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# *The Park Place Economist*

# The Park Place Economist

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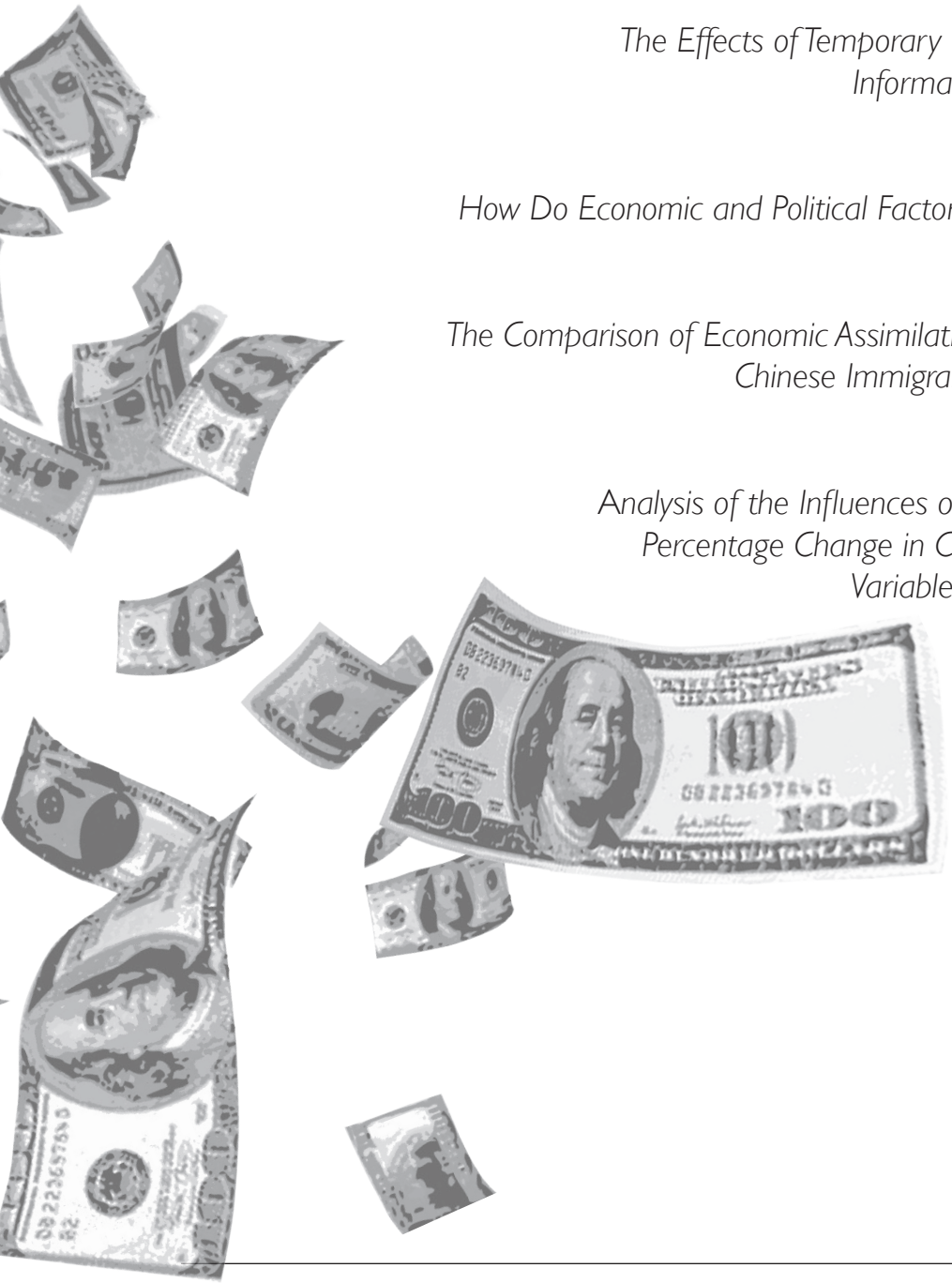

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# Letter from the Editor

Hello! I am proud and honored to have served as the Editor-in-Chief of the twenty-first volume of The Park Place Economist for the 2012 to 2013 school year. This student-run publication still remains one of the few undergraduate economic journals in the nation. The increase in submissions has risen tenfold, as well as the size of editorial board. The Park Place Economist Staff has expanded to all years of students from diverse academic backgrounds who participate in the publishing process. In addition, the journal brings valuable insights and exposes all students to upper-level undergraduate research. One significant change in the journal's recent history is that the publication is now a registered as a Registered Student Organization (RSO). With the help of being a RSO, the publication of the journal will continue for many years to come because funding will be allocated by Student Senate. I would like to thank Derek Lindgren, this year's treasurer, for accompanying Mark Giannis, Assistant Editor-in-Chief, and I to the Student Senate financial advisory board meeting.

The journal continues to acknowledge students' economic research at Illinois Wesleyan University by publishing a variety of topic areas and methodologies used for empirical research. This year thirteen articles have been published from the Economics' Senior Seminar classes and other economic electives. Topics within the United States include assessing happiness, unemployment of minorities, crime rates, temporary immigrant labor, NASA funding, immigrant assimilation, and stock performance. Internationally, other articles examine developing countries such as India and Brazil, the determinants of growth in the Former Yugoslavia, and water quality and sanitation in Africa. We are also fortunate enough to publish an article in the field of environmental economics that conducted an experiment simulation on Illinois Wesleyan's campus.

The high caliber of this year's The Park Place Economist would not have been possible without every single contributor. Firstly, I would like to recognize and thank all of the authors who allowed their economic research to be published because without their work there ultimately would be no journal. Secondly, I would like to thank my staff for completing their tasks on their own outside time and meeting all of my demands. Thirdly, I would like to thank Mark Giannis and Elizabeth Liubicich for putting in many hard hours of work on this volume. Fourthly, I would like to thank Sijia Song, the Editor-in-Chief of the Undergraduate Economic Review, for his moral support. Lastly, I would like to thank Gary Schwartz for printing this year's publication and Professor Robert Leekley for his kind words of wisdom.

Please enjoy the twenty-first volume of The Park Place Economist!

Tara Gracer
Editor-in-Chief

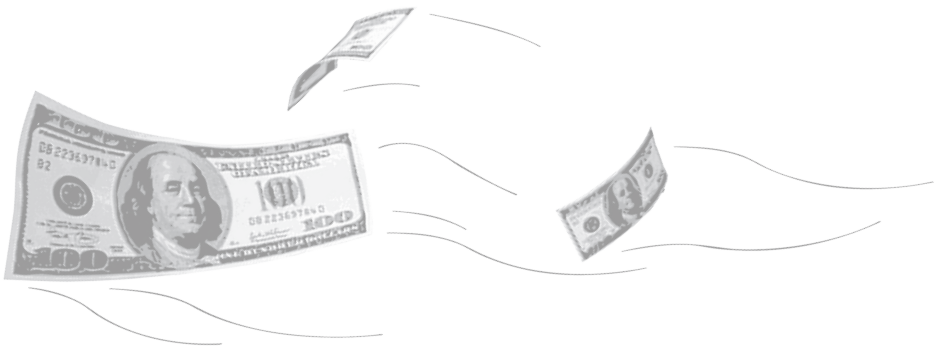
# Experimental Economics Comes to Life – Prior Appropriations in the Mimbres River Basin

**Melissa Seeborg**

Early in the 2012 fall semester, a group of thirteen seniors gathered in the CLA lab, knowing nothing more than that they had signed up for an incentivized experiment under Professor Broadbent's direction. It was quickly learned that they were blind subjects in a study searching to understand how water-leasing markets operate under the legal framework of prior appropriations, in which senior users have priority of water use over junior users. Each student was assigned a user on the Mimbres River, and logged into a computer program specially designed for the experiment. Professor Broadbent versed participants on the concept of prior appropriations, the landscape of the area in study, and what the main goal for each user was. However, once the software began running, the students were on their own to decide the allocation of their water and the price of trades with other members. No one user had the same amount of water rights in the market, and trading quickly became heated as students tried to make the most of the limited resource.

The making of this project was not a simple task. The design process of the interface began in 2009, with final results obtained in October of 2012. Collaborators worked together across the country and included economists from the University of New Mexico and University of Chicago, programmers from the University of Texas, and a group of hydrologists from the Sandia National Laboratories in Albuquerque. Preliminary results indicate that during times of drought junior users do not have access to water and are entering the market to effectively lease water from senior users. There is also evidence of crop protection through stacking, which is the idea of increasing crop yields by allocating more water to them.

Hayley Harroun, a 2012 December economics and environmental studies graduate, had the opportunity to focus her economics senior seminar paper on Professor Broadbent's experiment to see whether or not price differentials occurred in the water leasing market tested. She concluded that during times of a drought when a price differential did occur between the oldest water rights and the junior users. Hayley viewed the experiment as beneficial to all, stating: "My laboratory experiment, creating a hypothetical water leasing market, used test subjects from the senior class in the economics department at IWU. Because of this I wasn't the only student learning about experimental economics and the real world application of resource economics, the students that participated in the experiment were as well. I believe that provided a real learning opportunity for all of us."



# Professor Ilaria Ossella-Durbal's Sabbatical Adventures

## Melissa Seeborg

In the economics of developing countries, there often emerges the question of how one can take an abstract theory and transform it into a functional policy or project. During her sabbatical in the Spring of 2013, Professor Durbal is tackling this question and making the connections more fruitful for her students. The purpose of her work is to compile a series of different projects to create a supplemental reader for her ECON 355 Economics of Developing Countries course, which will then be utilized in assignments throughout the year.

'The Green Revolution' in Asia serves as an example of one of these projects. Here, a number of economic and technological initiatives were implemented to commercialize agriculture and increase food production. However, criticisms over the true value of increased production and fears have emerged over the abundant use of fertilizer and its long-run effects on the soil. By incorporating examples similar to 'The Green Revolution', Professor Durbal's supplement will force students to take a critical look at the material and see how projects in developing countries are panning out in reality.

Current examples of development projects will be compiled using information from The United Nations Development Programme (UNDP), Food and Agriculture Organization (FAO), World Bank, and other agencies. Professor Durbal will also be researching and keeping up with think tanks in developmental economics. Her final product is sure to provide a fuller picture of economics outside of the more traditional realm, and will be beneficial for many future classes to come.

In addition to research and the creation of the supplement, Professor Durbal took time out of the office for travel, which included an tiger safari in India!

Students and faculty look forward to welcoming Professor Durbal back next fall!

# Class of 2013 Senior Biographies

## *Graham Boden*

**Major/Minor**: Economics

**Hometown**: St. Louis, Missouri

**Activities Here at IWU**: Central Illinois Anime Club, Advanced Japanese Language Club, BYOD Game Club

**Plans after Graduation**: Pursue a Master's Degree in Economics

## *Mengyuan Chen*

**Major/Minor**: Economics

**Hometown**: Chengdu, China

**Activities Here at IWU**: Finance Society

**Plans after Graduation**: Employment!

## *Jesse Corkin*

**Major/Minor**: Economics

**Hometown**: Cincinnati, OH

**Activities Here at IWU**: Tau Kappa Epsilon Fraternity

**Plans after Graduation**: Unsure, not interested in life after college

## *William Erlain*

**Major/Minor**: Economics & Religion

**Hometown**: Naperville, IL

**Activities Here at IWU**: Office of Residential Life, Hattie's Coffee Shop, Undergraduate Economic Review

**Plans after Graduation**: Currently working at Allstate Insurance as a Quantitative Analyst
(Graduated Early)

## *Tara Gracer*

**Major/Minor**: Economics & Environmental Studies

**Hometown**: Varazdin, Croatia

**Activities Here at IWU**: IWU Swim & Dive, Argus Newspaper, Wesleyana Yearbook, SIERRA Student Coalition, Amnesty International, Spanish Club, Econ Society, National Society of Leadership and Success, The Park Place Economist, IWU Peace Garden, Action Research Center, UER

**Plans after Graduation**: A master's degree in Geography and Envrionmental Resources at Southern Illinois University for natural resource management or environmental economics.

## *Elizabeth Hancock*

**Major/Minor**: Economics & Sociology

**Hometown:** Bloomingdale, Illinois

**Activities Here at IWU**: Alpha Gamma Delta, Alpha Phi Omega, WESN, Economics and Statistics tutor, Titan Orientation Leader, Omicron Delta Epsilon (Economics Honor Society), Alpha Kappa Delta (Sociology Honors Society), Honors research candidate for Economics Department

**Plans after Graduation**: A job followed by pursing a Master's Degree.

## *Hayley Harroun*

**Major/Minor**: Economics & Environmental Studies

**Hometown**: Bloomington, Illinois

**Activities Here at IWU**: Sierra Student Coalition and Omicron Delta Epsilon

**Plans after Graduation**: Graduate School
(Graduated Early)

## *Jarrod Hill*

**Major/Minor**: Economics

**Hometown:** Springfield, Illinois

**Activities Here at IWU**: Black Student Union, Wind Ensemble, Jazz Ensemble, Symphonic Winds, Titan Leadership Program, IWU Gospel Choir, Summer Enrichment Program

**Plans after Graduation**: Attend the University of Illinois-Springfield to attain Master's Degree in Human Resources

## *Taylor Kaldahl*

**Major/Minor**: Economics/Political Science

**Hometown**: Chicago, Illinois

**Activities Here at IWU**: Cross Country & Track and Field

**Plans after Graduation**: Searching for a job

## *Zahra Lalani*

**Major/Minor**: Economics & Accounting

**Hometown**: Chicago, Illinois

**Activities Here at IWU**: Student Senate Executive Board, Kappa Delta (Social Sorority), Alpha Kappa Psi Executive Board (Professional Business Fraternity), Undergraduate Economic Review, IWU Club Volleyball, Vice President of Summer Enrichment Program, Girl Scouts of America, Accounting Society, Economics Society, Tour Guide for IWU Admissions office

**Plans after Graduation:** Auditor for McGladrey at Chicago auditing hedge funds and private equity

## *David (Will) Lawrence*

**Major/Minor**: Economics & Philosophy

**Hometown:** Great Falls, Virginia

**Activities Here at IWU**: Pembroke Program, Sigma Pi (Social Fraternity), Ethics Bowl

**Plans after Graduation**: Attending the University of Virginia School of Law

## *Hruday (Deepak) Mallubhotla*

**Major/Minor**: Economics & Physics

**Hometown**: Bhopal, India

**Activities Here at IWU**: Studying Economics

**Plans after Graduation**: Unsure

## *Aravind Nagavalli*

**Major/Minor**: Economics/Pre-Med

**Hometown**: Teaneck, New Jersey

**Activities Here at IWU**: Brother of Theta Chi, Econ society, Omicron Delta Epsilon, Intern for Lamu Center of Preventative Health through IWU's Action Research Center, Editor for PPE and UER

**Plans after Graduation** Medical School

## *Patrick O'Neill*

**Major/Minor**: Economics

**Hometown**: Lansing, Illinois

**Activities Here at IWU**: Theta Chi (Social Fraternity)

**Plans after Graduation**: Work then Law School

## *Ashvin Reddy*

**Major/Minor**: Economics

**Hometown**: Naperville, Illinois

**Activities Here at IWU**: Tennis Team, Office of Residential Life

**Plans after Graduation**: Working for Grant Thornton LLP in Chicago in the Valuation Services Group

## *Katelyn Rowley*

**Major/Minor**: Economics/Business

**Hometown**: Lee's Summit, Missouri

**Activities Here at IWU**: Alpha Phi Omega, Alternative Spring Break 2011, IES Abroad Ambassador, Clarinet Choir, Omicron Delta Epsilon, Park Place Economist, and the Undergraduate Economic Review

**Plans after Graduation**: Graduate School to earn a Master's Degree in Economics

## *Melissa Seeborg*

**Major/Minor**: Economics/Political Science

**Hometown:** Bloomington, Illinois

**Activities Here at IWU**: Cheerleading, UER (Marketing Coordinator/Editor), The Park Place Economist, heavily involved in the IWU Action Research Center

**Plans after Graduation**: Law School

## *Sijia (Sky) Song*

**Major/Minor**: Economics

**Hometown**: Wuhan, China

**Activities Here at IWU:** Student Senate Treasurer, Action Research Center, Editor-in-Chief of UER

**Plans after Graduation**: Ernst & Young-Transaction Advisory Services

## *Michael Sipple*

**Major/Minor**: Economics

**Hometown**: Palos Park, Illinois

**Activities Here at IWU**: Men's IWU Club Volleyball, National Society of Leadership

**Plans after Graduation**: Pursue a career in the Finance/ Insurance industry

## *Benjamin White*

**Major/Minor**: Economics & Mathematics

**Hometown**: Saint Joseph, Illinois

**Activities Here at IWU**: Men's Cross Country, Men's Track and Field

**Plans after Graduation**: Unsure

## *Joshua Slevin*

**Major/Minor**: Economics

**Hometown**: Peru, Illinois

**Activities Here at IWU**: Economics Society, Intramural Basketball and Softball, After school Basketball League, TKE Sand Volleyball, Student-worker for the Dean of Students

**Plans after Graduation**: Receiving a job

## *Le Yin*

**Major/Minor**: Economics & Accounting

**Hometown**: Hunan, China

**Activities Here at IWU**: Accounting Society, Habitat for Humanity

**Plans after Graduation**: Graduate School

## *Austin Smiley*

**Major/Minor**: Economics & Business Finance

**Hometown** Tucson, Arizona

**Activities Here at IWU**: Econ Society, Alpha Kappa Psi, Theta Chi, Track Team, Student Council, National Society for Leadership and Success, Law Society, Inter-Fraternity Council, and Omicron Delta Epsilon

**Plans after Graduation**: Work in finance with a focus on aerospace companies

## *Wei Zhang*

**Major/Minor**: Economics & Accounting

**Hometown**: Zhenjiang, China

**Activities Here at IWU**: National Association of Black Accountants, Undergraduate Economics Review, and Accounting Society

**Plans after Graduation**: Graduate School or work, still pending upon graduate school decisions

# Brazil: The Impact of Business Conditions and Hyper-Urbanization on Development in the Country of the Future

**Nicholas Desideri, Drake Hill, Elizabeth Liubicich, & Claudia Petcu**

## I. INTRODUCTION

In recent history, Brazil's economy has featured the typical boom and bust cycle. In the "boom" phases of this cycle the nation has been deemed "The Country of the Future." Unfortunately, Brazil has never been called "The Country of Now" because its booms are inhibited by culprits such as the bust in the cycle, a global downturn, or a lack of sufficient systems and infrastructure to continually support growth.

Brazil is situated in the northern part of South America, and covers 47.3 percent of the continent (United Nations, 2013). It ranks fifth in the world both in terms of area and population with 196,655,014 people (World Bank, 2011). Careful examination of Brazil's economic data indicates that it is moving towards a service-based economy, an indication that the economy is becoming similar to those of high-income nations. However, high inequality remains a problem as evidenced by its high GINI coefficient.

Throughout the years, Brazil has suffered from political turmoil and changes of regime. Since stabilizing, the main problem plaguing Brazil's political realm is corruption. In order for Brazil to change and become the country of today, two main economic issues must be addressed immediately. The first is that business conditions that are more conducive to completing transactions must be created. To accomplish this, Brazil must aim to improve its Ease of Doing Business rating by loosening its protectionist trade policies and reforming its archaic labor code. Furthermore, Brazil should address the problem of its ever-increasing urban population by providing more opportunities in the agricultural sector. If such ends could be achieved, Brazil may finally be able to change its status from "The Country of the Future" to "The Country of Now".

## II. ECONOMIC BACKGROUND

Despite suffering from the economic recession during the global financial crisis in 2008, Brazil is now South America's regional economic power. Though the country faced economic collapse due to diminished demand for exported goods, Brazil's natural resources, the sizeable labor force and international interest allowed it to recover. Classified by the World Bank as a middle-income country, Brazil's 2011 GNI per capita was 10,720 United States dollars. In 2011, Brazil's Gross Domestic Product (GDP) was 2.477 trillion (measured in current United States dollars). Brazil's average annual per capita GDP growth rate from 1990 to 2000 was 0.369 percent. During the 2000 to 2011 timeframe, the growth rate was 2.47 percent, indicating that Brazil is beginning to grow faster despite the economic downturn of 2008.

A breakdown of Brazil's GDP by sector reveals that the country is becoming more akin to high-income countries. 2011 data from the World Bank shows slight shrinkages in agriculture, which now accounts for 5.5 percent down from 5.6 percent in 2000, and in industry, which is now responsible for 27.5 percent down from 27.7 percent. The service sector, on the other hand has increased its contribution from 66.7 percent to 67.01 percent. Though these changes are slight, they are indicative of the overall trend of Brazil's economy becoming focused on service. Brazil's manufacturing exports as a percentage of its total exports have declined from 52 percent in 1990 to 34 percent in 2011 (World Bank). This contraction can be attributed to two things: the global recession and the growth of Brazil's service sector.

The GINI Index, a measure of the degree of income inequality with 0 being absolute equality and 100 being absolute inequality, was 53.9 in 2009 for Brazil (World Bank). While the nation has shown improvement from previous indices of 59.0, 60.6, and 59.2 for years 1985, 1990, and 1995 respectively, it is still among the most unequal countries in terms of

income inequality. The headcount index, based on the 1.25 dollar per day poverty line, is 6 percent of the population (.06).

Despite Brazil's rapidly fluctuating economic fortunes, Brazil's unemployment rate has remained relatively stable, below 10 percent during the same time period. The government tried to stimulate hiring with the Employment and Income Generation Program of 2003, offering credit to "small businesses and microenterprises" to motivate entrepreneurs (Gonzalez, 2010). Brazil's average annual inflation rate in terms of Consumer Price Index has changed drastically over the past two decades. The average annual inflation rate first spiked in the late 1980s and continued to vacillate until the mid 1990s when it finally remained consistently under 15 percent. In the early 1990's it drastically fell from 2947.73 percent in 1990 to 432.78 percent in 1991. Following the plummet, the average annual inflation rate began to climb steadily until its peak in 1994 at 2075.88 percent. It dropped to a comparatively low 66.01 percent in 1995 and continued to fall to a low of 3.19 percent in 1998. The average of the individual annual inflation rates for the 1990s is 767.26 percent. Since then, the rate has remained low; it has fluctuated minimally between the 1995 low of 3.19 percent and a high of 14.72 percent in 2003 (World Bank). The average of the individual annual average inflation rates for the 2000's was 6.72 percent. Despite its numerous economic challenges, Brazil does seem to be improving economically over all. With a few key economic changes, the country could be well on its way to being the "Country of Now".

## III. POLITICAL BACKGROUND

Since the country's independence, Brazil has lived under seven different constitutions. This exemplifies the political instability of the country, as each document signifies a regime change. Brazil has suffered a history of strongmen and authoritarianism. Other than the military junta that ruled from the 1964 to 1985, the most famous of these men is Getulio Vargas. Ruling Brazil from 1930 to 1954, Vargas implemented an import substitution plan for Brazil that many consider to be populist (Rabello de Castro and Ronci, 1991). Though he committed suicide in 1954, Vargas remains one of Brazil's most loved and in some circles, revealed of Brazil's politicians.

Brazil suffers from a low level of party fidelity, meaning its legislators switch political parties at a very high rate. This need to form broad coalitions among squabbling legislators enables Brazil's greatest institutional problem: corruption. Transparency International ranks Brazil as the 73rd most corrupt nation out of 173, and the Christian Science Monitor calls corruption "endemic… and rarely prosecuted" (Corruption Index, 2011; Downie, 2012). While the stability of Brazil's democracy is not in question, current president Dilma Rousseff's coalition could collapse if she is unable to play her cards right.

Political instability was a major issue for Brazil until Fernando Collor de Mello won the first direct presidential election since 1960. The victory was short-lived, as a corruption scandal led to his impeachment in 1992. The resulting political instability and resulting absence of economic policy likely contributed to the wavering of the average annual inflation rate. Since the mid 1990s Brazil has been politically stable and consistently growing. The government has been diligent about implementing policies, like tightening government spending, to keep inflation down, as they did in 2010 (CIA World Factbook, Brazil Government, 2012).

## IV. EASE OF DOING BUSINESS

### A. International Trade

The Ease of Doing Business ranking, compiled by the World Bank, ranks countries from 1 to 185 based on how conducive conditions in the country are to do business operations. Lower numbers indicate the most business-friendly conditions. Countries such as Singapore, Hong Kong, New Zealand, and the United States have climates that are favorable for business transactions. At the other end of the spectrum of rankings, the Central African Republic, Chad, and the Democratic Republic of Congo have some of the worst business conditions in the world. The Ease of Doing Business index is calculated by averaging the country's ranking in the following ten categories: starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting investors, paying taxes, trading across borders, enforcing contracts, and resolving insolvency. Brazil's rank for fiscal year 2013 is 128, and though Brazil experiences significant problems in each of the measured categories, trading across borders is currently one of their weakest areas.

Despite having significant exports such as soybeans, orange juice, ethanol, commercial aircraft, automobiles, and coffee, Brazil lacks efficient trading policies and procedures (Brazil Exports 2012, 2012; Brazil Economy). Brazil ranked 123 for trading across borders in fiscal year 2013. The ranking for this category is determined based on the number

of documents necessary to import and export, the costs associated with trade, and the time it takes for completion of the process. Brazil was ranked 123 in fiscal year 2012, as well, indicating that they have not experienced any significant improvement or decline (DoingBusiness.org Brazil). In addition to its poor rating by the World Bank, the International Chamber of Commerce's Open Markets Index ranked Brazil 68 out of 75 countries with a score of 2.3, indicating below average openness (Open Markets Index, 2011). Brazil's protectionist trade policies and lack of infrastructure and technology are the key factors preventing the country from becoming a more open economy.

Recently, Brazil has enacted new taxes and policies that are notably protectionist in nature. Protectionism is essentially the establishment of barriers to trade to protect domestic goods, and it was one of the primary causes of the world economic disaster of the 1930s (Protectionism Alert, 2012). It is one of the major reasons for difficulty of importing in Brazil. In January 2012, a tax increase of thirty percentage points was levied on imported cars, which already face a high import tariff, in response to stagnant economic growth (The Economist, September 24, 2011). The government has responded to strong economic relations with China, with whom friction is also quickly increasing, with "short-term protectionist measures combined with modest steps towards more constructive longer-term policy changes" (The Economist, September 24, 2011). The goal of this policy is to protect domestic industry in Brazil, and it is working. However, Brazil must be careful about protecting trade with China at the expense of its trading relationships with other Latin American countries, which are also suffering as a result of these protectionist policies.

The customs process that all imported good must go through is extremely convoluted and time consuming, and it is one of the mechanisms that accomplishes the protectionist agenda. It takes seventeen days to import a product in Brazil, eight of which are spent on document preparation and four of which are spent on customs clearance. The process of exporting goods is simpler, cheaper, and less time consuming than importing, but not by a significant amount. There are eight documents necessary for importation, and the cost of document preparation alone is 275 United States dollars (DoingBusiness.org Trading Across Borders). During 2009, when the World Trade Organization (WTO) was reviewing Brazil's trade procedures and policies, Brazil implemented a modified import declaration process, which has improved the number of rejected import declarations, but has not significantly reduced the number of documents or amount of preparation time necessary for the process (Trade Policy Review, 2009).

A lack of technological progress is another major contributor to the length of time necessary for goods to clear customs. As of the WTO Trade Policy Review in 2009, scanners, which allow non-invasive inspection of imported cargo, have been installed at only nine of the border entry and inspection points in Brazil. While these nine locations are responsible for 90 percent of the cargo imported to Brazil, the recent technological updates have had little impact in speeding up the customs process (Trade Policy Review, 2009). Though the implementation of this technology was expected to cut down customs clearance time significantly, it still takes an average of four days for imports to clear customs in addition to the three days that are spent on port and terminal handling (DoingBusiness.org Trading Across Borders). As the report notes, Brazil has been taking "gradual steps to simplify and modernize its customs procedures." However, these improvements have not had a significant enough impact on Brazil's trading efficiency, as their ranking has not changed in recent years.

In addition to a lack of sufficient technology, Brazil also lacks the infrastructure necessary to facilitate faster trade. In 2012 the World Economic Forum ranked Brazil's quality of infrastructure 104 out of 142 surveyed countries. It is also estimated that only 14 percent of the roads in Brazil are paved, contributing to the problem of inefficient inland transportation (The Economist, August 11, 2012). Unpaved roads are not the only infrastructure problem that plagues Brazil. The airports in the nation are ill equipped to handle the ever-increasing passenger and cargo traffic that they face, and are in need of updates and expansion (Centre for Aviation). Although promises to invest in and improve infrastructure have been made repeatedly by the government, Brazil lacks the necessary follow-through to fix this broken system.

### B. Solutions to International Trade Issues

Brazil's trade problems are deeply entrenched, and will require much more than a simple fix. The WTO Trade Policy Review notes the importance of repairing trade in Brazil: "Brazil needs to press on with its efforts to give additional impetus to trade and investment, […] by […] reducing the use of import prohibitions and providing greater predictability to the foreign investment and trade regime" (Trade Policy Review, 2009). The protectionist mind set in the country will be hard to overcome, as it stems from a

desire to protect the domestic industries in the country, namely the manufacturing industry. Fortunately, Brazil is already taking steps to improve its industries, such as cutting payroll taxes for local businesses, while these protectionist policies are in place (The Economist, September 24, 2012). Brazil has also been attempting to implement policy changes that will facilitate faster trade, such as the aforementioned streamlining of the customs and documentation processes. Unfortunately, they have not successfully changed their trade situation enough to improve the difficult business conditions in Brazil, making the current changes arbitrary. One of the simplest and most concrete ways that Brazil can effectively shorten the time it takes to move goods across the border is to invest in new technologies and improved infrastructure, specifically the high-tech scanners that have been implemented in a few of the busiest border entry points.

Brazil's infrastructure is among the worst in the world. With the 2014 World Cup and the 2016 Olympics on the horizon, the government knows that it must move quickly and invest heavily to improve the roads and airports. Unfortunately, what they have promised to do will not be nearly enough to catch up with countries of similar standing. Between 2011 and 2014, the government intends to invest 163 billion reals, or about 80 billion United States dollars on infrastructure (The Economist, August 11, 2012). The intended amount is equivalent to 1 percent of Brazil's GDP, but it is not enough. According to a 2010 report by Morgan Stanley, "Brazil would need to spend 6 to 8 percent of GDP annually to catch up with South Korea in 20 years and 4 percent per year to catch up with Chile" (The Economist August 11, 2012). Chile has the best infrastructure in Latin America with a Logistics Performance Index (LPI) sub score of 3.18 while South Korea scores a 3.74 (World Bank). The LPI is a tool created to help countries identify strengths and weaknesses in categories such as customs, infrastructure, international shipments, logistics competence, timeliness, and tracking and tracing. Germany has the highest infrastructure rating of all countries measured with a score of 4.26 (World Bank). The Latin American and Caribbean Transport Association recently highlighted Brazil's inadequate airport infrastructure, suggesting that they need to invest 4.9 billion United States dollars before 2014 in the already existing airports and must construct nine additional airports that are at least the size of Guarulhos, one of the nations largest and busiest international airports (Centre for Aviation). Investing more heavily in infrastructure will help Brazil catch up to similar nations more quickly in terms of their infrastructure ratings. Improvements in infrastructure will aid their poor trade situation by shortening the time it takes to transport products within the country.

Improving technology is another critical improvement that Brazil must make if it hopes to improve its trading across borders and ease of doing business ratings. According to the Trade Policy Review in 2009, nine border entry points have been equipped with scanners that are supposed to shorten the time it takes to clear customs. Unfortunately, Brazil has not implemented enough of this technology. Countries with more advanced trading procedures and better technology, such as the United States, clear imports in one day, and in Brazil it takes an average of four days (DoingBusiness.org Trading Across Borders). Brazil can remedy this problem by improving the technology in other border entry points and redirecting the location of import receipts so that each location is responsible for a smaller percentage of the country's imported good. This, in combination with increased spending on infrastructure will allow Brazil to hasten the process of bringing goods into and out of the country.

### C. The Labor Code

Another factor contributing to the difficulty of doing business in Brazil is the labor code, which is archaic, inefficient, and has little relevance in today's workplace. The labor code dates back to the time of Getúlio Vargas, a noted populist dictator, and was inspired by Mussolini's labor laws (Rohter, 2001). The labor code fosters high labor costs and low worker productivity, making Brazil an unfavorable place for entrepreneurs to invest.

The labor code unfairly protects the employees at the expense of employers. This is seen in the justice system when employers are taken to court because of unfair laws and the courts rarely rule in their favor (The Economist, March 10, 2011). Employers are taken to court on charges such as insufficient overtime pay and payroll records despite the fact that the employees are responsible for these tasks. In most, court cases employers are responsible for paying exorbitant settlements to their employees. In the labor code foreign investors often state salaries in a foreign currency forgetting that exchange rates are flexible. If the actual rate is less than the wage stated in the labor code charges can be filed against the employer (The Economist, March 10, 2011). The laws are set up in a way that makes it necessary for most claims to be taken to court, when in fact the employees may get a favorable long-term deal through negotiations. By taking their employers to court the

employees may get a high settlement sum, however it will not improve future workplace conditions.

The employer is also responsible for additional costs such as the high cost associated with firing workers without just cause and paid leave, both of which are guaranteed by the labor code (Gonzaga, 2003). At first glance this policy may seem as though it offers much needed protection to workers; however, low productivity and workplace truancy are not considered just causes for terminating a worker. Fundo de Garantia por Tempo de Servico (FGTS) is a program in which employers are required to put 8 percent of the employee's earnings monthly earnings in a bank account and when they terminate that worker, he gains access to the account. The employer must also pay a fine for firing the worker to both the worker and the government (Gonzaga, 2003). According to the code workers are entitled to three months maternity leaves and one month paid vacation (Gonzaga, 2003). These laws obligate the employers to pay their workers even when they are not productive at all. Unfortunately, the political party in power does not see how these laws are unfavorable to the economic health and the Minister of Labor is pushing for termination of workers to become more expensive for employers than it already is (The Economist, March 10, 2011).

Brazil ranks 15th out of 17 Latin American countries in terms of worker productivity, which was measured through a survey where the Conference Board was responsible for collecting data. Bolivia and Ecuador are the only two nations ranked lower than Brazil (Brazilian Bubble, 2012). Unfortunately, workers actually have incentives to be less productive such as the FGTS program (Gonzaga, 2003). Employees earn interest on the money saved for them under the FGTS program and only gain access to it if they are fired for an unjust cause. The interest rate that they receive while employed is lower than the rate of return they would earn in the money market. So, workers have an incentive to lose their jobs due to low productivity in order to gain access to these accounts and to deposit the funds in a private bank where they will earn higher yields (Gonzaga, 2003). Another piece of legislation requires the employer to provide one month's advance notice before a worker is fired (Gonzaga, 2003). If a worker knows that they will be jobless in a month, their productivity drops causing losses for the firm. The essential flaw of this system is that workers are better being fired without justification than if they performed their job functions at their maximum productivity level. Low worker productivity is undesirable for an employer because non-productive workers would make the company as a whole less productive. There is also evidence that Brazil has high turnover rates meaning employees change jobs frequently. For firms this means that they lack human capital and that they frequently have to train new workers. Low human capital prevents businesses from expanding.

### D. Reforming the Labor Code

A more lenient labor code will ultimately improve the business conditions in Brazil and will help improve their Ease of Doing Business Index. Reforming the labor code and eliminating some of its rigid laws is one possible proposal to improve labor productivity and reduce costs. First and foremost, the code itself should be reformed, as it would not be possible to implement unions without doing so. Removing the laws that prevent just firing of employees as well as those that mandate high firing costs would give power back to the employers. Some of the clauses in the code, such as the fact that a lazy employee does not constitute a reasonable cause for firing, should be eliminated.

In order to address the problem of employees taking their employers to court often, unions could be instituted so that employees could have a channel other than the court system to reach mutual agreements with their employers. Unions should be implemented in Brazil so that employees can remain protected, while giving employers more room to negotiate and to foster higher productivity levels among workers. This would better facilitate negotiations between employers and employees, and would make industries more productive (Rohter, 2001). To prevent arbitrary employer power, unions would be helpful in negotiating laws between employees and employers specific to their industries. It would be less costly for the employers to settle deals with the employees through unions rather than in court. However, solving Brazil's productivity problems by implementing unions may also have costs for businesses, as unions are often associated with hindered economic growth. Nevertheless, they would be a better alternative to the current restrictive labor code.

Since Brazil is faced with high job turnover and no accumulation of human capital, a reform of the FGTS system would also be appropriate (Gonzaga, 2003). The incentives associated with FGTS must be eliminated in order for worker productivity to rise. The rate of return on each worker's account should be based on how long they have worked in their current position,

rather than on one interest rate across the board. Reforming the interest rate alone would prevent the high turnover rate, which creates an additional burden on the employers, as they have to continually hire and train new workers, an added supplementary cost. Long-term financial incentives to stay on the job would ultimately decrease the turnover rate and improve human capital of a firm because they would have more experienced and productive workers making the firm more successful overall. It is possible that a reform of this nature would not improve worker productivity because there is a chance that the relationship between the program and high turnover merely correlate. Also, if the workers are more productive but the money stays in the hands of the employers income inequality in the country would increase, as the bulk of the money would stay concentrated in the hands of only a few people. Although aware of its shortcomings, a reform of the FGTS system would be necessary to encourage human capital accumulation in order to promote business expansion.

## IV. THE URBANIZATION EPIDEMIC

### A. The Current Situation and Its Implications

One of Brazil's major problems is its urbanization rate. With 85 percent of its population living in urban areas in 2011, Brazil surpasses other industrializing nations like India at 31 percent, South Africa at 62 percent, China at 62 percent, and Russia 74 percent. A main Latin American competitor, 78 percent of Mexico's population resides in urban centers. Surprisingly, Brazil's urbanization rate has been decreasing, reaching 3 percent in 1990 but dropping to 1 percent by 2011. In the same time period, the percentage of Brazil's population in urban areas has jumped by 11 percent, from 74 percent to 85 percent (World Bank). Meanwhile, Brazil's rural population has been shrinking, dropping from 26 percent of the country's total population to 15 percent between 1990 and 2011 (World Bank). This suggests that Brazil's rural population expects higher returns from life in the cities than they do from working in the agricultural sector. They migrate to the cities based on these perceived assumptions, which can be modeled using the Harris-Todaro Model. The migration phenomenon is understandable as the Inter-American Development Bank (IADB) notes that rural-dwellers "account for 46 percent of total extreme poverty nationwide," whereas only 5 percent of the urban population is considered "extremely poor" (IADB, 2012). Of the extremely poor rural dwellers, "46 percent are landless, unemployed laborers," according to the International Fund for Agricultural Development (IFAD, 2011).

Unfortunately, Brazil's cities are simply unable to accommodate the influx of migrants from the countryside. Usually these individuals settle in Brazil's famous favelas, or shanty-towns. These favelas, usually built on un-owned land, often lack formal infrastructure. While access to sanitation in urban areas has increased from 80 percent in 1990 to 85 percent in 2010, 15 percent are still without access to proper sanitation (World Bank). Even worse, 57 percent of the sewage in urban areas is disposed of improperly (Seligmann, 2012). Crime is also a problem; despite falling by nearly 75 percent over the past decade in Sao Paulo, one of Brazil's biggest cities, violent crime is now projected to reach "epidemic levels" by 2013 (Mean Streets, Revisted, 2012). The preparation for the 2016 Olympics in Rio de Janiero has highlighted the crime problems Brazil's favelas face. On December 4th, Brazilian law enforcement arrested 63 police offices for alleged collusion with drug traffickers in Rio's low-income favelas (Associated Press, 2012).

Though overall urban unemployment continued to fall to 6.4 percent from 6.7 percent in 2011, the percentage of urban youth unemployment has been fluctuating over the past decade, peaking at 26 percent in 2000, dropping to a low of 17 percent in 2007, and rising to 18 percent in 2009 (World Bank). Add to this Brazil's increasing problem with creating jobs in the formal sector since the 2007 economic downturn, and Brazil's falling urban unemployment rate seems far less peachy (International Labor Office, 2010). As of 2007, Brazil's informal sector employment at 50.6 percent was expected to grow, especially considering Brazil's falling formal job creation rate (Maurizio, 2012).

Overall, excessive urbanization creates many problems for Brazil. Even though urban growth rates are falling, decreasing rural population rates suggest continued migration to cities. Brazil's already bustling metropoli are having problems incorporating migrants, despite falling urban unemployment. Favela growth exacerbates sanitation issues and crime problems. Crime, ahead of the 2016 Olympic Games, is especially touchy for Brazil; a rise in crime before such an event could discourage international investment. Also, the youth unemployment rate's past fluctuations and more recent rise suggest that young individuals are having problems finding jobs in the cities, whether due to lack of education or lack of opportunities. Increasing urbanization can aggravate both, whether by increasing the amount of surplus labor or by putting more stress

on schools, lowering their effectiveness.

### B. Causes of the Epidemic

Multiple factors contribute to the migration of rural dwellers to Brazil's urban areas. While the deforestation of the Amazon Rainforest earns the most headlines, its effect on rural-urban migration needs to be explored in order to better understand its true impact. In 2010, the Brazilian government sold off multiple logging permits to companies, designating certain areas of the rainforest as "off limits" to industry (Pyne, 2010). The deforestation rate dropped 27 percent in the first half of 2012 (BBC, 2012 Nov 22).

This willingness to grant concessions to logging industries in order to stimulate local rural in Brazil economies ignores the increasing mechanization of Brazil's logging industry. Though specific figures are unavailable, the country's logging industry experienced a seismic shift in 1993, when Brazil's government lifted tariffs on heavy machinery (Murakami 2002). Though the cost of labor decreased overall between 1990 and 1995 from 21 United States dollars to19 United States dollars, firms had to respond to "increasing market pressures…" with "increases in the volume of production" with "…significantly intensified" mechanization (Murakami, 2002; Stone, 1996). As a result, many laborers found themselves out of a job and moved to the cities. In short, Brazil's logging industry, as a result of mechanization, contributes to rural-urban migration.

Another contributor to rural-urban migration is a convergence of various problems, mostly concerning the farming industry in Brazil. Most of these issues crystallize in the Sertao, a semi-arid region in Northeastern Brazil that covers 1 million square kilometers. As such, the analysis will focus there. 67 percent of the Sertao's rural population is poor. Years of cattle ranching and has led to desertification of the region 20 percent of the total. Furthermore, land tenure is incredibly unequal; though "smallholder farmers make up more than 84 percent" of the region's agricultural sector. Most of these individuals are able to export around 50 percent of their output, but are forced to subsist on the remaining half (IFAD). Much of these problems are due to poor irrigation in the region. Unlike other portions of Brazil, irrigation infrastructure would require pipelines to run uphill, making it far more expensive to implement (Cline, 1973). The Brazilian government has attempted to address these problems through expanding irrigation canals/pipelines, but Damiani (1999) notes that the agencies in charge of such projects "…have been paternalistic, not even enforcing the payment of subsidized land and water fees." Also, the lack of effective irrigation means that most farmers in the area grow subsistence crops like corn instead of more "high value crops like fruits or vegetables" that would earn them more profit due to the produce's higher price (Damiani, 1999).

