012). This singular event typifies the difference in strategies and philosophies each country has experienced on their path to autonomy. Even though Moldova switched sources of dependency it has yet to gain full financial independence. Estonia's advantage was in timing. In 1993, the Internet was a new phenomenon and over the past 20 years the IT industry has become so competitive and advanced that it is difficult to be 'cutting-edge' while simultaneously protecting an emerging economy.

As a late-industrializing country with a small labor force, repaying such a debt will take time. Decisions being made now about moving closer to the West, rather than the East, are defining a new future for the former Soviet republic. Decreasing the level of government corruption by fostering transparency online, should, by definition of the Big Push Theory and spill over effects, produce expansion in Moldova's economy. New

trade agreements made with the EU should not be done in haste, as free trade can be more damaging than beneficial during the infant stages of growth. Even with government corruption on the decline, the recent election from November 2014 shows that there will be continued disagreements in Parliament between the pro-EU and the pro-Russian factions over Moldova's future. Continually caught in a struggle between pleasing the East and the West, Moldova is a country of growing importance and now that the root of the development problem Moldova faced has been addressed, the future will hopefully embrace the ideals both the country and its people believe in.

As a concluding thought, Moldova went from Romanian to Russian control and now may potentially be ruled by the Internet. Is being dependent on technology a bad thing? Voting, paying taxes, and checking their children's homework online are just a few examples of the services offered to Estonian citizens, however, what may the consequences be if the Internet were to become a privatized good? In 2000 Estonia declared Internet access to be a human right, but what if Moldova does not do the same? What if this right cannot be maintained? The Internet is a wonderful resource and tool for development and production, but it also poses a risk that countries must be willing to take in order to practice e-governance.

Table 3.1: Increase in Rates of Internet Use in Estonia and Moldova between 2000 and 2013

| Year: | Rate of Internet Use: | |
|--------------|------------------------------|----------------|
| | Estonia | Moldova |
| 2000 | 28.2% | 0.6% |
| 2006 | 51.8% | 10.6% |
| 2010 | 75.1% | 30.0% |
| 2013 | 80% | 48.8% |

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Chapter 4

The Real Unemployment Rate? Estimating NAIRU with Alternative Measures of Unemployment

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¹

Abstract

This paper looks at the alternative unemployment rates measured by the Bureau of Labor Statistics since 1994. By using an estimation method devised in *The NAIRU in Theory and Practice* by Laurence Ball and N. Gregory Mankiw, it seeks to calculate a “natural rate of unemployment” for the U-4, U-5, and U-6 unemployment rates in order to provide a

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reference point from which these measures can be judged as they vary throughout time. Although it is found that the data found in this time period does not foster the use of this simple estimation method, interesting implications of the importance of future research into these rates are seen through the data.

Introduction

Out of the countless economic indicators economists use in their research, perhaps none hits as close to home, or is followed as meticulously by the general public, as the unemployment rate. A person's ability to pursue their worldly desires depends almost entirely on their ability to generate income. Politicians run and win entire campaigns trumpeting their superior ability to create jobs over their opponents'. It is the reality of the society that we live in that employment can make or break one's life. It is no wonder then that political pundits often attempt to convince others of their opinion about certain politicians or policies by citing unemployment statistics.

The unemployment rate declared official by the BLS (the U-3 unemployment rate) calculates unemployment by dividing the number of people currently looking for work by the number of people in the labor force. However, since 1994, the BLS has calculated alternative rates of unemployment, which it reports separately along with the usual rate. These alternative statistics have different definitions of who is considered to be unemployed, adding in other people who would normally be excluded from

the U-3 calculation. Depending on which number one looks at these can include discouraged workers (U-4 unemployment), marginally attached workers (U-5 unemployment), or those employed part-time for economic reasons (U-6 unemployment). As one might expect, expanding the definition of unemployment to include new variables often causes the rates to be higher than the official unemployment rate.

Recently, discussion of the alternative unemployment rates has become common. They are sometimes seen as representing a “real” unemployment rate, capturing important factors that the official rate leaves out. “Despite the significant decrease in the official U.S. Bureau of Labor Statistics (BLS) unemployment rate, the real unemployment rate is over double that at 12.6%.”² says Louis Efron in an August 2014 article for Forbes. While attempting to explain stagnating real wages between 2013 and 2014, Ben Walsh of the Huffington Post uses data from two different measures of unemployment, the U-3 and the U-6, saying just looking at the U-3 “leaves you with an isolated view of how many workers are not looking for a job because they don’t think they will find one, have looked for a job in the past year but not recently, and part-time workers who can’t find full-time work.”³

Simply citing alternative unemployment measures and comparing them to the numbers traditionally reported is not useful. There are major differences between the statistics, and just be-

² *Tackling the Real Unemployment Rate: 12.6%* by Louis Efron a contributor to Forbes.com

³ *Celebrate The Falling Unemployment Rate All You Want, But It Ignores A Key Point* by Ben Walsh from the Huffington Post

cause one is higher than the other may not mean that the actual health of the national labor market is being hidden. Like the U-3 unemployment rate, there should exist a natural rate of unemployment for each alternative unemployment rate. This paper attempts to begin stripping away at the ambiguity that comes with reporting multiple unemployment rates, by trying to calculate a natural rate of unemployment for the U-3, U-4, U-5, and U-6 unemployment rates. In theory this would give a reference point from which to judge the desirability of unemployment values for each tier of calculation.

This paper makes strong use of methods presented in Laurence Ball and N. Gregory Mankiw's paper *The NAIRU in Theory and Practice* which, among other things, calculates a natural rate of unemployment for the U-3 value from 1960-2000. This method is used to calculate natural rates of unemployment for the U-3 - U-6 for the years 1994-2006. The results indicate increasingly higher natural rates of unemployment for each successive tier of unemployment numbers. The results also show problems with calculating a natural rate from 1994-2006 which were not in the data from 1960-2000.

Background

Since the late 1960s the idea that there is a long-run rate of unemployment determined by structural factors has persisted in mainstream economic thought (Staiger, Stock, Watson 1997). This directly unobservable rate of unemployment, often called the "natural rate of unemployment" has a more proper name

within academic circles: the non-accelerating inflation rate of unemployment or NAIRU. Its value is the number of unemployed workers the economy settles to in the long-run, where inflation is stable.

It is best to explain the NAIRU using the framework of the Expectations Augmented Phillips Curve. The Phillips Curve is an empirically observed trade-off between unemployment and inflation. When unemployment is high, inflation is low and when unemployment is low, inflation is high. Under the Expectations Augmented Phillips Curve, this holds only in the short-run. People make decisions based on what they expect inflation to be. When inflation is lower than its expected level, businesses interpret this as indicating lower demand in the economy, so they cut back on costs by laying off workers. When inflation is high, businesses believe there is an increased demand in the economy and respond by hiring more workers. This is only true until people realize they are only richer in nominal terms, which leads them to revert to where they were before, by laying off or hiring workers. The level of unemployment that the economy returns to is the NAIRU.

Famed economists Milton Friedman and Edmund Phelps presented this idea in 1968. After the experience with stagflation in the 1970s, their theory became widely accepted. Since then many economists have attempted to calculate the NAIRU, as having accurate estimates of it could greatly help with the precision of monetary policy. The Congressional Budget Office, the Council of Economic Advisors, and multiple economists acting on their own have attempted to estimate the value of the NAIRU, with varying models and many different answers

(Staiger, Stock, and Watson, 1997). Some economists have even go so far as to question the NAIRUs existence. (Gordon, 1998).

This paper borrows mainly from the approach presented in *The NAIRU in Theory and Practice* by Laurence Ball and N. Gregory Mankiw, while some other ideas on the NAIRU and its calculation are borrowed from *The NAIRU, Unemployment, and Monetary Policy* by Douglas Staiger, James H. Stock, and Mark W. Watson. Both papers take a similar approach to estimating the NAIRU and they both make remarks on problems with its estimation.

The two papers differentiate between a constant NAIRU and a time-varying NAIRU. A constant NAIRU assumes that the natural rate is constant over time, while a time-varying NAIRU allows for changes in the estimate over time. To calculate the constant NAIRU, they define a simple regression equation that can easily be estimated using ordinary least squares. The basic form is

$$\Delta\pi = a\mu + aU_t + v \tag{4.1}$$

where $\Delta\pi$ is the difference between expected inflation and actual inflation, $a\mu$ is the constant term, equal to the NAIRU multiplied by some parameter. aU_t is the current unemployment rate in time t multiplied by a , and v is the error term, which is mostly assumed to be supply shocks. This model assumes none of the supply shocks within the error term are correlated with the independent variable in the model. Staiger, Stock, and Watson go further in their 1997 paper to show that the model can be estimated with extra lags of unemployment and/or inflation.

The estimation of a time-varying NAIRU is also done in

both of the papers using different methods. This paper will be replicating the one used in the Ball-Mankiw paper with some slight tweaks in the data. The method used by Staiger, Stock, and Watson is different, but they do not go into detail on how they achieve their time-varying estimation. It is assumed that the Ball-Mankiw and the Stager, Stock, and Watson method yield similar results (Ball and Mankiw, 2002).