Besides irrigation, the region also lacks basic opportunities for economic advancement. The region suffers from an overall lack of investment; after all, who would want to invest in Brazil's poor rural areas as opposed to its increasingly cosmopolitan cities? And as investment floods urban areas, the rural poor will become increasingly attracted to them.

### C. Curing Over-Urbanization

The solutions to Brazil's high urbanization rate is to increase opportunities for economic growth in the rural areas and agricultural sector. The first is to recognize that developing industry in the logging industry, especially through deforestation concessions, probably will not result in significantly increased opportunities for rural Brazilians. Cameroon, which also sold off permits to logging companies in the 1990s, provides an example. International investors poured money into the central African country and were required to invest in local infrastructure; however, the infrastructure was often shoddy, and the companies provided far fewer jobs than expected (Pyne, 2010; Karsenty, 2007). Instead, Brazil must look to other engines for rural growth.

Brazil can foster rural economic growth, and thus decrease incentives for urban migration, by improving infrastructure in rural areas, especially the semi-arid North East. Irrigation is the most needed amenity. While Brazil's infamous corruption has inhibited the effectiveness of government-funded irrigation infrastructure, Damiani (1999) proposes a solution. Since large private firms often short-change the Northeastern rural poor with poor irrigation infrastructure, and public work encourages graft, the Brazilian government should fund middle-size firms to undertake the projects. These firms would be far easier to work with in the sense that the government could withdraw subsidies or level other punishments if the firm did not meet production targets than larger conglomerates (2012). Later, Damiani (2003) cites the state of Petrolina-Juazeiro as Northeast Brazil's success story. Plagued by abject poverty in the 1960s, the Brazilian government's appropriation-cum-development of the region's irrigation infrastructure turned the state into an exporting powerhouse by 1990. Grape exports jumped from 0 hectares in1970

to 6,000 in 1990; the percentage of wage workers jumped from 5.9 percent to 37.8 percent, and "by 1996, irrigated agriculture in Petrolina-Juazeiro employed nearly 40,000 wager workers 30 percent of the rural labor force in the region" (Damiani, 2003). A smart mix of private and public investment enabled the state to export more valuable crops at a higher yield, raising wages by 21.7 percent higher than Brazil's minimum wage and creating jobs. However, it is worth noting that as the number of individuals growing valuable export crops increases, the supply would increase, thus lowering the world price. Brazil would have to be careful to avoid oversaturating the market with valuable crops.

An expansion of effective infrastructure would also aid rural areas in the development of other industries. Since 1980, IFAD has loaned Brazil 211.6 million United States dollars in loans for programs to "improve rural people's access to off-farm employment and other income-generating business activities" (IFAD, 2010). However, as detailed previously, Brazil's poor roads and river transit systems inhibit efficient trade. Businesses cannot get their goods in or out of rural areas cheap enough to warrant the investment. By investing in better infrastructure, more investment could be encouraged. However, there is a drawback; improved infrastructure would most likely result in increased deforestation rates as logging companies take advantage of lower transportation costs (Lind, 2010). But in terms of reducing rural-urban migration, better infrastructure would result in better rural opportunities, decreasing the desire to migrate to urban areas.

The Brazilian government also needs to expand the Bolsa Familia conditional cash transfer program, which currently covers one-third of Brazil's children (Soares, et. al., 2012). Bolsa Familia pays eligible families under the poverty line roughly 68 United States dollars per month if their children miss less than 15 percent of their classes; "12.4 mil households are now enrolled" (The Economist, 2010 July 29). At a mere cost of 0.5 percent of GDP, some experts expect the program to "increase enrolment rates by about 18 percent" (Glewwe, 2010). Bolsa Familia has reduced Brazil's poverty gap by 12 percent, and was 21 percent responsible for a GINI index drop by 4.7 percent between 1995 to 2004 (Soares, et. al, 2010). The Economist (2010) notes that Bolsa Familia has been specifically more successful at addressing rural poverty, with 41 percent of rural households covered. Not only does this provide rural families supplementary income that might help discourage migration, but it also increases the human capital potential of rural areas. The Northeast state of Pernambuco understands this need well. Increased cash flow from the Bolsa Familia program brought a host of new opportunities, such as car dealerships and restaurants (The Economist, 2012 Oct. 27). But as these industries grow, the state finds its populace ill-suited for non-agricultural work. This has created an "acute skills shortage" as illiteracy and other deficiencies constrain productivity (The Economist, 2012 Oct. 27). Though Brazil's 10 percent illiteracy rate, last measured in 2008, is not particularly high, encouraging poorer students to go to school through Bolsa Familia also encourages the accumulation of human capital in areas that are beginning to require it.

## V. CONCLUSION

Brazil's economic concerns go beyond their ease of doing business rating and hyper-urbanization. However, both of these issues have far-reaching consequences, and it is evident that Brazil should address these problems in order to stabilize its economy and country status in the world.

Brazil has a long way to go, in terms of its Ease of Doing Business ranking, until it can compete with high-income countries such as the United States. Brazil must reduce its reliance on protectionist trade policies by cutting out the red tape in the process across all industries if it is to gain favor on the international market. Technological progress and updated infrastructure are also musts, especially in light of the imminent World Cup and Olympics that will be hosted in Brazil. If Brazil is to improve its business conditions, the nation must also seek to foster worker productivity and longevity by reforming its labor code. Overcrowding in Brazil's urban centers must also be addressed. Though it is a social problem in nature, lack of adequate infrastructure and job opportunities in the cities have a negative economic impact on Brazil. Increasing funding to programs that increase wealth and opportunities in rural areas can help alleviate the strain on cities.

Brazil has proven to be resilient through decades of political and economic turmoil; it has bounced back from the most recent recession with impressive speed and strength. With a mixture of radical and relatively simple reforms to its policies, it is likely that Brazil will become a top international contender in the not-too-distant-future as the "Country of Today".

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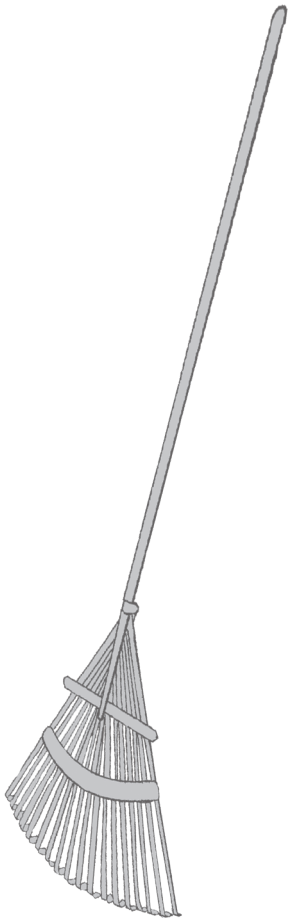

# The Determinants of Economic Growth in the Transitional Economies of the Former Yugoslavia

Tara Gracer

## I. INTRODUCTION

Transitional economies are special occurrences, which often contribute to their significance and need for analysis. The purpose of this study is to assess the determinants of economic growth in the recently independent transitional economies of the former Yugoslavia while using Slovenia as the main comparison country. Slovenia is deemed throughout the literature as the most successful state after transition, which is why it is used as the main comparison state. The countries included in this study are Slovenia, Croatia, Serbia, Bosnia and Herzegovina, Macedonia, and Montenegro. Kosovo has been excluded due to the instability created by its recent independence and its involvement in the Kosovo War. The time range of this study is from 2000 to 2011 due to the limited availability of data for all the countries since they are recently independent and the data is from the World Bank Database.

This study will first establish background knowledge of the Yugoslav region in order to set the stage and explain where economic growth was apparent before independence. Then, literature on the most successful state, Slovenia, will be discussed as well as the relevant information on the statuses of each country prior to the transitional period. This study adds to the overall literature about the former Yugoslavian countries by examining the components of economic growth to Gross Domestic Product (GDP) per capita growth. After the theory section, the data and methodology sections state the two methodologies used: descriptive statistics and means hypothesis testing to determine what factors are similar to Slovenia's means. Results and discussion will conclude the study where Slovenia is ranked highest in terms of future success with Croatia and Serbia following in second and third.

## II. BACKGROUND

This study includes only countries that once belonged to a socialist economy and that have transitional to a capitalist economy for a significant reason. The Yugoslavian War in 1991 produced five states, Slovenia, Croatia, former Yugoslav Republic of Macedonia, Bosnia and Herzegovina, and Republic of Yugoslavia (which included the current territories of Serbia and Montenegro). These states, unlike other transitional states, had to fight for their rights and independence to create a separate state. For example, Slovenia broke first in 1991 and reached its independent status before the other former countries in 1992. A list of each country's independence year can be found in Table 1. Similar transition states from the Soviet Union also changed their type of economy from a planned economy to a capitalistic one; however, obtaining their independence was relatively more peaceful with political demonstrations in 1989. The countries of the former Yugoslavia became independent as a result of war, which differed greatly from the former Soviet Bloc. The former Soviet bloc also received assistance from Russia and other foreign influences to transition while the former countries of Yugoslavia did not. This suggests that the countries of the Former Yugoslavia were by themselves and did not receive help once they broke off; their state resources were damaged or missing, which significantly halted economic activity and growth. Additionally, Russia was the main state which countries broke free from. In the case of former Yugoslavia, there was and is no main state with satellite states. No main state resulted because Yugoslavia was formed after World War I from different empires and because "Yugoslavia was not like other communist states, since it pursued its own course of economic development" (Rogel, 2004, p.12). Having no main state to send financial support, as in the case of the Soviet Union, led countries of the former Yugoslavia to be alone in reestablishing their new economies and government. Therefore, there is a significant difference between the types of transitional countries and their struggles to regenerate their economies. This is why

only the former Yugoslavian countries are examined here.

In Figure 1.1, GDP per capita growth is exemplified during the transition years of 1990 to 2000. GDP per capita growth was calculated using GDP per capita levels in constant 2005 international dollar terms to account for inflation. The year 1990 has no growth because no countries reported GDP per capita levels for the year 1989, and therefore, growth for the year 1990 is unable to be calculated. It can be seen that GDP per capita growth is negative during the war period. However, several countries increase GDP per capita growth after 1994. Bosnia and Herzegovina has the highest spike in GDP per capita growth in 1995 and 1996. Other countries never grow above 0.2 percent. The initial conditions of each country could demonstrate why some countries have been more successful in increasing their GDP per capita following the years after independence and war.

## III. LITERATURE REVIEW

This literature review covers a range of information from initial conditions, the most successful country, general studies on the former Yugoslavia, and the components of growth theory. This study adds to the overall literature by examining the components of economic growth to GDP per capita growth individually for each country.

### A. Initial Conditions

This section lays out the initial conditions of all the republics of the Former Yugoslavia in order to better understand each country prior to independence. It also explains where economic growth was most prevalent.

Physical geography is one example of how and why the former Yugoslavia was so economically different across all regions (Boduszynski, 2010). Access to natural resources, the coastline, good soil, and other prosperous Western economies of Europe were some of the reasons for successful transitions. The fertile hills of Croatia and Slovenia led to their successful development because they contained skilled labor, modern productions like machinery and electrical appliances, proper infrastructure for trade, and were closer to western European capitals (Boduszynski, 2010). According to Boduszynski (2010), the least developed regions were the mountainous "Bosnia and Herzegovina, Montenegro, southwest Serbia, the Dalmatian hinterlands of Croatia, and northern Kosovo" because they were isolated and had infertile land (p.51). The most fertile land is located along the Danube River; therefore, the Danube Plain supplies Slovenia, Croatia, and Serbia with the most fertile cropland. Macedonia, on the other hand, in the Vardar Valley, grew cotton and tobacco, which are cash crops. This land is also highly irrigated in order to compensate for the hot and dry summer climate (Singleton, 1991). Central Serbia and Macedonia have fertile soils however, "remained undeveloped due to poor economic planning and geographical isolation" (Bodusynski, 2010, p. 51). Croatia, having a coastline on the Adriatic Sea (which has mild winters), allows for it to grow citrus and olive trees as well as to have hills of vineyards. In addition, the coastline provides significant levels of tourist and trade revenue (Singleton, 1991; Boduszynski, 2010). However, with the increase in tourism along the coast, agriculture has declined due to alternative employment in the tourism sector (Singleton, 1991).

The amount of infrastructure and investment of each region could clearly be seen by the North and South divide of the former Yugoslavia (Singleton, 1991). Since the South was seen as less profitable, and therefore lacking in development, business investments left it underdeveloped. Therefore, "newly globalizing countries must be able and willing to open up their foreign markets in goods, services, and investments" in order to attract wealthy foreign investors (Kiggundu, 2002, p.141). The republics also invested in their own production to avoid dependence on other republics with which they had tensions (Singleton, 1991). However, capitals were interlinked such as Belgrade, Zagreb, Ljubljana, and Sarajevo. The first three had a rail and highway system that ran along the Sava River. The largest industrial area of the Former Yugoslavia in the early 1990s was Belgrade, located in present day Serbia. It produced transportation equipment, agricultural machinery, and consumer products such as clothing, television sets, and food products. Second was Zagreb , Croatia which produced electrical-engineering equipment, petrochemicals, machine tools, and consumer products such as textiles, paper products, and furniture. Thirdly, the area of Ljubljana and Maribor in Slovenia was ranked as the next largest industrial area which produced goods from aluminum and high-quality steel for trucks, electrical appliances, cotton fabrics, and shoes. Sarajevo in Bosnia and Herzegovina was ranked last because of its small industrial sector size and recent development in the 1990s, however it is known for its heavy industry use of iron and steel (Singleton, 1991).

Unemployment was a chronic problem in Yugoslavia before the 1990s because it reached over

17 percent (Boduszynski 2010). Underemployment was even higher, at 20 percent (Boduszynski 2010). Wherever development was lacking, there were dangerous levels of unemployment, such as in Macedonia, Kosovo, and Serbia, where rioting and strikes were common. As one moved from the north to south unemployment worsened. Slovenia and Croatia, therefore, had the lowest unemployment rates in 1990 while Serbia, Bosnia and Herzegovina, and Montenegro were in the middle. Kosovo and Macedonia had the worst unemployment rates, as high as 37 percent (Boduszynski 2010). This, therefore, had a serious effect on the competition for jobs and wages, which enabled a rise in infrastructure and demand for separation from the whole of Yugoslavia (Boduszynski 2010).

### B. The Most Successful: Slovenia

The initial conditions provided Slovenia with the upper hand in transitioning from a socialist economy to a capitalist system. Slovenia had a homogeneous, socially stable population, a diversified manufacturing sector, private agriculture, partly private service sector, well-established trade links with Western European markets, and an advantageous geographic position (Mencinger 2001).

During the transitional period, Slovenia was most successful for several different reasons over the other former Yugoslav states. The trade surplus in 1992 resulted from a decrease in domestic demand and increase exports (Mencinger 2001). After 1992, GDP increased by 2.8 percent in 1993 and later to 5.3 percent in 1994. In 1993, Croatia had a negative GDP growth rate of 8 percent which increased to a positive growth rate of 5.9 percent in 1994. Serbia, in 1993, had a severe negative growth rate of 30.5 percent which also increased to a 2.5 percent growth rate in 1994. Macedonia, on the other hand, remained at a negative GDP growth rate for both 1993 and 1994 at 7.5 percent and 1.8 percent respectively (World Bank). Montenegro and Bosnia and Herzegovina in 1993 were not yet declared independent states. Slovenia's secession also provided a great push for restructuring of the economy. It followed unemployment patterns of other European countries such as France and Germany. The prices remained stable and its government budget became balanced (Mencinger 2001). With the accumulation of these reasons, it is apparent that Slovenia has been the most successful state in transition and why it is being used as the frame of reference for this study.

### C. General Studies on the Former Yugoslavia

The volume of literature is not great, specifically in the sector of economic growth of the former countries of Yugoslavia. This is due to the fact that their independence is rather recent and not enough yearly data is available to observe significant findings. The war period and recessions after the war limited each country from recording figures due to a lack of resources and staff. The CIA Factbook only has economic figures for the most current year; therefore, it cannot provide data for a series of years. Slovenia, Croatia, and Macedonia broke free first and, as a result, have more literature from the early 1990s. Montenegro and Kosovo, on the other hand, have little to no literature at all because they gained independence in the early 2000s. Therefore, this study is relatively new in comparison to the remainder of the literature.

Naghshpour and Sergi (2008) and Piatkowski (2002) are the most relevant available literature that examine the economic growth of the Former Yugoslavia with different methods. Piatkowski (2002) creates a New Economy indicator that ranks countries on how prepared they are to transition; therefore, Piatkowski's study examines countries prior to their dissolution while this study examines post war effects. Piatkowski (2002) suggests, however, that the countries that are ranked lower are in a "technological trap", which is due to insufficient quality of institutional infrastructure and lack of investment in newer technologies. Higher ranked countries, such as Slovenia, have had the advantage of the institutional infrastructure because of their accession into the European Union (in May of 2004).

Naghshpour and Sergi (2008) examine countries of South East Europe and perform a spline trend on the data, such as real GDP levels to test for significance of the economic growth slopes of each country. This study acknowledges that "Yugoslavia is the only country to disintegrate, while the rest of the countries in the region kept their national identity" (Naghshpour and Sergi, 2008, p. 126). In the conclusion of this study, both authors note that it is important to determine the factors that affected the economic growth in the South Eastern European countries in different ways. This is why the following section and this study focus on the components of economic growth of the former Yugoslavia.

### D. Components of Growth Theory

Smith and Todaro (2012) introduce components of economic growth in their book *Economic*

*Development*. Appendix 3.1 in the book is broken down into three categories: capital accumulation, population and labor force growth, and technological progress. They state that these three components of growth "are of prime importance" for developing countries (Smith and Todaro, 2012). By examining each component separately to see its effect on the economy, ceteris paribus, it can be determined which component of economic growth will increase GDP levels and GDP per capita.

Capital accumulation increases both physical capital stock and human capital. Physical capital stock, known as machinery and technology, are used to create output and can help increase production if more physical capital stock is accumulated. Smith and Todaro (2012) suggest two methods for increasing physical capital stock by either using "a portion of present income to save and invest for future output and income" or increasing the "economic infrastructure and nation's resources" (p.140). Therefore, an increase in physical capital stock can occur if there is an increase in investment and savings. The proxy for physical capital in this study is saving rates, more specifically, gross domestic savings, which is a percentage of GDP. This proxy is not a best fit because savings are not always used for investment since they could be used to fund retirement, education, or be spent in the present. When savings increase, more money is available to distribute for investment. If an increase in physical capital stock occurs, the productivity and production of businesses will increase. Therefore, if the savings rate increases, the availability of investment will increase, which in turn will allow for an increase in physical capital stock and output. Ciftcioglu and Begovic (2010) also agree that by increasing capital accumulation, economic growth will increase, especially in the case of Central and Eastern European countries. Therefore, by increasing the savings rate, economic growth will increase due to an increase in physical capital stock.

Population and labor force growth, as explained by Smith and Todaro (2012), can be "considered a positive factor in stimulating economic growth" (p. 141). Depending on the economic system of the developing country, the surplus of labor created by an increase in population might "exert a positive or a negative influence on economic progress" (Smith and Todaro, 2012, p.141). However, the transitional economies of the former Yugoslavia were at war and their populations have been severely depleted and therefore need to restore their labor force to equal, if not higher, levels. Galor (2005) also concludes that population growth can be attributed to an increase in and sustain economic growth. In order to restore the labor force and increase output, population growth must increase for the former Yugoslavian countries. By increasing the productive labor force, output will increase, allowing for economic growth due to a larger labor force.

To Smith and Todaro (2012) and "to many other economists", "the most important source of economic growth" is technological progress. There are three types of technological progress that Smith and Todaro (2012) discuss: neutral technological progress, laborsaving technological progress, and capital-saving technological progress. The first "occurs when higher output levels are achieved with the same quantity and combinations of factor inputs", which can arise from simple divisions of labor. Laborsaving technological progress is "the achievement of higher output using an unchanged quantity of labor inputs as a result of some invention", which can typically be seen through mechanization. Lastly, capital-saving technological progress is facilitated through "some invention or innovation that achieves higher output levels using the same quantity of inputs of capital" (Smith and Todaro, 2012, p.142-143). Smith and Todaro (2012) state "in labor-abundant (capital-scarce) developing countries, capital-saving technological progress is what is needed most" (p.142-143). One of the reasons for using Foreign Direct Investment (FDI) as an explanatory variable is because "FDI is often used as a measure of a country's overall openness, competitiveness, and globalization" (Kiggundu, 2002,p.152). It is also used because "it increases a country's capital stock, creates employment, generates domestic income and savings, and facilitates technology transfer and management know-how", which could therefore be used to increase GDP per capita (Kiggundu, 2002, p.152). When developed countries and corporations send their FDI, they also send their technological experiences and industrial methods to less developed countries. FDI inflow therefore helps less developed countries develop with the expertise of those countries already industrialized. The more FDI developing countries receive, the more experience they learn from developed countries because agreements in FDI often include less developed countries adopting capitalistic qualities in the economy and democratic systems. Therefore, an increase in the FDI means more economic growth for the transitioning economies.

By individually examining all components of growth, physical capital, population, and technology,

to see the effects on growth, it is hypothesized that countries similar to Slovenia's economic growth patterns will have larger economic growth rates and have overall higher progress in the components of growth.

## IV. DATA

The data collected is from the World Bank Databank from years 2000 to 2011 (World Bank Databank). Some countries, such as Montenegro, lack data entirely and will only be used in comparison when data is available. By acknowledging the lack of data, future studies must be conducted when data is more available.

## V. RESEARCH DESIGN

Two methodologies will be used to assess which country has the best average mean in comparison to other countries and if the means of the data set are significant enough to determine a similarity to Slovenia's means. The dependent variable is GDP per Capita growth rates, calculated using 2005 constant international dollars. The explanatory variables are the domestic savings rate, foreign direct investment, population growth, and labor force participation rate.

### A. Descriptive Statistics

Since this dataset lacks large variation and figures, descriptive statistics will be used to examine how countries rank based on individual growth components. Descriptive statistics will examine the following problems:

1. Which country has the best (worst) average mean of the individual growth component?
2. Taking all rankings into account, which countries rank the highest/lowest?

### B. Means Hypothesis Testing

First, averages of each component are calculated for 2000 through 2011 using Slovenia as the main frame of reference. Every country will be examined individually relative to Slovenia.

Hypothesis testing using t-tests on the means will look as follows for each mean growth component:

- $H_o$: There is no difference between a country's mean and the Slovenian mean for that specific growth component
- $H_a$: There is a difference between a country's mean and the Slovenian mean for that specific growth component

Compute the standard deviation with the following equation:

$$\delta = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(xi - \mu)^2}$$

Next compute the standard error with the following equation:

$$\delta xbar = \frac{\delta}{\sqrt{n}}$$

The Critical Value Approach will be used to determine whether or not the null hypothesis should be rejected:

$$Z = \frac{xbar - \mu}{\delta/\sqrt{n}}$$

The z-value for the two-tailed test will determine the significance levels for the individual countries and their components of growth for alphas equal to 0.01 and 0.05 for all tests, so that z (alpha 0.01) = 2.326 and z (alpha 0.05) = 1.645.

## VI. RESULTS

The results section contains two sub-sections, descriptive statistics and means hypothesis testing, in order to analyze the components of economic growth for the former Yugoslavian countries relative to Slovenia.

### A. Descriptive Statistics

The appendix contains Table 2 which summarizes the rankings of all five countries based on the means calculated in Table 3. The rankings provide a sense of which countries are doing the best in each component of growth category and overall economic growth.

Slovenia has the most top rankings, and Serbia and Croatia are next with three second rankings each. The rest have different ranking numbers for all the categories and do not follow any patterns. It is interesting to note, however, that Slovenia has two sixth rankings in GDP per capita growth and FDI inflows, although it is the top ranking country overall.

### B. Means Hypothesis Testing

Table 3 summarizes the results from the means hypothesis testing. The means that fail to reject the null hypotheses are indicated by a bold "accept" in the right-hand columns.

The first means that are accepted by hypothesis

testing are the GDP per capita growth rates of Croatia ( 0.05 and 0.01 significance levels), Macedonia (0.01 significance level), and Montenegro (0.01 significance level). This suggests that the countries listed above have similar GDP per capita growth means to Slovenia. If Croatia, Macedonia, and Montenegro have similar means, this also signifies that these countries are on track for economic growth because they are following the same mean for GDP per capita as Slovenia. The other countries, Serbia and Bosnia and Herzegovina, did not fail to reject the null hypothesis and are, therefore, not exhibiting similar economic growth patterns as Slovenia.

The means hypothesis test for domestic saving rates found that Bosnia-Herzegovina and Montenegro both fail to reject the null hypothesis. However, by using descriptive statistics, this cannot be true. Both countries experienced negative rates of domestic savings rates, nowhere near the domestic savings rates of Slovenia. This could have resulted because the negative domestic savings rates were squared in order to find the z value. Therefore, no country has means similar to Slovenia's means and are not following the domestic savings rates average means to increase overall economic growth.

The only two countries to fail to reject the null hypothesis for FDI inflows were Serbia (0.05 significance level) and Montenegro (0.05 and 0.01 significance levels). This suggests that Serbia and Montenegro are receiving equal levels of FDI inflows or more to boost economic growth. Other countries, such as Croatia, Bosnia-Herzegovina, and Macedonia, have lower mean FDI inflows than Slovenia and therefore are not going to exhibit economic growth patterns like Slovenia.

The only country to fail to reject the null hypothesis for FDI outflows was Croatia (0.01 significance level). This suggests that Croatia and Slovenia have similar FDI outflow means while the other countries are not significantly close enough to Slovenia's means. Therefore, Croatia is the only country that follows an average mean of FDI outflow close enough to Slovenia.

Several countries fail to reject the null hypothesis for the means of population growth. Croatia (0.05 significance level), Serbia (0.05 and 0.01 significance levels), and Bosnia-Herzegovina (0.05 and 0.01 significance levels) fail to reject the null hypothesis. Therefore, their population growth means are statistically similar to Slovenia's population growth mean and are on the right track for economic growth by following Slovenia. Macedonia and Montenegro, on the other hand, are not following Slovenia in terms of this component of growth.

No countries fail to reject the null hypothesis for the means of labor force participation rates because they either do not have the same average means as Slovenia or they do not report labor force participation rates.

## VII. DISCUSSION

Based on the results above, several conclusions can be made about which countries are the most successful and what components of growth added to their success. Slovenia, the reference country, is ranked first and outperforms the other countries in terms of domestic savings rates, FDI outflows, and labor force participation rates. Serbia and Croatia are next in rank. Serbia has good performance in GDP per capita growth, FDI inflows, and FDI outflows, but does not record its labor force participation rate. Croatia is second in real GDP per capita, domestic savings rates, and labor force participation; however, other components of growth are lacking. Regardless, Bosnia and Herzegovina, Macedonia, and Montenegro are still countries that lack in increasing their components of growth and need to adopt policies that will promote these increases. For example, there is a need for more capital accumulation, since no countries exhibit similar domestic savings rates to Slovenia and should adjust interest rates to incentivize savings. Some countries, like Montenegro, were very successful in attracting FDI; however, they are not stable and developed enough to send FDI out such as Slovenia and Croatia. Other countries are increasing their population growth rates to replace their depleted populations, like Croatia, Serbia, and Bosnia and Herzegovina. Countries like Montenegro and Serbia need to record their labor force participation rates so that they know what kind of policies to implement to spur labor participation and ultimately productivity.

## VIII. CONCLUSION

In order to transition successfully, Bosnia and Herzegovina, Macedonia, and Montenegro have to increase their components of economic growth to reach Slovenia's level. There are several ways these countries can do this. In order to increase GDP per capita growth rates, they have to produce more output. To increase overall output, components of economic growth must be increased, with the most significant being FDI inflows. To increase FDI inflows, the least successful countries

should open their borders to foreign investors who bring money and technology into the country to spur economic activity. Either way, the governments of the former Yugoslavia must provide policies that encourage and promote economic growth to increase so that they can be as successful as Slovenia in economic growth and transitioning.

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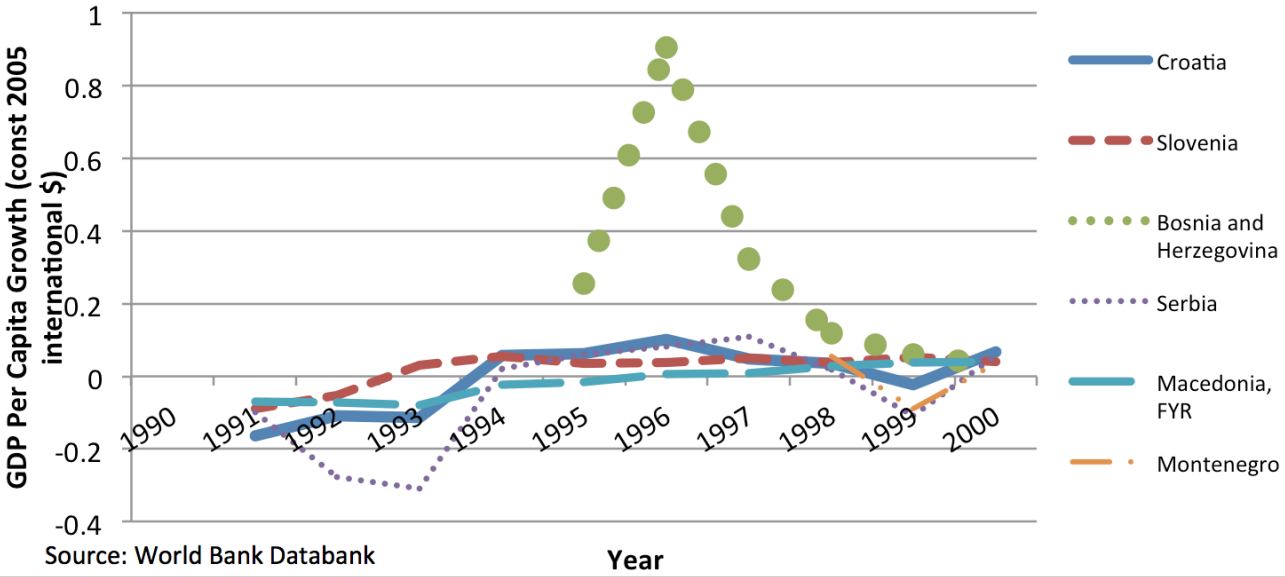
## XI. APPENDIX

Table 1: Breakup of the Former Yugoslavia

| Country | Year of Independence |
|---|---|
| Slovenia | June 1991 |
| Croatia | June 1991 |
| Macedonia | September 1991 |
| Bosnia & Herzegovina | January 1991 |
| Montenegro | June 2006 |
| Serbia | June 2006 |

*Montenegro & Serbia reported individual figures from 1997 onward to the World Bank

**Figure 1.1: GDP Per Capita Growth of the Former Yugoslavia During Civil War**




Source: World Bank Databank

Table 2: Country Rank

| Country | Real GDP per Capita | GDP per Capita % | Domestic Savings Rate | FDI Inflows | FDI Outflows | Pop. Growth Rates | Labor Force Part. Rate |
|---|---|---|---|---|---|---|---|
| Slovenia | 1 | 6 | 1 | 6 | 1 | 3 | 1 |
| Croatia | 2 | 5 | 2 | 4 | 3 | 5 | 2 |
| Macedonia | 5 | 4 | 3 | 3 | 5 | 2 | 3 |
| Bosnia & Herzegovina | 4 | 1 | 6 | 5 | 4 | 1 | 4 |
| Montenegro | 3 | 3 | 5 | 1 | --- | 4 | --- |
| Serbia | 6 | 2 | 4 | 2 | 2 | 6 | --- |

* Ranking based on means from 2000 to 2011 and are in Table 3

Table 3: Hypothesis Tests on Components of Growth

| | Mean | Std. Dev. | Std. Error | Z-Value | Alpha 0.05 | Alpha 0.01 |
|---|---|---|---|---|---|---|
| Real GDP per Capita (constant 2005 International $) | | | | | | |
| Slovenia | 23505.32 | | | | | |
| Croatia | 6489.77 | 962.08 | 290.08 | -21.37 | Reject | Reject |
| Bosnia & Herz. | 8442.45 | 1219.9 | 367.82 | -21.95 | Reject | Reject |
| Macedonia | 8165.00 | 912.23 | 275.04 | -28.69 | Reject | Reject |
| Montenegro | 8770.44 | 1348.82 | 406.68 | -20.57 | Reject | Reject |
| GDP per Capita Growth Rates | | | | | | |
| Slovenia | 0.0171 | | | | | |
| Croatia | 0.0237 | 0.0395 | 0.0119 | -0.9883 | ***Accept*** | ***Accept*** |
| Serbia | 0.0367 | 0.0272 | 0.0082 | -3.4722 | Reject | Reject |
| Bosnia & Herz. | 0.0401 | 0.0307 | 0.0092 | -3.3188 | Reject | Reject |
| Macedonia | 0.0246 | 0.0305 | 0.0092 | -1.676 | Reject | ***Accept*** |

| Table 3: Hypothesis Tests on Components of Growth | | | | | | |
|---|---|---|---|---|---|---|
| Montenegro | 0.0361 | 0.0409 | 0.0123 | -1.9266 | Reject | ***Accept*** |
| Gross Domestic Savings Rates (% of GDP) | | | | | | |
| Slovenia | 25.71 | | | | | |
| Croatia | 20.57 | 2.61 | 0.79 | -25.11 | Reject | Reject |
| Serbia | 0.83 | 6.05 | 1.82 | 0.55 | Reject | Reject |
| Bosnia & Herz. | -15.44 | 12.49 | 3.77 | 5.10 | ***Accept*** | ***Accept*** |
| Macedonia | 4.12 | 2.16 | 0.65 | -5.32 | Reject | Reject |
| Montenegro | -4.08 | 6.29 | 1.90 | 3.15 | ***Accept*** | ***Accept*** |
| FDI Inflows | | | | | | |
| Slovenia | 2.12 | | | | | |
| Croatia | 5.08 | 2.45 | 0.73 | -5.89 | Reject | Reject |
| Serbia | 6.02 | 4.23 | 2.30 | - | ***Accept*** | Reject |
| Bosnia & Herz. | 4.68 | 3.39 | 1.02 | -3.58 | Reject | Reject |
| Macedonia | 5.10 | 3.32 | 1.00 | 4.10 | Reject | Reject |
| Montenegro | 25.52 | 36.77 | 18.39 | 0.39 | ***Accept*** | ***Accept*** |
| FDI Outflows | | | | | | |
| Slovenia | 1.33 | | | | | |
| Croatia | 0.78 | 0.79 | 0.24 | -2.26 | Reject | ***Accept*** |
| Serbia | 1.27 | 1.27 | 0.38 | -2.47 | Reject | Reject |
| Bosnia & Herz. | 0.09 | 0.11 | 0.03 | -23.99 | Reject | Reject |
| Macedonia | 0.01 | 0.06 | 0.02 | -4.07 | Reject | Reject |
| Montenegro | 0 | 0 | - | - | - | - |
| Population Growth Rates | | | | | | |
| Slovenia | 0.28 | | | | | |
| Croatia | -0.27 | 0.25 | 0.25 | 2.10 | ***Accept*** | Reject |
| Serbia | -0.31 | 0.04 | 0.04 | 9.77 | ***Accept*** | ***Accept*** |
| Bosnia & Herz. | 0.34 | 0.25 | 0.25 | -0.34 | ***Accept*** | ***Accept*** |
| Macedonia | 0.26 | 0.02 | 0.02 | -11.85 | Reject | Reject |
| Montenegro | -0.05 | 0.07 | 0.07 | 1.64 | Reject | Reject |
| Labor Force Participation Rates | | | | | | |
| Slovenia | 69.75 | | | | | |
| Croatia | 64.65 | 20.45 | 6.47 | -9.78 | Reject | Reject |
| Serbia | - | - | - | - | - | - |
| Bosnia & Herz. | 52.16 | 16.54 | 5.23 | 11.36 | Reject | Reject |
| Macedonia | 61.76 | 19.61 | 6.20 | 1 | Reject | Reject |
| Montenegro | - | - | - | - | - | - |
| Reject $H_o$ if | | | | | | |
| $\alpha = 0.5$ | | | $\alpha = 0.01$ | | | |
| $\alpha \geqslant$ - 1.645 or 1.645 $\leqslant \alpha$ | | | $\alpha \geqslant$ -2.326 or 2.326 $\leqslant \alpha$ | | | |

# The Obstacles Facing India on Its Journey to Becoming a Developed Country

Tara Gracer, Zahra Lalani, & Chi Nguyen

## I. INTRODUCTION

Among the developing countries in the world, India marks itself as being one of the fastest growing economies. India, the seventh-largest country in the world, borders the Indian Ocean to the south, the Arabian Sea to the south-west, the Bay of Bengal to the south-east, and shares borders with Pakistan, China, Bhutan, Burma, and Bangladesh. India is recognized by a long history of commercial and cultural wealth. India's political and economic history has led it to become one of the fastest developing countries in the world. Despite being a newly industrializing nation, India continues to face challenges of over population, poor water and sanitation, and low adult literacy rates. These problems are addressed in this report along with the policy recommendations for India to overcome these challenges.

## II. POLITICAL & ECONOMIC HISTORY

India has 7,000 kilometers of costal access to the Indian Ocean and the Arabian Sea. The largest mountain range in the world, the Himalayas, separates India from Nepal and China. From the mountains, comes the most important fresh water source in the world. Both the Ganges and Brahmaputra rivers supply India's 1.2 billion people with fresh water (CIA Factbook). The Deccan Plateau is in the south and is an up-land plain. The Thar Desert sits in the west where it crosses over into Pakistan. India's climate varies throughout the region as it spans many different geographical areas. Climate can vary from tropical monsoons, hot temperatures in the desert, or to a mild temperate forest (CIA Factbook). All varying geographical features have had a significant effect on the country's access to natural resources, such as water, for its population.

India received its independence from the United Kingdom on August 15, 1947. In order to succeed in its independence, the people of India had to fight for their freedom from British colonial rule. The Battle of Plassey in 1757 determined India's colonial fate for many years. Finally, during and after World War II, demonstrations and violence took hold all over India between Hindus and Muslims. A resolution was met in June of 1947 when the Muslims moved into northern India and Pakistan while the Hindus and the Sikhs stayed.

India's constitution was passed on November 26, 1949 and came into force on January 26, 1950. India's independence allowed the government to become a federal republic, even though its full name is the Republic of India. The constitution states that Hindi is the official language of the Union. However, English can be used for official purposes as well (Statesman's Yearbook).

Since independence, India has had several regional tensions with its neighboring countries such as China and Pakistan. In 1948 and 1965, India engaged in several wars with Pakistan over a territory known as Kashmir. India also lost a short border war to China in 1965. Again in 1971, a third war began between Pakistan and India in which Eastern Pakistan was created into the country now known as Bangladesh. More territorial disputes arose in 1990 over Kashmir when Muslim separatist groups began using violence. In 1999, violence returned to the region where India and Pakistan went to war again. Tensions in Kashmir continued to rise into the 2000s until a ceasefire was called in 2003 (BBC). India has, therefore, undergone several war-like events in recent history, which has had a toll on its people and economy.

India is made up of 28 states and seven territories. Each state has its own Governor that is appointed by the President. The President is the head of the Union and is elected by an electoral college of the members of Parliament. The President appoints the Prime Minister. The Council of Ministers aids the President, and the ministers are appointed by the President with the advice

of the Prime Minister. Parliament is separated into three sections: the President, the Council of States, and the House of the People. The Council of States is known as the Upper House, which contains 245 members that are elected by the members of the Legislative Assembly of that State. The House of the People is known as the Lower House, which consists of 545 members that are elected based on their adult suffrage from territorial constituencies in both the states and territories. State legislatures can be divided into three sections: the Governor, the Legislative Assemblies and the Legislative Councils. Parliament has the power to abolish any existing Legislative Council members (Stateman's Yearbook). The Indian government has developed, as a result, into a stable democracy that can enforce its policies, such as contraceptive and educational programs.

The current President is Pranab Mukherjee and the Vice-President is Hamid Ansari. Some of the political parties are Bharatiya Janata Party (BJP), Indian People's Party/ Bharatiya Lok Dal (BLD), Indian National Congress (INC), Indian National Congress-Indira Gandhi faction (INCi), People's Party/Janata Dal (JD), and United Progressive Alliance (UPA). India has dozens of national and regional political parties. However, parties with four or more chairs are considered representatives in the People's Assembly (Statemen's Yearbook). Therefore, it can be said that India is the largest democracy in the world because of the vast number of political parties. In 2007, India even had a women become president, Phratibha Patil, for the first time in history (BBC).

For economic growth, Gross Domestic Product (GDP) per capita in 1990 for India, Pakistan, and China was between 316 dollars and 449 dollars, with India at the lower end. Twenty years later the growth of China's GDP has far surpassed that of India and Pakistan. In 2011, China's GDP per capita was approximately three times that of India's. While India had a higher GDP per capita than Pakistan (837 dollars to 672 dollars) in 2011, India's government still has a lot of work to do in order to reach the same GDP per capita as China or the United States. The United States is not pictured in the appendix because it has a relatively higher GDP per capita throughout the time period which distorts the scale of the Figure 1. For comparison purposes, the United States GDP per capita in 1990 was 28,298 and 37,691 in 2011.

India began to liberalize its economy in 1991, and since then it has slowly moved towards a free-market system by emphasizing both foreign trade and direct investment inflows. After four years, India joined the World Trade Organization (WTO) on January 1, 1995. India's primary exports include petroleum products, precious stones, machinery, iron, steel, chemicals, vehicles, and apparel (India, 2009). A decrease in the percentage of manufactured goods of the total exports was caused by more service exports, especially in the areas of software outsourcing. While India is an expert exporter of jewelry, gems, textiles, and chemicals, it lacks oil resources to meet its growing energy needs. The growth rate of India's exports in 1990 was 11 percent and increased to 18 percent in 2000 (World Bank). Meanwhile, imports were growing at 3.4 percent in 1990 and 4.6 percent in 2000 (World Bank). Terms of trade in India were 127.20 in 2010, and it was much higher than Pakistan, China or even the United States (World Bank). India has managed to keep its export prices high, which implies that to maintain the same level of imports, India can trade fewer exports. Thus, India could save its scarce productive resources and import machinery, vehicles, raw materials to build up its capital. From a baseline of more than 236 million dollars of Foreign Direct Investment (FDI) in 1990, India received more than 102 times that (over 24 billion dollars) from foreign investors in 2010 (World Bank). In 2010, India ranked approximately 16th in terms of inflows of FDI. India became the largest FDI recipient in South Asia and accounted for four fifths of total FDI inflows to the region. Also, a recent survey by United Nations Conference on Trade and Development (UNCTAD) projected that India would become the second most important FDI destination after China. Highest FDI inflows were recorded in services, telecommunication, construction activities, computer hardware and software, and hospitality sectors. India has therefore exemplified significant economic measures to enlarge its economy and prosperity.

## III. POPULATION

One of the most pressing problems India is currently facing is its total population size and growth. India's population in 2010 was 1.2 billion (CIA Factbook). It is predicted to exceed 1.63 billion by 2050, which would overtake China's estimated population of 1.44 billion (BBC News, 2004). This means that India's population could become the largest in the world in the years to come. Population size, therefore, is a significant issue for India to address in order to ensure its prosperity and security on a national level.

To address India's population crisis, population growth rates should decline. Figure 2 demonstrates

that India is indeed experiencing a decrease in its population growth rate from 1990 to 2000, where the rate dropped below 2 percent. India, in relation to Pakistan's population growth rate, has a lower rate. The United States and China, on the other hand, both have decreasing population growth rates, which are lower than India's. Therefore, India is stuck in the middle between these three countries according to its population growth rate.

From 2000 to 2010, the Indian population growth rate continued to drop under 1.5 percent, which is shown in Figure 3. Once again in Figure 3, the United States and China have lower population growth rates than India while Pakistan has higher population growth rates than India. All countries, however, have decreasing population growth rates from 1990 to 2010. This decrease in population growth rates can be attributed to several policies that India and others have implemented in decades before. However, the population growth rates are still not as low as that of the United States and China, which pose a serious threat to scarce resources.

In 1952, India was the first nation to implement a national family planning program focused on supporting small family sizes and human development (WHO). India continued to implement policies in support of family planning. For example, in 1992, 1994, 1997, and 2000, several pieces of legislation and programs were passed. In 1992, new constitutional amendments were implemented to decentralize the family planning program to a new institution for control. The Indian Parliament, in 1994, even passed a law to "regulate and prevent the misuse of modern prenatal diagnostic techniques, largely for sex-selective abortion" (WHO). The 1997 policy created the Reproductive and Child Health (RCH) program where health services should be delivered with full satisfaction of the client. Finally in 2000, the National Population Policy set up one goal to lower the average total fertility rate of 2.1 by the year 2010, which dissolved centrally fixed targets and created a target-free approach. India has not reached this national goal because its estimated total fertility rate is 2.58 (WHO).

Besides implementing legislation, India has adopted several methods to reduce total fertility through contraceptives, which are becoming more and more popular (WHO). In 2000, 48.3 percent of married women used contraception, which demonstrates that unwanted child bearing still occurs. Three out of four people in India rely on sterilization as a contraceptive because it is the preferred method by 85 percent of married women. Only 7 percent of married women use pills, IUDs, or condoms as modern contraceptive methods (WHO). Two more methods have been used: a shot that lasts up to ten years and an after pill that was expected to decrease the unwanted child bearing and unsafe abortions (WHO). However, contraceptives have not been entirely successful because of India's poor literacy rates, little access to family planning information, poverty, and discrimination against the female sex. Access to family planning in rural areas is nearly non-existent, in addition to the staffing shortages and proper health services. These reasons exemplify why India is still having problems with lowering their population growth rates to those of developed countries such as the United States.

### A. Solution for High Population Growth

In order for India to solve its population problem, it should continue the same policies because they are having some positive effect on decreasing the overall population growth rate. In addition, these policies are boosting funds and access for contraceptives to areas with lagging fertility rates. By spreading a policy to provide equal access to contraceptives, India can help women lower unwanted births and unsafe abortions. Birth control and safe abortions can prevent women from having children beyond their family's financial supportive capabilities. An increase in contraceptive use will therefore result in a decrease in population growth rates, which India is striving for.

The advantages of India continuously reducing its population growth rates are as follows: more capital per capita, an increase in output, less competition for jobs, unemployment decreases, and a drop in unnecessary births. Just by dropping the unnecessary births, India will stop a larger labor force from being born. If fewer workers are born, then fewer workers are competing for jobs and fewer workers are unemployed. Therefore, by reducing the number of unwanted births, unemployment in the future can be decreased. According to the Solow Growth Model, if India were to have an increase in population growth, it would result in a decrease in output and a decrease in capital per capita, which is shown by Figure 3. However, since India is implementing policies that have reduced the population growth rate from 1990 to 2010, the opposite will occur. Instead of moving from point A to point B, India is moving from point B to point A. The arrows in Figure 3 showing output decreasing and capital per capita

decreasing both will increase if population growth rates are reduced. This means by lowering its population growth rates, India has the potential to make workers more productive because more capital per capita will be available as well as an overall increase in output of India's economy. However, India has to decide whether or not these advantages outweigh the disadvantages.

Several disadvantages lay ahead if population growth rates continue to decline. Since fewer workers are being born, this signifies that the number of replacement births will decline. This has the potential to cause severe problems if population growth rates become negative and begin to harm the productivity of the workers and the output of the economy. In addition to negative replacement birth rates and population growth rates, the smaller new generations of workers will have to support the bigger older generations who move into retirement. This could put strains on the small new working generation because they would have to be more productive because there would be fewer workers to produce the same amount of output. This, however, can be overcome through technological changes and accumulating capital stock. Regardless, India will have consequences on output by reducing its population growth rate, but the severity can be dampened through technological research and foreign aid.

## IV. WATER AND SANITATION

Water impacts every facet of human life. Improving access to safe drinking water can result in tangible health benefits. According to the United Nations, safe drinking water is defined as water whose consumption does not cause health problems over a person's lifetime. Disruptions in water supplies and sanitation services increase the likelihood of children under five acquiring diseases such as diarrhea, cholera, typhoid, and respiratory and skin infections.

Poorly developed storage capacity, a growing population, and a large agricultural industry, combined with a lack of rainfall, creates a devastating shortage of safe drinking water in India. Demand for water currently outweighs the supply and is likely to cause heightened food shortages in the futures. Aside from pollution and fecal contamination, the issue of water scarcity could in large part have been prevented by using better management with respect to legislation, conservation, efficiency, and investment in infrastructure. Issues of water management were placed on the back burner to issues of economic growth and food scarcity after India gained independence. In the absence of legislation, the people are able to draw any water that lies under their plot of land. Free access to water results in over pumping and provides no incentive for the user to conserve. With the government's focus on growth, the more water a farmer pumps, the more he can grow, and the more income he can generate. Agriculture is, therefore,important since India has a constant increasing demand for food to meet its growing population.

The World Bank defines an improved water source as:

"*the percentage of the population with reasonable access to adequate amount of water from an improved source, such as a household connection, public standpipe, borehole, protected well or spring, and rainwater collection. Unimproved sources include vendors, tanker trucks, and unprotected wells and springs. Reasonable access is defined as the availability of at least 20 liters a person a day from a source within one kilometer of the dwelling.*"

Unfortunately for India, there are regions in the country which lack an improved water source. India and China both had lower water accessibility levels than the United States and Pakistan in the 90s, but as of 2010, all four countries had accessibility levels in the 91 to 99 percent range.

Poor sanitation, especially in rural areas, is the number one cause of death of children under the age of five (UNICEF). Children are highly prone to diarrheal diseases and respiratory infection which can greatly be reduced by washing hands with soap. Washing hands with soap before eating and after using the bathroom is the most effective way to prevent diarrheal disease. In 2008, only 31 percent of India's population used improved sanitation (UNICEF).

Much of the sanitation issues in the country deal with problems of open-defecation. According to UNICEF, 638 million people in India defecate in public and 44 percent of mothers dispose of children's feces in the open. Over 50 percent of the population still defecates in the open. The widespread prevalence of this activity has direct impact on water contamination, which when used for drinking, causes diarrhea and other adverse effects on health. The root of this problem lies in the lack of private toilets. Without toilets, the only option to defecate is in the open. Women and young girls often wait until the night fall to defecate in order to maintain safety and preserve their dignity, by avoiding being seen by others during the daylight hours.

Contracting disease makes it more difficult for children to attend school to obtain an education that would make them contributing members of society. Thus it is essential to invest in the maintenance of water supplies and sanitation facilities. Initiatives such as the Total Sanitation Campaign, along with the work of UNICEF have made improvements in water and sanitation for schools. This decreases the likelihood of contracting disease and infections, and increases regular attendance, subsequently making it more likely for them to achieve their educational goals.

The World Bank defines improved sanitation facilities as:
*"the percentage of the population with at least adequate access to excreta disposal facilities that can effectively prevent human, animal, and insect contact with excreta. Improved facilities range from simple but protected pit latrines to flush toilets with a sewerage connection. To be effective, facilities must be correctly constructed and properly maintained."*

As seen in the graph in the appendix, India has not made significant progress towards improved sanitation conditions as China and Pakistan have over the last twenty years.

Significant lags exist between the pronouncement of a policy and its subsequent implementation. These lags are heightened when data availability is limited. The responsibility for water and sanitation at the central and state levels is shared by various ministries. Central ministries, however, only have advisory capacity and provide limited funding for improvement initiatives. Thus the main responsibility for improvement falls upon state governments.

In 1986 India implemented its first sanitation program, the Central Rural Sanitation Program. This program was restructured in 1999 and renamed the Total Sanitation Campaign (henceforth TSC). The restructured campaign moved from a high subsidy to low subsidy program, with the hopes of encouraging direct community participation in the program. The program emphasized information, education, and communication to generate demand for sanitation facilities. The program was launched in a few cities, with the goal sanitation in all households and schools. Local village leaders had the primary responsibility of spearheading the campaign in their respective communities. Often times these leaders, also known as Gram Panchayats, contributed their own income towards the projects. Non-governmental organizations are used to spread awareness about the significant health benefits of improved sanitation in rural communities as well as to ensure that people actually use the latrines built. Unlike the earlier program, the cost of building sanitation facilities lies completely with the communities.

School Sanitation and Hygiene Education is a subsection of the TSC. The program promotes children's rights to have a clean and healthy environment. It also provides the following facilities at school: toilets and urinals (separate for structures in co-ed schools), hand washing facilities, water supply facilities, garbage and soaking pit, and drainage systems.

From the TSC imitative stemmed an incentive scheme in 2003 called Nirmal Gram Puraskar (henceforth NGP). Gram Panchayats, Blocks and Districts qualify for a monetary rewards and national recognition if they reach 100 percent sanitation coverage in households and schools, and that are open-defecation free. The monetary rewards should be used for the maintenance of sanitation facilities.

More recently, the government of India has implemented a similar program for urban cities called the National Urban Sanitation Policy. The goal is to create "totally sanitized cities." These cities would ideally be open-defecation free, would safely collect and treat all wastewater, and collect and dispose of waste safely. The plan was launched with the hopes of generating awareness amongst households and institutions about sanitation and its linkages with public and environmental health, in the same manner as TSC.

### A. Solutions to Poor Water and Sanitation

With the low sanitation coverage shown in the "Improved Sanitation Facilities" graph located in the appendix, and the current policies in place, it is important to continue monitoring these programs. While sanitation is increasing, it is not increasing nearly as rapidly as it is in Pakistan or China, which were both at the same level of coverage in 1990. In addition to ongoing monitoring, implementing hygiene and health into grade school curriculum should be the top priority of schools. Early exposure to the links between sanitation and health, may lead to changing open-defecation behavior. While latrines are being built, many people in India do not see a reason to change their behavior. A school curriculum on the matter may help change that idea. The future benefits of these initiatives greatly exceed the current costs needed to put them

in place. While costs of implementing new education programs may require training teachers and spending resources on developing a new curriculum, it would have long term positive effects of changing behavior. If people live healthier lives as a result of improving their hygiene practices, then their life expectancies increase. If their life expectancies increase they are healthier for longer periods of time and can obtain higher education. Higher education in conjunction to high life expectancy would increase the Human Development Index for India. Aside from the heavy initial outlay of funds, the only other side effect to this initiative would be that the results causing a change in behavior would take time to observe and measure.

## V. LITERACY RATES

According the Word Bank Data, the adult literacy rate in India in 2006 was 62.75 percent. With this number, India belonged to the bottom group of lower middle income countries, along with its neighbor Pakistan which had a rate of 54.15 percent. At that time, China already had a 93 percent adult literacy rate. Compared with India, its number of just slightly over 60 percent would clearly suggest a critical issue for India to cope with.

Illiteracy in India also stems from high dropout rates, which was 52.79 percent in 2005 (Kondapalli). In 2008, the percentage of students entering primary school was 116 percent, according to the World Bank, while the percentage of students entering secondary schools was 60 percent (World Bank). However, the primary school enrollment figure is not reliable because it is recorded as over 100 percent. The dropout rate is more consistent. Children drop out of school regularly because of various reasons, including their families' financial situations or quality of education.

Another problem is that India has a shortage of teachers. The average student-teacher ratio in India was 40:1 in 2004 (World Bank). This ratio was relatively high compared to Pakistan (37:1), China (21:1) and United States (14:1) (World Bank). Even though literacy rate and dropout rate have been improving through the years, the teacher to student ratio seems to be stagnant. More seriously, India also had to grapple with the challenge of teacher truancy because 25 percent of teachers in government schools failed to turn up for class every day which gives India one of the most dismal rates of teacher absenteeism in the world (Coulter, 2004). A large number of teachers simply cut off their teaching time for private family earnings. Among the devoted teachers, most of them are often pulled out of classroom by the government for non-educational duties: taking census data, updating voter rolls, running vaccination programs, fetching rice for school lunch, or even counting cattle and sheep (L.A. Times, 2008). These flaws in the educational system have gravely worsened the attempt to improve the literacy of India.

The issue of literacy does not only explain the underdeveloped society in India but it also captures one of the reasons that have held back India's economic growth. Even though literacy demonstrates social value to the society, it is considered to be a key indicator of economic development in that country as well. Literacy leads to the enhancement of human capital, which is a part of the economic resources that make the prosperity of a country. School enrollment, which directly affects literacy rate, is proven to have positive correlation with GDP per capita. This is shown by Friedrich Huebler's graph in the appendix (2005).

With a developing country like India, it is important to move from a traditional subsistence economy to an industrialized economy. However, like any developing country undergoing the industrialization process, India faces the underdevelopment trap in which the country remains stuck in subsistence agriculture. It happens when firms are not willing to enter the market or plant themselves in one area if workers do not possess the skills that firms need. Likewise, workers do not acquire skills if there are no firms to employ them. As no one makes the first move, the solution to get out of this trap could be government intervention in education. If the government trains the people, firms will have more incentive to invest in the area, and will catalyze industrialization. Thus, when a country is trying to find its way into development, it is essential that literacy should be emphasized in order to maximize the human capital of the country.

In addition, literacy has proved to give better access to formal sector employment for poor households. With more education, people from rural areas have the incentive to migrate to urban areas for better jobs, higher wages and better prospects of life. Because of this, more people are coming into the manufacturing industry and leaving traditional agriculture. According to the Harris Todaro Model, this increasing labor entering manufacture helps both agriculture and manufacture laborers. The labor in agriculture decreases which leads to an increase in their wages (see Harris Todaro Model in appendix). With better education, migrating people

have better chance of getting into the formal sector as mentioned above. And informal sector in fact provides training for transitional phase to enter formal sector, which prepares them for future application.

### A. Solutions to Low Literacy Rates

In order to deal with this issue, India has implemented many acts and laws that help decrease illiteracy and promote school enrollment. The government started Right to Education Act in 2009 to ensure that all children between the ages of 6 to 14 have the right to free and compulsory elementary education. Besides encouraging children to go to school, the government makes sure to provide good health treatment to children, which eventually helps improve school participation. In 2000, UNICEF launched a project to address the absence of safe drinking water and toilets in many schools in India after acknowledging that students fall ill frequently because of poor sanitation. Also, the Indian government keeps reinforcing the ban on the employment of children, pushing more and more children to school while at the same time reducing the dropout rate. This law was amended to spread the range of prohibition from hazardous industries to domestic servants or roadside restaurants (Kazmin, 2012). With so many policies boosting the number of children in schools, the government also tries to overcome the shortage of teachers by introducing the para-teacher scheme. These para-teachers are generally members of the same community in which they teach, and share many experiences and cultural practices with their students. The program has managed to gather more than 500 thousand para-teachers in a number of states, and this number is sure to rise more in the future (UNICEF India, 2006).

After clearly recognizing India's most critical problems with literacy, there are several possible solutions. Firstly, India should implement more effective legislation on the teacher retention issue in order to meet the demand for primary and secondary education in rural areas. In addition, the Indian government should increase the prestige attached to the teaching profession, making it more attractive to students entering that field. Raising salaries for teachers might be one solution. However, it is not enough to talk only about the quantity. What is most important is that the government improves the quality of teaching at Indian schools. According to a report, teachers' declining morality and responsibility most commonly stem from the underequipped infrastructure of schools, the lack of a staffed system, and poor condition of teaching materials (Coulter, 2004). Thus, there should be greater incentives for teachers to perform their job well by improving the physical quality of schools and providing adequate school management. With a disciplined and organized system of schooling, teachers have more time to concentrate on their teaching instead of helping the government with unrelated tasks. Moreover, performance pay should be encouraged to motivate them to enhance their teaching quality. While these are ideal solutions, a poor country like India cannot easily get the funds to invest in improving school facilities while simultaneously raising teacher salaries. To do this would require additional foreign aid.

In order to obtain more foreign aid to address its illiteracy issues, India should encourage the involvement of non-governmental organizations and international agencies like the United Nations. The difficulty that India faces with this solution is that external aid is small and governments have set a higher distributional priority for those funds. Thus, it is best to receive earmarked foreign aid. Also, in the long run, the country should not depend too much on outside help. Yet, the advantages that can be seen are evidently an increase in the rate of literacy, which, in the long term will help develop India both socially and economically.

## VI. CONCLUSION

The critical challenges India faces today can only be overcome through communication and cooperative initiatives between the people of India and the current political administration. Once both parties recognize that these critical problems of population, water and sanitation, and literacy rates need to be addressed, only then can India truly begin to successfully develop. If these issues go unaddressed, India might encounter severe consequences that can result in potential and permanent damage to India's chance of becoming a developed nation.

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**Figure 1: GDP per Capita (Constant 2000 US$)**

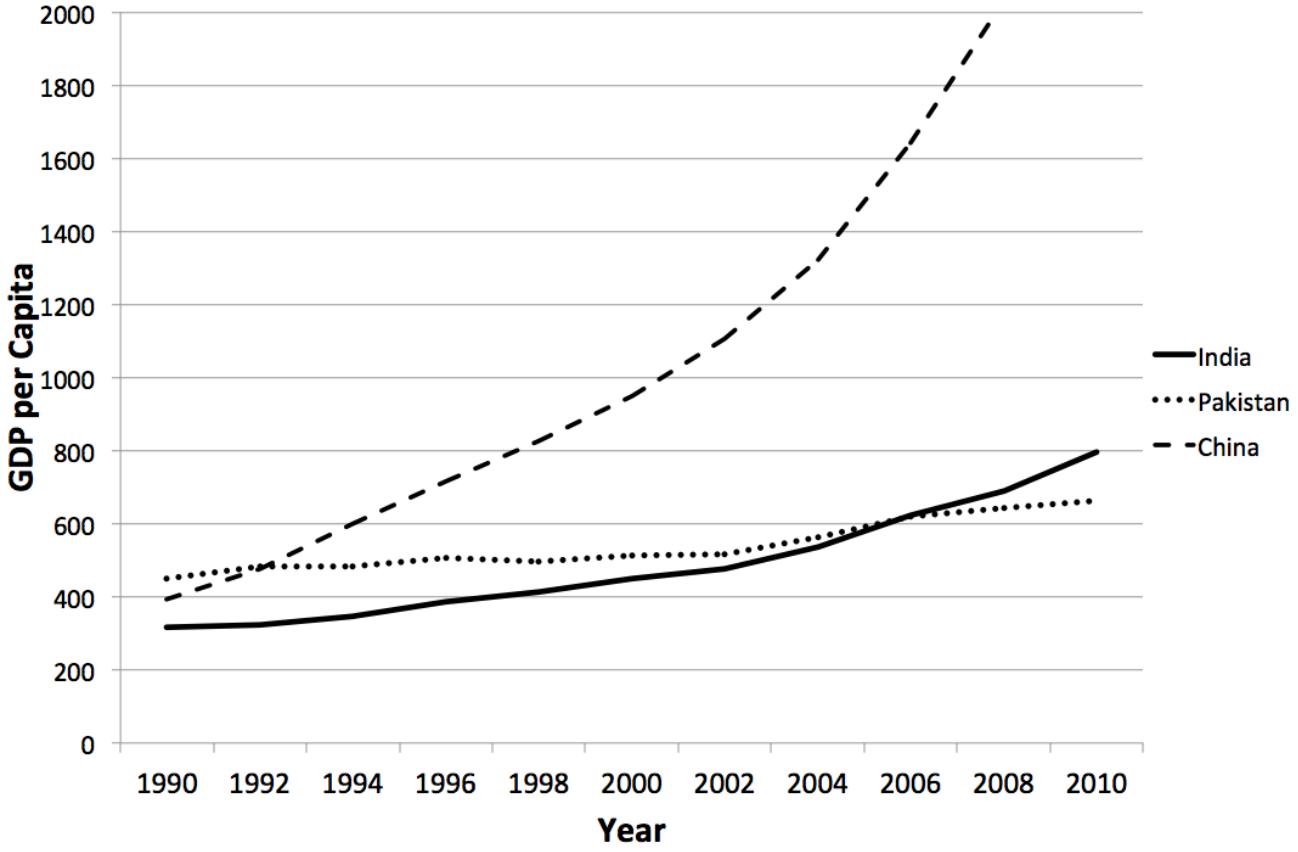
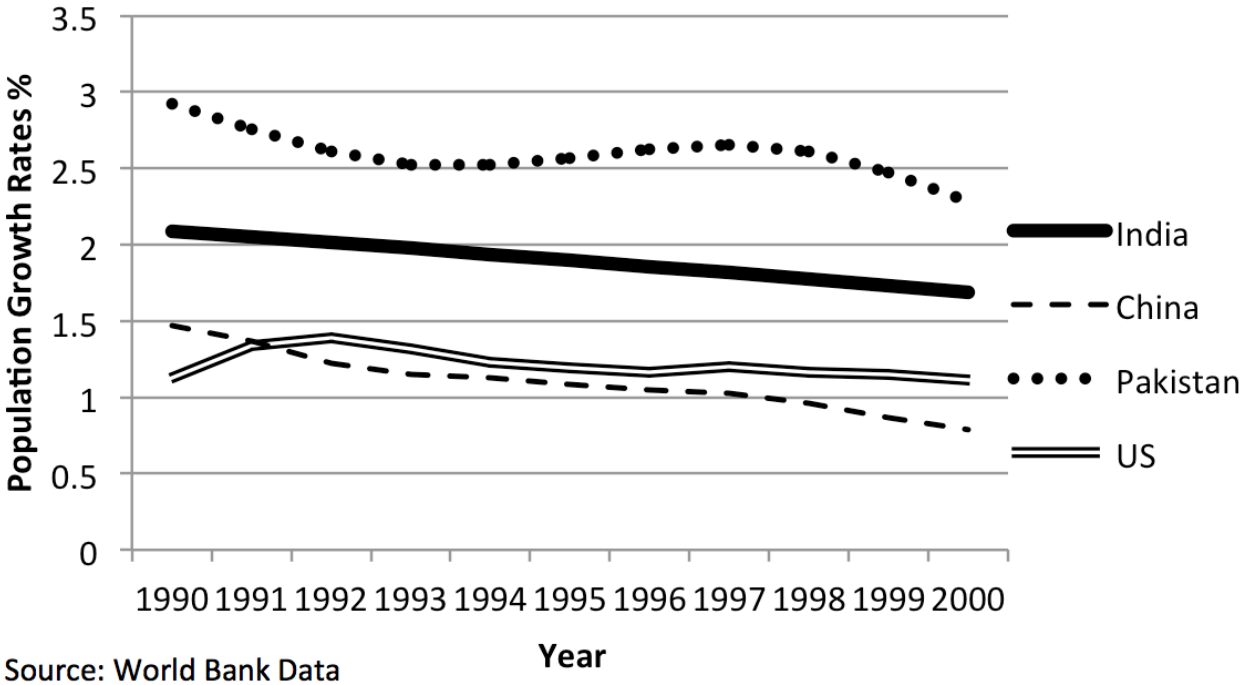
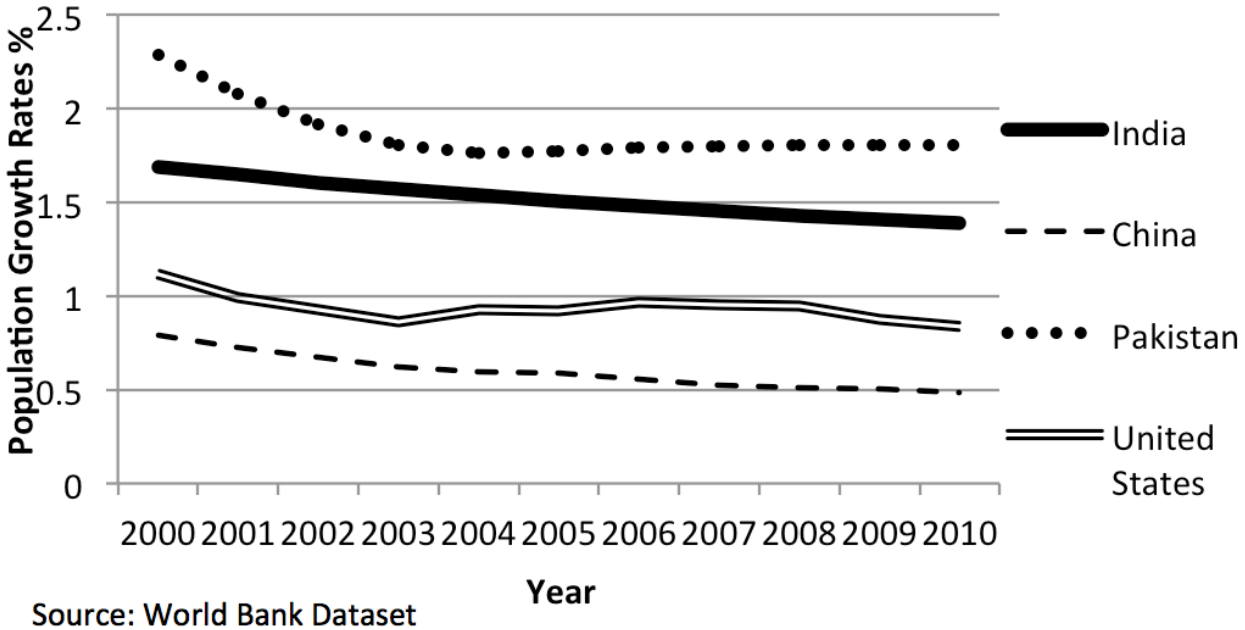



**Figure 2: 1990-2000 Population Growth Rates**




Source: World Bank Data

**Figure 3: 2000-201 Population Growth Rates**




Source: World Bank Dataset

Figure 4: Solow Growth Model

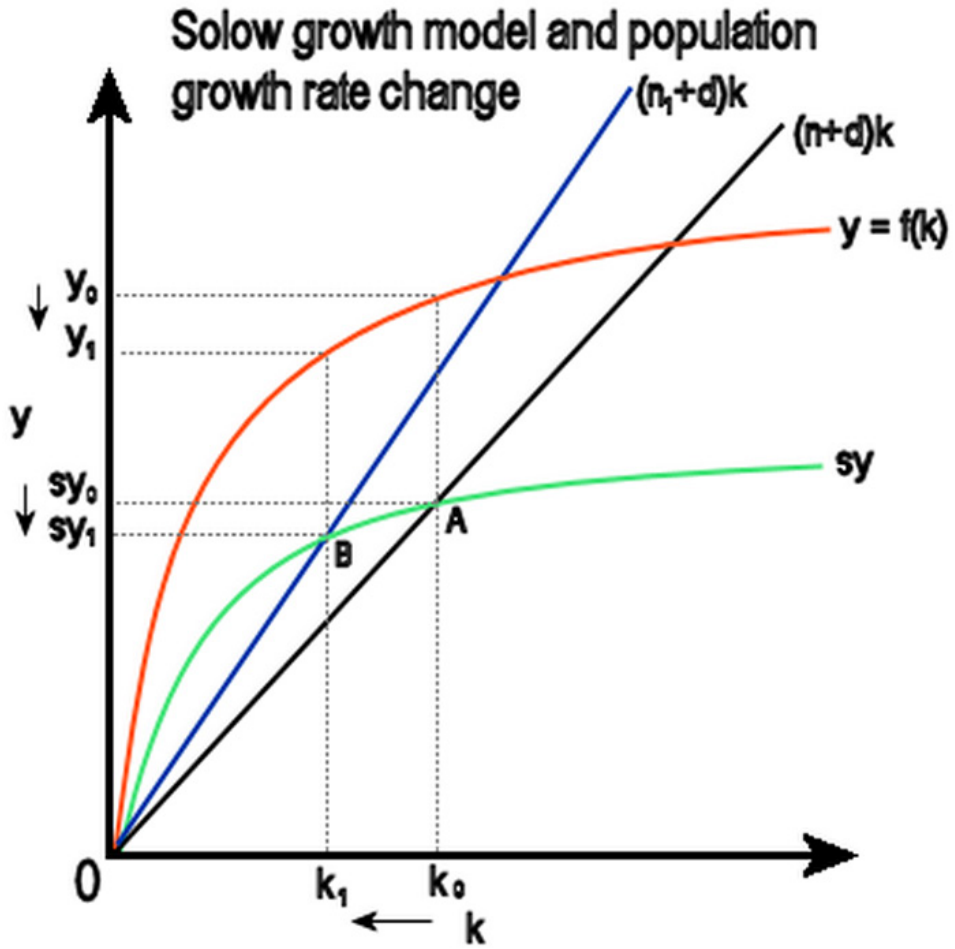


**Figure 5: Improved Water in Rural Areas**

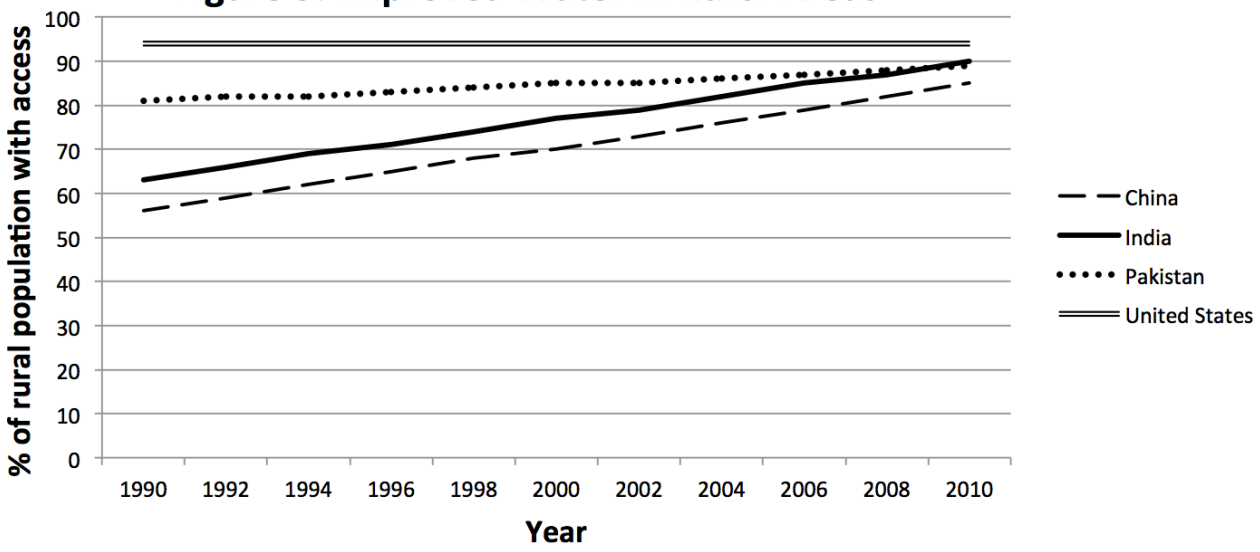



**Figure 6: Improved Sanitation Facilities**

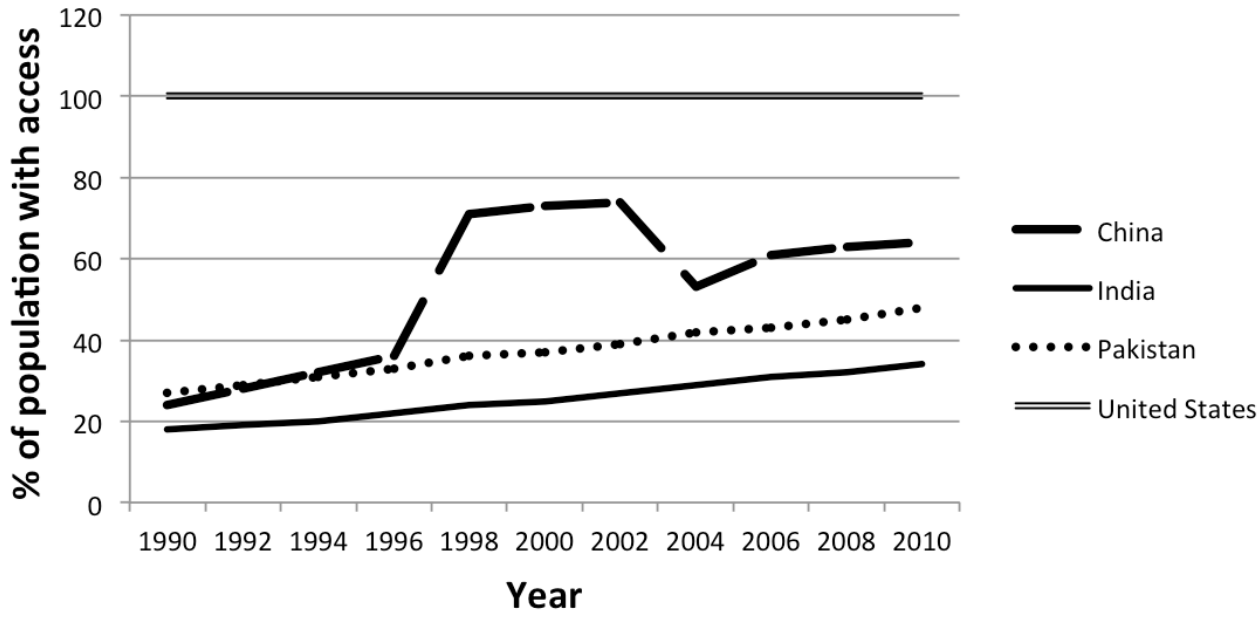


Figure 7: Harris Todaro Model

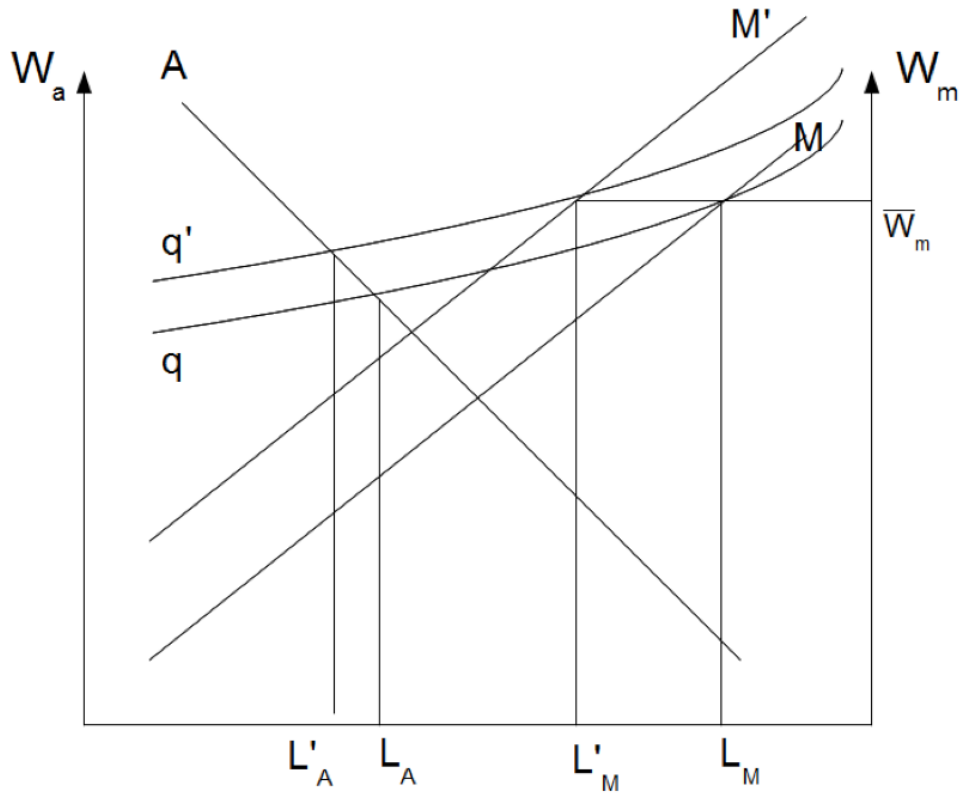
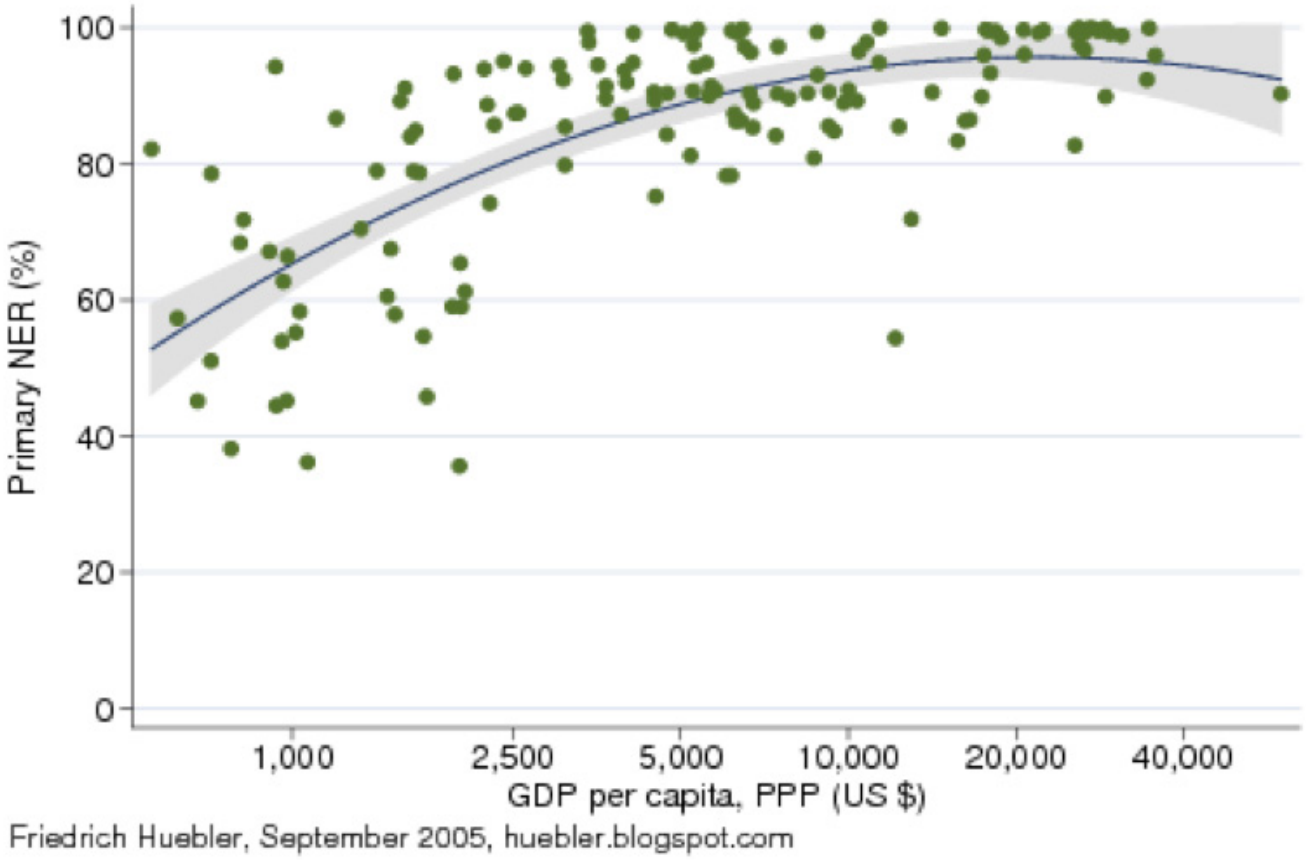



Figure: 8 Primary school NER and GDP per capita of 120 countries, 2002



# Assessing Happiness: How Economic Factors Measure Up

Elizabeth Hancock

## I. INTRODUCTION

The perception of economics as a dismal science for killjoys is challenged with the development of happiness economics. The economics of happiness refers to the study of subjective well being compared to income, unemployment, and other economic factors. In addition, the field expands the notions of happiness and welfare past basic measures of utility simultaneously posing serious policy implications. For example, if an economic policy is not contributing to the happiness of its constituents then what is its purpose? Furthermore, are policy makers catering to the needs of individuals or larger entities like corporations? The development of the economics of happiness is important when addressing the true well-being of people relative to the economy.

This study will assess the relationship between happiness and economic factors. The project will have a microeconomic framework and focus on individual well being. Specifically, it questions if one's standard of living has a meaningful impact on their happiness level given the scarcity of time. The study will also explore the possible non-pecuniary factors that are important in relation to happiness. It is expected that non-pecuniary factors will have significant effect on happiness levels along with economic factors.

## II. THEORY & LITERATURE REVIEW

Since the project will focus on individual happiness, microeconomic theory is essential. Foremost, theories on consumer preferences and utility are helpful in the analysis. Indifference or utility curves are the basic measurement of happiness or well being in neoclassical economic theory. According to this theory, a consumer on a given indifference curve is indifferent to baskets of goods on that curve, because they create the same amount of utility. Further, the ability to consume baskets with larger quantities of goods causes a consumer's utility to increase. The assumption is that as a consumer obtains more goods, they will have more utility or happiness. An individual maximizes her utility when the highest possible utility curve correlates with her budget (Parkin, 2009). This microeconomic theory is limiting, because it only uses income and consumption as a means to assess happiness and generally assumes that the utility surface is given. However, the model serves as a starting point for the analysis of the study. A more well-rounded analysis of happiness is needed.

The neoclassical model of indifference curves neglects the opportunity cost of consuming and working. In order to have a budget line for the model, one must be working for wages. However, time is finite and scarce; therefore, any time allocated for work is an opportunity cost for other activities (Buchanan, 2008). Opportunity costs are subjective and dependent on how much an individual values a particular option. The allocation of time between work, consumption, and leisure is essential to this project because it may affect an individual's happiness. Perhaps, working less generates more happiness which renders the neoclassical model of consumer choice with indifference curves incomplete. Happiness is subjective; hence, consumption and income cannot be its only determinants.