Besides estimating the NAIRU, the papers look at potential problems with its estimation. The assumption that the error term is uncorrelated with the independent variables in equation (1) is a bold assumption to make. It is highly likely that any supply shocks included in the error term are correlated with the unemployment rate. In order to control for the supply shocks, one must include independent variables correlated with unemployment, but not correlated with the particular supply shock. This is extremely difficult to do and is often inadequately done in estimation attempts (Ball and Mankiw, 2002). Although there are undoubtedly other, more rigorous methods within the vast literature on the subject, the one provided in the Ball-Mankiw paper offers a great starting point for beginning to examine alternative unemployment rates and their properties.

Analysis

This section will thoroughly describe the different unemployment rates and explain the intuition behind the existence of a NAIRU for each unemployment rate.

The U-3 unemployment rate is considered the official rate of

unemployment by the BLS. It includes all citizens of working age who are not in a job, but have currently looked for work within the past four weeks.

One tier higher than the U-3 is the U-4 unemployment rate. This statistic is calculated by adding all people included in the U-3 to the amount of discouraged workers in the labor force. Discouraged workers are considered to be those who have a desire to work, but have given up looking for work. This could be a person who at one point was counted in the U-3 because she was consistently looked for a job but, after repeated failures, decided to give up.

One level higher is the U-5 unemployment rate. Individuals added to this rate are marginally attached workers. These are people who have indicated they are interested in working, but do not have a job and are not looking for one.

Before moving forward it is important to make a distinction between the U-4 and the U-5 unemployment rates. The definitions of marginally attached and discouraged workers are deceptively similar, and without some clarification the difference can seem meaningless. Marginally attached workers are those who, in the BLS surveys used to determine these rates, have indicated that they have a desire to work but they are not looking for employment. Discouraged workers have a more specific definition. These are people who have a desire to work, but have given up the search for a job for reasons indicated to be related to the economy. ⁴ To elaborate, consider a mother with

⁴To see the BLS exact definitions go to <http://www.bls.gov/webapps/legacy/cpsatab15.htm>

a newborn child. Perhaps for the first year after the child is born she decides to put her career on hiatus. She may indicate on the BLS survey that she wants to work but has to stay with her child for this time period so she has decided to drop the job search for the time being. This new mother would be deemed a marginally attached worker. In contrast, consider a man who was laid off in a particularly brutal recession. This man may look for work for a period of time with no avail. Perhaps after weeks of not finding a job he becomes disheartened and decides to wait out the period of economic difficulty by living off of his savings. This man is now a discouraged worker.

Finally there is the U-6 unemployment rate. This rate is the U-5 rate along with those working part-time who indicate they want to, and are available to, work full-time. Imagine a person who has looked for a job and can only seem to find part-time positions available. Although he desires full-time employment, he reluctantly decides to take a part-time position, concluding that some income is better than no income. This person would be counted in the U-6 unemployment rate.

The existence of a natural rate of unemployment for each of the different rates can be justified in a fashion similarly to its justification for the U-3 unemployment rate. Recall that, for the U-3 rate, its NAIRU is determined by structural factors. It may be that at any given moment, regardless of any external shocks to the economy, there is a certain percentage of the labor force that is in between jobs. Maybe the existence of some strong unions in different sectors creates a distorted labor market equilibrium, where a certain amount of the supply of labor is cut out of the market. Factors such as these may determine

the value of the natural rate of unemployment.

This logically leads to the idea that there may be a natural rate of discouraged workers, marginally attached workers, and part-time workers that the economy tends to in the long-run. It could be that there is always a small portion of the labor force that is cut out of the labor market because the skills that they offer are becoming less demanded by employers. Eventually only those workers considered the best in their skill set are being hired, while the rest of those laborers are left without work. They may become discouraged and give up looking for jobs, before realizing that the evolution of the economy has led to the extinction of the demand for their labor.

Students studying full time at universities could account for a natural rate of marginally attached workers in the economy. All else equal, there may always be a certain amount of students within the economy who desire to work but cannot do so because their studies take up too much time. They decide to live off of their parents' income or prior savings until they have enough free space in their schedule to get a job. The example with the mother stated earlier could also contribute to a theoretical natural rate of marginally attached workers.

For the U-6 unemployment rate it may be the case that there are always some businesses that decide to minimize costs by only allowing their employees to work the maximum amount of hours legally allowed to be considered part time. In this way they do not have to pay all of the benefits that must be paid to full-time workers by government mandate. Perhaps also, at any given time there are workers who desire to work full time, but their marginal productivity of labor is not enough for any business to

hire them for full-time work. They may work part-time jobs in order to increase their marginal productivity, so that those who demand labor will want to hire them full-time.

This paper will calculate the NAIRUs described above by using estimating equation (1) by OLS, as is done in the Ball-Mankiw paper. The estimation will allow for the calculation of a NAIRU assumed to be constant over the time period.