Max Weber is a fundamental social and economic thinker that provides insight for my paper. In his The Protestant Ethic and the Spirit of Capitalism (1930), Max Weber describes how religious asceticism eventually defers to the consumption of private goods. Asceticism refers to the renouncement of private goods and leisure because they do not serve God. However, Weber asserts that private goods became overwhelmingly appealing to individuals. This theory implies that obtaining or consuming goods influence happiness. Weber's theory is consistent with the indifference curve theory mentioned above. Therefore,

his work also limits the contributing factors of happiness. Newer theories in the field of economics identify a problem of attributing happiness to only economic factors.

Another aspect to consider is patterns between absolute and relative happiness levels and their impact on well-being. There is an inherent difference in money, consumption, and how each can affect happiness levels. American money is green, rectangular strips of paper which is not intrinsically valuable or useful. In other words, individuals do not have a "scale" for money to convert to happiness because it is a medium of exchange. The feeling or satisfaction that consumption brings causes money to become valuable. This is apparent in neoclassical thought. When one has a larger budget, he or she consumes at a higher indifference curve. Yet, relative income is cited as an important determinant of happiness, not absolute income (Hsee, C. K., Yang, Y., Li, N., & Shen, L., 2009). Relative income refers to one's income compared to their peers and coworkers. If one's relative income is less than a peer's, then it may cause discontent despite its absolute value ability to purchase goods. Social status affects subjective well-being. Therefore, the neoclassical model fails to account for this aspect of relative income as well. In addition, coupled with the Easterlin Paradox, it implies that absolute income may not have a significant effect on happiness.

The Easterlin Paradox is widely associated with happiness economics. Richard Easterlin, a pioneer of the economics of happiness, found that increases in per-capita income had little or no impact on average happiness, across countries. After basic needs are met, changes in aspirations, relative income, and security of gains become more important (Graham, 2008). Therefore, wealthier countries are only happier than poorer ones to a certain extent. A possible explanation for this paradox is the ability of capitalism to turn luxuries into necessities which consumers begin to take for granted. People are stuck on a consumption treadmill where they become inured to the pleasures of a higher standard of living (Economist, 2006). This is a central detail of the Easterlin Paradox for this project, because it changes the focus from absolute income to more personal factors like rising aspirations. Also, relative income is said to be more important than absolute values, which affects the interpretation of the neoclassical model. The Easterlin Paradox will be an important guiding force for this project because it acknowledges other possible influences on happiness.

Easterlin discovered the Easterlin Paradox in the 1970s. Since then, he has continued his research on happiness economics. Working with Sawangfa, Easterlin conducted research to analyze the cross-sectional relation of happiness to socio-economic status (Easterlin & Sawangfa in Dutt, 2009). Easterlin and Sawangfa analyzed the net effect of satisfaction in different domains of life on overall happiness. Domains of life included family, job, education, and health. By studying the respondents' subjective satisfaction in these domains, Easterlin is not reliant on objective measures of happiness. The results of the study report a positive correlation between socio-economic status and happiness. In addition, education level had a positive relationship to happiness. Overall, the model of domain variables estimated happiness well. Therefore, Easterlin and Sawangfa affirm that socio-economic status, family, job status, and health are important in measuring happiness subjectively.

The simplistic neoclassical model of utility is missing other factors of well-being like age, gender, race, marital status, and education. According to Frey and Stutzer, a socio-demographic approach to happiness reveals that younger and older individuals are happier than middle-aged people. Young people have high aspirations and good health. Individuals lose these qualities over the life course resulting in lower life satisfaction. Prospects increase after the middle age period because older people tend to adapt better to their experiences (2002).

Women on average are happier than men according Frey and Stutzer. The difference in happiness is small but may be a result of women experiencing more intense emotions. It is socially acceptable for a woman to express more feeling than men which may contribute to subjective well-being answers. However, women in the labor force report lower levels of happiness possibly due to discrimination and lower wages (Frey, et al., 2002).

In the United States, African Americans are less happy than whites according to both psychological and sociological studies. This difference can be attributed to many blacks having lower incomes, less education, and lower social status.

Health is another contributor of subjective well being. On subjective well-being tests, health is highly correlated with happiness levels. Yet, this observed effect decreases with objective health ratings by physicians

(Frey, et al., 2002). People demonstrate tremendous ability to cope, which does not affect their happiness significantly. Yet, other studies show individuals that have experienced adverse health conditions like paraplegics, show lower levels of happiness. Therefore, increases in the severity of the health condition will decrease one's happiness levels.

According to Frey and Stuter, married persons report greater subjective well-being than persons who have never married, divorced, separated, or been widowed (2002). Marriage also provides advantages in mortality, morbidity, and mental health (Lee, Seccombe, and Shehan in Frey et al., 1991). People are less likely to feel lonely or have low self-esteem when involved a committed relationship.

As seen in Easterin and Sawangfa (2009), education is positively correlated with happiness levels. Educational attainment is likely positively linked to happiness because of its contribution to socio-economic status. Highly educated individuals possess more human capital to help productivity and success in the economy. People will show higher rates of happiness with more education.

Given the neoclassical theories, one could deduce that income and other economic factors have a significant relationship to happiness. Yet, it is found that these theories miss crucial aspects of happiness such as education, family, gender, race, religiosity, and marital status. Focusing solely on economic factors would not encompass all the influences on happiness. This project asserts that these non-pecuniary factors will be significant in evaluating happiness which challenges fundamental economic theory.

## III. DATA

The National Longitudinal Survey of Youth of 1979 (NLSY79) is a panel study with nearly 13,000 participants. The questionnaire was administered in 1979, and respondents answered annually until 1994 when the surveyors shifted to biannual questionnaires (Bureau of Labor Statistics, n.d.). The NLSY79 is an appropriate data set for this research project, because the survey asks a variety of questions ranging from self esteem, employment status, and other personal characteristics. The NLSY79 data will be essential to assess economic and non-pecuniary factors in relation to happiness.

In addition, a panel study like NLSY79 is ideal for measuring happiness because it questions the same respondents over time. Aside from usual statistical problems, assessing happiness has its own errors. For example, personality and temperament are important influences on happiness that the study cannot reasonably quantify. Similarly, there is not an available proxy for personality. Therefore, using panel data is of utmost importance to control these sources of error.

## IV. EMPIRICAL MODEL

Before diving into regression analysis, a bivariate analysis of the independent variables and happiness was utilized. The cross tabulation allows for the deciphering of the proportion of respondents in each independent variable category and their happiness level. Continuous variables like income were sorted into brackets for clarity. Chi-square tests are utilized to test for dependence between variables. By conducting the cross tabulation, there are some initial results regarding the influence of each independent variable on happiness. The cross tabulations are found in Table 3 of the appendix.

To test the hypothesis that asserts the influence of non-pecuniary factors on happiness, the empirical model utilizes ordinary least square regressions. Happiness will be the dependent variable which is measured by a self esteem proxy. The survey question of self esteem in the NLSY79 questionnaire is an appropriate proxy for happiness, because it measures self-perceived well being. In the survey, respondents were asked to decide their level of agreement with the statement, "I am satisfied with myself." Considering the nature of the question, the dependent variable is not a continuous measure. The possible answers were as follows: "Strongly Agree," "Agree," "Disagree," and "Strongly Disagree." To account for these four possible answer choices in analysis, the data set codes "Strongly agree" as the highest level of happiness and "Strongly Disagree" as the lowest. The answer choices rank from 1-4, with 4 being the highest level of happiness. With a value of 4, the respondent is "Happy." For values 3, 2, and 1, the respondent is "Somewhat Happy," "Somewhat Unhappy," and "Unhappy," respectively. The relationship between the possible answer choice, its numerical value, and its degree of happiness is essential to analysis, because it is an ordinal measure. Ranking answer choices is not ideal for measurement because numerical values cannot capture happiness wholly. Yet, this compromise is necessary in order to utilize ordinary least square regressions.

In the first regression model will only assess economic factors to assess happiness. This will allow me

to test the mentioned neoclassical economic theories at face value. Statistical significance does not need to be explained. The model will include independent variables for income, net worth, ability to work, employment status, and employment type (Table 1). Income and net worth represent standard of living or the ability to consume more goods. For the subsequent regression, it will include non-pecuniary variables.

Model 1, Regression 1:
Happiness(Happy, Somewhat Happy, Somewhat Unhappy, Unhappy) = ß0 + ß1(IncomeThou) + ß2(FamilyWorthThou) + ß3(Employed) + ß4(HealthytoWork) + ß5(GovernJob) + ß6(PrivateJob) + ß7(NonProfitJob) + ß8(SelfEmployed)

The second regression of Model 1 will include the same economic variables with a set of controls for well-being. These variables include: age, gender, race, religiosity, education, family size, and marital status. The hypothesis states that all the non-pecuniary variables will be statistically significant determinants on happiness and obtain their expected sign (Table 1).

Model 1, Regression 2:
Happiness (Happy, Somewhat Happy, Somewhat Unhappy, Unhappy) = ß0 + ß1(IncomeThou) + ß2(FamilyWorthThou) + ß3(Employed) + ß4(HealthytoWork) + ß5(GovernJob) + ß6(PrivateJob) + ß7(NonProfitJob) + ß8(SelfEmployed)+ß9(Female) + ß10(AgeCurrent) - ß11(Hispanic) + ß12(Black)+ ß13(Married)+ ß14(FamilySize)+ ß15(HighestGrade) + ß16(Religiosity)

Because the dependent variable is categorical and not continuous, ordinary least squares is not the most efficient form of analysis. However, condensing the four options of happiness into two categories, the ordinary least squares regressions become linear probability models. In other words, the regression can predict the probability of being happy or not. Therefore, the second model of regressions follows the same form as above except the dependent variable is condensed to "Happy" or "Not Happy." Respondents that strongly agreed or agreed with the statement, "I am satisfied with myself" were grouped into the "Happy," and respondents that strongly disagree or disagree were sorted into the "Not Happy" category. This regression is easier to interpret in the ordinary least squares format yet lacks the degree of accuracy in the first model.

## V. RESULTS

The results will be presented in three sections to account for the cross tabulations and both empirical models. The two models represent different degrees of happiness and therefore, present slight differences in results. The first set of results in Model 1 demonstrates the effect of economic variables on the four levels of happiness. Then, the second regression in Model 1 accounts for both economic and non-pecuniary variables. The comparison of these two sets of results will determine the significance of both types of variables (economic and non-pecuniary) and if the neoclassical model holds.

The second model is a probability model. Therefore, the results of the regression will be interpreted differently. However, the comparison of economic and non-pecuniary variables remains the focus. A summary of regression results are in Table 2 of the Appendix.

### A. Cross Tabulations of Happiness & Independent Variables

As mentioned, this paper used Chi-square testing to find if there was a relationship between the variables. The economic variables for income, new worth, employment status, and the ability to work demonstrated statistical significance and largely impacted happiness. This result is consistent with neoclassical theory and verifies that economic variables are appropriate for measuring happiness. Of the non-pecuniary variables, education, gender, race, marital status, family size, and religiosity affected one's happiness. The statistically significance of the relationship between happiness and these non-pecuniary variables suggests they should be used in the regression models.

Measures for job type and age were not statistically significant and therefore do not affect the measures of happiness used in this study. The negative outcome for age is understandable because the respondents of the survey are in the same age group. The slight differences in age will not produce dramatic effects on happiness.
Nonetheless, the variables will be included in the regression models because some literature suggests that they are important determinants of happiness.

### B. Model 1: Multinomial Dependent Variable

After running an ordinary least square

regression for Model 1, it is apparent from the results presented in Table 2 that the economic variables were highly significant predictors of happiness. Income, net worth, employment status, and the ability to work passed the .01 significance level. This affirms the neoclassical models that cite income and the ability to consume as the major influences on happiness. Also, all these coefficients followed their predicted sign. The high significance of these four pecuniary independent variables occurred in both models and all four regression analyses. The only unsuccessful economic variables were the four dummy variables for job type. Despite job type showing no significance, the other economic variables are consistent with neoclassical relationships of happiness.

In the second regression of Model 2 (Appendix Table 2), all independent variables were used to predict the four degrees of happiness. Again, the first four economic variables showed high significance. Unfortunately, the non-pecuniary variables did not exhibit the same success. The only significant attributes of the respondent were their marital status, education level, and whether they were African American or not. Marital status and education level had positive coefficients as expected; the dummy variable for African American did not have its predicted sign. Because African Americans are a minority and a marginalized group, it would follow that their race would negatively affect their happiness. However, the regression showed that being black actually positively influenced happiness, an unexpected result.

The results show insignificant coefficients for the variables female, age, Hispanic, family size, and religiosity. It is surprising that being a female was not significant because like African Americans or other minorities, woman experience inequality compared to white men. This inequality may lead to decreases in happiness. In addition, the literature stated that women express more emotions, which affects happiness (Frey, et al., 2002). Yet, this theory was not supported in the first model, because being female or Hispanic was insignificant and the Black dummy variable had the opposite sign than predicted.

Model 1 identified the key variables in assessing the four degrees of happiness. Consistent with the neoclassical models, income and other economic variables were statistically significant. This demonstrates that happiness is a function of standard of living. Furthermore, it suggests that non-pecuniary variables like gender and race are not nearly as significant to assessing happiness.

### C. Model 2: Binomial Dependent Variable

Model 2, finds results consistent with the first model. Again, the first four economic variables are highly significant and important to the model. Job type fared slightly better because working in the private sector was significant and followed its predicted sign. In the second regression, all the previously significant economic variables remained. Yet, the non-pecuniary variables show different levels of significance than Model 1. Race and education level are no longer significant. Marital status is still highly significant along with age and gender.

Because NLSY79 is a cohort study, age should not be a significant variable. All the respondents are within ten years of age of each other. It is interesting that only one non-pecuniary variable was significant across both models. This may be due to subjectivity in that the non-pecuniary variables are too personal and not easily measured. Ideally, more non-pecuniary variables would be consistently significant.

Overall, the results demonstrated strong support of neoclassical models. Economic variables were highly significant for each regression. Non-pecuniary variables did not achieve the same success; therefore, the hypothesis is not sufficiently supported. A possible reason for this result is immense subjectivity. In other words, the personal differences in happiness cannot be fully measured by objective variables. Therefore, the empirical model was limited in assessing happiness.

## VI. DISCUSSION & CONCLUSIONS

The economics of happiness is an emerging field with important policy implications. Essentially, economies should behave in a way to benefit their constituents. Microeconomic theory can aid in this task when it is all encompassing or includes several influences on happiness. Yet, we find in neoclassical models that income and consumption are the essential determinants of happiness. While this appears to limit happiness to pecuniary variables, the results of this study show that economic variables have significant effects on happiness. Non-pecuniary variables demonstrated low statistical significance, which is inconsistent with more sociological theories. Therefore, this research suggest that happiness economics should remain largely determined by economic factors like income, net worth, employment status, and the ability to work.

Future research could address the empirical limitations of this study. Firstly, subjectivity due to personality differences could be controlled more appropriately. Assessing happiness in each domain of life like family, education, financial situation, and occupation could have a more statistically significant relationship as found by Easterline and Sawangfa (2009). Therefore, the use of subjective independent variables versus objective independent variables may better assess well-being. Happiness was measured using categories of life satisfaction when regression analysis is more useful for numerical dependent variables. The use of a probit model in the future will alleviate this issue. Overall, the study presented an analysis of an emerging field of economics, happiness. While the study had its limitations, there is evidence that, for the NSLY79 cohort, income and assets are important determinants of happiness.

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## VIII. APPENDIX

| Table 1: Variables Descriptions | | | |
|---|---|---|---|
| Variable Name | | Description | Exepected Sign |
| Dependent | | | |
| | Happiness: Four Degrees | 4 = Happy, 3 = Somewhat happy, 2 = Somewhat unhappy, 1 = Unhappy | |
| | Happiness: Two Degrees | 1 = Happy, 0 = Not Happy | |
| Independent | | | |
| | IncomeThou | Previous year's income in Thousands of Dollars | + |
| | FamilyWorth Thou | Total Family Net Worth in Thousands | + |
| | Employed | 1 = Employed 0 = Not Employed | + |
| | HealhtoWork | 1 = Able to work 0 = Not able to work | + |
| | GovernJob | 1 = Works for Gov't 0 = Does not work for Gov't | - |
| | PrivateJob | 1 = Works in Private Sector 0 = Does not work in Private Sector | + |
| | NonProfitJob | 1 = Non-Profit Sector 0 = Does not work in Non-Profit Sector | + |
| | SelfEmployed | 1 = Self-Employed 0 = Not Self-Employed | + |
| | Female | 1 = Yes 0 = No | - |
| | AgeCurrent | Age as of 2006 | - |
| | Hispanic | 1 = Hispanic 0 = Not Hispanic | - |
| | Black | 1 = Black 0 = Not Black | - |
| | Married | 1 = Yes 0 = No | + |
| | FamilySize | Number of Family Members | + |
| | HighestGrade | Total number of grade levels passed | + |
| | Religiosity | How often respondent attends religious services<br>5 = More than Once a week<br>4 = About Once a week<br>3 = 2-3 times a month<br>2 = About Once a month<br>1 = Several times a year or less<br>0 = Not at all | + |

| Table 2: Regression Results for Both Models | | | | |
|---|---|---|---|---|
| Variable | Model 1<br>4 Degrees of Happiness | | Model 2<br>2 Degrees of Happiness | |
| | Regression 1 | Regression 2 | Regression 1 | Regression 2 |
| Constant | 2.904<br>.000*** | 2.44<br>.000*** | 0.746<br>.000*** | 0.545<br>.000*** |
| Income | 0.001<br>.000*** | 0.001<br>.000*** | 0.000<br>.003*** | 0.000<br>.060* |
| Net Worth | 7.93e-5<br>.000*** | 6.328e-5<br>.003*** | 2.835e-5<br>.003*** | 1.910e-5<br>.057* |

| Table 2: Regression Results for Both Models | | | | |
|---|---|---|---|---|
| Employed | 0.094<br>.000*** | 0.091<br>.000*** | 0.049<br>0.000*** | 0.043<br>.000*** |
| Healthy to Work | 0.225<br>.000*** | 0.221<br>.000*** | 0.130<br>.000*** | 0.128<br>.000*** |
| GovernJob | 0.034<br>0.235 | 0.000<br>.994 | 0.000<br>.990 | -0.006<br>.668 |
| Private Sector | -0.028<br>0.114 | -0.024<br>0.187 | -0.019<br>.022** | -0.018<br>.029** |
| Non-Profit Sector | -0.011<br>0.786 | -0.024<br>0.560 | -0.011<br>.544 | -0.015<br>.438 |
| Self Employed | 0.034<br>0.214 | 0.040<br>0.152 | -0.004<br>.759 | -0.003<br>.829 |
| Female | N/A | -0.015<br>0.370 | N/A | -0.014<br>.054* |
| Current Age | | 0.004<br>0/194 | | 0.004<br>.021** |
| Hispanic | | 0.030<br>0.159 | | -0.007<br>.462 |
| Black | | 0.084<br>0.000*** | | 0.011<br>.185 |
| Married | | 0.080<br>.000*** | | 0.033<br>.000*** |
| Family Size | | -0.004<br>0.441 | | 0.001<br>.698 |
| Education | | 0.014<br>.000*** | | 0.002<br>.240 |
| Religiosity | | 0.011<br>.151 | | 0.003<br>.442 |
| | | | | |
| N | 6565 | 6290 | 6590 | 6312 |
| Adjusted $R^2$ | .044 | .052 | .045 | .048 |

*Significance at the 0.1 level
**Significance at the 0.05 level
***Significance at the 0.01 level

| Table 3: Cross Tabulations for Happiness Levels and Independent Variables | | | | | | |
|---|---|---|---|---|---|---|
| | Cases | | | | | |
| | Valid | | Missing | | Total | |
| | N | Percent | N | Percent | N | Percent |
| SelfEsteeem * BracketSalary | 7213 | 56.9% | 5473 | 43.1% | 12686 | 100.0% |
| SelfEsteem * FamilyWorthBracket | 7541 | 59.4% | 5145 | 40.6% | 12686 | 100.0% |

| | | | | | | |
|---|---|---|---|---|---|---|
| SelfEsteerms * Employed | 7611 | 60.0% | 5075 | 40.0% | 12686 | 100.0% |
| SelfEsteem * HighestGradeBracket | 7611 | 60.0% | 5075 | 40.0% | 12686 | 100.0% |
| SelfEsteem *HealthytoWork | 7448 | 58.7% | 5238 | 41.3% | 12686 | 100.0% |
| SelfEsteem * Female | 7611 | 60.0% | 5075 | 40.0% | 12686 | 100.0% |
| SelfEsteem * AgeCurrent | 7611 | 60.0% | 5075 | 40.0% | 12686 | 100.0% |
| SelfEsteem * Black | 7611 | 60.0% | 5075 | 40.0% | 12686 | 100.0% |
| SelfEsteems * Married | 7611 | 60.0% | 5075 | 40.0% | 12686 | 100.0% |
| SelfEsteem * FamilySize | 7611 | 60.0% | 5075 | 40.0% | 12686 | 100.0% |
| SelfEsteem * Freq of Attending Religious Services | 7102 | 56.0% | 5584 | 44.0% | 12868 | 100.0% |

**Table 3.1: Self Esteem & Bracketed Salary**

| Self Esteem 4 Categories | | Salary | | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $0 - 10,000 | $10,001 - 20,000 | $20,001 - 30,000 | $30,001 - 40,000 | $40,001 - 50,000 | $50,001 - 60,000 | $60,001 - 70,000 | $70,001 - 80,000 | $80,001 - 90,000 | $90,000 - 100,000 | > $100,000 | |
| Unhappy | Count | 34 | 10 | 9 | 5 | 4 | 1 | 1 | 1 | 1 | 0 | 0 | 66 |
| | % within Salary | 1.7% | 1.2% | 0.9% | 0.5% | 0.6% | 0.2% | 0.3% | 0.4% | 0.6% | 0.0% | 0.0% | 0.9% |
| Somewhat Unhappy | Count | 298 | 68 | 86 | 57 | 35 | 22 | 16 | 9 | 9 | 5 | 7 | 612 |
| | % within Salary | 14.9% | 8.1% | 8.5% | 6.0% | 5.1% | 4.4% | 4.7% | 3.8% | 5.7% | 4.0% | 1.9% | 8.5% |
| Somewhat Happy | Count | 1143 | 530 | 616 | 574 | 384 | 282 | 172 | 136 | 79 | 80 | 184 | 4180 |
| | % within Salary | 57.2% | 63.1% | 60.7% | 60.4% | 55.7% | 56.0% | 56.0% | 57.6% | 50.0% | 64.0% | 51.1% | 58.0% |
| Happy | Count | 522 | 232 | 303 | 314 | 266 | 199 | 151 | 90 | 69 | 40 | 169 | 2355 |
| | % within Salary | 26.1% | 27.6% | 29.9% | 33.1% | 38.6% | 39.5% | 4.4% | 38.1% | 43.7% | 32.0% | 46.9% | 32.6% |
| Total | Count | 1997 | 840 | 1014 | 950 | 689 | 504 | 340 | 236 | 158 | 125 | 360 | 7213 |
| | % within Salary | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

| Chi-Square Tests | Value | df | Asymp. Sig. (2- Sided) |
|---|---|---|---|
| Pearson Chi-Square | 295.054[a] | 30 | .000 |
| Liklihood Ratio | 294.268 | 30 | .000 |
| Linear-by-Linear Association | 206.789 | 1 | .000 |
| N of Valid Cases | 7213 | | |

a. 6 cells (13.6%) have expected count less than 5. The minimum expected count is 1.14.

| Table 3.2: Self Esteem & Family Worth | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Self Esteem 4 Categories | | Salary | | | | | | | | Total |
| | | < $50,000 | $50,001 - 100,000 | $100.001 - 150,00 | $150,001 - 200,000 | $200,001 - 250,00 | $250,001 - 300,000 | $300,001 - 350,000 | > $350,001 | |
| Unhappy | Count | 44 | 10 | 3 | 7 | 2 | 2 | 1 | 1 | 70 |
| | % within Salary | 1.2% | 1.1% | 0.5% | 1.4% | 0.5% | 0.8% | 0.4% | 0.1% | 0.9% |
| Somewhat Unhappy | Count | 438 | 62 | 39 | 31 | 20 | 11 | 10 | 33 | 644 |
| | % within Salary | 11.8% | 7.1% | 6.3% | 6.3% | 5.4% | 4.2% | 4.5% | 3.3% | 8.5% |
| Somewhat Happy | Count | 2143 | 524 | 365 | 293 | 212 | 144 | 124 | 567 | 4372 |
| | % within Salary | 57.9% | 60.0% | 59.3% | 59.3% | 57.6% | 54.5% | 55.6% | 56.7% | 58.0% |
| Happy | Count | 1077 | 278 | 209 | 163 | 134 | 107 | 88 | 399 | 2455 |
| | % within Salary | 29.1% | 31.8% | 33.9% | 33.0% | 36.4% | 40.5% | 39.5% | 39.9% | 32.6% |
| Total | Count | 3702 | 874 | 616 | 494 | 368 | 264 | 223 | 1000 | 7541 |
| | % within Salary | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

| Chi-Square Tests | Value | df | Asymp. Sig. (2- Sided) |
|---|---|---|---|
| Pearson Chi-Square | 159.233[a] | 21 | .000 |
| Liklihood Ratio | 171.295 | 21 | .000 |
| Linear-by-Linear Association | 119.301 | 1 | .000 |
| N of Valid Cases | 7541 | | |
| a. 4 cells (12.5%) have expected count less than 5. The minimum expected count is 2.07. | | | |

| Table 3.3: Self-Esteem & Employment Status | | | | |
|---|---|---|---|---|
| SelfEsteem4Cateogories | | Employed | | Total |
| | | Not Employed | Employed | |
| Unhappy | Count | 29 | 41 | 70 |
| | % within Employed | 1.9% | 0.7% | 0.9% |
| Somewhat Unhappy | Count | 264 | 385 | 649 |
| | % within Employed | 16.9% | 6.4% | 8.5% |
| Somewhat Happy | Count | 902 | 3507 | 4409 |
| | % within Employed | 57.6% | 58.0% | 57.9% |
| Happy | Count | 371 | 2112 | 2483 |
| | % within Employed | 23.7% | 34.9% | 32.6% |
| Total | Count | 1566 | 6045 | 7611 |
| | % within Employed | 100.00 | 100.0% | 100.0% |

| Chi-Square Tests | Value | df | Asymp. Sig. (2- Sided) |
|---|---|---|---|
| Pearson Chi-Square | 227.377[a] | 3 | .000 |
| Liklihood Ratio | 202.898 | 3 | .000 |
| Linear-by-Linear Association | 180.892 | 1 | .000 |
| N of Valid Cases | 7611 | | |
| a. 6 cells (13.6%) have expected count less than 5. The minimum expected count is 1.14. | | | |

**Table 3.4: Self-Esteem & Highest Grade Attained**

| SelfEsteem4Categories | | Highest Grade Attained | | | | Total |
|---|---|---|---|---|---|---|
| | | Grade School | High School | Undergrad | Beyond Grad | |
| Unhappy | Count | 3 | 44 | 21 | 2 | 70 |
| | % within HighestGrade | 1.5% | 1.1% | 0.8% | 0.3% | 0.9% |
| Somewhat Unhappy | Count | 22 | 392 | 187 | 48 | 649 |
| | % within HighestGrade | 10.9% | 10.1% | 6.8% | 6.2% | 8.5% |
| Somewhat Happy | Count | 134 | 2327 | 1525 | 423 | 4409 |
| | % within HighestGrade | 66.3% | 59.8% | 55.6% | 54.8% | 57.9% |
| Happy | Count | 43 | 1131 | 1010 | 299 | 2483 |
| | % within HighestGrade | 21.3% | 29.0% | 36.8% | 38.7% | 32.6% |
| Total | Count | 202 | 3894 | 2743 | 772 | 7611 |
| | % within HighestGrade | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

| Chi-Square Tests | Value | df | Asymp. Sig. (2- Sided) |
|---|---|---|---|
| Pearson Chi-Square | 88.815[a] | 9 | .000 |
| Liklihood Ratio | 91.130 | 9 | .000 |
| Linear-by-Linear Association | 80.342 | 1 | .000 |
| N of Valid Cases | 7611 | | |
| a. 1 cell (6.3%) has expected count less than 5. The minimum expected count is 1.86. | | | |

**Table 3.5: Esteem & Healthy/Able to Work**

| SelfEsteem4Categories | | Healthy to Work | | Total |
|---|---|---|---|---|
| | | No | Yes | |
| Unhappy | Count | 19 | 45 | 64 |
| | % within Healthytowork | 2.0% | 0.7% | 0.9% |
| Somewhat Unhappy | Count | 194 | 412 | 606 |
| | % within Healthytowork | 20.2% | 6.4% | 8.1% |

| | | | | |
|---|---|---|---|---|
| Somewhat Happy | Count | 544 | 3790 | 4334 |
| | % within Healthtowork | 56.6% | 58.4% | 58.2% |
| Happy | Count | 204 | 2240 | 2444 |
| | % within Healthytowork | 21.2% | 34.5% | 32.8% |
| Total | Count | 961 | 6487 | 7448 |
| | %within Healthytowork | 100.0% | 100.0% | 100.0% |

| Chi-Square Tests | Value | df | Asymp. Sig. (2- Sided) |
|---|---|---|---|
| Pearson Chi-Square | 258.593[a] | 3 | .000 |
| Liklihood Ratio | 212.051 | 3 | .000 |
| Linear-by-Linear Association | 188.794 | 1 | .000 |
| N of Valid Cases | 7448 | | |
| a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.26. | | | |

**Table 3.6: Self-Esteem & Female**

| SelfEsteem4Categories | | Percent Male/Female | | Total |
|---|---|---|---|---|
| | | Male | Female | |
| Unhappy | Count | 28 | 42 | 70 |
| | % within Female | 0.8% | 1.1% | 0.9% |
| Somewhat UnHappy | Count | 281 | 368 | 649 |
| | % within Female | 7.6% | 9.4% | 8.5% |
| Somehwhat Happy | Count | 2155 | 2254 | 4409 |
| | % within Female | 58.0% | 57.9% | 57.9% |
| Happy | Count | 1251 | 1232 | 2483 |
| | % within Female | 33.7% | 31.6% | 32.6% |
| Total | Count | 3715 | 3896 | 7611 |
| | % within Female | 100.0% | 100.0% | 100.0% |

| Chi-Square Tests | Value | df | Asymp. Sig. (2- Sided) |
|---|---|---|---|
| Pearson Chi-Square | 12.534[a] | 3 | .000 |
| Liklihood Ratio | 12.580 | 3 | .000 |
| Linear-by-Linear Association | 10.013 | 1 | .000 |
| N of Valid Cases | 7611 | | |
| a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 34.17 | | | |

**Table 3.7: Self-Esteem & Current Age**

| SelfEsstem4Categories | | Current Age | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | |
| Unhappy | Count | 6 | 15 | 11 | 7 | 11 | 9 | 3 | 7 | 1 | 70 |
| | % within AgeCurrent | 0.9% | 1.4% | 1.0% | 0.7% | 1.0% | 1.0% | 0.4% | 0.8% | 0.5% | 0.9% |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Somewhat Unhappy | Count | 59 | 86 | 96 | 86 | 96 | 89 | 59 | 65 | 13 | 649 |
| | % within AgeCurrent | 9.0% | 8.1% | 9.0% | 8.3% | 8.9% | 9.7% | 7.5% | 7.8% | 7.1% | 8.5% |
| Somewhat Happy | Count | 387 | 612 | 578 | 604 | 631 | 539 | 471 | 480 | 107 | 4409 |
| | % within AgeCurrent | 58.8% | 58.0% | 54.2% | 58.5% | 58.8% | 58.7% | 59.7% | 57.4% | 58.5% | 57.9% |
| Happy | Count | 206 | 343 | 381 | 335 | 335 | 281 | 256 | 284 | 62 | 2483 |
| | % within AgeCurrent | 31.3% | 32.5% | 35.7% | 32.5% | 31.2% | 30.6% | 32.4% | 34.0% | 33.9% | 32.6% |
| Total | Count | 658 | 1056 | 1066 | 1032 | 1073 | 918 | 789 | 836 | 183 | 7611 |
| | % within AgeCurrent | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

| Chi-Square Tests | Value | df | Asymp. Sig. (2- Sided) |
|---|---|---|---|
| Pearson Chi-Square | 20.327[a] | 24 | .678 |
| Liklihood Ratio | 20.736 | 24 | .654 |
| Linear-by-Linear Association | .594 | 1 | .441 |
| N of Valid Cases | 7611 | | |

a. 1 cell (2.8%) has expected count less than 5. The minimum expected count is 1.68

**Table 3.8: Self-Esteem & Race-Black**

| SelfEsteem4Categories | | Black | | Total |
|---|---|---|---|---|
| | | Not Black | Black | |
| Unhappy | Count | 43 | 27 | 70 |
| | % within Black | 0.8% | 1.1% | 0.9% |
| Somewhat Unhappy | Count | 435 | 214 | 649 |
| | % within Black | 8.3% | 9.1% | 8.5% |
| Somewhat Happy | Count | 3125 | 1284 | 4409 |
| | % within Black | 59.5% | 54.4% | 57.9% |
| Happy | Count | 1649 | 834 | 2483 |
| | % within Black | 31.4% | 35.4% | 32.6% |
| Total | Count | 5252 | 2359 | 7611 |
| | % within Black | 100.0% | 100.0% | 100.0% |

| Chi-Square Tests | Value | df | Asymp. Sig. (2- Sided) |
|---|---|---|---|
| Pearson Chi-Square | 18.105[a] | 3 | .000 |
| Liklihood Ratio | 17.990 | 3 | .000 |
| Linear-by-Linear Association | 2.583 | 1 | .108 |
| N of Valid Cases | 7611 | | |

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 21.70.

| Table 3.9: Self-Esteem & Marriage | | | | |
|---|---|---|---|---|
| SelfEsteem4Categories | | Married | | Total |
| | | Not Married | Married | |
| Unhappy | Count | 29 | 41 | 40 |
| | % within Married | 1.1% | 0.8% | 0.9% |
| Somewhat Unhappy | Count | 323 | 326 | 649 |
| | % within Married | 11.7% | 6.7% | 8.5% |
| Somewhat Happy | Count | 1594 | 2815 | 4409 |
| | % within Married | 57.9% | 57.9% | 57.9% |
| Happy | Count | 805 | 1678 | 2483 |
| | % within Married | 29.3% | 34.5% | 32.6% |
| Total | Count | 2751 | 4860 | 7611 |
| | % within Married | 100.0% | 100.0% | 100.0% |

| Chi-Square Tests | Value | df | Asymp. Sig. (2- Sided) |
|---|---|---|---|
| Pearson Chi-Square | 67.962[a] | 3 | .000 |
| Liklihood Ratio | 66.155 | 3 | .000 |
| Linear-by-Linear Association | 50.610 | 1 | .000 |
| N of Valid Cases | 7611 | | |
| a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 25.30. | | | |

| Table 3.10: Self-Esteem & Family Size | | | | | | |
|---|---|---|---|---|---|---|
| SelfEsteem4Categories | | Family Size | | | | Total |
| | | 1-3 | 4-6 | 7-9 | 10 or more | |
| Unhappy | Count | 44 | 25 | 1 | 0 | 70 |
| | % within Family Size | 0.9% | 0.9% | 0.9% | 0.0% | 0.9% |
| Somewhat Unhappy | Count | 459 | 179 | 11 | 0 | 649 |
| | % within Family Size | 9.5% | 6.7% | 10.1% | 0.0% | 8.5% |
| Somewhat Happy | Count | 2788 | 1546 | 64 | 11 | 4409 |
| | % within Family Size | 57.9% | 57.9% | 58.7% | 73.3% | 57.9% |
| Happy | Count | 1528 | 918 | 33 | 4 | 2483 |
| | % within Family Size | 31.7% | 34.4% | 30.3% | 26.7% | 32.6% |
| Total | Count | 4819 | 2668 | 109 | 15 | 7611 |
| | % within Family Size | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

| Chi-Square Tests | Value | df | Asymp. Sig. (2- Sided) |
|---|---|---|---|
| Pearson Chi-Square | 22.527[a] | 9 | .007 |
| Liklihood Ratio | 24.477 | 9 | .004 |
| Linear-by-Linear Association | 9.336 | 1 | .002 |
| N of Valid Cases | 7611 | | |
| a. 4 cells (25.0%) have expected count less than 5. The minimum expected count is .14. | | | |

**Table 3.11: Self-Esteem & Frequency of Attending Religious Services**

| SelfEsteem4Categories | | Freq of Attending Religious Services | | | | Total |
|---|---|---|---|---|---|---|
| | | Not at all | Yearly | Monthly | Weekly | |
| Unhappy | Count | 8 | 11 | 23 | 24 | 66 |
| | % within Freq of Attending Religious Services | 1.0% | 0.7% | 1.2% | 0.8% | 0.9% |
| Somewhat Unhappy | Count | 65 | 151 | 160 | 216 | 592 |
| | % within Freq of Attending Religious Services | 8.1% | 10.3% | 8.4% | 7.4% | 8.3% |
| Somewhat Happy | Count | 467 | 902 | 1100 | 1678 | 4147 |
| | % within Freq of Attending Religious Services | 58.0% | 61.2% | 58.0% | 57.3% | 58.4% |
| Happy | Count | 265 | 409 | 612 | 1011 | 2297 |
| | % within Freq of Attending Religious Services | 32.9% | 27.8% | 32.3% | 34.5% | 32.3% |
| Total | Count | 805 | 1473 | 1895 | 2929 | 7102 |
| | % within Freq of Attending Religious Services | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

| Chi-Square Tests | Value | df | Asymp. Sig. (2- Sided) |
|---|---|---|---|
| Pearson Chi-Square | 29.027[a] | 9 | .001 |
| Liklihood Ratio | 28.984 | 9 | .001 |
| Linear-by-Linear Association | 10.424 | 1 | .001 |
| N of Valid Cases | 7102 | | |
| a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.48. | | | |

# Allocating Scarce Water Resources:Examining if Price Differentials Exist in a Prior Appropriations Setting

**Hayley Harroun**

## I. INTRODUCTION

The Southwestern United States is an arid region with significantly low levels of precipitation. This region not only has a limited water supply, but also consequently has a large percentage of population growth. From 1965 to 2000 population has increased by 80 percent (Konieczki and Heilman, 2004). With the population increasing from year to year, as a result, there has also been an increase in the demand for water. This is seen in the withdrawal rate of water for domestic use, which has increased by 64 percent (Konieczki and Heilman, 2004). While a growing population increases the demand for water use among humans, a majority of the water supply still goes towards irrigation for agriculture. The demand for water is not the only increasing factor, but temperatures over the last century have increased 1.5 degrees Fahrenheit around the globe (United States Environmental Protection Agency, 2012). The warming climate has impacted, for example, the natural flow of the Colorado River, which supplies water to a large portion of the arid Southwestern region of the United States (United States Environmental Protection Agency, 2012). Future prospective droughts due to climate change and an increasing population have the potential to create conflicts over water supplies, which is amplified by the nature of the water rights in the Southwest.

The water right laws in the Southwest differ from the rest of the country (i.e. riparian rights). In the western United States the predominant water law is known as the Doctrine of Prior Appropriations. This law was a response to the arid climate and has been in existence since the settlement of the west. The concept of prior appropriations states that water can be set aside for "beneficial use", which is an ambiguous term (Fort, 2002). Prior appropriations give senior users the first claim to the water in the times of a drought. A drought is commonly referred to as a call. Therefore, leasing of water rights amongst senior users and juniors, those with secondary claims on the water source, during times of drought has been proposed. Water leasing, also known as water banking, provides a temporary transfer of water rights, which could provide a market for smaller water users who need to buy water for irrigation purposes in times of drought. One possible problem could arise in a water market under a prior appropriations setting. As a result, the price differentials occur where higher prices are paid for "senior" water rights vs. "junior" water rights as defined by Libecap (2005).

In cases of water scarcity, consideration for a water market is necessary especially if the watershed is over allocated. This is supported at the state and national level. On the national level, the Department of the Interior (2005) discussed the issue of water scarcity in their report entitled Water 2025: Preventing Crises and Conflict in the West. Many states have drafted plans to address issues in water management. These state level water plans have been drafted by: California, New Mexico, Nevada, Utah, and Wyoming. (California Department of Water Resources, 2012; New Mexico Office of the State Engineer, 2009; State of Nevada Division of Water Resources, 2011; Utah Division of Water Resources, 2001; Wyoming Water Development Office, 2007). The water scarce region of the western United States has consistently increased its demand for water despite limited water supplies. This points to a need for improved water allocation mechanisms, such as water leasing markets.

The inefficiencies of water allocation can be addressed through two market institutions: permanent water rights transfer or the leasing of water rights. Permanent transfer of water rights is an established practice in the west. Los Angeles would not exist today without the purchase and transfer of water rights from the Owens Valley. Water leasing markets, on the other

hand, are a newly emerging market institution. Water leasing provides a temporary transfer of water rights, which would provide a market for smaller water users who need water for irrigation purposes (Shupe et. al., 1989).

This study examines the potential for a water leasing market within one singular basin in Southwestern, New Mexico. The goal of this research is to test the feasibility of a water market in the river basin and determine if price differentials are found in a prior appropriations setting. This was done through a laboratory experiment to test if participants would simulate an effective water leasing market in a basin within New Mexico. In order to assess the potential for a water leasing market, a water leasing market was designed to incorporate the hydrologic, engineering, institutional, and economic market of the Upper Mimbres Basin (Broadbent et. al., 2009). Using experimental economics, which uses computer programs and simulation to test an economic theory, the market value of water was induced through the set up of the experiment. The set up involved double auction where all bids and offers are presented publicly and each bid and offer is presented simultaneously. The advantages of conducting a laboratory experiment is predominantly time, data that would usually take a year to collect can be done in a short amount of time. By simulating the water leasing market we can test participants' reactions to drought conditions, which could take years to occur in the real setting of New Mexico.

The data from two trials (each simulating a year's worth of transactions) were studied. From these experiments, individual transactions are recorded including the stakeholders involved in the trade, the quantity of water traded, price of water traded and the impacts on the hydrologic model. It is, therefore, hypothesized that stakeholders will fulfill their assigned roles under the experimental leasing system (the market price will be equal to the expected market price) and there will be a price differential between senior and junior user's water rights during times of a call. The focus of this research is firstly is to test whether the experimental market follows realistic expectations and secondly to examine the benefits of instituting a water leasing market within the river basin.

## II. LITERATURE REVIEW

Broadbent et al. (2009) summarize the literature on water leasing markets. Their article establishes the need for water leasing markets in the west, the barriers to establishing water leasing markets, and past theoretical and empirical studies on water leasing markets.

Permanent transfer of water rights, have been studied for almost forty years. Literature regarding permanent transfer of water rights has outlined criteria essential for successful water market transactions. Broadbent et al. (2009) outline the criteria as "1) well-defined, securable, and tradable property rights; 2) hydrologic and engineering reality; 3) environmental quality; 4) social/community and traditional uses; 5) transaction costs; and 6) third-party effects" (p. 713). Third party effects are resolved through the adoption of the "no-injury" rule, transactions that economically harm third parties cannot occur. Typically, transaction costs are higher in water markets and therefore addressing third party effects is necessary to create a successful water leasing market. Water markets must acknowledge traditional water uses such as Native American rights to water as well as the environmental impacts of water leasing on the watershed. Understanding the hydrologic and engineering reality of a watershed will not only determine the feasibility of trading water in specific locations but also address the impacts on the watershed. Above all, well-defined property rights encourage right holders' to act in their own self-interest.

Theoretical studies on water leasing markets have acknowledged it as "an attractive option for both parties because it maintains continuity, preserves ownership by holder of the right for future use, and accommodates an intermediate use" (Shupe et al. 1989). Empirical studies have been conducted in the Western United States (Yoskowitz, 1999; Czetwertynski, 2002; Yoskowitz, 2002; Loomis et.al., 2003; Adams et. al., 2004; Howitt, 2005; Brown, 2006; Brewer et.al., 2007), as well as southeastern Australia (Crase et.al, 2000; Bjornlund, 2003, 2004; Crase, et. al., 2004; Turra et. al., 2005), and Southern Chile (Hadjigeorgalis, 2004). These studies show that water leasing has received national and international attention. Studying the literature on water leasing markets establishes a basis to study water-leasing markets.

A recent article by Basta and Colby (2010) examine the trends of water markets for leasing and permanent transfers. Basta and Colby expand the literature on water markets through the compilation of the monthly water transactions reported from 1987 to 2007 in the journal Water Strategist. From this they establish a large dataset of many states and regional water markets. Through the analysis of water sales

data, Basta and Colby ascertain trends in the water market. Trends, such as total transactions, total quantity traded, and average prices, aid in the understanding in the valuation of water rights and the water market itself. Almost all states and regions observed a general trend of an increasing number of transactions in the sale and lease of water rights, whereas New Mexico is experiencing a growing leasing market instead of the permanent sale of water rights. Leasing is a growing market within California, Colorado, New Mexico, Texas, and the Pacific Northwest Region. Prices are rising, with a variance in prices between regions. This supports the concept of the increased strain on the water supply, especially in the Western United States. It also signifies the importance to understand trends in the burgeoning water market.

Watson and Davies (2011) examine regional growth in the South Platte River Basin in Colorado to understand the incentive structures for different users if the water supply is fixed (2011). They examine the demand of both agricultural and municipal water users, finding that with an increasing population will strain the water supplies and force water to be used for urban user rather than irrigation. In addition, return flows from municipal to agricultural users provide more water for irrigation. Finally, they found the price of municipal water to increase by 25 percent where the agricultural price for water remained the same. This is likely due to the increasing population within the region, which subsequently increases the municipalities demand for water; whereas, the demand from the agricultural sector remains largely the same.

Yoskowitz (2001) looks at existing price differentials in water market transactions in the Rio Grande Valley in Texas. In order to understand this phenomenon the article addresses the institutional nature of the water markets. This is done by statistics to show price differentials converging and diverging over time among agricultural users and urban users. In addition, Yoskowitz hypothesizes possible reasons why price differentials occur. The results support a differential price among different water users, and price convergence has yet to occur. Yoskowitz (2001) attributes price differentials to asymmetries in information and the price elasticity of different water users. Yoskowitz (2001) looks at price differentials between consumers and represents the empirical model used to test if price differentials occur.

### A. Summary of Literature

There are many challenges facing the current water leasing markets. Broadbent et al. (2009) outlined requirements necessary to ensure water-leasing markets are efficient. These included well-defined water rights, markets based upon hydrologic and engineering reality, markets that protect environmental quality, community and traditional uses, acknowledge transactions costs, and address third-party effects. Basta and Colby (2010) survey the current trends of water markets in the Western United States and find a general increase in the number of transactions of water rights through both leasing and sales. While there have been many studies done examining water leasing markets in the Western United States (Yoskowitz 1999; Czetwertynski, 2002; Yoskowitz, 2002; Loomis et al., 2003; Adams et al., 2004; Howitt, 2005; Brown, 2006; Brewer et. al., 2007), very few have examined the occurrence of price differentials (Yoskowitz, 2001; Watson, 2011). These studies have found price differentials occurring between agricultural users and urban users.

## III. THEORY

The design of the hypothetical water leasing market draws upon experimental economics. Experimental economics uses laboratory techniques to test an economic theory. Essentially, experimental economics induces values through the use of participants to test a hypothesis. The data for this paper was collected through a double auction experiment. A double auction means that all bids and offers are presented publicly and each bid and offer is presented simultaneously.

Basic supply and demand theory is the conceptual framework where the demand function is a step demand function (Smith, 1982). The step demand function occurs due to a differing market price value between irrigators and municipalities. The flat region of the demand curve in Figure 1 refers to the irrigators demand for water. The marginal utility for municipalities is higher than irrigators and therefore the left flat region on the demand curve represents municipalities demand for water (See Figure 1). Municipalities value water rights at a higher price than irrigators because there are a fixed number of water rights based upon the hydrology of the basin and the supply of water is perfectly inelastic. Users are not able to draw more than their allotment of water, even when flows are high. In times of a call the supply moves left and water prices rise (See Figure 1). Water is only supplied to senior users during a drought. Senior users are those with the

oldest claim to the water. Junior users are those with newer claims to the water and are the first to have their water cut off during times of a drought. Therefore junior users as well as the municipalities' willingness to pay for these rights will increase in times of drought.

Based upon the step demand function, during times of a drought a price differential will occur between senior and junior users if prices depend upon the users' willingness to pay. Price differentials occur as a result of differing marginal values between users. According to Libecap (2005) price differentials still exist within the water leasing market because of the infrequency of trades. Libecap states, "Water trades take place and are growing in frequency and magnitude, but they are not sufficient to cause water prices to equalize on the margin, adjusting for transport costs" (p. 39). Water markets still face heavy regulations on the transfer of water rights due to the interconnectedness of water uses (Libecap, 2005).

## IV. DATA

The data for this study comes from an experimental water leasing market that was designed for the Upper Mimbres Basin in southwestern New Mexico. The two treatments used in this paper to understand the impacts of a call under a prior appropriations setting. The data collected from each experiment measures a full years worth of transactions. Conducting an experiment to test the feasibility of a water leasing market was chosen primarily because of a lack of data for the region. This data is appropriate to measure the hypothesis because the experiment induced values in which stakeholders first learned about the subject matter and had a monetary incentive to act in their best interest. In the Upper Mimbres Basin there are eleven stakeholders.

The oldest priority date is 1869, which has a yearly allocation of 789 acre-feet of water. This is the senior user who has the most favorable water rights during periods of drought, since they will be the last to get their water cut off. There are four users with the priority date of 1870 with an average allotment of 18 acre-feet of water. Following the four users of 1870, there is one user with a priority date of 1880 with a yearly allocation of 99 acre-feet. Then there is one user with an 1893 priority date with a yearly allocation of 132 acre feet and two users with an 1894 priority date with an average of 117 acre feet of water. The previously mentioned users are currently using their water for irrigation purchases but there are two municipalities in the region interested in leasing water rights. The water leasing market allows users to trade water each month to address inefficiencies in the current water allocation. Each trading round, which represents one trading round, users are able to buy or sell water to other users since this experiment is a double auction and all prices posted to buy and sell water are visible to all users. These trading decisions are then applied to the hydrologic model, which factors in the affects on water flow within the basin. Each month individual transactions are recorded including the stakeholders involved in the trade, the quantity of water traded, price of water traded and the impacts on the hydrologic model.

## IV. EMPIRICAL MODEL

In this study, two T-tests are done to measure whether there is a statistical difference between the following groups. Firstly, to investigate whether the data collected reflects the expected market price. Market price is determined through the experiment in each round of trading. For each round of trading the average price per quantity of water or market price was determined. Expected price is the price per quantity of water that should be elicited from the trading rounds given the unique payout of each participant. The expected market price was three dollars per acre-foot of water as shown in Figure 1; the null hypothesis was that market prices would not be equivalent to expected prices. To test whether market prices were equivalent to three dollars the following T-test was done.

$$T - Test = \frac{Market\ Price - Expected\ Price}{\frac{Se}{\sqrt{n}}}$$

$$\alpha = 0.10$$
$$\alpha = 0.05$$

$$Tcrit\ dF\ (n-1) = \frac{\alpha}{2}$$

Secondly, the study determines if a price differential between senior and junior users during times of a drought exists. Senior users' price per quantity of water should be higher than junior users in times of a drought. To accomplish this, the average price per quantity of the senior user's water (1869 priority date) in each round was compared to the price per quantity of all other users (all other priority dates). Both experiments were aggregated in an effort to increase the sample size. The null hypothesis is: price is not dependent upon priority date. The following T-test

was done to see if there was a statistical significance between priority dates.

$$T - Test = \frac{W.A.1869 - W.A.18..}{\sqrt{\frac{SE^2 1869}{n_{1869}} + \frac{SE^2\ 18..}{n_{18..}}}}$$

$$\alpha = 0.10$$

$$\alpha = 0.05$$

$$dF(n_1 + n_2 - 2) = 0.05$$

## V. RESULTS

The results proceed in four sections. First, results are presented that compare the expected price with the market price. Secondly, price differentials allow for the comparison between priority dates. Thirdly, the total number of transactions and, fourthly, the call results of both experiments. These are necessary comparisons when looking at the feasibility of a water leasing market for any basin operating under the setting of prior appropriations.

### A. Market Prices

Descriptive statistics were used on the experimental data to determine the average price per acre-foot sold in every trading month (See Table 1). As well as each priority dates average price per acre-foot (See Table 1). A T-test calculated to see whether market prices were equivalent to the expected market price of three dollars per acre-foot. Overall both experiments found the market prices were equivalent to the expected market price, except in times of a call (See Table 1 and 2). Rejecting the null in times of drought could be an indicator that price differentials exist. In the first few months of both experiments the null hypothesis can be accepted this is likely due to the fact that users were adjusting to the market as well as preemptively purchasing water in case of a call. This means that participants for the most part did take on their assigned role.

### B. Price Differentials

The results of the first T-test indicate the potential for price differentials. To determine whether price differentials occur between the oldest priority date and the rest of the priority dates, a second T-test was performed. The T-test found that there was a statistical difference between priority dates (See Table 4) and that there was a lag in price differentials during times of a drought. The high prices for the oldest priority date occurred in the month following the beginning of the drought and remained high the month after the drought ended. The small sample size did affect the ability to test certain months, even with the aggregation of data between the two experiments (See Table 3).

### C. Total Number of Transactions

The total number of transactions in both experiment one and two is displayed in Table 3. Table 3 illustrates how minute the water leasing market is within the Upper Mimbres Basin, New Mexico. In some rounds, there were only one or two transactions. The small sample statistics indicate that an alternative method may be needed to further test the hypothesis. This can be done using a Willcoxon rank sum test.

### D. Call Results

For both experiments, one and two, the expected drought given the hydrologic model is seen in Table 2. Without a water leasing market, the drought was expected to occur in the months of July and August. The drought in July would affect 1880, 1893, 1894, and in August it would affect 1994 users. In both experiments there is a decline in the severity and longevity of the drought (See Table 2). In experiment one the drought occurred in July and August and affected 1894 users and the drought in experiment one occurred in July and affected 1894 users. These results show that the water leasing market allowed the participants to minimize the impacts of a call and therefore trading was beneficial.

## VI. CONCLUSIONS

Increased populations are adding pressure on the already scarce water resources of the Western United States. Establishing water-leasing markets within basins that are well established in the hydrological and engineering reality have the potential to increase efficiencies. Through this experimental market, which was modeled after an actual basin in New Mexico, the benefits of water leasing can be seen. However, this experiment data does reflect the expected outcome of a water leasing market in terms of average price per quantity of water.

In this study market prices overall were equivalent to expected prices, with the exception of months when there was a drought. Price differentials between the oldest priority dates and the rest of the priority dates do occur. Price differentials are a limiting factor in implementing a water leasing market. Water is not homogenous and thus price differentials might slow the transaction process down and result in less water allowed to the market, which in turn results in increased prices and making the market less efficient. The results of this study support results of previous studies

(Yoskowitz, 2001; Libecap, 2005; Watson, 2011) of which found price differentials between agricultural users and urban users. Libecap (2005) explains "the persistence of large price differentials between agricultural, urban, and environmental users reflects the lack of extensive, routine market trades that would otherwise arbitrage to narrow the differences" (p. 4). Promoting widespread use of water leasing markets should help eliminate price differentials between users.

This study had very few transactions in certain trading rounds. The thin market impacted the ability to calculate a significance level as well as to compare between priority dates. This led to an aggregation of both experiments in order to test whether price differentials occur between junior and senior users. A Wilcoxon Rank Sum Test eliminates the concern for a small sample size because it is a nonparametric distribution free test. This would be an ideal way to extend this study.

Establishing a water leasing market within this particular basin has shown environmentally beneficial. Due to the nature of the experiments, both trials had the same expected outcome in terms of a drought. In both experiments the length and severity of the expected drought was reduced due to the reallocation of water from the leasing of water. This displays the potential for water leasing markets to reallocate resources in a more efficient manner in regions where the Doctrine of Prior Appropriations is the predominant water law.

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Figure 1: Step Demand Function

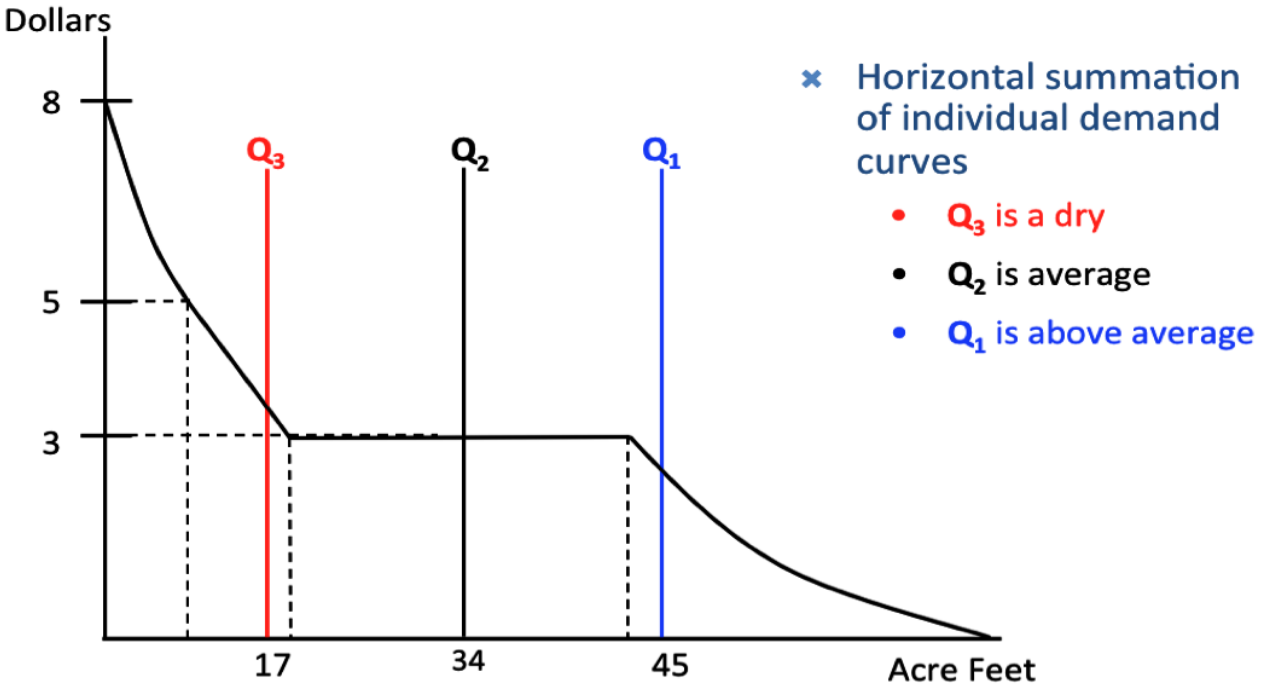


Table 1: Weighted Average Market Prices

| Trading Month | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Experiment 1 | | | | | | | | | | | | |
| Market Price | 3.89** | 3.91* | 2.59+ | 4.5+ | 4 | 4.71** | 5.5** | 5.33* | 3.71* | 3.61 | 5+ | 0 |
| | -1.06 | -0.89 | -0.65 | 0 | -1 | -1.29 | -1.15 | -0.88 | -0.25 | -0.67 | 0 | 0 |
| 1894 | 2 | 3 | 2 | 0 | 0 | 0 | 0 | 4.333 | 3.5 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1893 | 3.5 | 2.5 | 3.4 | 0 | 5 | 0 | 0 | 0 | 4 | 4 | 0 | 0 |
| | -0.7 | 0 | -0.29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1880 | 4.29 | 3.5 | 3.5 | 0 | 3 | 4 | 4 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1870 | 5 | 3 | 0 | 0 | 4 | 7 | 6 | 0 | 0 | 0 | 5 | 0 |
| | 0 | -1.06 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1869 | 4 | 4.43 | 0 | 4.5 | 0 | 5.4 | 6 | 5.83 | 3.6 | 3.56 | 0 | 0 |
| | 0 | -0.12 | 0 | 0 | 0 | -0.71 | 0 | -0.23 | -0.12 | -0.75 | 0 | 0 |
| Experiment 2 | | | | | | | | | | | | |
| Market Price | 4.63* | 3.9* | 3.59* | 3.5++ | 3.17 | 3.61* | 2.6+ | 2.8+ | 3++ | 3.33 | 0 | 0 |
| | -0.82 | -0.2 | -0.27 | 0 | -0.25 | -0.32 | -0.3 | -0.19 | 0 | -0.35 | 0 | 0 |
| 1984 | 3.5 | 3.5 | 3.6 | 3.5 | 0 | 0 | 2.4 | 2.75 | 3 | 0 | 0 | 0 |
| | 0 | 0 | -0.3 | 0 | 0 | 0 | -0.07 | -0.23 | 0 | 0 | 0 | 0 |

| Table 1: Weighted Average Market Prices | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1893 | 4.5 | 4 | 3.5 | 3.5 | 3 | 3.33 | 3 | 3 | 3 | 3.33 | 0 | 0 |
| | -0.71 | 0 | 0 | 0 | 0 | -0.47 | 0 | 0 | 0 | -0.35 | 0 | 0 |
| 1880 | 4 | 4 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1870 | 5.5 | 0 | 0 | 0 | 0 | 3.6 | 0 | 0 | 0 | 0 | 0 | 0 |
| | -0.71 | 0 | 0 | 0 | 0 | -0.12 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1869 | 4 | 4 | 0 | 0 | 3.5 | 3.5 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 0 | 0 | 0 | -0.47 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Denotes 0.05 +Denotes only one transaction<br>**Denotes 0.10 ++ More than one transaction, no standard error | | | | | | | | | | | | |

| Table 2: Expect Versus Actual Affects of Drought | | | |
|---|---|---|---|
| Year | Expected Affects of Drought | | |
| | June | July | August |
| 1869 | | | |
| 1870 | | | |
| 1880 | | X | |
| 1893 | | X | |
| 1894 | | X | X |
| Drought in Experiment 1 | | | |
| 1869 | | | |
| 1870 | | | |
| 1880 | | | |
| 1893 | | | |
| 1894 | X | X | |
| Drought in Experiment 2 | | | |
| 1869 | | | |
| 1870 | | | |
| 1880 | | | |
| 1893 | | | |
| 1894 | X | | |

| Table 3: Total Number of Trades | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Trading Month | | | | | | | | | | | |
| Scenario | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
| No Stack/ Call #1 | 6 | 7 | 5 | 1 | 3 | 4 | 3 | 3 | 7 | 5 | 1 | 0 |
| 1894 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 1893 | 2 | 1 | 3 | 0 | 1 | 0 | 0 | 0 | 4 | 1 | 0 | 0 |
| 1880 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1870 | 1 | 2 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
| 1869 | 1 | 2 | 0 | 1 | 0 | 2 | 1 | 2 | 2 | 4 | 0 | 0 |
| No Stack/ Call #2 | 8 | 6 | 6 | 2 | 4 | 6 | 5 | 3 | 3 | 2 | 0 | 0 |
| 1894 | 1 | 2 | 5 | 1 | 0 | 0 | 2 | 2 | 1 | 0 | 0 | 0 |
| 1893 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 1 | 2 | 2 | 0 | 0 |
| 1880 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1870 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1869 | 1 | 3 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

| Table 4: Weighted Average Price by Priority Dates | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Trading Month | | | | | | | | | | | |
| Weighted Avg. Price | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
| 1869 Priority | 4 | 4.25* | 0 | 4.5* | 3.5+ | 4.86 | 6* | 5.83* | 3.6 | 3.56 | 0 | 0 |
| | 0 | -0.236 | 0 | 0 | 0 | -1.258 | 0 | -0.236 | -0.118 | -0.74 | 0 | 0 |
| All Other Priorities | 4.35 | 3.71 | 3.09 | 3.5 | 3.5 | 3.88 | 3 | 3.38 | 3.58 | 3.6 | 5 | 0 |
| | -1.047 | -0.744 | -0.499 | 0 | -0.837 | -1.315 | -1.252 | -0.739 | -0.496 | -0.5 | 0 | 0 |
| Transactions by Priority Date | | | | | | | | | | | | |
| 1869 | 2 | 5 | 0 | 1 | 1 | 3 | 1 | 2 | 2 | 4 | 0 | 0 |
| All Other Priorities | 12 | 9 | 10 | 2 | 6 | 7 | 8 | 4 | 8 | 3 | 1 | 0 |
| * Denotes 0.05 significance + Denotes only one transaction<br>** Denotes 0.10 significance | | | | | | | | | | | | |

# The Effects of the Great Recession on the Unemployment Rates of Minorities in the United States

Jarrod Hill

## I. INTRODUCTION

As America continues to "reel" from the effects of the recession, unemployment rates continue to be a pertinent topic among politicians and the media. The seasonally adjusted unemployment rate increased from five percent in 2007 to 9.5 percent in 2009 (Hoynes et. Al, 2012). Minorities are affected by the recession more than are whites. Specifically, Hispanics have suffered greatly as a result of the recession. "The recession has hit Hispanic employment relatively hard, resulting in employment that is 9.5 percent lower than it would have been if the recession had not occurred" (Engemann & Wall, 2010).

Similarly, certain industries have also been more adversely impacted by the recession. Most notably, blue-collar industries, such as manufacturing and construction, have been affected by the recession disproportionately comparing to other industries, such as education. The employment rate fell by 27 percent from the start of the recession in 2007 in the residential construction industry. Likewise, there was a 14.8 percent decrease in employment during the recession in the nonresidential construction industry (Hadi, 2011). Although the employment rate declined the most in industries such as construction, more resilient industries such as hospitality and retail trade also experienced decreases in employment (Goodman & Mance, 2011).

While it is evident that the recession has affected a diversity of people in different ways of life, there is a unique connection between industries and ethnic groups. "Many of the demographic groups that exhibit larger cyclical variation such as those with lower education, minorities, and males, are more likely to be employed in the industries with greater exposure to cycles (Hoynes et. al, 2012). Construction and manufacturing have experienced the largest declines in employment rate of the post-WWII era, with a 13.7 percent decline in construction employment and a 10.0 percent decline in manufacturing employment (BLS, February 2012). Despite government programs to level the playing field such as affirmative action laws and other aid that is available to those seeking employment, there is a continuous disparity among different ethnic groups. With regard to "The Great Recession," there is a disparity among the unemployment rates of Hispanics and other ethnic groups. This paper intends to explain why there is a disparity. Specifically, it addresses reasons that the unemployment rates of Hispanics are more adversely affected by the Great Recession when compared to the unemployment rates of other minority groups. Also, did concentrations of Hispanics in adversely affected industries contribute to higher unemployment levels during the Great Recession?

## II. THEORY

The theoretical framework of this paper is based on two economic theories: the human capital theory and the occupational segregation theory. In regard to the former, human capital is the productive capabilities that one possesses to generate income within an economy (Rosen, 2008). An individual with higher levels of human capital is less likely to be unemployed and more likely to be employed because of their productive capabilities. Furthermore, greater levels of human capital will allow individuals to be in corresponding industries that require higher levels of productivity. As a result, individuals with higher levels of human capital tend to be in industries that are less cyclical in nature and will suffer less during recessions.

As for human capital theory, the occupational segregation theory is also relevant to this research. According to Gordon Marshall (1998), sociologist and former chief executive of the Economic Social and Research Council, occupational segregation refers to labor being divided in such a way that groups of people are channeled into specific types of occupations with specific roles and tasks. Based on other studies such

as Catherine Hakim's Key Issues in Women's Work: Female Heterogeneity and the Polarisation of Women's Employment (1996), Marshall links "channeling" or occupation segregation to discrimination. It is commonly explained as a consequence of discrimination (Marshall, 1998). This "segregation" can take place among men and women or among different ethnic groups. For this research, the definition will be in reference to the latter. Specifically, Hispanics are being "sorted" into certain industries such as construction that were more adversely affected by the recession and in effect, are hurt more than other individuals in this sector and those that are not in this sector. This "sorting" may be due to human capital factors or lack thereof. Conversely, it could be due to discrimination. The means of sorting may be different, but the result is the same.

These two theories work together to suggest why Hispanics in the labor market are at a disadvantage relative to other groups. Lower levels of human capital yield difficulties in finding work for Hispanics. Moreover, jobs that are successfully obtained by Hispanics tend to be in blue-collar industries.

In the research, there are three main hypotheses that flow from the theoretical framework:

1. High unemployment rates among Hispanics are due to low levels of human capital;
2. Individuals with lower levels of human capital are less likely to be employed in "white collar" industries and thus, are more likely to be employed in "blue collar" industries;
3. Hispanics are being channeled into "blue collar" industries, which were hit harder by the recession and thus, suffer more adverse consequences than those who are not in blue-collar industries.

## III. LITERATURE REVIEW

As "The Great Recession" has wreaked havoc in the lives of many Americans, particularly Hispanics, much has been documented about the effects it has had and is still having on the nation as a whole. With regard to unemployment rates in general, African Americans and Hispanics have historically had higher unemployment rates than Whites (Bureau of Labor Statistics, February 2012). Table 1 shows the unemployment rates of four different racial groups.

According to the Bureau of Labor Statistics, Hispanics and African Americans have been most adversely affected by the recession. Although African Americans have the highest unemployment rate after the recession at 16 percent, Hispanics have seen the biggest change in their unemployment rates with an increase of 7.3 percentage points between 2006 and 2010. African Americans are a close second with a change of 7.1 percentage points. Whites and Asians have been less adversely affected with differences of 4.7 and 4.5 percentage points respectively.

When compared to past recessions, greater declines in employment were experienced during "The Great Recession" than any other recession in history (BLS, February 2012). The Great Recession caused a 7.9 percent decrease in employment, which is an even greater decline than experienced during the recession between 1981 and 1982 when there was a 6.0 percent total change in employment (Engemann & Wall, 2010). "Despite recent improvements, the labor market continues to struggle from the aftermath of a historic employment downturn" (Goodman & Mance, 2011).

The literature points to specific industries that have been hit more than others by the recession and, as a result, these are some of the industries that continue to suffer even after the recession has officially ended. According to Goodman and Mance (2011), manufacturing employment fell 14.6 percent, from 2007 to 2009. Also, the automobile industry's employment fell 35 percent during the recession. Similarly, construction employment fell by 19.8 percent during the recession, seeing the most devastating depths in employment since March 1998 (Hadi, 2011).

Working in these industries, there is a disproportionate amount of Hispanic workers compared to other minority and ethnic groups. According to the Bureau of Labor Statistics, 11 percent of all Hispanics are in the construction industry (September 2012). Comparatively, 3.3 percent of African Americans and 7.2 percent of whites are in the construction industry. Similarly, the leisure and hospitality industry as well as the manufacturing industry employ a higher percentage of Hispanics at 13 percent and 11 percent, respectively. Table 2 shows the percentage of each race in a given industry for 2011.

The coalescence of the recession, race, and industry has been evident in other studies, especially during economic downturns. According to Gregory Defreitas (1985), the single most important factor is the above-average elasticity of Hispanics' employment with respect to variations in aggregate demand. In

other words, because Hispanics are employed in industries that are based on the demand of consumers or the cyclicality of the economy, they bear "harsher" consequences from recessions and are in effect, more adversely affected. Conversely, other studies approach the effect of the recession on Hispanics in terms of human capital factors. For instance, a study conducted by Boisjoly and Duncan (1994) concluded that lower levels of education accounted for the difference in employment numbers between Hispanics, other minorities, and whites.

From the literature, one can make the conclusion that human capital factors such as educational attainment and occupational segregation across industries are pertinent in explaining why Hispanics were adversely affected by the Great Recession. However, this paper will contribute to the literature by focusing on the effects of the Great Recession on Hispanics rather than comparing recessions or looking at less severe recessions.

## IV. DATA & EMPIRICAL MODEL

The data is collected from the American Community Survey that is distributed by IPUMS-USA at the University of Minnesota. This database is chosen because of the large sample size and the variables that are accounted for in this survey. Specifically, the years 2006 and 2010 are chosen to account for the boom year, 2006, when unemployment levels were low, and the recession year, 2010, when unemployment levels were persistently high. Although people of all ages are included in the sample with over 6 million cases, only "working age" individuals are considered in this research. Similarly, individuals in the work force and out of the work force are included in the sample, but only individuals in the work force are considered.

Descriptive statistics will be used to compare unemployment rates before and after the recession. Change in the percentage points of unemployment rates before and after the recession will be used to measure the effects of the recession. Specifically, change in the percentage points of unemployment rates by race and industry will be analyzed. In connection with my hypotheses, there will be a greater change in the unemployment rate before and after the recession among Hispanic workers in blue collar industries such as construction and manufacturing.

When considering the effects of the recession, three regressions will be used to account for various factors such as human capital, age, and gender. Specifically, unemployment will be the dependent variable. Model 1 will account for race and the recession year. Therefore, the regression will be as follows:

$$\text{Unemployment} = \beta_0 + \beta_1(\text{Race}) + \beta_3(\text{Rec Yr})$$

Next, model 2 will be ran to account for human capital factors such as age, language, years in the United States, educational attainment, and gender. Model 2 is as follows:

$$\text{Unemployment} = \beta_0 + \beta_1(\text{Race}) + \beta_2(\text{Rec Yr}) + \beta_3(\text{Language}) + \beta_4(\text{Age}) + \beta_5(\text{Yrs. in the U.S.}) + \beta_6(\text{Gender}) + \beta_7(\text{Ed}^n)$$

Lastly, model 3 will take industry into consideration. Hence, model 3 is as follows:

$$\text{Unemployment} = \beta_0 + \beta_1(\text{Race}) + \beta_2(\text{Ed}^n) + \beta_3(\text{Yrs. in the U.S.}) + \beta_4(\text{Language}) + \beta_5(\text{Rec Yr}) + \beta_6(\text{Age}) + \beta_7(\text{Gender}) + \beta_8(\text{Industry})$$

In models 2 and 3, language, gender, unemployment, age, and industry are all dummy variables. This model will account for both human capital issues and occupational issues in regard to the theoretical framework of this paper.

The groups included in this research are defined as follows:

- Asians (NonHispanAsian)
- African Americans (Black)
- Other minorities (NonHispanOther)
- Hispanics (Hispanic)
- Whites (NonHispanwhite)
- Non-Hispanic Blacks (NonHispBlack)

These groups are all dummy variables with the value of 0 or 1.

Educational attainment was also considered and is defined as follows:

- High school diploma (HSdiploma)
- Some college (Somecollege)
- Bachelor's degree (Bachelorsdegree)
- Masters + (Masterplus)

Likewise, these variables are dummy variables with a value of 0 or 1.

People of all ages are included in the sample; however, because people usually do not begin to work

until their teen years, age in this research will be split into five groups:

- Young people (16-26)
- Mid twenties & thirties (27-36)
- Mid thirties & forties (37-46)
- Mid forties & fifties (47-56)
- Mid fifties & sixties (57-66)

With regard to industry, the industries included in this research are as follows: agriculture, mining, construction, retail trade, transportation and warehousing, utilities, information and communications, finance, professional services, education/health and social services, the arts, public administration, and other services. All these industries are dummy variables, possessing a value of 1 if employed in the given industry and 0 if one is not in the given industry.

Language is an important variable in this research as well. It is a dummy variable having a value of 0 if English is not the primary language spoken and 1 if English is the primary language spoken.

It is hypothesized that the following variables will have positive signs: Hispanic, language, recession year, age, and gender. In agreement with the literature, males will have higher unemployment rates than females. Education will have a negative sign, decreasing unemployment as more education is attained. Years in the United States will also have a negative sign, decreasing unemployment as the number of years in the United States increases.

The industry variable will have a positive sign if it is an industry that was more adversely impacted by the recession. This means that the given industry will add percentage points to unemployment rates. Conversely, the industry variable will possess a negative sign if the given industry is less adversely impacted by the recession. Hence, percentage points will be deducted from the unemployment rates of individuals within the given industry.

## V. RESULTS

In conjunction with the hypotheses of this paper, Hispanics are in fact channeled into certain industries. Moreover, Hispanics are concentrated in industries that are more adversely impacted by the recession. Table 3 shows the percentage of all employed individuals of a given race within an industry. In 2006, 8.3 percent of all employed Hispanics were in the retail trade industry. This figure increases to 10 percent in 2010, the highest of any race in 2010. Similarly, 6.9 percent of all employed Hispanics were in the construction industry in 2006; 6.5 percent of all employed Hispanics were in the construction industry in 2010. In 2010, whites, blacks, other minorities, and blacks enjoyed lower percentages in this industry at 4 percent, 2.8 percent, 4 percent, and 4.1 percent, respectively.

Similarly, Hispanics are more concentrated in the arts and entertainment industry. Before the recession, 7 percent of all employed Hispanics were in the arts and entertainment industry. This figure increased to 8.6 percent after the recession. In comparison, only 5.5 percent and 5.7 percent of all employed whites were in the arts and entertainment industry in 2006 and 2010, respectively. Likewise, only 5.4 percent of all employed Asians were in the arts and entertainment industry in 2006, increasing minutely to 5.5 percent in 2010.

With regard to Hispanics, approximately two-fifths of all Hispanics are in industries that were heavily impacted by the recession. However, some are in the professional services industry, a "white-collar" industry. This finding is in opposition to my hypotheses. Furthermore, it shows that some Hispanics are in "white-collar" industries; nonetheless, it still speaks to the testimony that Hispanics were in industries that were heavily impacted by the recession. Specifically, 7.1 percent of all employed Hispanics were in the professional services industry in 2010, the highest percentage among the included groups.

In concurrence with the aforementioned descriptive statistics, the regression results for models 1, 2, and 3 each present results that are in agreement with the three hypotheses of this paper. Table 4 shows the coefficients for each regression model before and after the recession. The constant for Model 1 is .029 before the recession and .050 after the recession; i.e., without controlling for anything, there is an unemployment rate of 2.9 percent before the recession and 5 percent after the recession. Recall, Model 1 accounts for race and whether or not it was a recession year or not. In conjunction with the literature, blacks have the highest coefficient at .030 before and after the recession. Merely being black adds 3 percentage points to the unemployment rate. Hispanics are second with .7 percentage points added to their unemployment rate. Asians and other minorities are impacted less when only accounting for race and the year.

In addition to race, Model 1 also accounts for

the year. In 2006, a boom year, the coefficient is negative. That is, one was less likely to be unemployed in 2006. Specifically, 2.1 percentage points could be deducted from unemployment rates on account of the year. Conversely, in 2010, a year after the recession officially ended, the coefficient carried a positive sign. This means that the year impacted unemployment rates in a negative manner. After the recession, 2.1 percentage points were added to unemployment rates.

Model 2 accounts for human capital and demographic factors in addition to the factors accounted for in Model 1. These additional variables include language, age, years in the United States, educational attainment, and gender. With the exception of years in the United States, these factors had a negative impact on unemployment rates, adding percentage points to unemployment rates.

Compared to older individuals, young people were more likely to be unemployed before and after the recession. In 2006 and 2010, 6.5 additional percentage points were added to the unemployment rates of young people. In relation to the human capital theory, as individuals increase their education, unemployment becomes less likely. In Table 4, Model 2, as more education is obtained, the sign changes from positive to negative. Both before and after the recession, individuals with some college are still impacted negatively with .9 percentage points being added to their unemployment rates. However, individuals with a bachelors or masters degree decrease their unemployment rates by 1.1 and .7 percentage points, respectively.

With regard to gender and in conjunction with the literature, males are more adversely impacted by the recession when compared to women. Men have an additional .9 percentage points added to their unemployment rate.

The language variable also possessed a positive sign. When compared to individuals who do not speak English, those who do speak English suffer higher levels of unemployment. A substantial 1.1 percentage points are added to the unemployment rates of those who speak English.

Surprisingly, years in the United States do not add or subtract percentage points from unemployment rates. Although it is statistically significant at the .000 level, it is insignificant in regard to unemployment rates. This could be due to how years in the United States were measured. Unlike the other variables, years in the United States are an absolute variable, not a dummy variable. Nonetheless, years in the United States are not an important variable in this research.

Finally, Model 3 considers industry as well as the aforementioned variables accounted for in models 1 and 2. By way of this model and the descriptive statistics presented in Table 3, my hypothesis that Hispanics are concentrated in blue-collar industries that were hit harder by the recession and thus, are more adversely impacted by the recession is proven. In 2006, being in the construction industry added 3.6 percentage points to unemployment rates. In 2010, this figure ballooned to 11.8. That is, 11.8 percentage points were added to the unemployment rates of those in the construction industry.

Recall, in 2006, 6.9 percent of all employed Hispanics were employed in the construction industry. Although this figure decreased by .4 percentage points to 6.5 percent, there was still a higher concentration of Hispanics in the construction industry and hence, their concentration within this industry contributed to their high unemployment rates.

Similarly, the manufacturing industry shared a similar story. In 2006, being in the manufacturing industry added 2 percentage points to their unemployment rates. In 2010, this figure increased to 6.2 percent. The retail trade and arts/entertainment industries also saw increases before and after the recession in relation to unemployment. In 2006, 2 and 5.3 percentage points were added to the unemployment rates of those in the retail trade and arts/entertainment industries, respectively. In 2010, these figures increased to 4.6 and 5.3 percent.

In contrast to the hypotheses of this paper, the professional services industry, a white-collar industry, was an adversely impacted industry in which Hispanics were employed. Like the other four industries mentioned, there was an increase in the coefficient for this industry before and after the recession. Before the recession, this industry added 2.8 percentage points to the unemployment rates of those within the industry. In 2010, this figure jumped to 5.9 percent.

Although this industry is a white collar industry, notice the percentage of Hispanics in this industry. According to Table 3, 5.8 percent of all employed Hispanics were in the professional services industry

in 2006, compared to 6.3 percent of all employed whites, Asians, and other minorities, and 6.2 percent of all employed blacks. Perhaps the difference between Hispanics and everyone else is educational attainment. Normally, this industry requires higher levels of education. In connection with one of my hypothesis, this shows that low levels of educational attainment does contribute to the high unemployment rates of Hispanics. In 2010, Hispanics led all other racial groups with 7.1 percent of all employed Hispanics being in the professional services industry.

## VI. CONCLUSIONS

By way of this research, there are many conclusions that can be made. For instance, as levels of human capital increase, an individual is less likely to be unemployed. In connection with one of the hypotheses, individuals with less human capital are more likely to be unemployed and are thus, less likely to be in "white collar" industries. Low levels of human capital are a factor that is affecting Hispanics employment or lack thereof.

Also, the descriptive statistics used in Table 3 show that there are high concentrations of Hispanics in industries that were more adversely affected by the recession. The regression results show that some of these industries that Hispanics were highly concentrated experienced high levels of unemployment after the recession. Specifically, cyclical industries like construction, manufacturing, retail trade, and the arts contained high concentrations of Hispanics and were hit harder by the recession compared to other industries. Also, the professional services industry, a white-collar industry, was adversely impacted. Hence, Hispanics were channeled into industries that were hit hard by the recession and consequently, suffered more adversely compared to other minorities and whites.

## VII. POLICY IMPLICATIONS/ FUTURE RESEARCH

There are serious policy implications that flow directly from this research. It is evident that there are high concentrations of Hispanics in particular industries, some of which experience high levels of unemployment. Work needs to be done to increase human capital levels among Hispanics. Work programs that allow individuals to increase their educational attainment and work simultaneously need to be made more readily available to Hispanics. Also, colleges and universities need to continue to seek talent from all demographic groups, in an effort to give everyone in America an equal opportunity to succeed.

Future research could focus more on immigrants. Specifically, are Hispanic immigrants more adversely affected by recessions than Hispanic natives? Also, do the same factors affect the unemployment rates of Hispanic natives and Hispanic immigrants? Lastly, is there a factor that has a greater net effect on the unemployment rates of Hispanic immigrants and Hispanic natives before and after the recession? These types of questions should be considered in the future to better understand why these Hispanics suffer more during and after recessions.