The assumption that the NAIRU is constant could be incorrect. In fact, it may vary over time as the structure of the economy changes. Perhaps unions become less prevalent and sectors that were once filled with a surplus of labor are now pulled closer to labor market equilibrium. It is possible that manufacturing jobs which once employed a large portion of the population begin to disappear from the economy. Workers that had built careers off of manufacturing are left without job prospects. Structural changes such as these may cause the NAIRU to drop or rise depending on which way it shifts the national labor market. In order to take these possibilities into account, this paper will also calculate a time-varying NAIRU. By manipulation of equation (1) we have

$$\mu + v/a = U + \Delta\pi/a \quad (4.2)$$

The time varying NAIRU can be pulled from equation by applying a Hodrick-Prescott filter, which will separate the trending and cyclical components from the data and theoretically yield the NAIRU in the form of the trending component. The Hodrick-Prescott filter separates data by minimizing the sum of square deviations between the components (Ball and Mankiw, 2002). The trending portion is smoothed depending on the value

of a parameter chosen by the one doing the estimation. The choice of the smoothing parameter will be discussed in more detail later.

The Data

Although the Ball-Mankiw estimate of NAIRU uses annual data, this paper will use monthly data. The scarcity of alternative unemployment data restricts the years that can be used to a range from 1994 - 2013. Using yearly data would only give at most 19 observations. The years used in this estimation will be from 1994 to 2006, so using monthly data will give an adequate number of observations.

Inflation data is taken from the Federal Reserve of St. Louis' data base on the Consumer Price Index for all Urban Consumers (CPI). The CPI is a way for economists to follow the nominal prices of specific goods over time. The BLS defines a basket of goods, which they deem to be an appropriate approximation of the basic items the average consumer buys. They then track the price of those items and report them in the form of an index, with 100 being equal to the base year. The percent change from one year to another is considered the inflation rate. The inflation data used in this paper is equal to the percent change in the CPI from a year ago in month m to the current year in month m .⁵

⁵A broader explanation can be found at <http://www.bls.gov/cpi/cpifaq.htm#Question.1>

There are many different forms of the CPI, with different variables included depending on the specific index. Using CPI is not the only way to measure inflation, as seen in the Staiger, Stock, and Watson paper, which uses changes in the GDP deflator to calculate inflation. Using their choice of data would require the use of quarterly data and less observations in the estimation.

The U-4, U-5, and U-6 unemployment rates have been calculated by the BLS every month since 1994. The statistics are gathered through the Current Population Survey, which has been done every month since 1940. During this survey, the bureau asks specific questions to over 60,000 households and the answers are used to determine their employment status.⁶

As mentioned earlier, the data set used in this paper is restricted to only include the years from 1994 to 2006. It has been cut off at 2006 because of the onset of the Great Recession in 2007. There is a possibility of extreme structural changes in the economy during that time period. As will be seen later, the regressions with these restrictions already suffer from bad identification problems effecting the variance of the errors and distorting the results. Including the Great Recession in the data set would only prove to add more identification problems without adding any reasonable benefit to the testing of the hypothesis.

⁶A broader explanation can be found at http://www.bls.gov/cps/cps_htgm.htm#unemployed

A Preliminary Look at the Numbers

Looking closely at the data before running any regressions gives some idea of the underlying relationships and gives some impression of what the results may look like. Each variable consists of 156 monthly observations, ranging from the years 1994 to 2006.

Inflation

Change in inflation is defined to be the current inflation rate minus the expected inflation rate, in which case having expected inflation equal to inflation from twelve months ago inflation makes sense. It would seem improbable that individuals would base their expectations of inflation off of inflation from two or three months ago. They may not notice its variation from one month to the next. More likely is that people base their expectations of inflation off of what it was a while ago.

The values of change in inflation range from -2.940% to 2.200%, but the mean of 0.020% is very different from these numbers. This suggests that, on average, the change in inflation from 12 months ago is not usually very different from current inflation. It has a standard deviation of 1.010 percentage points.

Unemployment

From 1994 to 2006 the unemployment rates varied slightly. The late 1990s saw massively low levels of unemployment, especially from 1997 to 2000 where the U-3 unemployment even dropped below 4.000% for a time. However, the economy also saw a

minor recession in the early 2000s which explains some of the higher values of the U-3 (though it never quite goes higher than 6.600%).