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## IX. APPENDIX

| Table 1: Descriptive statistics: Average Unemployment Rates Before and After the Recession | | | | |
|---|---|---|---|---|
| Year | Whites | African American | Asians | Hispanics |
| 2006 | 4% | 8.9% | 3% | 5.2% |
| 2010 | 8.7% | 16% | 7.5% | 12.5% |

| Table 2: Descriptive Statistics for Industry Employment in 2011 | | | |
|---|---|---|---|
| Industry | African Americans | Hispanics | Whites |
| Construction | 3.3% | 11% | 7.2% |
| Ed'n and Health Services | 22.8% | 17% | 22% |
| Wholesale and Retail Trade | 13.3% | 15% | 14.3% |
| Leisure and Hospitality | 9.5% | 13% | 8.8% |
| Professional & Business Services | 9.1% | 12% | 11.5% |
| Manufacturing | 8.3% | 11% | 10.4% |

| Table 3: Descriptive statistics: Distribution of Employed Individuals by Race & Industry | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Whites | | Blacks | | Other Minorities | | Asians | | Hispanics | |
| Industry | 2006 | 2010 | 2006 | 2010 | 2006 | 2010 | 2006 | 2010 | 2006 | 2010 |
| Construction | 4.5% | 4% | 3.1% | 2.8% | 4.4% | 4% | 4.6% | 4.1% | 6.9% | 6.5% |
| Manufacturing | 8% | 6.9% | 7.3% | 6.6% | 8% | 6.9% | 8% | 6.8% | 7.9% | 7.2% |
| Retail Trade | 8.9% | 9.2% | 8.3% | 9.4% | 8.9% | 9.2% | 9% | 9.2% | 8.3% | 10% |
| Arts/ Entertainment | 5.5% | 5.7% | 6.7% | 7.5% | 5.4% | 5.7% | 5.4% | 5.5% | 7% | 8.6% |
| Professional Services | 6.3% | 6.7% | 6.2% | 7% | 6.3% | 6.7% | 6.3% | 6.5% | 5.8% | 7.1% |
| All other industris | 66.8% | 67.5% | 68.4% | 66.7% | 67% | 67.5% | 66.7% | 67.9% | 64.1% | 60.6% |
| Total | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

| Table 4: Regression results for Model 1, Model 2, and Model 3 | | | | | | |
|---|---|---|---|---|---|---|
| | Model 1 | | Model 2 | | Model 3 | |
| Variables | Before Rec | After Rec | Before Rec | After Rec | Before Rec | After Rec |
| Constant | .050 | .029 | .028 | .007 | .031 | .014 |
| | (32.674) | (18.990) | (17.954) | (4.323) | (20.032) | (9.412) |
| Hispanic | .007 | .007 | .007 | .007 | .006 | .005 |
| | (4.561) | (4.561) | (4.582) | (4.582) | (4.027) | (3.296) |
| Black | .030 | .030 | .028 | .028 | .028 | .030 |
| | (116.452) | (116.452) | (107.320) | (107.320) | (110.481) | (117.247) |

| | | | | | | |
|---|---|---|---|---|---|---|
| NonHispan Asian | .000*** | .000*** | -.002 | -.002 | -.002 | -.002 |
| | (1.039) | (1.039) | (-4.518) | (-4.518) | (-4.248) | (-5.262) |
| NonHispan Other | -.005*** | -.005*** | -.004*** | -.004*** | -.004*** | -.004*** |
| | (-3.271) | (-3.271) | (-2.411) | (-2.411) | (-2.621) | (-2.528) |
| LanguageEng | | | .011 | .011 | .010 | .008 |
| | | | (43.425) | (43.425) | (38.859) | (32.137) |
| Youngppl | | | .065 | .065 | .061 | .060 |
| | | | (275.803) | (275.803) | (257.818) | (256.581) |
| Yrs. In the US | | | .000 | .000 | .000 | .000 |
| | | | (39.264) | (39.264) | (34.909) | (27.343) |
| Somecollege | | | .009 | .009 | .007 | .005 |
| | | | (45.258) | (45.258) | (36.672) | (23.301) |
| Bachelors degree | | | -.011 | -.011 | -.010 | -.009 |
| | | | (-37.949) | (-37.949) | (-36.508) | (-33.283) |
| Masterspplus | | | -.007 | -.007 | .006 | -.004 |
| | | | (-18.345) | (-18.345) | (-15.628) | (-9.744) |
| Male | | | .009 | .009 | .007 | .003 |
| | | | (55.876) | (55.876) | (43.012) | (16.721) |
| afterrec | | .021 | | .021 | | .002 |
| | | (131.864) | | (132.350) | | (13.601) |
| beforereec | -.021 | | -.021 | | -.029 | |
| | (-131.864) | | (-132.350) | | (-165.419) | |
| Construction | | | | | .036 | .118 |
| | | | | | (63.717) | (202.048) |
| Manfacturing | | | | | .020 | .062 |
| | | | | | (45.977) | (134.249) |
| Retail Trade | | | | | .020 | .046 |
| | | | | | (47.953) | (112.299) |
| ArtsEnter-tainmentetc | | | | | .034 | .053 |
| | | | | | (65.451) | (105.498) |
| Professional serv | | | | | .024 | .059 |
| | | | | | (58.142) | (125.656) |

# Improving Water Quality and Sanitation Through Growth and Aid: The Case of Africa

**Zahra Lalani**

## I. INTRODUCTION

It's not the amount of water that matters, it's the quality of the water consumed that is most important. For an agricultural continent, like Africa, that relies so heavily on physical labor, improvements in water quality could improve health for those employed on farms. 90 percent of human health depends on consumed water, making the availability of safe drinking water a top priority in African nations.

UNICEF's seventh Millennium Development Goal is to reduce the portion of people without access to safe drinking water and basic sanitation in half by 2015. Failure to obtain safe water leads to widespread diseases like cholera and infant diarrhea. The poor health of an economy can be attributed to unclean water and lack of proper sanitation facilities, which in turn can hinder the learning potential of children and the further development of the country as a whole.

Lakes, rivers, and ground water are all sources from which people can obtain drinking water. Water from each source will need to go through some purification processes to attain the acceptable level before it can be consumed. Whether or not water can be used for drinking after being treated heavily depends on the raw water source quality. For example, surface water collects hazardous runoff as it flows through rivers, which needs more purification, while most ground water is mildly contaminated and requires less treatment. There are two methods of treatment: point of entry treatment and point of use treatment. Disinfecting is a point of use treatment, but it does not ensure that drinking water is safe. The chemicals used during point of use treatment to disinfect pathogens are a health hazard in high quantities.

Only 62 percent of Africans have access to safe water. 75 percent of drinking water comes from groundwater and is consumed with little or no purification. And when drinking water is not easily accessible on land, women bear the burden of collecting it. In research done by the World Health Organization (WHO) and UNICEF, it found that women in African are more than five times as likely as men to walk to a source in order to collect drinking water for the entire household.

In Africa, poor legislation on water pollution and regulation of water activities leave much of the raw water sources untreated and unprotected. Dirty, contaminated water leads to an ongoing cycle of poor health, which in turn impacts more aspects of life such as the level of education attainment existing poverty. Since 85 percent of water resources in African are shared river basins there is unequal usage of the water among citizens. This is due to the varying social, political, and economics structures adopted by individual countries. The different priorities of each country result in large fluctuations in usage and high demand for water.

Safe drinking water is scarce in Africa primarily due to practices of open defecation and poor sanitation facilities. Fecal pollution is among the most pressing concerns on the continent with regards to safe drinking water. In addition, fecal pollution is the largest contributor of water born diseases such as typhoid.

Poor water quality in the region is also a result of untreated waste water, such as industrial and domestic waste, entering water sources. The combination of dangerous waste and naturally existing chemicals in the bed rock allow for disease and contamination to spread. Water, therefore, has an extremely high level of toxic pollutants such as heavy metals, persistent organic pollutants, and biological contaminants. It is difficult for African countries to implement water management programs because many African governments do not

establish water quality monitoring programs. Data on water pollution in present day is also as a result very limited, as are analytic laboratories where water quality can be studied. Without a structured framework for water governance, it has become apparent that African governments are finding it hard to manage their own water sources efficiently.

## II. LITERATURE REVIEW

There are several paths that can lead towards improved water quality and sanitation facilities. Working with governments to improve technology and hygiene education decreases the inefficiencies in wasted freshwaters and the need for treatment. Developing low cost programs that address efficient use and promote hygiene should be the primary focus of African countries. The African Development Bank Group founded in 1964 works on several developmental efforts throughout the continent including water and sanitation (OWAS). The OWAS department reported on the water and sanitation index of development effectiveness in Sub-Saharan Africa in February of 2012. The study compares the countries' performance in the water and sanitation sectors and analyzes how well the outputs correlate with the resources and developmental aid that they receive (Stampini, et. al., 2012). This is compiled in the Watsan Index of Development Effectiveness (WIDE). Gabon and Mauritius were found to be better off in terms of resources than the other Sub-Saharan countries, in that they received over 10 USD per capita per year of Official Development Aid (ODA) to assist their water and sanitation sectors (Stampini, et. al., 2012). Gabon, in addition, also has more water resources per capita, about 58 times more than Mauritius. Mauritius, while lacking in water resources, has the least amount of corruption and the best governing body to allow for progress and efficient use of resources (Stampini, et. al., 2012). Relative to Gabon and Mauritius, Zimbabwe and the Democratic Republic of Congo have the least amount of ODA per capita and water resources in addition to having a highly unstable government structure that is more conducive to corruption and less likely to successfully implement new initiatives. This study helps clarify the positive relationship between GDP and ODA on water quality and sanitation; however it does not address the impacts of education or human capital's impact on water quality.

With respect to the quality of life, research has found that there are non-economic factors that impact the quality of life, in addition to the conventionally measured economic factors of income, growth, poverty, and inequality (Lee, et.al., 1982). Non-economic measures such as happiness, satisfaction, and optimism react slowly and are more costly to measure than the conventional economic factors. In addition, growth in economic factors, such as an increase in per capita income, does not necessarily correspond with increases in the general well being of human life (Rossouw, 2008). Despite the difficulty of measuring these variables, the quality of life measurements can prove useful for policy makers. Nleya (2008) claims that there is a direct relationship between the standard of water services and the poverty level. Kapatamoyo (2004) similarly states that the mere lack of clean water is a manifestation of poverty, which has serious consequences for the survival of individuals and communities.

As of 1990, the United Nations Development Program created the Human Development Index that averages values for income, life expectancy, and literacy into a single measure (Rossow, 2007). The purpose of the measure is to shift policy focus away from national income accounting to people centered policies. This shift is done in order to evaluate human development by not only economic advances, but also through improvements in overall human well-being. But critics of the HDI say that life expectancy and literacy are too closely correlated with Gross National Product (GNP) per capita, which makes the index redundant. Rossouw and Naude (2007) developed their own measures and found that in South Africa the most populous cities were not the cities with the best geographical and environmental quality of life. The areas with the highest quality of life were those that were sparsely populated with lower than average per capita income. While their research looks at the relationship between non-economic factors and quality of life, there is little research on the impacts of water accessibility or water cleanliness on quality of life.

The benefits of higher quality water and sanitation suggest lower healthcare costs and an increase in productivity of workers (Hutton et al., 2007). On the cost side, the water supply and sanitation industry is a natural monopoly because the fixed costs for entering the industry are so high. Due to the class nature of water problems, there is no real incentive for elites to invest in this industry if they already have water security, which is the idea that water is accessible and affordable to allow people to lead a healthy, dignified, and productive life and that ecological systems are maintained in a sustainable level (Nleya, 2008). By encouraging investment in this monopolistic market, Nleya (2008) states it is important

to produce at the socially optimal level instead of at the profit maximization level, which will allow for water security to increase for more individuals and ultimately positively impacting their quality of life.

## III. THEORETICAL FRAMEWORK

Grossmand and Krueger (1995) along with the World Bank found that pollution in developing economies first increases and then decreases as the country's wealth increases over time. They captured this theory in the environmental Kuznets curve (henceforth EKC). This is similar to Simon Kuzenets' idea of income inequality. It can be seen from the figure that, income inequality and pollution is greatest for middle-income countries. Grossmand and Krueger (1995) support their findings from air and water quality experiments, which is why their conclusions can hold true for water and sanitation. These conclusions seem reasonable as most developing countries do not have the technology or resources with which to produce sustainably. Thus, as a country becomes more financially stable and wealthy, it can be expected that the country will have more resources to dedicate towards improving production processes that reduce pollution.

The EKC can be divided up into three parts: scale, composition, and technique. In theory, as an economy grows the scale of all activities increases proportionally. This implies that pollution will grow proportionally to the economy's growth. However, the growth of an economy can change if the composition of the goods produced change. For example, if richer countries produce less polluting goods, due to a change in preferences, then the composition effect leads to a decline in overall pollution as economic growth continues. In addition, pollution also falls if richer countries adopt new technological practices that reduce pollution residuals.

Greater economic activity hurts the environment initially due to the lack of technology and environmental investments available for low-income countries. However, as income rises, the demand for improvements in environmental quality increases; resources available for investment will also increase. Beckerman (1992) claims that "there is clear evidence that, although economic growth usually leads to environmental degradation in the early stages of the process, in the end the best-and probably the only-way to attain a decent environment in most countries is to become rich." Therefore, countries should strive to increase their overall national income, in hopes of reducing pollution in the future.

According to the United Nations, many African nations are in the pre-industrial economy stage and are classified by the United Nations as least developed countries (LDCs). Thirty-four African countries fit the criteria of an LDC (See Appendix A for a complete list). Criteria for inclusion in this category include (a) a gross national income per capita of 750 dollars or less, (b) a weak human assets index that reflects nutrition, health, education, and adult literacy, and (c) economic vulnerability as measured by instability in agricultural production and instability in exports.

Using the EKC framework of Grossmand and Krueger (1995), it is therefore hypothesized that GDP, HDI, and ODA (defined in Appendix B) will have a positive impact on water quality and sanitation.

## IV. EMPIRICAL RESEARCH, DESIGN, & DATA

A simple OLS regression of paneled data is conducted. The four regressions, shown below, predict improved water sources and improved sanitation facilities respectively, definitions for all variables can be found in the Appendix. The first two regressions predict the dependent variables separately through HDI and ODA, and the second set of regressions includes ODA and GDP. GDP and HDI are collinear variables that generally move in the same direction, so to isolate their effects separate regressions were performed. HDI includes a Gross National Income (GNI) component that is similar to GDP, therefore by performing separate regressions eliminates the redundancy or double counting for GDP. The regressions run in SPSS as follows:

y1=Improved Water Source

$$y1=ß0 + ß1(LN_{ODA}) + ß2(LN_{ODA}) + ß3(1990) + ß4(1995) + ß5(2000) + ß6(2005) + ß7(2006) + ß8(2007) + ß9(2008) + ß10(2009) + ß11(2010)$$

y2=Improved Water Source

$$y2=ß0 + ß1(HD1) + ß2(LN_{ODA}) + ß4(1995) + ß5(2000) + ß6(2005) + ß7(2006) + ß8(2007) + ß9(2008) + ß10(2009) + ß11(2010)$$

y3=Improved Sanitation Facilities

$$y3=ß0 + ß1(HD1) + ß2(LN_{ODA}) + ß4(1995) + ß5(2000) + ß6(2005) + ß7(2006) + ß8(2007) + ß9(2008) + ß10(2009) + ß11(2010)$$

y4=Improved Sanitation Facilities

$$y4=ß0 + ß1(HD1) + ß2(LN_{ODA}) + ß4(1995) + ß5(2000) + ß6(2005) + ß7(2006) + ß8(2007) + ß9(2008) + ß10(2009) + ß11(2010)$$

The data for this study is derived from the World Bank Dataset, which is an important source of financial and technical assistance to developing countries. Drawn from this data base were the following variables: Human Development Index, GDP per capita, Improved Sanitation Facilities, Improved Water Source, and Net Official Development Assistance received. See Appendix B for World Bank definitions of the variables as well as how they are calculated.

The time period for the data begins in 1990. Prior to 1990 few African countries reported per capita GDP and any other variable used. The years that include complete data are 1990, 1995, 2000, 2005, 2006, 2007, 2008, 2009 and 2010. The gaps in years can be attributed to the political turmoil of African countries, such as civil wars, which make gathering and sharing data costly and difficult. All African countries were included with the exception of Sao Tome and Principe, Seychelles, Somalia, and South Sudan due to the fact that little data is available for the above mentioned variables. See Appendix C for a full list of countries included in this study.

GDP and ODA were adjusted for by taking the natural log of each variable, so that the results were not dominated by one variable having large absolute values. This is an important step since HDI, IWS and ISF are in absolute terms which are relatively smaller than GDP and ODA. Ideally, literacy, life expectancy, employment, democratic freedom, government corruption levels and pollution variables would have been included, but data for those variables are not reported for the years used in this study. Instead the Human Development Index is used, which includes its own measures for literacy and life expectancy.

A control for time is also included. The data was compiled in a panel comprising of 50 countries over nine observed years. The regression spans a total of 450 observations. Cases in specific years where GDP, HDI or ODA were not reported were omitted from the regression.

## V. RESULTS

This first regression, which is reported in Table 1, shows that both HDI and ODA have a significant impact on the accessibility of water. HDI increases accessibility to water by 84 points. On the other hand, a one percent change in ODA reduces accessibility by 3 percent. The sign for HDI is positive and thus consistent with the hypothesis. However, ODA is negative and thus does not support the original hypothesis that ODA would have a positive impact upon water quality. T-statistics for both values are greater than 2 or -2, which indicate that the coefficients are significant with a greater than 95 percent confidence level. The R Square is 46.2 percent, which explains the total variation by HDI and ODA for the improved water source. The results indicate that there is a significant positive correlation between HDI and water quality, the greater the HDI is the greater the percentage of people with access to an improved water source.

In the regression shown in Table 2, the second regression, HDI has a greater impact on access to proper sanitation facilities than it did on accessibility to water. ODA has a negative impact but it is not significant at the 0.1 or 0.05 level, meaning the variable is unable to conclude its impact on sanitation. The t-statistic for HDI is greater than 2, indicating that the coefficient for the variable is significant above a 95 percent confidence level. The same cannot be said for ODA, since the t-statistic is less than -1.68, which is not significant with 90 percent confidence level or greater. The hypothesis for HDI is supported in that it has a positive impact on sanitation, however the hypothesis does not hold true for ODA since it is not significant enough. 48.2 percent of the total variation in improved sanitation facilities variable is explained by HDI and ODA. The results indicate that there is a significant positive correlation between HDI and sanitation. The greater the HDI is, the greater the percentage of people with access to improved sanitation facilities.

In Table 3, for regression 3, we predict accessibility to water but with the use of GDP instead of HDI. The regression shows that both GDP and ODA have a significant impact on accessibility of water. A one percent change in GDP causes a 9.8 percent increase in accessibility to water, while a one percent change in ODA causes a 2 percent decrease in accessibility. The t-statistics for both variables are greater than 2 or -2, implying that the coefficients for those variables are significant with a greater than 95 percent confidence level. In addition both are significant at the p-value of 0.05. 44.1 percent of the variability in the improved water source is explained by GDP and ODA. Despite

this, the hypothesis again does not hold true for ODA, but it does support the positive impact which was expected for GDP to have. Thus there is a strong positive correlation between GDP and improved water sources, so as GDP increases the percentage of people with access to quality water also increases. There is a negative correlation between ODA and an improved water source so as ODA increases the percentage of people with access to water decreases.

Table 4 predicts accessibility to an improved sanitation facility by using GDP and ODA in regression 4. The regression results show that GDP has a significant impact on access to better sanitation. A one percent change in GDP causes a 17.5 percent increase in accessibility to proper sanitation, while a one percent change in ODA causes a 0.678 percent increase in accessibility. However since the coefficient for ODA is not significant at the 0.1 or 0.05 levels we cannot conclude its impact on sanitation. The t-statistic for GDP is greater than 2, indicating that the coefficient is significant at significance level greater than 95 percent; my hypothesis holds true for GDP. However the same cannot be said for ODA. The t-statistic for ODA is less than 1.68 thus it is not significant at 90 percent confident level or greater. The results do not support the hypothesis because they do not show a significant positive correlation to improved sanitation facilities. 50.9 percent of the variability in improved water sanitation can be explained by GDP and ODA. Thus as GDP increases we can expect the percentage of people with access to sanitation to also increase.

## VI. CONCLUSIONS & POLICY IMPLICATIONS

In conducting research on water quality and sanitation, it is expected to find that an increase in GDP, HDI and ODA would all correspond with an increase in water quality and sanitation. According to the theory underlying the EKC, the richer a country becomes the less polluted its environment should be. Less pollution implies fewer people pollute and water quality increases.

This study found that GDP had a significant positive impact on water quality and sanitation, meaning that as the GDP per capita in African countries increases it can be expected that the accessibility to quality water and proper sanitation increase. This implies that countries should continue to do what they have been doing in order to increase their GDP per capita. HDI also had a significant positive correlation to water and sanitation, implying that the components of HDI should also continue to improve. If a person lives a longer lifespan, they become more educated, and make a greater income. With a larger income, the people of African are more likely to invest and promote accessibility to water sources and improved sanitation facilities.

Taking this research further, there is a dire need for data collection on the African continent. Specifically, a database needs to be developed over time so that it includes more direct variables that could predict quality water. These variables should include: the distance and time it takes to collect water on a regular basis, pollution levels of nearest water source, amount of surface and ground water available in the country, and lastly an index that measures the stability of the government. An increase in the amount of surface or ground water available would mean that, that country should most likely receive more aid in developing better water management systems because they have the natural resources available to work with. In addition if an index were developed to measure the stability of the government over time, the more stable the government, the less likely it is that corruption will take place. If there's less corruption, then the success rate of a water and sanitation management program is a lot higher, and thus the likelihood of improving water quality and sanitation increases.

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## VIII. APPENDIX

| Table 1: Regression Results: Dependent Variable is Improved Water Source | | |
|---|---|---|
| Variable | Coefficient | T-Statistic |
| HDI | 84.63* | 15.004 |
| LN_ODA | -2.889* | -4.949 |
| Adj R Squared | .462 | |
| Sample Size | 390 | |
| * Denotes significanct at the .05 level | | |

| Table 2: Regression Results: Dependent Variable is Improved Sanitation Facilities | | |
|---|---|---|
| Variable | Coefficient | T-Statistic |
| HDI | 138.635* | 17.729 |
| LN_ODA | -.973 | -1.192 |
| Adj R Squared | .482 | |
| Sample Size | 394 | |
| *Denotes significant at the .05 level | | |

| Table 3: Regression Results: Dependent Variable is Improved Water Source | | |
|---|---|---|
| Variable | Coefficient | T-Statistic |
| LN_GDP | 9.841* | 14.312 |
| LN_ODA | -2.377* | -3.898 |
| Adj R Squared | .441 | |
| Sample Size | 424 | |
| *Denotes significant at the .05 level | | |

| Table 4: Regression Results: Dependent Variable is Improved Sanitation Facilities | | |
|---|---|---|
| Variable | Coefficient | T-Statistic |
| LN_GDP | 17.504* | 19.672 |
| LN_ODA | .678 | .849 |
| Adj R Squared | .509 | |
| Sample Size | 426 | |
| *Denotes significant at the .05 level | | |

| Appendix A: List of Least Developed Countries in Africa | | | |
|---|---|---|---|
| Angola | Djibouti | Liberia | Sierra |
| Benin | Equatorial Guinea | Madagascar | Sao Tome and Principe |
| Burkina Faso | Eritrea | Malawi | Sudan |
| Burundi | Ethiopia | Mali | Somalia |
| Cape Verde | Gambia | Mauritania | Tanzania |
| Central African Republic | Ghana | Mozambique | Togo |
| Chad | Guinea | Niger | |
| Comoros | Guinea-Bissau | Rwanda | Uganda |
| Conog, Dem. Rep. | Lesotho | Senegal | Zambia |
| Source: United Nations | | | |

| Appendix B: Definitions of ariables used and how they are mesaured |
|---|
| Human Development Index |
| The Human Development Index (HDI) is a summary measure of human development. It measures the average achievements in a country in three basic dimensions of human development: a long and healthy life (health), access to knowledge (education) and a decent standard of living (income). The HDI was created to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth alone. The HDI can also be used to question national policy choices, asking how two countries with the same level of GNI per capita can end up with such different human development outcomes. |
| GDP per capita (constant 2000 US$) |
| GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant U.S. dollars. |
| Improved Water Source (% of population with access) |
| Access to an improved water source refers to the percentage of the population with reasonable access to an adequate amount of water from an improved source, such as a household connection, public standpipe, borehole, protected well or spring, and rainwater collection. Unimproved sources include vendors, tanker trucks, and unprotected wells and springs. Reasonable access is defined as the availability of at least 20 liters a person a day from a source within one kilometer of the dwelling. |
| Improved Sanitation Facilities ( % of population with access) |
| Access to improved sanitation facilities refers to the percentage of the population with at least adequate access to excreta disposal facilities that can effectively prevent human, animal, and insect contact with excreta. Improved facilities range from simple but protected pit latrines to flush toilets with a sewerage connection. To be effective, facilities must be correctly constructed and properly maintained. |
| Net Official Developmental Assistance |

Net official development assistance (ODA) consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients. It includes loans with a grant element of at least 25 percent (calculated at a rate) of discount of 10 percent). Data are in constant 2009 U.S. dollars.

| Appendix C: African countries included in empirical study | | | |
|---|---|---|---|
| Algeria | Cote d'Ivoire | Liberia | Rwanda |
| Angola | Djibouti | Libya | Senegal |
| Benin | Egypt, Arab Rep. | Madagascar | Sierra Leone |
| Botswana | Equatorial Guinea | Malawi | South Africa |
| Burkina Faso | Eritrea | Mali | Sudan |
| Burundi | Ethiopia | Mauritania | Swaziland |
| Cameroon | Gabon | Mauritius | Tanzania |
| Cape Verde | Gambia, The | Morocco | Togo |
| Central African Republic | Ghana | Mozambique | Tunisia |
| Chad | Guinea | Nambia | Uganda |
| Comoros | Guinea-Bissau | Niger | Zambia |
| Congo, Dem. Rep. | Kenya | Nigeria | Zimbabwe |
| Congo, Rep. | Lesotho | | |
| Note: Sao Tome and Principe, Seychelles, Somalia, and South Sudan were excluded from study due to data inaccessibility. | | | |

# Does Gentrification Lower Crime: A Look at Granger-Casuality in Washington, D.C.

**Will Lawrence**

## I. INTRODUCTION

Driving through Washington, D.C. today is noticeably different from twenty years ago. In the 1980s and early 1990s, the crack epidemic took hold of Washington D.C. and in 1991, the murder rate peaked at 479 deaths (NBC4 Washington, 2011). Since then, crime has plummeted and investment in the poverty-stricken areas is on the rise. According to the Federal Bureau of Investigation, from 1995 until 2010, the violent crime rate in Washington, D.C. fell by more than half from 2,661.4 per 100,000 individuals in 1995 to 1,330.2 per 100,000 in 2010 (FBI, 1995, 2011). During that same timeframe, the median housing price (2010 $) rose three-fold from $176,000 to $528,000 (NeighborhoodInfo DC, 2011). These astonishing changes are not a mere coincidence. There is a definite social phenomenon called 'gentrification' occurring in the nation's capital.

This project looks at the relationship between gentrification and violent crime rates, specifically in Washington, DC. Gentrification is a social phenomenon that involves middle and upper class residents moving into the city center where violent crime had previously acted as a barrier for keeping unwanted demographics out. An increase in demand for housing by the higher income residents drives up the cost of housing which, in turn, forces out the lower income residents. Higher income residents generally have lower crime rates, so the crime rate falls as the lower income residents with higher crime rates move. This, however, is all theory. This study explores whether crime rates fall as a result of these upper income families moving in or if the drop in crime is one more reason the upper income residents want to move.

## II. THEORY & LITERATURE REVIEW

As gentrification is a pressing phenomenon, large amounts of literature have been devoted to it, and more specifically, its relationship with crime. McDonald (1986) provides somewhat of a literature review, albeit a dated one, of the competing theories regarding the effects of gentrification. McDonald (1986) characterizes gentrification as "the apparent revitalization of central city private housing markets". An important distinction that must be made in that definition is the existence of a population shift. Simply upgrading the housing supply by long-term residents does not qualify as gentrification. There has to be a movement of middle and upper-class people into what was formerly a predominately lower-class neighborhood.

While it may seem that this 'revitalization' will be a positive influence on neighborhoods, the theory is not so cut-and-dry. In Fairmount, a neighborhood of Philadelphia that previously had strong ethnic bonds, upper class residents with different cultural norms moved in and led to direct conflict escalating into violence with the lower class, long-term residents (McDonald, 1986, p. 167). That being said, this is usually rare because of how strong the ethnic and cultural bonds need to be. A potpourri of different cultures living together simply because of lower housing costs is not enough for this to occur. Rather, it is more in line with the districts of Chinatown and Little Italy in New York City.

McDonald (1986) outlines five potential reasons why crime rates drop with gentrification and four potential reasons why they might rise, along with one reason why it might stay stagnate. The reasons they might drop are as follows: (1) affluent neighborhoods have, on average, less crime than impoverished neighborhoods, (2) revitalization at the hands of the new residents can "pull up" instead of "push out" the former residents, (3) new residents are more cognizant of the crime problem and establish initiatives to combat crime, for example, the neighborhood watch, (4) affluent residents usually have more political influence which leads to more funding devoted to the police department, more stringent stances on crime, etc., and

(5) the displacement of the poor residents can lead to the individuals responsible for committing the crimes to be displaced. Reason five is what gets at the heart of gentrification and is directly related to, if not the cause of, reason one. Reasons two, three, and four are periphery causes of the drop in crime, at least in the context of a model of gentrification.

On the other hand, McDonald (1986) also gives several reasons why gentrification might not lead to a decrease in crime: (1) when individuals are displaced, they may only be displaced to adjacent blocks or neighborhoods which hardly prevents them from committing crime in their old neighborhood, especially with an influx of attractive targets, (2) if gentrification is drawn out over a long period of time, there will be a very apparent income-gap between residents which suggests an increase in violent crime, (3) gentrification in 'cohesive ethnic neighborhoods' rather than 'disorganized ghetto neighborhoods' may lead to the breakdown of natural order in the communities, (4) gentrification can cause community conflicts which, on some occasions, results in criminal activity, and (5) it may not have any effect at all. Most of these theorized effects occur at the onset of gentrification. As time goes on, it appears that the end-result of a fully gentrified neighborhood will have lower crime rates.

Much research use case-studies to look at individual neighborhoods (McDonald, 1986; O'Sullivan, 2005; Kreager et al, 2011). This paper is different in that it examines the city-wide effect of gentrification. By using data from every neighborhood in a city, regression analysis can be employed to explore the effects of gentrification. Unfortunately, by not focusing on specific neighborhoods, this paper cannot examine the specific reasons gentrification affects crime rates. Instead, it will focus on the gentrification process as it permeates throughout a city.

This paper employs location theory to look at the general effects of gentrification on crime. Location theory states that in a completely un-gentrified city, the city center is high in crime with a low income residential population while the suburbs around the city with low crime rates are populated by higher income people who commute into the city. O'Sullivan's (2005) model of location theory holds that as the cost of travel into the city center goes up and the cost of security in the city center goes down, the higher income people will move into the center of the city to take advantage of the cheap housing and low travel costs. As the higher income population moves in, they push out the lower income population and the crime rate should fall further due to a variety of factors that McDonald covered previously. The lower income population gets pushed out because while they also value the low travel expenses that are a result of living close to the center of the city, the higher income population is able to outbid the lower income population in order to take advantage of the convenience. The lower income population will be pushed out, starting from the center, to the edges of the city. Once the gentrification process is complete, they will ultimately move elsewhere. Rising travel costs for the upper income population in addition to less crime in the center of the city, based on location theory's explanation of gentrification, will ultimately lead to higher housing costs and a further reduction of crime.

A Granger-causality Test is used in order to examine the relationship between gentrification and crime. A Granger Test attempts to show causality between two variables, although it is closer to an inference than a conclusive finding. The idea behind the Granger Test is that if an independent variable 'X' combined with lags for a dependent variable can give a better estimate of the dependant variable 'Y' than just the lags, X is said to have 'Granger-caused' Y. Specifics of running the test will further be explored in the outline of the empirical model.

The hypothesis states that gentrification will Granger-cause crime rates to go down, at least in Washington, D.C, but crime rates will not Granger-cause gentrification. While location theory holds that both the crime rates are going down as well as travel costs are going up which causes gentrification, this study examines if D.C. is a unique case. Washington, D.C. has the second worst traffic among US cities (Weather.com). Washington D.C. is a high commuter city with the limited upper class neighborhood options concentrated in a very small area. A large population works in Washington D.C. but commutes every day, as evidenced by the fact that the population of Washington D.C. almost doubles during the workday according to the 2000 Census. This study, therefore, has important policy implications for the city of Washington D.C. If gentrification is a socially desirable outcome, it would be beneficial for the government in Washington D.C. to allow travel costs to rise to encourage gentrification. On the other hand, if gentrification is undesirable, it would be more efficient to subsidize travel so that the upper income population stays in the suburbs and does not displace the lower income population in the city.

In the context of this study, it is possible for crime to Granger-cause gentrification just as gentrification Granger-causes crime. If this occurs, this study will be forced to conclude that the two variables are working simultaneously and the causal factors cannot be brought out. If neither gentrification nor crime Granger-cause the other, then the two variables are unrelated.

## III. DATA

This study uses data directly from the Metropolitan Police Department's (MPD) Research and Analysis Branch. Washington D.C. has several different divisions including quadrants (NW, SE, etc.), wards (1-8), police districts (1-7), and police service areas (PSAs) (within each police district). Quadrants, police districts, and wards are all too large areas to approximate the effect of individual neighborhoods. Another problem is there are not enough data points to get significant results. Even with wards, 8 wards and 6 years (2004-2010) only yield 48 observations. Because of the Granger-causality Test, lagging variables take even more observations away. Therefore, this study uses PSAs, both to combat a small sample size and to attempt to get at neighborhood differences. Ideally, this study would examine data going back to 1995, or when the crack epidemic of the late 1980s and early 1990s was winding down. Unfortunately, MPD was not comfortable releasing data prior to 2004 due to reporting and geographic inconsistencies. In order to get the prior data, a FOIA request is necessary, which leads to a natural continuation of this research. Going back to only 2004 will yield a large enough sample size to conduct a regression analysis, but it is unlikely to show as strong of a correlation between crime and gentrification. Because gentrification is a process, only six years might not be enough to show the process happening.

This study also uses data from a website called NeighborhoodInfoDC.com which is a source that pulls together data from a variety of sources including the DC Department of Human Services and the D.C. Office of Tax and Revenue's Real Property Tax Administration's real property database. From this website, the average property values as well as Temporary Assistance for Needy Families (TANF) for each individual PSA will be used. Property values are used as a proxy for one side of gentrification: the upper class residents moving in. TANF will be used as a proxy for the other side of gentrification: the lower classes moving out. TANF is a means-tested government subsidy so the more individuals receiving TANF implies that there is a higher population of poor people. If gentrification is occurring, an increase in housing prices, accompanied with a fall in individuals receiving TANF, will show that crime rates are falling.

In 2004, Washington, D.C. redrew the lines for the Police Service Areas. Unfortunately, the data from the Metropolitan Police Department were coded for the post-2004 PSAs while the data from NeighborhoodInfoDC.com were coded for the pre-2004 PSAs. While this certainly detracts from the credibility of the data, it does not completely undermine the study. The police districts have not changed. So while the districts may have been slightly different, the neighborhoods still have much overlap. The biggest issue is that in the redistricting, two new PSAs were created. Because this study cannot accurately redistribute the crime data from the new PSAs to the old ones, those data points have been omitted. Due to the same overall police districts and the two omitted PSAs, there should not be significant errors in the analysis.

Due to the limited scope of this project, the effect of traffic will not be examined. While it is an important effect with regards to location theory, the other half of the location theory still warrants a treatment. An increase in housing prices implies that there is a higher demand for houses in neighborhoods with high crime rates, which accounts for the gentrification. In addition, looking at the effects of gentrification (the smaller number of lower income people proxied by the TANF measure) can also be fruitful. A continuation of this paper would incorporate traffic and attempt to show that traffic Granger-causes gentrification, although the exact method for conducting that test is not overtly apparent.

## IV. EMPRICIAL MODEL

The empirical model in this paper follows the Granger-causality Test. Two separate Granger-causality tests will be run: one with housing as the independent variable and the other with TANF as the independent variable. To begin, an Ordinary Least Squares (OLS) regression is run to see the correlation between the dependent variable (crime) and the independent variables (housing or poverty), as well as a variable for lagged crime. The number of violent crimes related to the city-wide mean will be CRIME. HOUSE is the median house price for the individual PSA. TANF is the number of individuals receiving the subsidy as related to the city-wide mean. This takes the following form:

$$CRIME = ß_0 + ß_1 HOUSE + ß_2 CRIME_{t-1}$$

Next, the variable 'HOUSE' is removed yielding the following equation:

$$CRIME = ß_0 + ß_1 CRIME_{t-1}$$

Finally, a Wald test is done between the two regressions. The first equation with housing included is the unrestricted model. The second model with the HOUSE variable omitted is the restricted model. An F-test is then run to determine if the omission of HOUSE had a statistically significant effect on the prediction of CRIME. The F-statistic is as follows:

$$F = \frac{(ESS_R - ESS_U)/(DF_R - DF_U)}{ESS_U/DF_U}$$

Where ESS is the Error Sum of Squares for the respective restricted and unrestricted models and DF is the Degrees of Freedom for the respective restricted and unrestricted models. If the F-test is significant, then it can be said that HOUSE 'Granger-caused' CRIME.

The test then needs to be run again to determine if CRIME 'Granger-causes' HOUSE. It will look exactly the same as the first Granger-causality Test except the initial setup will look as follows:

$$HOUSE = ß_0 + ß_1 CRIME + ß_2 HOUSE_{t-1}$$

$$HOUSE = ß_0 + ß_1 HOUSE_{t-1}$$

The F-test is then run to determine if CRIME 'Granger-caused' HOUSE. The hypothesis is HOUSE will 'Granger-cause' CRIME to fall but CRIME will have no effect on HOUSE in terms of Granger-causality. This is in accordance with the location theory as previously articulated.

The previous test is then run again with the variable TANF in place of the variable HOUSE. Equations 1 to5 are followed and the methodology is exactly the same.

## V. RESULTS

In order to simplify the Granger-causality Tests, only one variable at a time is introduced . This results in two separate Granger Tests, one for housing prices and the other for TANF. These two tests get at both sides of the gentrification process: the former is a proxy for the upper income residents moving in and the latter is a proxy for the lower income residents moving out.

To start, two regressions are run: the first regression is HOUSE on CRIME and the second regression is TANF on CRIME. This is done to check both the coefficients and the signs. As a Granger Test only examines Granger-causality, the coefficients and signs are irrelevant. Table 1 shows the first regression with HOUSE is significant at the .01 level, has the correct sign, and a coefficient of -.287. Table 2 shows the second regression with TANF also is significant at the .01 level, has the correct sign, and a coefficient of .150. The reason for running the two regressions separately was that the variables have high multicollinearity. Since both housing prices and TANF numbers are directly related (lower income residents have lower housing prices), including both HOUSE and TANF in the same regression with crime is not productive.

Table 3 shows the first Granger Test examined, CRIME and HOUSE. As previously explained, HOUSE and $CRIME_{t-1}$ are regressed on CRIME in the unrestricted model. Then, $CRIME_{t-1}$ is regressed on CRIME in the restricted model. The resulting F-value comparing the restricted and the unrestricted models is 39.94 which is statistically significant at the .01 level. Next, CRIME and $HOUSE_{t-1}$ are regressed on HOUSE. Then, CRIME is taken out and $HOUSE_{t-1}$ is regressed on HOUSE. The resulting F-value is 102.68, which is also statistically significant at the .01 level. From these results, HOUSE Granger-causes CRIME and CRIME Granger-causes HOUSE.

Table 4 shows the second Granger Test which repeats the above test, this time examining the relationship between TANF and CRIME. The unrestricted model involves regressing TANF and $CRIME_{t-1}$ on CRIME while the unrestricted model excludes TANF and only has a regression of $CRIME_{t-1}$ on CRIME. The resulting F-value was 36.6, which is statistically significant at the .01 level. The process is then reversed with CRIME and $TANF_{t-1}$ having a regression on TANF in the unrestricted model. CRIME is then excluded from the restricted model and the resulting F-value was 6.3, which due to the high sample size is significant at the .01 level. From this, it can be shown that TANF Granger-causes CRIME and CRIME Granger-causes TANF.

## VI. CONCLUSIONS

From the results, the effects of gentrification can clearly be seen. The individual regressions show that an increase in housing price and a decrease in the number of poor people will each lead to a decrease in crime. That being said, the goal of this project is not to merely

note the existence of gentrification. Rather, it is to show a potential causal relationship between the proxies for gentrification and the effects of the gentrification.

The two Granger Tests yielded the same result: both examined variables Granger-caused the other. This essentially means that the variables influence each other, preventing any causal conclusions from being drawn. While there is no one way Granger-causality, these results still allow some inferences to be made.

It is worth looking at the TANF Granger Test a little more closely. The F-statistic for the first half of the Granger Test to determine if TANF Granger-causes CRIME was 36.6, which is statistically significant at the .01 level. The F-statistic for the second half of the test was merely 6.3, but is also statistically significant at the .01 level due to the large sample size. Because the F-test is designed to examine the difference between two regressions, the large difference in magnitude between the two F-statistics may lead one to believe that there is a difference. While conclusions cannot be drawn given that they are both statistically significant, it appears that TANF may Granger-cause CRIME to a higher degree than CRIME Granger-causes TANF.

One possible reason why no conclusive Granger-causality results were drawn is that the data only went back to 2005. Because the Metropolitan Police Department did not grant access to earlier data, the entire process of gentrification could not be examined. One important aspect of gentrification on a city-wide level is that it is an ongoing process. In Washington, D.C., the process started in the early 1990s with the end of the crack epidemic. Without including almost a decade's worth of data, it is hardly a surprise that the results are not exactly what are expected. Once the entire gentrification process is contained in the data, the results might be more in line with what is hypothesized.

Even without Granger-causality one way or the other, this study still has merit. In short, it served as a confirmation of one side of location theory. A fall in crime rates does lead to the occurrence of gentrification. While the traffic side has not been accounted for, it is an area for additional research. Washington, D.C., at least according to the results in this study, is simply another example of location theory at work.

Unfortunately, without any Granger-causality to build from (aside from the weak inference with the TANF results), it is not as easy to make policy implications. That being said, this information can be useful for city planning. If gentrification is a desired outcome, governments should allow traffic costs to rise (assuming the traffic side of location theory still holds) as well as combating crime in the inner-city. This brings up an entirely new debate, however, about whether or not gentrification is, in fact, desired. There is a difference between pushing lower income people out and pulling them up into a better social standing. It appears that gentrification is guilty of the former, although this area deserves more research. If this is the case, it is difficult to see gentrification as anything more than a geographic redistribution of the indigent; a hardly desirable outcome when it comes to social justice.

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## VIII. APPENDIX

| Table 1: Preliminary Housing Regresion | | | |
|---|---|---|---|
| Vairable | Explanation | Coefficient | Significance |
| Dependent Variable | | | |
| CRIME | Number of crimes in a given year | | |
| Independent Variable | | | |
| HOUSE | Median house sale for a given year | -.287 | -.2900(***) |
| Adjusted $R^2$ | .030 | Sample Size | 243 |

| Table 2: Preliminary Temporary Assistance for Needy Families Regression | | | |
|---|---|---|---|
| Variable | Explanation | Coefficicent | Significance |
| Dependent Variable | | | |
| CRIME | Number of total crimes in a given year | | |
| Independent Variable | | | |
| TANF | Number of individuals receiving Temporary Assistance for Needy Families | .150 | 6.627(***) |
| Adjusted $R^2$ | .143 | Sample Size | 257 |

| Table 3: HOUSE Granger Test | | |
|---|---|---|
| Variable | Unrestricted | Restricted |
| HOUSE | -.009 (-.396) | |
| CRIMEt-1 | .974 (64.971)*** | .975 (71.994)*** |
| Error Sum of Squares | 1632386 | 1953531 |
| Sample Size | 206 | 257 |
| F-Statistic | 39.94*** | |
| CRIME | -.012 (-1.346) | |
| HOUSEt-1 | .966 (64.014)*** | .959 (58.928)*** |
| Error Sum of Squares | 598383 | 907136 |
| Sample Size | 201 | 207 |
| F-Statistic | 102.68*** | |

| Table 4: TANF Granger Test | | |
|---|---|---|
| Variable | Unrestricted | Restricted |
| TANF | .013 (2.230)** | |
| CRIMEt-1 | .964 (64.240)*** | .975 (71.994)*** |
| Error Sum of Squares | 1673740 | 1953531 |
| Sample Size | 220 | 257 |
| F-Statistic | 36.6*** | |
| CRIME | -.043 (-2.460)** | |
| TANFt-1 | .999 (144.045)*** | .993 (160.756)*** |
| Error Sum of Squares | 2071699 | 2132402 |
| Sample Size | 215 | 224 |
| F-Statistic | 6.3*** | |

# An Analysis of the Relationship Between Employment and Crime

**Deepak Mallubhotla**

## I. INTRODUCTION

The relationship between aggregate unemployment rates and the incidence of crime has been frequently analyzed (Cantor and Land, 1985; Bennett, 1991; Bushway, 2011). However, the result of this analysis has been inconsistent. This discrepancy could be related to the inconsistent application of both economic and sociological theory, as well as several methodological issues with previous research and literature (Bennett, 1991). Becker's 1968 paper describes crime as an individual decision made based on potential loss and gain. However, many prior analyses examine aggregate data, masking changes in individuals' situations behind aggregate numbers.