Overall the U-3, U-4, U-5, and U-6 have means of 5.11%, 5.34%, 6.05%, and 8.94% respectively. The U-3 ranges in value from 3.800% to 6.600% with a standard deviation of 0.690 percentage points, the U-4 from 4.000% to 7.000% with a standard deviation of 0.730 percentage points, the U-5 from 4.600% to 8.100% with a standard deviation of 0.793 percentage points, and the U-6 from 6.800% to 11.80% with a standard deviation of 1.140. Each of the unemployment rates seem roughly as volatile, though the U-6 seems to be much more so, with its standard deviation being almost 0.400 percentage points higher than the U-3.

It is interesting to note how the different unemployment rates vary with each other over time.

The most noticeable feature of Figure 4 is the massive gap between the U-6 unemployment rate and all of the other rates. It seems that the amount of part-time workers desiring to work full-time is quite larger than the amount of discouraged or marginally attached workers in the economy. It is also important to note that, while the lines do move closely together in their ups and downs, there is no point on the graph that any of the lines converge, further indicating that there could be a natural rate that each of the rates settle to in the long-run.

Inflation and Unemployment

Figure 4.2 shows a scatter plot with change in inflation on the y -axis and U-3 unemployment on the x -axis.

There seems to be hardly a relationship at all during this time period between change in inflation and unemployment. It is possible to see what could be a tiny negative relationship between the variables, but overall the variance seems to be high. Making a scatter plot of the change in inflation with the other unemployment rates gives similar results.

Having such a small relationship between change in inflation and unemployment from 1994 to 2006 will greatly affect the accuracy of the estimation technique, which was already relatively simple to begin with. To contrast, consider the relationship between change in inflation and unemployment from 1960 to 2000. Figure 4.3 shows the relationship in a scatter plot like before. The year range is the same range used in the Ball-Mankiw paper and the data is the same except for the use of monthly data instead of yearly data.

It is clear from the graph that the relationship will not be as strong as the relationship in the Ball-Mankiw paper.

The period used in Figure 4.2 is smaller than the time period used in Figure 4.3, so it makes sense to see if smaller intervals within the 1960 to 2000 period have any similar cases of wide variance. Doing so does not show any similar outcome during shorter periods from 1960 to 2000. While some periods have less notable relationships than others, one can usually see a clear negative relationship between the variables, with a lot less variance than in Figure 4.2.

NAIRU Estimation

The NAIRU can now be calculated, with some idea of what results can be expected. There are four different regression equations to be estimated

$$\Delta\pi = a\mu + aU3 + v \quad (4.3)$$

$$\Delta\pi = a\mu + aU4 + v \quad (4.4)$$

$$\Delta\pi = a\mu + aU5 + v \quad (4.5)$$

$$\Delta\pi = a\mu + aU6 + v \quad (4.6)$$

In the U-3 regression R^2 is equal to 0.031, in the U-4 regression R^2 is equal to 0.026, in the U-5 regression R^2 is equal to 0.028, and in the U-6 regression R^2 is equal to 0.028. These are highly different from the R^2 value in the regression using monthly data from 1960-2000, which is closer to 0.200. In this case, all of the unemployment rates hardly explain any of the variation of change in inflation.

Besides small R^2 values, there are some interesting coefficients on the unemployment variables. Each one is statistically significant at the 5% level. The coefficients have a negative value, which is expected considering the predicted negative relationship between unemployment and change in inflation. The absolute values of the coefficients decrease progressively as each successive unemployment rate is used.

Dividing $a\mu$ by a will yield the NAIRU in its constant form. Doing this for each regression gives

$$\text{U-3 NAIRU} = 5.192\%$$

$$\text{U-4 NAIRU} = 5.435\%$$

$$\text{U-5 NAIRU} = 6.151\%$$

$$\text{U-6 NAIRU} = 9.079\%$$

The mathematical logic behind calculating a time-varying NAIRU follows directly from equation (1) from which equation (2) is formed from algebraic manipulation. Equation (2) is formed by rearranging equation (1) so that the sum of the long-run unemployment rate (NAIRU) and all external shocks to the economy divided by some parameter is equal to the unemployment rate in time t plus the change in inflation divided by the parameter a .

The next step is to separate the equation into trending and cyclical components (as represented algebraically by μ and $\frac{v}{a}$ respectively). This can be done using a Hodrick-Prescott filter. How smooth the trend line is, depends on the value used for the smoothing parameter (represented by λ). Choosing a low smoothing parameter will keep the trend line bumpy, and a sufficiently high smoothing parameter will result in a trend line that is parallel with the x -axis. While Ball-Mankiw claim that the choice of the value for λ is largely arbitrary (they calculate their trend line using two different λ s), economists Morten O. Ravn and Harald Uhlig published a paper stating that λ should equal 129,600 when using monthly data (Ravn and Uhlig, 2002). λ is set to this value for the estimation.