The importance of predicting crime for law enforcement and public policy can have a large significance and magnitude on informed decisions. This can both reduce the cost of law enforcement and increase the efficiency of anti-crime measures.

Potential criminals include their own situations in their decision-making processes. In order to examine how changes in situation affect changes in crime rates, it is necessary to look at time series data to see the subject's response to changes. The longitudinal nature of time series analysis also allows for comparison between individuals. As a result, it is possible to make general statements about responses to economic conditions.

NLSY97 data was examined to see whether employment variables predict crime, with employment represented by both income and the number of weeks worked. Theory predicts that there are lagged effects of employment on crime, which is why both lagged and unlagged cases are examined. In order to validate the assumption that changes in employment cause changes in crime, rather than the other way around, the impact of lagged crime on employment variables is also tested. Employment is found to have a significant effect on crime, although the theory fails to explain the lagged effects of employment measures.

## II. THEORY & LITERATURE REVIEW

Many of the economic theories of criminal activity draw from Becker's 1968 paper, analyzing crime as the result of rational choice. In his model, individuals consider the expected benefit of crime, taking into account the chance of success and the possible monetary gain. If the expected benefit is greater than the expected cost, which takes into account the chance of failure and the cost of being punished, the individual will commit a crime.

The expected benefit of crime depends on a variety of factors. For crimes such as theft or burglary, there is usually a clear monetary gain. However, the utility gained from many types of violent crime, including rape and murder, is usually not measurable. The expected benefit of crime should also depend on income and wealth; money has diminishing marginal effects on utility, so people with higher wealth or income benefit comparatively less from the same amount of capital.

The costs of crime offer a more direct relationship between employment status and crime. In general, the cost of crime is its punishment and depends on the chance of being caught. The costs include any fines for the crime and the opportunity cost incurred by imprisonment. While in jail, a person cannot earn the wages they would have earned if not in jail. There may also be a loss in future wages. With a conviction on record, it is harder to find higher paying jobs, which means that past crimes can lead to lost wages well into the future (Barak, 2009). Often included in other studies is a measurement of the utility gained by being honest or the cost of being dishonest. Many individuals associate immorality with crime, and incur a "moral cost" by committing a crime (Bourguignon, 2003).

If unemployed, a person earns no wages, and so loses no wages if in jail. This decreases the opportunity cost of committing crime. Additionally, if a person's wealth decreases while unemployed, the same financial benefit from a crime will have greater relative value. Both effects lead to a higher chance of committing crime.

Cohen and Felson (1979) predict additional effects on crime from unemployment. They base their theory around the idea that individuals tend to fall into routines. According to them, individuals who have fallen into routines while employed tend to stay in their routines immediately after losing employment. According to the routine activities theory, routines take a certain amount of time to change. Instead of changing their habits, Cohen and Felson claim that they the recently unemployed will tend to draw on savings for a short period of time to perpetuate their old routines while first unemployed, without changing their behavior. If conditions while unemployed are favorable for committing crimes, individuals will commit crimes only after taking time to break routines. Routine activities theory thus suggests that there is a lagged effect of unemployment on crime.

Christenson and Thornberry (1984) point out that it is important to also consider reciprocal effects. As mentioned above, committing a crime can make it more difficult to procure employment in the future. This not only increases the expected cost of current crime, decreasing crime rates, but also leads to lagged effects of crime on employment. Without testing for reciprocal effects, conclusions assuming the changes in crime could occur before changes in employment are invalid.

Theory predicts that both the number of weeks worked and income should correlate negatively to the probability that an individual commits a crime. Routine activities theory predicts that this correlation should be lagged. It is important to separately test for reciprocal effects, as they influence the validity of the forward relationship between employment measures and crime.

## III. EMPIRICAL MODEL

By using longitudinal data, we can account for each individual's characteristics by looking at the likelihood of committing a crime changes over time. The NLSY97 has longitudinal data for a many individuals that include self-reported crimes and information about employment. In order to simplify the analysis, only three types of crime are examined: destruction of property, theft both above and below 50 dollars, and assault. The survey question about assault focuses on fights, which are more likely to offer a financial benefit than other types of violent crime, such as murder or rape. As Land (1985) finds, purely violent crimes such as murder or rape respond differently to changes in economic variables than other types of crime, partly because these crimes usually offer a psychological benefit, rather than a financial one. As a result, no other violent crimes are analyzed.

Self-reported crime data tends to underestimate the number of crimes committed (Mosher, et. al, 2002). Minor offenses are particularly liable to being under-reported; the inclusion of thefts below 50 dollars could skew the data. This problem is difficult to avoid for longitudinal data, as surveys rely on self-reported information.

When analyzing the chance of an individual committing a crime based on their current economic situation, the total number of crimes isn't as relevant as whether or not a crime was committed at all. If conditions make crime favorable, individuals should commit crimes as long as they continue to offer a net benefit. As a result, we look solely at whether or not an individual committed a crime in the survey year. This leads to a binary dependent variable. Although subjects tend to underestimate the number of crimes committed, they are more likely to accurately answer binary questions about crime (Mosher, et. al, 2002).

Income per week is included to take into account the potential opportunity cost of time in prison, as well as the lower relative benefit from committing crimes. Both effects should lead to a negative correlation between income and crime. The amount of employment is measured by the number of weeks worked each year. This doesn't discriminate between full-time and part-time workers. However, the amount of work per week is reflected in weekly income. These variables collectively represent employment.

Several other variables can also impact crime rates and are important to control for. As many authors have shown (Shelley, 1981), age has a strong negative impact on crime rates, an effect that is separate from correlations between age and other variables. Because age is known to have non-linear effects on crime (Shelley, 1981), age squared is included as well. Education is also measured. The subject's highest degree is used to

measure education, even if the survey year is before the subject obtained the degree. In these cases, the highest degree variable serves as a proxy for educational achievement, ranging from a high school education to a PhD, omitting the case of no high school or high school equivalent degree.

Because the dependent variable is a binary variable, a logistic regression model is used. The relationship is assumed to be multiplicative, as in Equation 1.

$$P = Emp*Income*ß$$

Here, P represents the odds of an individual committing a crime, Emp is the number of weeks employed and Income is income per week. The variable ß represents the product of other factors. Taking the logarithm, the following regression equation is created, Equation 2.

$$\ln P = \alpha\_0 + \alpha\_1 \ln Emp + \alpha\_2 \ln Income + \alpha\_3 Age + \alpha\_4 Age^2 + \alpha\_4 Female + \sum_i y_k HighestDegree_i$$

Here, the $\alpha_k$ represent the coefficients for the different variables. The $y_k$ represents the coefficients for the collection of education dummy variables Highest $Degree_i$.

The logarithmic nature of Equation 2 makes the equation focus on the multiplicative assumption in Equation 1, which is equivalent to the assumption that the equation is linear in the proportional changes of the variables. This suggests that Equation 2 measures the individuals' responses to changes in variables. As a result, dummy variables are unnecessary for each individual in Equation 2.

Some survey questions are phrased in terms of the calendar year before the interview, while others are based on the duration since the last interview. Subjects who missed survey years are likely to report data with different scopes, making the data meaningless. In order to avoid these errors, all missing years and cases following missing years are excluded from the analysis.

In order to measure the lagged effect of employment variables on crime, another regression is run. According to the routine activities theory mentioned above, there should be a lagged effect of income and weeks worked on crime. As Thornberry and Christenson mention (1984), there are also reciprocal effects to consider. However, using unlagged crime rate variables to test such effects is mathematically a re-arrangement of the regression in Equation 2. In order to measure the reciprocal effects, regressions are run to measure the impact of crime on future economic variables by lagging the crime variable. Equation 3 shows the regression equation for the number of weeks worked.

$$WeeksWorked = [(\alpha+ß)]\_0 + LagCrimeInYear + ß\_1 Age + ß\_2 Age^2 + ß\_3 Income + ß\_4 Gender + \sum\_i y\_i HighestDegree\_i + ß\_5 LagWeeksWorked$$

These regressions are simple linear regressions. They are run for both the length of employment and weekly income. The other variables are included for the same reason as in the first set of regressions. Income and WeeksWorked are lagged in their own regressions, and unlagged in the others. Including a lagged dependent variable as an independent variable for time-series data reduces autocorrelation. Along with variables like education and age, income can be seen as a measure of productivity, which influences the length an individual, is hired. If productivity is taken to explain the length of employment, then the length of employment cannot be used in the regression for productivity, as it gives no new information. Equation 4 shows the income regression.

$$Income = [(\alpha+ß)]\_0 + LagCrimeInYear + ß\_1 Age + ß\_2 Age^2 + ß\_3 Gender + \sum\_i y\_i HighestDegree\_i + ß\_4 LagIncome$$

Table 1 gives some descriptive statistics for the data. The ages range from 13 to 30, with every subject within a couple years of the same age. For both WeeksWorked and income earned, the means are decreased by the number of cases with no reported employment.

## IV. RESULTS

Table 2 presents the results of the unlagged crime regression. The coefficients are the log odds ratios for each independent variable. As expected, both the number of weeks worked and employment show a significant negative relationship with the likelihood of committing a crime. Because the regression is run in log terms, the magnitudes of the coefficients represent the powers of the terms multiplied. More importantly, the significance of the coefficients points to a multiplicative relationship between these independent variables and crime rates. To interpret the log odds ratio, the coefficient is exponentiated, yielding the odds ratio,

which is then converted to a probability.

The odds ratio for number of WeeksWorked means that for an increase by a factor of e in the number of weeks worked, the odds of committing a crime decrease by 10 percent, meaning that the individual is 2.4 percent less likely to commit a crime. Similarly, when income increases by a factor of e, the individual's chance of committing a crime decreases by around 2.2 percent compared to even odds. This comparison to even odds represents the exponentiation of the odds ratio mentioned earlier. However, the change in probability for a given change in odds is nonlinear, and so the comparison to even odds serves only as an illustrative tool.

Because there is a finite number of weeks in a year, there is a limit to how low weeks worked can decrease the odds ratio for committing a crime. Compared to an identical individual with no employment in a year, an individual with 52 weeks worked will be around 10 percent less likely to commit a crime. Given the cost required to employ someone throughout the year, this is a relatively small decrease in crime rates.

The education dummy variables are generally as expected, with more education leading to lower crime, with two exceptions. The variables range from a GED, the first case, to a professional degree, the seventh case, which omits the case of no GED and no high school. Subjects with a PhD and subjects with a GED show a higher chance of committing a crime than those without degrees, which contradicts the hypothesis that education leads to higher crime. The result for doctorates is small and very insignificant, which makes sense given that there are very few individuals in the study with a highest degree of a PhD. However, the results for GEDs are significant to the .05 level. There are many possible explanations for this: individuals who took the time to get a GED could be the same individuals who are more willing to take risks for economic gain, for instance. For the other education levels, the results make sense: as education level rises, the chance of committing crime drops.

The age results also support Shelley's empirical findings (1981). As discussed above, age should have a negative, but diminishing, effect on crime rates. The results show a strong negative impact of age on crime; however, age squared shows a slight, but significant, positive correlation with the chance of committing crime. This nonlinear term, although small, significantly reduces the marginal effect of age for the ranges of ages in the study. Theoretically, the turning point at which the nonlinear effects dominate and higher age leads to more crime is around 26 with the data given. However, this is unreliable simply because of the limited age range of the study. With a highest age of 30, there are too few points above the age of 26 to make a claim about a turning point; however, it is notable that a turning point was seen at all, and gives opportunity for further analysis with larger data sets.

Gender also has a significant coefficient, showing that women are less likely to commit crimes. Compared to even odds, the probability of committing a crime decreases by more than .13 for women, an effect that supports other criminological research (Shelley, 1981).

Table 3 contains the regression results for the model with only lagged employment variables included. Most of the coefficients are similar to those obtained from the first regression. However, the lagged income and lagged number of WeeksWorked variables both correlate positively to crime. As mentioned by Shelley (1981) and Cohen and Felson (1979), this could be because individuals compare their current position to past positions, and once an individual has been more successful, they are willing to take greater risks to continue their success.

Table 4 summarizes the regression with both the lagged and non-lagged cases. The same patterns seen earlier are seen here as well. The impact of age on crime is much larger, while the coefficient for gender is smaller.

Compared to the first and second regressions, the coefficients for the employment variables are greater in magnitude. This can be interpreted in a variety of ways. The positive sign of the lagged variables suggests that to a certain extent, the amount that an individual's income or employment has improved within a year plays a role in determining when to commit crime.

The results for the reciprocal effects are summarized in Tables 5 and 6. For the regression with only lagged crime rate, we see that most coefficients have the expected sign. As expected, as age increases the number of weeks worked increases as well. Diminishing returns for age suggest that age squared should reduce the impact of age, with a coefficient with the opposite sign. Age squared here has a slight but significant negative effect, as expected. The education dummy variables all have positive effects, but interestingly, higher education

has less of a positive impact than an associate degree or junior college.

As can be seen, lagged crime rates have a negative impact on the number of weeks worked. However, this effect is both small, and statistically insignificant. This suggests that crime does not have a strong lagged effect on employment.

Table 6 summarizes the results for the income regression. For income per week, crime has an even smaller, statistically insignificant effect. The same is true for unlagged crime: the effect is relatively small and insignificant. This suggests that the result obtained by Thornberry needs to be revisited, as the effects of crime on employment and wages are small.

## V. CONCLUSIONS

As expected, employment correlates negatively to crime. Assuming that this relationship is a causal relationship, this suggests that increasing employment leads to lower crime rates. Because the relationship is logarithmic, the effect has diminishing marginal returns, meaning that increasing employment is most effective for individuals who are unemployed or have little employment. The same is true for income.

The results support Becker's rational choice theory. However, for the lagged variables, the effect is positive, and fails to show evidence for routine activities theory, which claims that Becker's predicted negative effect would be lagged. The positive effect observed is statistically significant. Moreover, the effect's magnitude increases when the unlagged variables are included as well, suggesting that, to a certain degree, the difference between current and past employment status is an important determinant of crime. This could be because of the importance of comparison for individuals: the routine activities theory describes a necessary lag in time for routines to be broken, but, rather than the change of routine, the change in lifestyle necessitated by changes in employment may be more relevant.

For the reciprocal effects described by Thornberry (1984), the results are mixed. The effects of crime on the number of weeks worked and on weekly income are both small and statistically insignificant. This suggests that the relationship is more complex than the description of either routine activities theory or the reciprocal effect theory.

Shelley (1981) mentions that given the complexity of the causes of crime, it is impossible to come up with coherent prediction. However, Becker's rational choice theory remains well supported by the evidence, which justifies its continued use (Levitt and Miles, 2006) in analyzing crime.

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## VII. APPENDIX

**Table 1: Descriptive Statistics**

| | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|
| AnyCrimesinYear | 0 | 1 | .19 | .389 |
| WeeksWorked | 0 | 60 | 24.84 | 21.035 |
| IncomePerWeek | 0.00 | 44091.00 | 223.6962 | 814.42017 |
| HighestDegree | 0 | 7 | 2.21 | 1.375 |
| Gender | 1 | 2 | 1.47 | .499 |

**Table 2: Unlagged Employment**

| B | S.E. | Wald | df | Sig. | Exp(B) | |
|---|---|---|---|---|---|---|
| LnWeeksWorked | -.159 | .025 | 39.649 | 1 | .000 | .853 |
| LnIncomePerWeek | -.063 | .016 | 14.608 | 1 | .000 | .939 |
| HighestDegree | | | 140.047 | 7 | .000 | |
| HighestDegree(1) | .196 | .075 | 6.735 | 1 | .009 | 1.216 |
| HighestDegree(2) | -.165 | .065 | 6.344 | 1 | .012 | .848 |
| HighestDegree(3) | -.180 | .089 | 4.065 | 1 | .044 | .835 |
| HighestDegree(4) | -.468 | .073 | 41.508 | 1 | .000 | .626 |
| HighestDegree(5) | -.540 | .117 | 21.127 | 1 | .000 | .583 |
| HighestDegree(6) | .059 | .389 | .023 | 1 | .879 | 1.061 |
| HighestDegree(7) | -.728 | .229 | 10.089 | 1 | .001 | .483 |
| Age | -.744 | .062 | 144.518 | 1 | .000 | .475 |
| Gender(1) | -.470 | .038 | 156.780 | 1 | .000 | .625 |
| AgeSquared | .014 | .001 | 94.939 | 1 | .000 | 1.014 |
| CrimeLastYear | 1.414 | .038 | 1361.635 | 1 | .000 | 4.111 |
| Constant | 8.400 | .615 | 186.763 | 1 | .000 | 4445.093 |

a. Variable(s) entered on step 1: LnWeeksWorked, LnIncomePerWeek, HighestDegree, Age, Gender, AgeSquared, CrimesLastYear.

| Table 3: Lagged Employment | | | | | | |
|---|---|---|---|---|---|---|
| B | S.E. | Wald | df | Sig. | Exp(B) | |
| LagLnWeeksWorked | .180 | .023 | 60.543 | 1 | .000 | 1.198 |
| LagLnIncomePerWeek | .213 | .013 | 254.126 | 1 | .000 | 1.237 |
| HighestDegree | | | 154.125 | 7 | .000 | |
| HighestDegree(1) | .141 | .075 | 3.559 | 1 | .059 | 1.151 |
| HighestDegree(2) | -.284 | .064 | 19.885 | 1 | .000 | .753 |
| HighestDegree(3) | -.365 | .090 | 16.555 | 1 | .000 | .694 |
| HighestDegree(4) | -.522 | .072 | 53.331 | 1 | .000 | .593 |
| HighestDegree(5) | -.737 | .121 | 37.354 | 1 | .000 | .478 |
| HighestDegree(6) | -.355 | .475 | .559 | 1 | .455 | .701 |
| HighestDegree(7) | -.638 | .221 | 8.365 | 1 | .004 | .528 |
| Age | -1.084 | .054 | 403.658 | 1 | .000 | .338 |
| Gender(1) | -.373 | .038 | 97.190 | 1 | .000 | .689 |
| AgeSquared | .020 | .001 | 228.190 | 1 | .000 | 1.020 |
| CrimeLastYear | 1.688 | .043 | 1561.462 | 1 | .000 | 5.411 |
| Constant | 10.326 | .578 | 319.232 | 1 | .000 | 30524.587 |
| a. Variable(s) entered on step 1: LagLnWeeksWorked, LagLnIncomePerWeek, HighestDegree, Age, Gender, AgeSquared, CrimeLastYear. | | | | | | |

| Table 4: Unlagged and Lagged Employment | | | | | | |
|---|---|---|---|---|---|---|
| B | S.E. | Wald | df | Sig. | Exp(B) | |
| LagLnWeeeksWorked | .259 | .036 | 52.845 | 1 | .000 | 1.296 |
| LagLnIncomePerWeek | .261 | .020 | 173.035 | 1 | .000 | 1.298 |
| LnWeeksWorked | -.300 | .039 | 60.439 | 1 | .000 | .741 |
| LnIncomePerWeek | -.186 | .025 | 53.755 | 1 | .000 | .830 |
| HighestDegree | | | 85.394 | 7 | .000 | |
| HighestDegree(1) | .002 | .106 | .000 | 1 | .985 | 1.002 |
| HighestDegree(2) | -.377 | .091 | 17.180 | 1 | .000 | .686 |
| HighestDegree(3) | -.496 | .122 | 16.540 | 1 | .000 | .609 |
| HighestDegree(4) | -.602 | .099 | 36.586 | 1 | .000 | .548 |
| HighestDegree(5) | -.755 | .156 | 23.561 | 1 | .000 | .470 |
| HighestDegree(6) | -.587 | .578 | 1.031 | 1 | .310 | .556 |
| HighestDegree(7) | -1.136 | .311 | 13.325 | 1 | .000 | .321 |
| Age | -.970 | .088 | 121.764 | 1 | .000 | .379 |
| Gender(1) | -.355 | .051 | 48.502 | 1 | .000 | .701 |
| AgeSquared | .018 | .002 | 81.550 | 1 | .000 | 1.018 |
| CrimeLastYear | 1.742 | .053 | 1096.264 | 1 | .000 | 5.710 |
| Constant | 10.327 | .904 | 130.507 | 1 | .000 | 30551.427 |
| a. Variable(s) entered on step 1: LagLnWeeksWorked, LagLnIncomePerWeek, LnWeeksWorked, LnIncomePerWeek, HighestDegree, Age, Gender, AgeSquared, CrimeLastYear. | | | | | | |

Table 5

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | -69.281 | 2.500 | | -27.715 | .000 |
| | CrimeLastYear | -.257 | .190 | -.006 | -1.351 | .177 |
| | AgeSquared | -.148 | .005 | -1.325 | -27.898 | .000 |
| | IncomePerWeek | -.003 | .000 | -.140 | -32.567 | .000 |
| | Age | 7.763 | .233 | 1.593 | 33.386 | .000 |
| | KEY!SEX(SYMBOL)1997 | -.288 | .145 | -.008 | -1.992 | .046 |
| | GED | 1.218 | .297 | .024 | 4.106 | .000 |
| | High School | 4.826 | .248 | .142 | 19.422 | .000 |
| | Associate/Junior College | 6.348 | .355 | .094 | 17.875 | .000 |
| | Bachelor's | 4.719 | .277 | .112 | 17.064 | .000 |
| | Master's | 4.110 | .441 | .045 | 9.322 | .000 |
| | PhD | 2.060 | 1.923 | .004 | 1.072 | .284 |
| | Professional Degree | 1.028 | .844 | .005 | 1.218 | .223 |
| | LagWeeksWorked | .175 | .003 | .278 | 62.440 | .000 |

a. Dependent Variable: Weeks Worked

Table 6

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | -837.039 | 146.285 | | -5.722 | .000 |
| | CrimeLastYear | -2.329 | 11.394 | -.001 | -.204 | .838 |
| | AgeSquared | -.084 | .306 | -.015 | -.273 | .785 |
| | WeeksWorked | -8.097 | .266 | -.157 | -30.497 | .000 |
| | Age | 68.495 | 13.539 | .282 | 5.059 | .000 |
| | KEY!SEX(SYMBOL)1997 | -68.853 | 8.368 | -.041 | -8.228 | .000 |
| | GED | 46.472 | 17.255 | .019 | 2.693 | .007 |
| | High School | 106.984 | 14.594 | .064 | 7.331 | .000 |
| | Associate/Junior College | 156.113 | 20.653 | .047 | 7.559 | .000 |
| | Bachelor's | 99.585 | 16.192 | .048 | 6.150 | .000 |
| | Master's | 68.071 | 25.593 | .015 | 2.660 | .008 |
| | PhD | 91.678 | 107.206 | .004 | .855 | .392 |
| | Professional Degree | 16.854 | 49.480 | .002 | .341 | .733 |
| | LagIncomePerWeek | .047 | .005 | .043 | 8.592 | .000 |

a. Dependent Variable: IncomePerWeek

# The Effects of Temporary Immigrant Labor on the Information Technology Industry

**Katelyn Rowley**

## I. INTRODUCTION

Outsourcing is typically viewed as the process of shipping jobs overseas to another country so the job can be done by workers for a lower cost. However, there are many types of corporate restructuring that can fall under the broad scope of outsourcing. Wooster and Paul (2010) define outsourcing as sending in-house production to another company, which can achieve the same results at a cheaper price, whether domestic or overseas. This paper asserts that the immigration of temporary labor, such as the H-1B visa program, is yet another type of outsourcing.

This study specifically examines the Information Technology (IT) industry because the majority of the H-1B immigrants work in the IT industry (Kerr & Lincoln, 2010). The H-1B program was developed in 1990 and was a refinement of the H-1 immigration program. The H-1 program was created to allow individuals who show special merit or ability to perform temporary services to immigrate for a period of time. The H-1B program specified the requirements of these types of visas more definitely. This program places a cap on the number of immigrants allowed into the country each year, and specifies a six-year limit on the length an H-1B visa can be in effect. Many companies, specifically in the IT industry, have lobbied the government to expand the quota of H-1B visas every year since the cap was put into effect (Watts, 2001).

There are a significant number of H-1B immigrants who are employed through specific outsourcing companies upon which United States' companies then contract with for contract labor. According to Thibodeau & Machlis (2012), the top United States companies that employ H-1B immigrants are "offshore outsourcing companies", including Cognizant and Infosys, which each employ approximately 5000 H-1B immigrants who are then contracted out to other United States companies for specific jobs. The fact that most H-1B immigrants are not employed directly by the United States companies for which they are working, implies that there will be some discrepancy between the temporary immigrant workers and the native workers in terms of: types of jobs, wage rate, and job security. Therefore, this paper aims to study how the recession of 2008 affected the market for workers in the IT industry, specifically focusing on the number of jobs lost or retained by temporary immigrant workers compared with those of native workers.

## II. LITERATURE REVIEW

The H-1B program was developed in the 1990s, and little research has been done on the program or its effects on either the temporary immigrant workers or the native workers in specific industries. The literature reviewed for the purpose of this paper varies in many different ways. Some of the articles, such as Das et al. (2012), look specifically at a comparison of immigrant labor and outsourcing of jobs. Other papers, such as Zavodny (2003), focus more on the problem this paper aims to analyze. This paper focuses on the idea of using immigrant labor compared to outsourcing, while taking into account the view that temporary immigration is an aspect of outsourcing.

It is important to examine why firms decide to outsource production to another firm, either domestically or offshore. Paul and Wooster (2010) investigate this specific decision. Typically, firms find a way to produce the same products either at a cheaper price or more efficiently. However, recently with the addition of the H-1B visa program, businesses are finding a niche where they can produce at cheaper prices while keeping jobs in the United States. Thibodeau and Machlis (2012) argue that offshore outsourcing companies employ the majority of H-1B users in the United States. The source they cite is the United States Citizenship and

Immigration Service (2012), which is the government organization that controls the application process for these companies to employ H-1B visa to immigrants. The niche these outsourcing companies are now able to fill with the H-1B visa program is allowing them to become the "major beneficiary of the H-1B program" (Thibodeau & Machlis, 2012, p. 1).

Paul and Wooster (2010) assert that because the IT industry is so competitive and operates in an "environment where continuous innovation is crucial," (p. 300) the need to outsource is greater than in other industries. According to Thibodeau (2010), Congress increased the scope of the H-1 program in 1990 "in response to warnings of an emerging 'skills gap' or 'skills mismatch' among United States engineering and technology professionals" (p. 1). Kerr and Lincoln found that "science and engineering and computer-related occupations account for approximately 60 percent of H-1B admissions" (2010, p. 474). This paper focuses on the IT industry to analyze the effects the H-1B program has on both the temporary immigrants and the native workers because IT was one of the industries that this program was aiming to benefit.

Much of the literature that specifically studies the H-1B program focuses on what the H-1B program is as a whole and to articulate the reasoning behind the need for temporary immigrant workers. Julie Watts (2010) states that, "because the IT industry accounts for nearly one-third of the growth of the United States economy, and because IT has penetrated almost all sectors, a shortage of skilled IT labor threatens the global competitiveness of the entire United States economy" (p. 145). Kerr and Lincoln (2010) look at how the H-1B program has affected innovation on behalf of the native workers and the temporary immigrants. The authors assert that "total invention increased with higher admissions primarily through the direct contributions of immigrant inventors" (p. 504). The purpose of this paper most resembles Zavodny's study, The H-1B Program and Its Effects on Information Technology Workers. Zavodny (2003) examines the effect the temporary immigrants have on wages as a whole in the IT industry. However, her results do not support her hypothesis that an influx of H-1B workers will cause downward pressure on wages and ultimately lower wages in the entire IT industry.

The H-1B visa program and other similar programs, have both proponents and opponents. The primary argument against the H-1B program is that the immigration of temporary workers will take jobs away from United States workers. While on the other hand, the primary argument in favor of the H-1B program argues that the temporary immigrants are helping fill a void or shortage in skilled laborers specific to the IT industry. The majority of the literature on this topic explains the reasons for temporary immigrant labor or provides policy implications to either reduce or increase the number of temporary immigrant workers allowed in the country. The paper aims to contribute to this body of research by specifically looking at the effect that the business cycle has on both temporary immigrants and native workers in the IT market, after the temporary immigrants have entered the IT industry.

## III. THEORY

Zavodny's (2003) paper looks specifically into the topic of what effects an increase in H-1 B immigrants (due to an increase in the cap of H-1 B Visas) have on wages. Zavodny's study assumes that there is one labor market that includes the temporary immigrants, as well as the native workers. The main hypothesis of this study is that the influx of temporary immigrants who are willing to work at a lower wage will cause pressure on the entire labor market in the IT industry, ultimately lowering all wages. The study finds that the results do not support this hypothesis; wages did not in fact decrease during this time period (2003).

Zavodny's paper, in conjunction with the fact that the majority of H-1B visa immigrants are hired by outsourcing companies rather than directly by United States companies, as well as the temporary status of the immigrant workers, all lead to the conclusion that there seems to be a segmentation of the labor market between the temporary immigrants and the native workers. Therefore, the theory of a dual labor market in this situation seems to be the underlying theory that needs to be taken into account. A dual labor market means that there are two labor markets separated by some barrier (Reich et al., 1973). In this case, the temporary immigrants are in their own labor market, which is segmented from the labor market of the natives in the IT industry. These two labor markets have a barrier between them, which prevents mobility of labor;. Specifically, the temporary immigrant workers are hired by different companies (outsourcing companies) rather than those of the natives. This allows for a different equilibrium for wages and quantity of labor in each of the labor markets.

This theory assumes that if there is a change in

one of these labor markets, there will be no effect on the other labor market. In the native workers' market, we assume that supply and demandare derived based on the economy and available workers in the field. In the temporary immigrant workers market, we assume that demand is derived from the number of jobs needed, but that supply is only derived up until the point of the quota for the H-1B visas. Reich et al. identifies this as a dual labor market, where one market is the primary market with more stability and higher wages, and the other market is the secondary market with less stable working environments lower wages generally. According to Das et al., "the host country workers and migrant workers are imperfect substitutes" (2012, p. 111). The idea of imperfect substitutes suggests that the native workers are in the primary market because they live in the country and can be employed for an unlimited amount of time. The secondary market consists of the temporary immigrant workers who are only allowed to work in the country for a short period of time (1973).

The figures in the appendix graphically represent the situation of a dual labor market- where Figure 1 represents one labor market, the temporary immigrant workers- and Figure 2 represents the other labor market, the native workers. The line drawn between the two graphs represents the barrier where no worker can cross from one market to the other. As is shown by W* and Q* in both graphs, it is clear that in the secondary market, Figure 1, the temporary workers have a lower wage than that of the native workers in Figure 2. The graphs also represent how the equilibrium is derived. In Figure 1, the Q* is forced because there is a quota of the number of H-1B visas allowed in the country each year, and therefore, there is a maximum number of temporary workers that can be accounted for. In figure 2, the native workers equilibrium is derived from the market where supply of native workers equals the demand of native workers. When taking into account the segmented labor market theory, we can hypothesize that the temporary immigrant workers will be more subject to fluctuations in the business cycle than the native workers Thus, we would expect a decrease in the temporary immigrants' quantity of labor during tough economic times. It is expected that since the temporary immigrant workers are in the secondary labor market, they are the most expendable and hence, will be the first to be let go during times of economic struggle. While the native workers are seen as more permanent workers, there is less of a chance they will be let go before the immigrants, regardless of the fact that native workers have higher wages than their temporary immigrant counterparts. Therefore, this study hypothesizes that during the 2008 recession, there was a decrease in temporary immigrant workers in the IT industry relative to the amount of workers in the native market, which I hypothesize will stay about equal, or will at least decrease less than the temporary immigrant market does

## IV. DATA

The primary database used in this study is iPums-USA American Community Survey. The data that specifically look at the effect on H-1B immigrants is not available, however, through the ACS, it can be controlled for specific variables, such as immigration status, year naturalized, country of birth, and so on, to get the data of a specific group of immigrants who meet the requirements of the H-1B visa. There is no certain way to ensure that all members of the sample of temporary workers in my study have the H-1B visa, but it is known that the immigrants in this study meet the qualifications. So it is assumed that the data received will be similar to that which it would be if there was a database of H-1B immigrants.

Second, this study will be looking at a native group of individuals who are similar to the temporary immigrant group in terms of age , education status and occupation. The individuals in this group will be citizens of the United States and born in the United States. The third group of individuals in this study will be called all other immigrants. This group will include individuals who are immigrants, thus not born in the United States, but do not have temporary status, which means that these individuals have been naturalized or are working towards naturalization and likely to have a green card which assures permanent residency. The theoretical assumption of this analysis suggests that there are two markets, the native market and the temporary immigrant market. For this reason, the group labeled all other immigrants will be counted in the native group because if they have become citizens, it is reasonable to assume they have mostly assimilated into the United States.

In this dataset, the only extracted data is of individuals within the age parameter of 25 to 65 years. In addition, more data was extracted from working age adults to demonstrate the IT type occupations defined by the 1990 occupation code as: computer systems analysts and computer scientists, operations and systems researchers and analysts, computer software developers, programmers of numerically controlled

machine tools, and computer and peripheral equipment operators. The reason for looking at these types of jobs is to attain data of workers in IT type occupations.

Furthermore, in this study, temporary immigrant workers and native workers are analyzed in three specific years. The first year is during relatively good economic times in 2006. The second year, 2008, is during the recession, with relatively bad economic times. The third year is during the recovery of the recession, 2010, where the economy is thought to have recovered some, but was by no means completely recovered.

## V. EMPIRICAL MODEL

The empirical model in this study uses descriptive statistics that summarizes the numbers of employees in each group through the three years to test the hypothesis that temporary immigrant employment in IT employment decreases relative to employment of natives in IT. The empirical model will also consist of an OLS regression, with the purpose to confirm the results found through descriptive statistics. Table 5 gives definitions of all of the variables included in the regression model along with the expected signs. The dependent variable in this case will be usual hours worked per week to determine if employees during the recession had to cut back their hours worked per week. There will be multiple independent variables to control for human capital and demographic determinants of hours worked including a dummy variable indicating temporary status immigrants (TEMPSTAT); dummy variables for educational, and control variables for age (AGE); and gender (GENDER). This regression will be run three different times for each of the three years, a boom year, in 2006, the recession in 2008, and the slow recovery in 2010. The results of the three years will be compared to determine if the dependent variables, and specifically TEMPSTAT, have a significant effect on the IT sector hours worked. The equation below is what is being estimated.

$$\text{Usual hours worked per week} = \alpha + \beta_1(\text{TEMPSTAT}) + \beta_2(\text{NATIVES}) + \beta_3(\text{EDUCHS}) + \beta_4(\text{EDUCCOLG}) + \beta_5(\text{EDUCGRAD}) + \beta_6(\text{GENDER}) + \beta_7(\text{AGE})$$

This regression will be run to allow for comparison between the two groups, temporary immigrants and the native workers. When this regression is run, the expected sign that will prove my hypothesis would be for $\beta_1$ to be negative all three years. This means that having temporary status would cause a negative effect on the usual hours worked per week. It is also expected that $\beta_1$ decreases each year to support my hypothesis that temporary immigrants are being hurt more than the native workers by the recession. The other independent variables in this regression should be interesting to determine if they affect usual hours worked per week, but they are not the prime focus of this regression.

## VI. RESULTS

The results from both the descriptive statistics and the OLS regression are presented in tables in the appendix at the end of this paper. The results will be examined in two sections. The first will discuss the descriptive statistics used to determine the quantity of individuals employed throughout the three years. The second section will discuss the regression results.

### A. Descriptive Statistics

Descriptive Statistics were run on the data for each year separately to determine how the IT employment numbers changed from year to year. Table 1 represents the breakdown of the data collected to determine the dispersion throughout the five IT sector jobs through the three years. This table includes only workers who would be deemed full time, meaning they work at least 35 hours per week for at least 48 weeks the prior year. As is represented in the table, the total number of workers in each job type from 2006 to 2008 has increased. Then looking from 2008 to 2010, the total number in the sample has decreased from these two years; this is also what we would have expected to occur because of the recession in 2008. It is particularly interesting to note that in one of the jobs the number of workers actually increased from 2008 to 2010, which means that there is growth in that part of the IT sector regardless of the recession.

Table 2 represents a complete breakdown of the sample each year by employment status. This allows us to look at the changes in employment, as well as changes in unemployment, and people who have dropped out of the labor force but whose last job would have been in the IT sector. From 2006 to 2008, it appears that unemployment and individuals not in the labor force decreased, while those employed increased. From 2008 to 2010, we expect unemployment and individuals not in the labor force to increase quite significantly and employment to decrease. The data does show this, which suggests that the IT sector did in fact have to let individuals go during the slow recovery after the recession.

Table 3 represents the percent distribution for IT workers of the three groups, (native workers, temporary immigrant workers, and all other immigrants) over the three years. This table includes only those who are working full time, which is denoted earlier. According to Table 3, employment in the native group actually decreased significantly from 2008 to 2010, with a 4.2 percent decrease in employment. Surprisingly, while employment of natives decreased, there was an unexpected increase in the employment in the temporary immigrant group from 2008 to 2010. The third group, which includes all other immigrants, appeared to increase but only by less than 1 percent. These results are extremely surprising and suggest that employers are reducing employment of the native employees rather than the temporary immigrant workers. One reason employers could decide to let go of the native workers instead of the temporary workers is because typically the native workers are paid more, and thus the employers would save more money as a result of reducing their employment.

Table 4 shows the percent of workers in the IT sector in each group mentioned above: natives, temporary immigrants, and all other immigrants. As this table makes clear, it appears that employers are decreasing the jobs of native workers relative to the jobs of temporary immigrants, as well as all other immigrants. This suggests that employers are turning more towards temporary immigrant workers instead of retaining or creating more native jobs in the IT sector.

### B. OLS Regression

Table 5 defines each of the variables used in the regression. The dependent variable is number of hours worked. The results of the regression, which was run for each year, 2006, 2008, and 2010, are presented in Table 6. The results for all three years have extremely low adjusted R-squares, which suggests that less than 5 percent of the variance in the dependent variable each year can be explained by the independent variables in the regression.

The coefficients of the regression all appear to be significant at the .01 level except NATIVES in the first year, 2006 with a significant level at the .05. In the results, the TEMPSTAT variable, which is the most important for the purposes of this research study, appears to be negative in all three years, similar with the expectation. Also, it appears to be increasing each year, which is also what my hypothesis predicted. The fact that the TEMPSTAT variable is increasing suggests that the temporary status of an individual is becoming more important in the prediction of the number of hours worked each week. This reflects the hypothesis that temporary status is important when companies decide how many hours' employees work. However, when taking into account the descriptive statistics, it appears TEMPSTAT is important, but that employers are deciding to increase temporary immigrant's hours rather than maintaining or increasing the native workers' hours.

## VII. CONCLUSIONS

In conclusion, the results of this study appear not to support my hypothesis that during a recession, temporary immigrant workers will be affected by the recession more adversely than native workers. In fact, it appears that the native workers were affected more than the temporary immigrant workers. This is surprising given my hypothesis, but also suggests two things: first, that employers could be saving more money through letting go the more expensive workers, and second, some of the decrease in native workers could be explained by people deciding to retire or being forced into retirement.

The first explanation would make sense when looking back at the previous literature. Specifically, the article suggests that many United States companies are hiring more temporary immigrant workers because, according to Thibodeau (2010), there is "an emerging 'skills gap' or 'skills mismatch' among United States engineering and technology professionals" (p. 1). Perhaps this is correct and the temporary immigrant workers still employed during the recession have some skills that the native workers do not.

The second explanation of why natives were let go more than the temporary immigrant workers could represent the natives choosing to retire or being forced into retirement. This is an interesting hypothesis and one that could be considered for further research. The data used for this paper did not take into account retirement specifically However, it could be that it was accounted for in the variable employment status under 'not in labor force'.

The assertion in the introduction of this paper suggesting that the influx of temporary immigrant workers is just another type of outsourcing, just domestically, appears to be the case. This is true if, as the results provide, the temporary immigrants were not let go because the cost of these workers is cheaper

than the cost of keeping the native workers employed. Overall, it appears that the IT sector is putting more emphasis on temporary immigrant labor instead of native labor as is shown through the results of both the descriptive statistics as well as the OLS regression.