Figure 4.4 shows the predicted time-varying NAIRUs for the U-3, U-4, U-5, and U-6 unemployment rates. Note that, as before when their values were simply graphed together, the estimated NAIRUs for each unemployment rate follow each other closely, but they never converge. The next section will review the results and discuss the potential pitfalls of this estimation.

The results of the regressions above show the tendency for the coefficient on the unemployment variable to decrease in absolute value as higher, more encompassing unemployment rates are used. This makes sense mathematically. Recall that the constant NAIRU is equal to the constant term in the regression divided by the parameter a (the coefficient on the unemployment variable). The estimated constant NAIRUs get larger the more expansive the unemployment definition being used, but the constant term in the regressions stay almost the same. This implies that the parameter a must be getting smaller in absolute value as higher order unemployment rates are used. Also noticeable is that higher levels of unemployment rates result in lower R^2 values for the regression.

While all of the independent variables in the regressions are statistically significant at the 5% level, the regressions also exhibit high amounts of heteroskedasticity and serial correlation. Attempting to correct for this using Newey-West standard errors results in the independent variables becoming statistically insignificant below the 10% level. It is important to note that correcting for heteroskedasticity in the 1960 to 2000 data did not cause the independent variables to become insignificant.

Earlier it was stated that the regressions implicitly assume no correlation between the supply shocks represented in the er-

ror term and the independent variables. It is more than likely that various supply shocks on the U.S. economy during the time period being observed *are* correlated with the unemployment rates. Leaving variables that control for these shocks out of the regression will cause the coefficient on the unemployment variables to be positively or negatively biased.

Imagine that in one of the years from 1994 to 2006 the southern part of the United States experienced a particularly harsh hurricane season that destroyed much of the capital in many major cities. With buildings being destroyed and costs heavily increasing for many businesses the unemployment rate in several of the southern states doubles. In addition, with many firms key to the production of natural resources (such as oil) affected, the prices of these goods, and many other goods, will rise. Thus, inflation rises as well. Not controlling for this supply shock would cause positive bias in the estimation of the coefficient on unemployment, and the estimates of the NAIRU would be lower than they should be. The results of the estimation would not be accurate.

Unfortunately, identifying and controlling for these possible shocks to the economy is extremely difficult. The models suffer from an identification problem, meaning controlling for them is only possible by including variables that are correlated with unemployment, but not correlated with the supply shock being controlled for (Ball and Mankiw, 2002). As one might imagine, coming up with variables matching these specifications is a daunting task.

Another possibility is omitted variable bias stemming from not including lags in the unemployment variable. This is an

idea brought up in Staiger, Stock, and Watson's paper. It is not hard to imagine that unemployment from a few time periods ago may be affecting the change in inflation in time period t . Adding lags to unemployment in the regression may cure some of the bias in the independent variables.

Attempts were made to fix this omitted variable problem by including an unemployment variable with twelve lags in the regression equation. The results looked promising. Both current unemployment and lagged unemployment were highly statistically significant. In addition, the R^2 for the regression jumped from 0.020 to 0.200 and after correcting for heteroskedasticity and autocorrelation the independent variables were still statistically significant. However, when attempting to calculate a time varying NAIRU, the trending component varied between negative values and extremely high positive values, which is impossible.

Perhaps the greatest downfall of estimating NAIRU during this period is the period itself. Because of all of the various supply shocks and structural changes to the economy in the late 1990s and early 2000s, the Expectations Augmented Phillips Curve may have broken down. Indeed, many experts predicted accelerating inflation in the end of the 1990s due to highly reduced unemployment, but inflation decelerated instead (Gordon, 1998). The fact that the change in inflation versus unemployment relationship is not as significant during this period likely invalidates the attempt to use the Ball-Mankiw method when calculating NAIRU.

In the end, the results do not invalidate the hypothesis that there exists a natural rate of unemployment for alternative un-

employment calculations, but it does not validate it either. Although the estimates of constant NAIRUs and time-varying NAIRUs cannot be considered precise, the estimates still fell within the range of values one would believe to be plausible. In order to sufficiently determine if a natural rate exists and to estimate its value, more data must be collected on the alternative unemployment rates. Economists will need to wait many years until this is adequately done. An alternative method for calculating the NAIRU may also exist. One that is not as reliant on the variability of the Phillips Curve relationships over periods of time.

Though an accurate estimate of a NAIRU for alternative unemployment rates was not estimated, one can see with clarity that even in good economic times the unemployment rates do not converge. This makes it clear that using alternative unemployment rates to determine anything about the national economy is a practice that must be used with caution. The U-6 unemployment rate being 9.000% is not something to worry about if that is its usual rate during an economic expansion.

Then what use, if any, do alternative unemployment rates have? For one, they may be useful in allowing economists to more carefully observe structural components of the economy. If ten years from now the U-3 unemployment rate stays where its current natural rate, but the gap between the U-3 and the U-4, U-5, or U-6 begins to grow larger this may be a sign of undesirable changes taking place in the very structure of the economy. It could be an indication of a larger natural rate of discouraged workers or part-time workers wanting full-time work. With the U-3 omitting these variables, the alternative rates could be very

useful in detecting a structural shift of that nature. Being able to accurately estimate a natural rate of unemployment for each of these figures will only add to the ability of economists to recognize these problems.

The unemployment rates may have useful implications as indicators and predictors of economic activity other than the inflation rate. Estimating Okun's Law with alternative rates of unemployment may prove to be a worthwhile research topic. With many extra variables added into the unemployment calculations, alternative rates may make better predictions of change in real GDP than the current official rate does.

We may be a long time away from determining if alternative rates of unemployment reflect the "real" unemployment rate. They are still relatively new concepts in economic thought. The data on hand is small and will continue to be for years to come, but once more research is done and we are able to have a clearer understanding of their properties, and where they fit in with the rest of the macro-economy, they may prove to be worthwhile tools for economic analysis.

Figure 4.1: U-3, U-4, U-5, and U-6 unemployment rates from 1994 - 2006

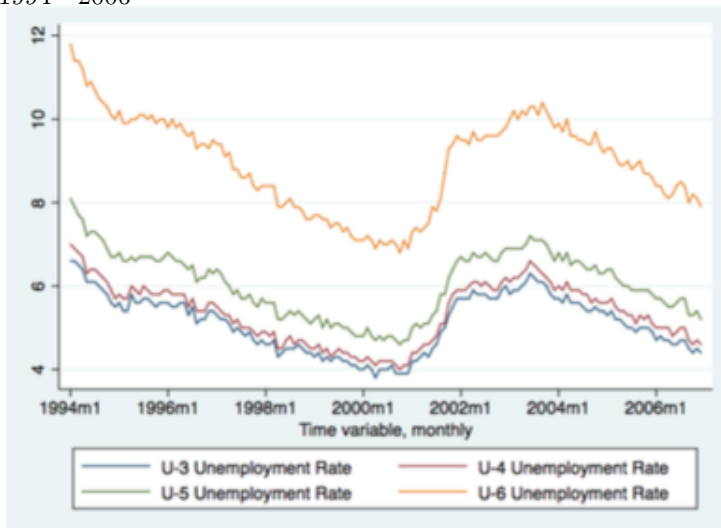


Figure 4.2: Change in Inflation vs U-3, Unemployment 1994 - 2006

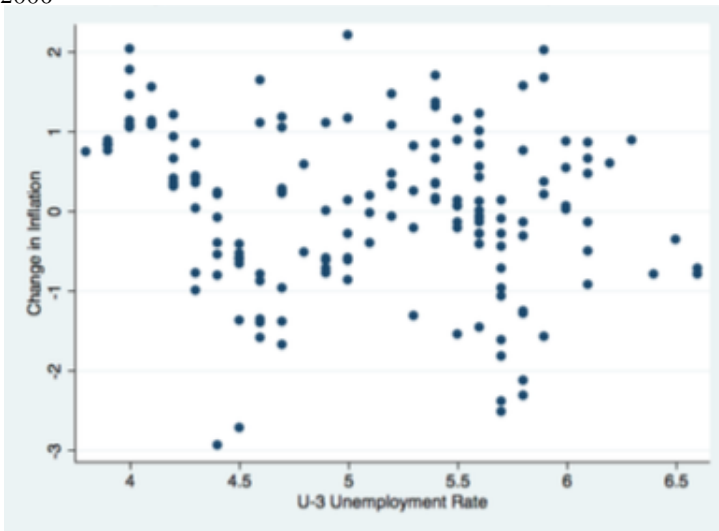


Figure 4.3: Change in Inflation vs U3 Unemployment, 1960 - 2000

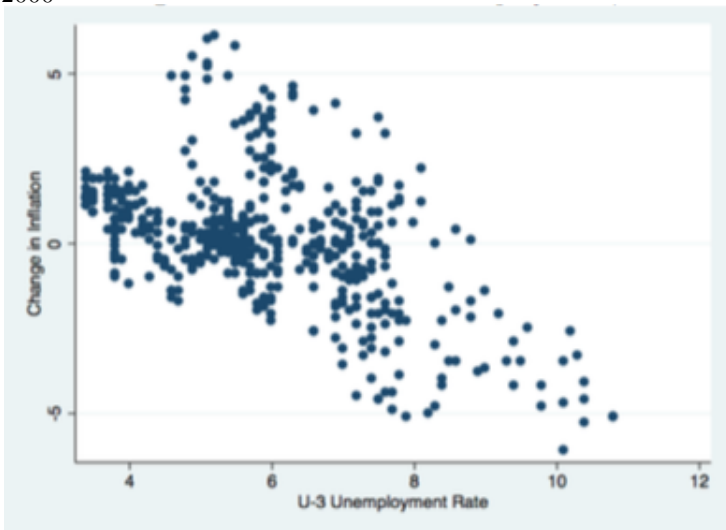


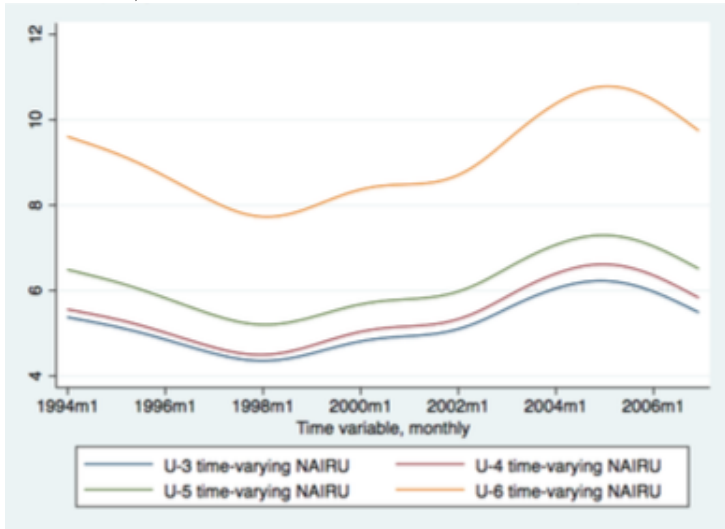
Table 4.1: Alternative Unemployment Phillips Curve Estimations

| | (1) | (2) | (3) | (4) |
|---|--------------------|--------------------|--------------------|--------------------|
| U3 unemployment rate | -0.257* (-2.22) | | | |
| U4 unemployment rate, adds discouraged workers | | -0.227* (-2.05) | | |
| U5 unemployment rate, adds marginally attached workers | | | -0.214* (-2.11) | |
| U6 unemployment rate, adds workers employed part-time for economic reasons | | | | -0.148* (-2.10) |
| Constant | 1.336* (2.23) | 1.234* (2.06) | 1.315* (2.12) | 1.348* (2.12) |
| Observations | 156 | 156 | 156 | 156 |

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 4.4: Time - Varying NAIRU for Alternative Unemployment Rates, 1994 - 2006



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Afterword

The Editorial Board

Dakota Firenze

Dakota Firenze graduated from the Commonwealth Honors College at UMass in May 2015, where he earned two Bachelor of Arts degrees in Economics and Political Science, and was inducted into the Phi Beta Kappa Society. During his undergraduate years, Dakota worked on campus as a technician at the HFA IT Help Desk. In 2014, he had the privilege of participating in a research internship at an executive search firm in London. Currently, he is exploring opportunities to pursue his interests in real estate investment and management. In his free time, he loves to travel and explore the world with close friends.

Andrew Furman

Andrew Furman is a senior economics major. In addition to editing for the MUJE, Andrew is the current president and founder of his UMass fraternity, Tau Kappa Epsilon. He is also involved with the UMass Men and Masculinities Center, which is a resource center on campus for healthy masculinity. Furthermore, he interns as a legislative aide at the Massachusetts Governor's Office in Springfield. Andrew is going to attend law school in the greater Washington D.C. area next fall in hopes to pursue a career in public service.

Marton Gal

Marton Gal is a rising senior studying economics and math. He is interested in macroeconomics and economic history, as well as anthropology.

Andre Gellerman

Andre Gellerman is a Sophomore studying International Relations and Economics. His academic interests center around the study of nuclear non-proliferation and the economics of WMD research and acquisition. Andre grew up bilingual in a Russian/American household, has traveled widely across the world, and lived in Germany where he studied German. In his free time Andre enjoys reading, playing water polo, and spending time with his family.

Parham Yousef Gorji

Parham Yousef Gorji is a graduating Senior at UMASS Amherst pursuing a double major in Political Science and Economics. Originally a native of Iran, Parham moved to the United States in 2003 and now holds dual citizenship in both nations. Beyond his work editing for the University Economics Journal, here at UMASS Parham competes on the wrestling team and with the Brazilian jiu-jitsu club, and also is a member of the Undergraduate Economics Club. Outside of school, he's passionate about photography and travel with trips in the last year to Africa, Australia, the Philippines, and Turkey. Impressed by the transformative nature of Economic policy in developing nations, after graduation Parham plans to utilize his education experience to work on global micro-finance initiatives.

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