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## IX. APPENDIX

| Table 1: Number Employed in IT Occupations | | | | |
|---|---|---|---|---|
| | Census Year | | | |
| Occupation, 1990 basis | 2006 | 2008 | 2010 | Total |
| Computer systems analysts and computer scientists | 14235 | 16140 | 15562 | 45937 |
| Opearations and systems researchers and analysts | 1463 | 1592 | 1787 | 4842 |
| Computer software developers | 10976 | 11692 | 11329 | 33997 |
| Programmers of numerically controlled machine tools | 544 | 643 | 524 | 1711 |
| Computer and periheral equiptment operators | 1169 | 1062 | 991 | 3222 |
| Total | 28387 | 31129 | 30193 | 89709 |

| Table 2: Distribution of Sample by Employment Stauts and Survey Year | | | | | | |
|---|---|---|---|---|---|---|
| Employment Status | 2006 | | 2008 | | 2010 | |
| | Frequency | Percent | Frequency | Percent | Frequency | Percent |
| Employed | 31948 | 90.40% | 34225 | 91.80% | 33543 | 88.80% |
| Unemployed | 887 | 2.50% | 913 | 2.40% | 1951 | 5.20% |
| Not in the Labor Force | 2529 | 7.20% | 2143 | 5.70% | 2270 | 6% |
| Total | 35354 | 100% | 37281 | 100% | 37764 | 100% |

| Table 3: Number of Individuals Employed in IT | | | | | |
|---|---|---|---|---|---|
| Number of: | 2006 | % Change | 2008 | % Change | 2010 |
| Natives | 22404 | 8.6% | 24328 | -4.2% | 23297 |
| Temporary Workers | 1026 | 6.8% | 1096 | 5.1% | 1152 |
| All other Immigrants | 4957 | 15.1% | 5705 | 0.7% | 5744 |

| Table 4: Percent Distribution of Individuals Employed in IT by Immigration Status | | | |
|---|---|---|---|
| % Employed | 2006 | 2008 | 2010 |
| Natives | 79% | 78% | 77% |
| Temporary Workers | 3.6% | 3.5% | 3.8% |
| All other Immigrants | 17.4% | 18.3% | 19% |

| Table 5: Variables and Decriptions | | |
|---|---|---|
| Variable Name | Description | Expected Sign |
| **Dependent** | | |
| Usual hours worked per week | Numerical number of hours worked per week | |
| **Independent** | | |
| NATIVES | 0=immigrant, 1=native | Unknown |
| TEMPSTAT | 0=citizen, 1=temporary status | - |
| Education Attainment | | |
| EDUCHS | 0=no high school diploma, 1=has high school diploma | Omitted |
| EDUCCOLG | 0=no college diploma, 1=has college diploma | + |
| EDUCRGRAD | 0=no education beyond college, 1=attended some graduate school | + |
| GENDER | 0=male, 1=female | Unknown |
| Age | Number 25 through 65 | Unknown |

| Table 6: Regression Results Predicting Hours Worked | | | |
|---|---|---|---|
| | 2006 | 2008 | 2010 |
| Constant | 46.539*** | 47.385*** | 45.479*** |
| TEMPSTAT | -2.834*** | -2.931*** | -3.459*** |
| NATIVES | .410** | .434*** | .558*** |
| EDUCCOLG | .743*** | .751*** | 1.543*** |
| EDUCGRAD | 1.362*** | 1.398*** | 2.118*** |
| GENDER | -3.914*** | -3.963*** | -3.587*** |
| Age | -.147*** | -.161*** | -.155*** |
| | | | |
| Adjusted R-Squared | .039 | .046 | .038 |
| Sample Size | 35354 | 37281 | 37764 |
| *Significance at the .10 level<br>**Significance at the .05 level<br>***Significance at the .01 level | | | |

# How Do Economic and Political Factors Affect NASA Funding?

Austin Smiley

## I. INTRODUCTION & THESIS

The research problem of this study is concerned with the United States' investment in National Aeronautics and Space Administration (NASA). This funding is important for several reasons. Firstly, NASA's accomplishments provide benefits not only to America, but to the rest of the world. All of humanity can be proud of landing a man on the moon. NASA's space expeditions are indeed monumental in their own right, but human pride is not the only benefit of NASA. The technological advancements required to make such explorations possible have impacted our daily lives. NASA's research is directly responsible for the CAT scan, microceramics used to fight cancer, personal water filters, and 1,300 other advances we use every single day. Some of NASA's inventions are now used to save lives; while others are used to make life a little easier. It is important to understand that NASA is a significant technological agency and providing funding for it implies that America is committed to advancing technology. Our country is beginning to lose its once vast lead as the world leader in technology due to other competing nations and the decreased amount of available funds for NASA. Investing in NASA is important if we are going to maintain our status as a world leader. The question, therefore, is how much are we willing to sacrifice as a country in order to pursue advancements in this industry?

The funding trends analyzed in this paper aim to answer that question. By analyzing our country's funding of NASA in relation to economic success factors, such as unemployment and debt, and political factors such as party in power and military activity, we can determine the level of support the public maintains for investing in NASA. This analysis will show us how much dedication there is to funding NASA during both prosperous and difficult economic times. This research is also meant to identify any other factors that significantly affect NASA's funding.

The hypothesis for this research project is that difficult economic times, periods of increased military spending, and high levels of debt will negatively affect NASA's funding.

## II. LITERATURE REVIEW

One of the most relevant pieces of literature to my project is Lambright's (2010) research on NASA. Lambright sets the stage by supporting the importance of NASA. This paper looks at the history of NASA, its costs, and its contributions to society. Lambright (2010), therefore, deems that NASA is indeed a worthwhile investment. Lambright (2010) goes on to argue how significant it is to continue NASA's funding since the future of NASA is expected to continue to provide significant technological advances. Additionally, Robolledo and Nollet (2011) provide evidence for the use of cooperation in advanced technological sectors. Cooperation saves time and resources while expediting the Research and Development (R & D) process greatly. NASA is a central hub for the space exploration industry. All of the private companies are connected through NASA, which gives out funding and contracts to the private companies that work in the industry. Since they all have a connection, they are better able to utilize each others' knowledge. Since NASA awards contracts and funding on a competitive basis, the companies are still motivated to be as efficient as possible. This study further supports Lambright's conclusion that NASA is a valuable agency that should be maintained in coming years.

Dussauge and Garrette (1993) support the combining of efforts to advance aerospace, defense, and space exploration technology. They cite how many resources are saved, especially when private companies are able to collaborate. Scott (1993) discusses the benefits of the high concentration of aerospace companies in southern California. Scott finds that the close proximity is beneficial to all of the companies

in the industry. Whether this is due to cooperation or not is unclear. Dussauge and Garrette (1993) also analyze the factors that cause an industry to change and evolve. They argue that private innovation is the most efficient form of advancement but allow for the need of government funding when circumstances call for it. They discuss NASA's need for billions of dollars which, while impractical for most institutions, is a relatively small investment for a national government such as America's. Dussage and Garrette point out that under such circumstances it is very beneficial for the government to fund NASA. Analyzing the factors that affect NASA's funding will reveal how effectively the US government fulfills this potential benefit.

Schoeni and Dardia (1998) focus on government assistance to the space industry. They found that the government gives assistance to the industry workers so that they may be maintained when project work is down. Their research supports the notion that the unique skills that specialized workers have are valuable enough that the government wants at least some of the workers to stay onboard with NASA and its affiliates even if there is not enough work to warrant keeping them employed. This suggests that the government does indeed value NASA and space exploration workers, especially in the long run.

Bowen (2012) compares and contrasts discretionary spending, like NASA, to entitlements, such as social security. Bowen discusses how beneficial it is for a government to have power of rejection that comes with discretionary spending. However, his research shows that entitlements are usually more consistent in their success for the obvious reason that they can predict their funding consistently. When discretionary funding for technology is looked at, he concludes that it should not be cut lightly. This can be directly applied to NASA as they are entirely focused on technological development.

## III. THEORY

Schoeni and Dardia (1998) did find that NASA is important to the government but they do not take the same approach as the analysis in this paper. The focus of this research project will involve the economic principles of discretionary spending and public choice; as opposed to simply analyzing facts like Schoeni and Dardia (1998). The theory behind this research is that discretionary funding will decrease as a result of public choice during difficult economic times. This theory stems from the fact that difficult economic times require governments to cut spending or raise taxes, and from the fact that the public demands more welfare during recessions, which puts further pressure on decreasing discretionary spending. Bowen (2012) explains that NASA has not received a "guarantee" on their funding since the space race was won in 1969. Ever since then NASA has been discretionarily funded. Although even during the Space Race NASA was never officially guaranteed funding, they could just be extremely confident in their continued funding due to the national security interest in beating the Soviets to the moon.

When looking at government spending it is crucial to differentiate between discretionary spending and entitlements. Entitlements are previously set costs to the government that they cannot back out of. Entitlements include things like Medicare or Social Security. Discretionary spending, like funding for NASA, is usually determined on a yearly basis and depends on the performance of the agency and on the amount of funds available for the government to give out in the first place. As a matter of definitions, discretionary spending will react more to shocks to the country than entitlement spending will. The issue is how much will NASA's funding react to such shocks. This will depend on the type of shock and the dedication our government and the American people have to NASA.

The most important factor for discretionary spending is, theoretically, the health of the economy. This depends on if our Gross Domestic Product (GDP) is high, the United States' unemployment low, the interest rates under control, and basically if the economy is in a recession or not. But this is not the only factor that may affect discretionary funding. The amount of government spending as it compares to the total GDP is an important thing to take into consideration as well. If the economy grows but government expenditure stays the same, then discretionary spending will not increase even though the nation's growth could support more spending. In addition to breaking down government spending as a portion of GDP, it is also important to account for the most influential shock to our economy: war. Several wars like WWI, WWII, Vietnam, Korea, and to a certain extent the Cold War, utterly consumed our government's main attention. War is a serious enterprise and requires vast resources which may have to be taken from other discretionary spending. This suggests that defense spending as it compares to our GDP must be considered when analyzing discretionary spending trends.

Another fiercely contested issue that is important to discretionary spending is the national debt. Today, more so than ever, the national debt has been a crucial issue, as it is in every country. Yes, some debt helps fuel growth. But once the debt reaches the point where people realize that they, and their descendants, are going to be bearing a heavy burden for the governments overspending, they call for decreases in government spending or for an increase in taxes. A decrease in government funding is going to affect discretionary funding first. Of course, not all discretionary funding is viewed as equally important. This research paper aims to find out how NASA's funding is affected, by national debt levels, the health of the economy, political factors, and other crucial indicators.

## IV. EMPIRICAL MODEL

The figures for NASA's budget can be obtained from the United States Office of Management and Budget. Unemployment, total government expenditure, military expenditure, and national debt can be found in the World Data Bank dataset for the United States. The values for political parties and the space race time period are commonly available.

The empirical model for this analysis will be as follows:

$$\text{NASA Budget (NASA)} = \alpha + \beta(\text{Unemployment}) + \beta(\text{Total Government Expenditure/GDP}) + \beta(\text{Military Expenditure/GDP}) + \beta(\text{National Debt/GDP}) + \beta(\text{Political Party}) + \beta(\text{Space Race}) + e$$

The empirical model is designed to test what affects the government's level of funding for NASA, which is measured in constant 2007 US Dollars. Unemployment will represent the health of the economy, and is expected to be negatively correlated with NASA's funding. Unemployment was chosen because it is a dependable indicator of the state of the economy. It is affected by business cycles and it increases during recessions. Most importantly the unemployment measurement will capture the level of discontent within the nation. When people cannot find a job they want the government to step in and assist. This suggests that citizens will want the government to spend wisely so that all available funds can go towards supporting them in their time of need. This will ultimately demonstrate how much people value NASA as an organization. If NASA retains funding even when unemployment is high then that would represent very interesting results.

Total government expenditure as a percentage of GDP is included to control for increased government spending overall. If the government spends more across the board then NASA will obviously benefit as well; this implies that this variable is expected to be positively correlated with NASA funding. Additionally, the percentage of GDP that the government spends on military spending will account for several things. Firstly, it will represent whether or not our nation is at war. The costs of war can be expected to draw funding from nearly every other candidate the government supports. Secondly, this variable will account for the overlap that is present between NASA and the department of defense. Missile defense, satellite systems, and global defense grids all use similar, if not the same, type of technology that NASA is continuously developing. These overlaps indicate that NASA and the department of defense may be substitutes to some degree. If they are substitutes then when military spending increases, NASA's funding will decrease. Whether due to war, or due to substitution, it is expected that the military spending variable will be negatively correlated with NASA funding.

National debt is also an important variable. As national debt increases the public calls for more responsible spending and for cuts in spending. If the government decides to reduce deficits through spending cuts then those cuts are most likely going to come from discretionary spending, such as NASA. The cuts will almost definitely not come from entitlements spending because the government is obligated to pay that already. This means that funding programs like NASA will come into question as our national debt increases. Our country has never shied away from debt in the past, for better or worse, and this makes it seems like NASA's funding is not hugely threatened by increasing national debt. Despite this, it is still expected that this variable will be negatively correlated with NASA funding.

The last two variables are both dummy variables. The first one, political party, is meant to control for the different spending preferences between Democrats and Republicans. The difficulty with this variable is that NASA is not definitively supported or opposed by either party. It can be inferred by political party platforms that Republicans prefer military spending while Democrats prefer social spending. NASA is a little bit of both with many social benefits in addition to providing technological advances for defense. Political Party is not expected to largely impact NASA funding negatively or positively, though one will certainly win

out. The Republican party is the one being tested so the results will apply to them.

The variable for the Space Race is another significant variable. During the Space Race the government was committed to landing a man on the moon as quickly as possible. Cost was almost not a serious issue. Due to this it is necessary to control for this variable or else all of the other results will be skewed.

The data for this analysis will include all of the variables for the years 1958-2010. There are no more data to draw from and the variables included are each important as well. High significance rate for unemployment, government spending, and military spending is expected. Political party is expected to be insignificant but it will be interesting to see if either party is partial to NASA funding.

## V. RESULTS

Figure 1 represents the funding levels for NASA from 1960 to 2009. Figure 2 through 5 represent the data for the independent variables. Table 1 displays the regression results and analysis.

Figure 1 shows that funding for NASA clearly spikes soon after the creation of the agency. The decrease after the spike occurs due to the end of the Space Race. The overall trend after that drop is slightly upward although there are clear shocks. Around NASA's thirty-fourth year, the largest shock occurs. This is around the same time the oil crisis in the 1980s occurred. Although gas prices are not tested in the regression, it seems likely that this is not a coincidence.

Figure 2 shows that unemployment, government spending, and military spending have fairly fluctuating values. There is no clear relation between NASA's funding trend and the trends for these three variables. As Figure 6 shows later, these variables definitely impact NASA's funding significantly, it is just not apparent when comparing the raw data.

Figure 3 shows that the national debt does not have any clear relationship to NASA's funding. The debt level fluctuates significantly while the trend for NASA's funding, other than during the Space Race years, is relatively smooth.

Figure 4 shows the years when a Republican was president. Again, there is no clear relationship between this independent variable and NASA's funding trend in Figure 1.

Figure 5 shows there is a very clear relationship between the space race and the spike in NASA's funding. While these two trends being so similar is not enough in its own right to confirm the relationship, it is a fact that the Space Race fueled NASA's high funding level, which is why it must be accounted for in the regression.

Table 1 represents the regression results. It shows a .497 adjusted R –Square, which indicates that a significant amount of the variation in NASA's funding has been explained by the tested variables. This is a skewed value given that the data sample was small. It means that the regression was still able to find worthwhile results regarding the factors that affect NASA's funding, however the sample size might bias the results. A larger sample size would have demonstrated a more significant variation among the data. Table 1 also shows that the independent variables are generally statistically significant. Unfortunately, the variable for the National Debt as a percentage of GDP was not statistically significant. The poor significance value for the debt variable indicates that the regression analysis was not able to identify a significant relationship between the national debt and NASA's funding.

Unemployment is one of the most essential variables because it represents the health of the economy in this analysis. Table 1 shows that the significance value for this independent variable is 0.001 which means the results are highly significant. The negative impact value for unemployment indicates that as unemployment rises the funding for NASA decreases. This meets the previously established expectations and proves that as people lose their jobs, presumably due to difficult economic times, they, through the government, divert resources away from this important agency to handle matters that are considered more pressing. The nominal value of the negative impact that unemployment has is -1,935.381 (in millions of dollars). This means that as unemployment increases by one percentage point the funding for NASA decreases almost 2 billion dollars. This is a huge decrease given that NASA's funding was only 17.8 billion in 2010. This is not a good sign because it means that the government takes away fairly aggressively from NASA during difficult economic times. This means that the government, and theoretically the people they represent, is not very willing to support the advancement of technology and exploration when money is tight for many individuals across the nation.

Unemployment is not the only variable that impacts the amount of funding NASA receives, though.

The next variable analyzed in Table 1 is total government spending as a percentage of GDP. The significance level of the results for this variable is smaller than .000. This means the correlation results between total government spending and NASA's funding is extremely significant based on this regression. The results show that the impact that a one percent increase in this variable has on NASA's funding is 6,175.06 which comes out to over 6 billion dollars. The positive correlation is expected because if the government is spending more, then all of its agencies and programs are likely to receive at least some extra support. What is interesting is the size of the positive impact that increased government spending has on NASA funding. A one percent increase in government spending leads to a 6 billion dollar increase in funding when the most funding NASA has ever received is 33.5 billion dollars. That is almost a 20 percent increase for NASA funding as a result of a 1 percent increase in government spending. Such a disparity implies that NASA is a very valued agency to the US Government. This contradicts what the results of the unemployment analysis reveal. NASA is either important to the government or it is not. It is possible that the high funding that still occurs after the Space Race throws off the regression results.

The analysis of the military spending variable is also provided in Table 1. The regression shows a significance value of less than .000 which means the results are very accurate just like for government spending. The impact that a one percent increase in this variable would have on NASA funding is - 4,032.593 (millions of dollars). Such a large negative correlation indicates that the military and NASA can't both get what they want. Military spending increases in the United States are usually in response to a threat of attack. So it makes sense that NASA must take budget cuts in order to protect our national interests, especially safety. Even though NASA's technology is the same as much of the military's global defense network it can be seen that they are not both utilized to respond the national threats. It could be that most threats are not advanced enough to require NASA's expert aerospace technology. It is also possible that the military's structure of command allows it to be more efficient or perhaps more trusted than NASA. It is the case that the government turns to the military as a priority over NASA. Whether it is a matter of safety first or simply avoiding funding the same thing twice does not change the results.

The political party variable is the next variable analyzed in Table 1. The regression analysis shows that when a Republican is the president there is a - 4,198.071 (millions of dollars) impact on NASA's yearly funding. The significance level for this factor is .007. Republicans have a reputation of wanting smaller government and cutting taxes. So, in theory, it makes sense that such downsizing would negatively affect NASA. However, the magnitude of the downsizing seems excessive. A 4 billion dollar decrease in NASA funding would be roughly 25 percent of their current budget. While such a cut would not destroy the agency by any means it seems like a drastic cut to me. The explanation may lie in the dates used for the Space Race variable. It is also possible that the increases in military spending that usually accompany Republican presidents is what causes NASA spending to drop during Republican administrations.

Finally, Table 1 also shows the Space Race variable is significant at the .005 level which indicates high significance. The positive magnitude for the impact of this factor on NASA funding is extremely high at 13,963.558 (millions of dollars). Such an accurate and high correlation between the Space Race and NASA is not surprising since the Space Race is what fueled NASA's creation and it was the purpose of NASA to win that race. This variable was originally intended to avoid the extreme bias that would occur if the Space Race was not accounted for. After the Space Race was won, the funding for NASA dropped off significantly. This excessive drop is not accounted for in the model since it occurs after the Space Race officially ended. It cannot be concluded indefinitely, but it would seem that this excessive drop, which occurred during a Republican presidency, negatively influenced the results for the Political Party variable.

## VI. CONCLUSION

In conclusion, the hypothesis that NASA follows the trends for discretionary spending is proven true. NASA's funding decreases significantly during economic strife and when defensive spending increases. NASA's funding increases when government spending increases and was much higher during the space race. The one aspect of the hypothesis that was not proved is that the debt level would have a negative impact on the level of funding for NASA. The political party variable did its job of controlling for party influences and indicated that Republican presidents are likely to cut funding to NASA.

This paper does not strongly confirm the results of Schoeni and Dardia but does not disprove them either. Bowen's recommendation that technology be funded intensely is not followed by the American government. The future of our nation is said to rely upon our staying ahead technology wise. NASA's funding has proven to be discretionary funding without a doubt. The trends seen and the correlations found in the data prove that the technological advances that NASA had accomplished have not allowed them to maintain a well funded position, but as seen in Figure 1, the funding levels have not suffered to a severe extent. It is important that the United States maintain interest in this organization and the technology sector in general in order to maintain or success in the future.

Future research may benefit from including additional control variables. Finding a way to account for the government providing funding simply to keep aerospace technicians employed, even if they were not currently needed, so that they would be available in the future, might help account for NASA's funding. Also, controlling for the lagging effects of the Space Race would be a valuable addition to this study. Accounting for lagging high funding will help account for everything that could affect NASA's funding.

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## VIII. APPENDIX

**Table 1: Regression Results & Analysis**

| Independent Variable | Impact on NASA Funding (Millions of Dollars) |
|---|---|
| Constant | -50,143.823*** (-3.347) |
| Unemployment | -1,935.381*** (-3.586) |
| Total Government Spending/ GDP | 6,175.060*** (5.595) |
| Military Expenditure/ GDP | -4,032.593*** (-3.927) |
| National Debt/ GDP | 14.292 (.249) |
| Political Party | -4,198.071* (-2.818) |
| Space Race | 13,963.558** (2.946) |
| *** Significant at .001 level<br>** Significant at .005 level<br>* Significant at .01 | |
| Adjusted R-Square = .497 | |

**Figure 1: NASA Funding History (2007 Dollars)**

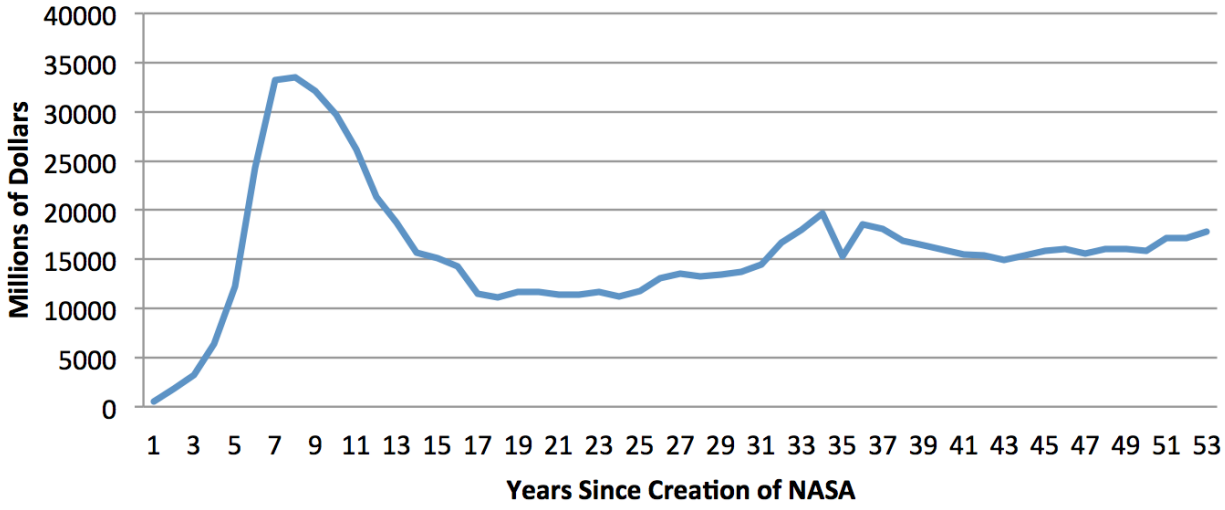
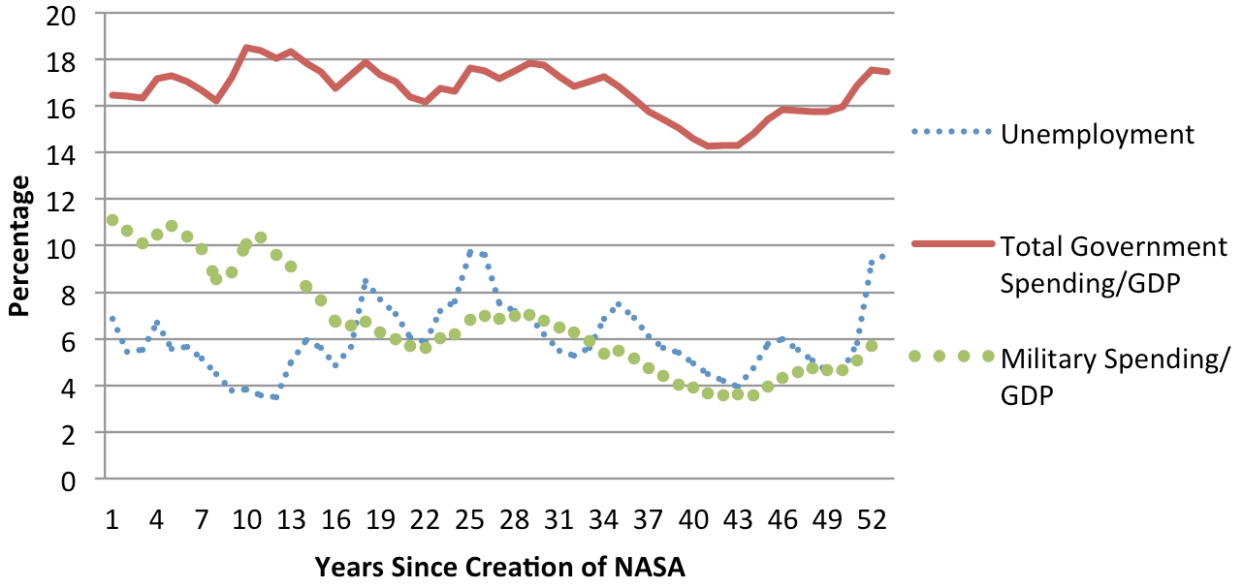
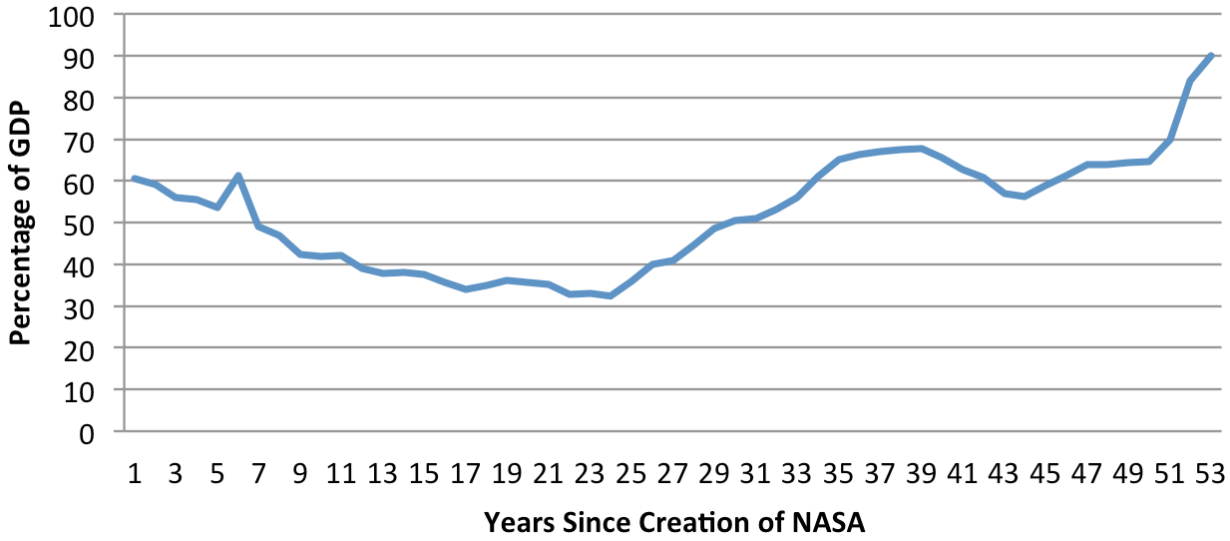


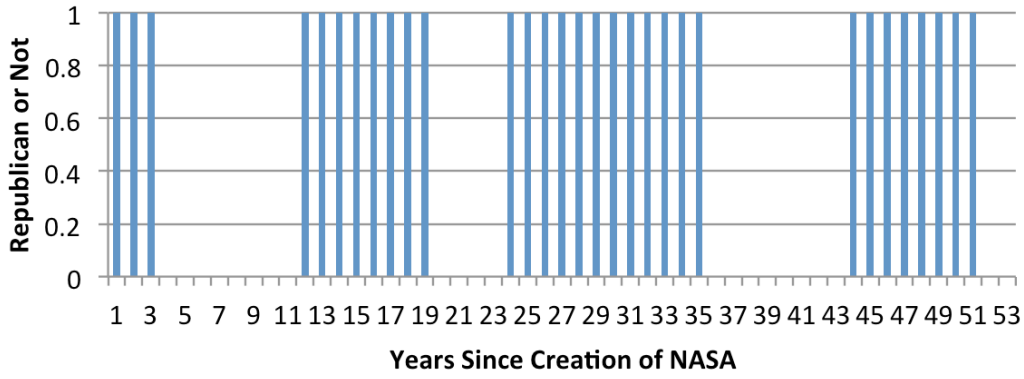

**Figure 2: Spending and Unemployment**



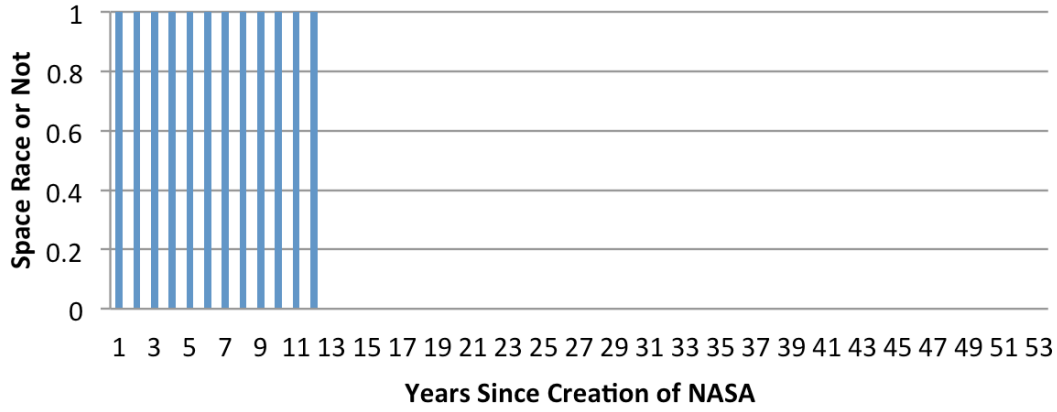
## Figure 3: National Debt




## Figure 4: Repulican Presidency Years




## Figure 5: Space Race



# The Comparison of Economic Assimilation Between Indian and Chinese Immigrants in the United States

**Zongda Tu**

## I. INTRODUCTION

People have been immigrating from India and China to the United States for many generations and the immigrants from these countries have been contributing to the United States' economic development tremendously. After the Luce–Celler Act of 1946, an increase in immigration of Indians to the United States occurred as well as other to other big Indian communities in United Kingdom, Singapore, and Malaysia. The major Chinese immigration trend occurred after the enactment of the Immigration and Nationality Act Amendments in 1965, when Chinese immigrants with skills or high educational attainment immigrated to the United States. Both Indian and Chinese immigrants and their descendants are active in a broad range of job fields including science, technology, business, media, government, and politics. As of 2008, Indians and Chinese had the highest educational attainment level and median personal income of any racial demographic in the country (Walt, Proctor, & Smith, 2008).

Nevertheless, mass media reports and studies show that Asian Americans are paid up to twenty-nine percent less than equally qualified natives (Min, 2006, Debusmann, 2010). Borjas (2009) states that most of the highly educated immigrants are able to assimilate economically into the United States labor market and are able to significantly contribute to the economy. Since both Indian and Chinese immigrants have a similar level of educational attainment distribution, according to IPUMS CPS statistics from 1994 to 2011, their economic assimilation should be similar in many ways. However, Vugt (2009) demonstrates that the common English language spoken by new immigrants from English speaking countries accelerates immigrants' assimilation with natives. Therefore, the economic assimilation models tend to be different for English-speaking immigrants and non-native speaking immigrants.

This issue is important because of the rapid increases in the number of Chinese and Indian immigrants, which has raised a greater concern about economic assimilation over time. According to United States Census Bureau (2010, 1980 & 1970), there are 2.8 million Indian Americans in 2010, which is approximately 7.2 times higher than the number in 1980. For the Chinese, there are 3.8 million Chinese Americans in 2010, which is almost 8.5 times more than forty years ago. Since an increase in immigrants may create a greater gap in income between the immigrants and the natives, this problem should be taken seriously and analyzed clearly to determine whether there is an income convergence and the different rates of economic assimilation for these two immigrant groups.

The purpose of this research is to determine and compare economic assimilation of Indian and Chinese immigrants over time in the United States. On the one hand, because both groups come from fast growing developing countries in Asia, they could follow the same career path and face the same income disparity in the United States with natives. On the other hand, Indian immigrants have a higher level of English proficiency than Chinese immigrants do, so Indians might have an advantage over Chinese immigrants in terms of assimilation with natives. Based on data from IPUMS CPS (1995, 2000, 2005 & 2010), this paper applies the regression methodology, theories of assimilation and human capital, age earnings profile and the theoretical correlation between language proficiency and economic assimilation of immigrants. The study follows cohorts of Indian and Chinese immigrants in 1995, 2000, 2005 and 2010. It is designed to re-examine and expand the conclusions of previous studies and explain similarities and difference in economic assimilation for these two immigrant groups.

## II. THEORY & LITERATURE REVIEW

The research is based on assimilation theory and human capital theory. Assimilation is defined as a socio-political response to demographic multi-ethnicity that supports or promotes the assimilation of ethnic minorities into the dominant culture. Clark (2003) explains that assimilation theory is an acquisition of new customs and attitudes that occur spontaneously through the contact and communication between majority and minority groups. According to Waters and Jemenez (2005), core measurements of immigrant assimilation are socioeconomic status, spatial concentration, language assimilation, and intermarriage. After immigrants settle down in a new region, they tend to learn and imitate how natives act and think by improving their host country language, acquiring local human capital and becoming permanent citizens (Schaeffer, 2006).

Assimilation is a long-period process and the duration in the host country is statistically significant to the immigrants' economic assimilation (Beenstock, Chiswick, & Paltiel, 2010). In other words, the more time immigrants spend in a new country, the less their income disparity is compared to natives. By testing the immigrant assimilation hypothesis with longitudinal data, they suggest that immigrants who spend a long time in the host country have rapidly increasing earnings over the time and almost reach the income parity eventually.

Human capital expresses the unique set of abilities and acquired skills which each of us bring into the labor market (Borjas, 2005). Human capital theory emphasizes the impact of education on the income of minorities and therefore, claims that high levels of educational attainment increases the prospects for better wages and a more satisfying career (Barringer, Takeuchi, & Xenos, 1990). Moreover, a study by Barringer, Takeuchi and Xenos (1990) shows that education increase the rate of economic assimilation for Asian immigrants in the United States. Vigdor (2008) also states that an increase in the amount of education helps immigrants become more assimilated to the natives.

Age earnings profiles are used to describe an individual's earnings over his or her work life. Chiswick (1978) includes cross-sectional data in his research to sketch out the age-earnings profiles of immigrants and natives. The wage of immigrants is lower than that of natives at the initial point but increases at a faster rate and surpasses the natives' income at around the age of 35. Both the curves for immigrants and natives increase at first and reach their peak at the age range of 45 to 50, and then decrease to a somewhat lower point. The age earnings profiles indicate that upward mobility is a critical factor for immigrants and that their income tends to converge towards and then exceed native income. Nevertheless, Wu (2012) and Borjas (2009) suggest that the one year database in Chiswick's study is misleading because different cohorts and the year of arrival in the U.S. can be significantly different, thus causing huge biases. The adjusted age earnings profile shows the significance of the age for both immigrants and natives and is analyzed by including age and age squared variables from multiple years in the regression model (Wu, 2012).

Language proficiency is one of four major indicators in assimilation as stated in the previous literature (Waters & Jemenez, 2005). Bleakley and Chin (2010) demonstrate that English proficiency helps immigrants integrate economically into their new home. Their research also suggests that English proficiency raises wages and narrows the income gap between immigrants and the United States natives by analyzing the relationship of age at arrival, English proficiency and social assimilation among United States immigrants. In addition, Beenstock, Chiswick, and Paltiel (2010) research the effect of language proficiency on assimilation of immigrants and conclude that immigrants who can speak the local language fluently assimilate faster than those who cannot.

In summary, the theoretical model for this research consists of assimilation theory, human capital theory, age earnings profiles and theoretical correlation between language proficiency and economic assimilation of immigrants. Based on the theoretical model, this study explores whether Indian and Chinese immigrants' income converge to natives' and whether language proficiency affects immigrants in assimilating economically in a country after controlling for human capital factors.

It is hypothesized that:

1. Human capital has a significant influence on Indian and Chinese immigrant earnings.
2. Both Indian and Chinese immigrants would reach income parity with natives eventually due to their high educational attainment.
3. Indian immigrants would assimilate faster and sooner than Chinese immigrants at the economic level because they have a higher level of English proficiency than do Chinese immigrants.

## III. EMPIRICAL RESEARCH DESIGN

### A. Data

All the data in this research is based on the IPUMS CPS database. IPUMS CPS is a project dedicated to integrating and disseminating data from the Current Population Survey conducted by the U.S. Census Bureau and the Bureau of Labor Statistics. This paper uses data extracted every March from 1994 to 2011 due to the availability of data for Indian and Chinese immigrants.

This research follows the following three cohorts:

1. Native born individuals who had positive earnings and were in the age range of 25 to 50 during the 1995 survey year.
2. Indian born individuals who immigrated the U.S. prior to 1995, had positive earnings and were in the age range of 25 to 50 during the 1995 survey year.
3. Chinese born individuals who immigrated the U.S. prior to 1995, had positive earnings and were in the age range of 25 to 50 during the 1995 survey year.

The study compares the earnings among natives, Indian and Chinese immigrants based on the data in survey years 1995, 2000, 2005 and 2010. The same groups of cohorts are examined over time for the corresponding year. The descriptive statistics are applied to compare cohorts generally. They include mean values of earnings, ages and usual hours worked per week last year, percentages of each education attainment and being currently married, and the sample size for natives, Chinese and Indian cohorts at the survey year 1995 and 2010 (see Table 1).

### B. Dependent variable

The variable Wage and Salary Income is each respondent's total pre-tax wage and salary income for the previous calendar year. Amounts are stated as they were reported to the interview. RealInc indicates each respondent's real wage and salary income adjusted for inflation using Consumer Price Index (CPI) adjustment factors based on a 2010 price level (see Table 2). LnRealInc is the natural log of RealInc and is used as the adjusted earnings in this study. The natural log of income is widely applied in different studies because the adjusted dependent variable has a clear and simple relationship with other independent variables in the regression. A one unit change for a given independent variable leads to a certain percentage change, approximately the same as its regression coefficient after being adjusted, in the dependent variable - income.

### C. Independent variables

All variables and their detailed definitions are shown in Table 3 of Appendix.

Education attainment is the used to determine the highest degree of education an individual has completed. According to assimilation and human capital theory, it is an important factor in my research. The variable is recorded into a set of dummy variables:

* Bachelors
* Masters
* Professionals
* Doctors

The reference group for the education dummy variables is respondents who have high school degrees or under.

Age indicates each person's age at last birthday. It measures each respondent's life experience and working experience briefly. It is included in the regression as the estimate of the time in the labor market.

Uhrswork (usual hours worked per week last year) is used as a more accurate and specific indicator of working experience. It is the number of hours per week that respondents usually worked if they worked during the previous calendar year, including either working at a job at any time or doing "any temporary, part-time, or seasonal work even for a few days" during the previous year.

Indian and Chinese variables indicate the origin of immigrants and the reference group is natives. They show the impact of the difference between Indian and Chinese immigrants on the level of their earnings and their economic assimilation. The major difference between Indian and Chinese immigrants is that English is widely spoken and an official language in India and the United States but not in China. Since language proficiency is stated as a significant factor in determining economic assimilation in previous studies, these two variables are set as two dummy variables to roughly estimate the level of English proficiency.

Married variable gives each individual's current marital status, including whether the spouse was currently living in the same household. It is adjusted into a dummy variable, with the reference group of individuals that are not currently married.

### D. Empirical Model

The empirical model of my research consists of two parts:

1. Descriptive statistics
2. OLS regression analysis

Descriptive statistics provides mean values of earnings, ages and usual hours worked per week last year, percentages of each education attainment and being currently married, and the sample size for three groups of cohorts at the survey year 1995 and 2010. It is presented and defined in Table 1 and 2, and used to compare variables that determine economic assimilation in this study.

Ordinary Least Squares (OLS) regression analysis estimates the unknown parameters in a linear regression. It is applied to determine whether each variable is statistically significant on the level of income of Indian and Chinese immigrants and natives. The OLS regression model is also used to compare rates of economic assimilation of Indian and Chinese immigrants.

The regression model is stated as following:

$$\text{LnRealWage} = ß0 + ß1(\text{Indian}) + ß2(\text{Chinese}) + ß3(\text{Bachelors}) + ß4(\text{Masters}) + ß5(\text{Professionals}) + ß6(\text{Doctors}) + ß7(\text{Age}) + ß8(\text{Uhrswork}) + ß9(\text{Married})$$

OLS regression analysis tests whether Indian and Chinese immigrants have an income convergence towards natives and whether Indian immigrants have a faster economic assimilation than Chinese immigrants with the following five steps:

Step 1: Run the regression with corresponding statistics from the database in 1995 and find out the coefficient of each independent variable. The data used are the combined set of statistics of natives, Indian immigrants and Chinese immigrants.

Step 2: Compare the signs of coefficients for Indian, ß1, and Chinese, ß2, to examine whether the group has reached the income parity with natives.

Step 3: Compare the coefficients of Indian and Chinese variables to determine whether their economic assimilation is different.

Step 4: Analyze the percentage of income difference between two immigrant groups and natives by taking the antilog of the coefficients for Indian and Chinese and subtracting 1. The analysis compares the economic assimilation of Indian and Chinese immigrants.

Step 5: Repeat the above steps for each of the remaining three selected survey years for 2000, 2005, and 2010.

The five-step analysis is applied to obtain and explain results. The regression model analyzes the similarity and differences of economic assimilation among Indian and Chinese immigrants while controlling for human capital factors. If the sign of either ß1 or ß2 is positive or zero, then the matching group of immigrants have reached income parity with the natives. Otherwise, the corresponding group has not reached economic assimilation yet. If the adjusted ß1, which means the percentage difference of real income based on the native level, is smaller than the adjusted ß2, it can be concluded that Indian immigrants have an advantage over Chinese immigrants in that survey year and that they assimilate faster than Chinese. In this case, language proficiency may be a factor that contributes to the phenomenon. Otherwise, Chinese immigrants have an advantage and assimilate faster so the hypothesis is not valid.

## IV. RESULTS

Based on the descriptive statistics in Table 1, both Indian and Chinese immigrants have higher means of wage than natives. However, high percentages of advanced degrees indicate that they are more likely to get a college degree or above. Because these two groups of immigrants have more human capital on average, it is reasonable that they have higher income.

### A. OLS Regression Analysis

Regression results from 1995 to 2010 for all three cohorts are shown in Table 3 in Appendix 1. In Table 3, almost all coefficients for independent variables are statistically significant except for Chinese and Indian variables in some years. Specifically, education attainment, age, usual hours worked per week and marital status are significant at the 1 percent level for every year researched. Being Chinese is significant at the one percent level in 1995, fiver percent level in 2000 and is not statistically significant in 2005 and 2010. Being Indian is not significant at all throughout the four years.

By controlling for human capital factors and comparing the coefficients for Chinese and Indian, I

find that Chinese immigrants do have a disadvantage for earnings in 1995, with a negative impact of -.214 for the natural log of their real wage. They are assimilating fast though, from the impact of -.214 in 1995 to -.010 in 2010. Although the coefficient of Chinese is still negative in 2010 it is extremely close to zero and is insignificant too. Based in this it can be concluded that Chinese immigrants reached income parity in 2010. For Indian immigrants there has been no income disparity since the initial year. In other words, they were already assimilated at the beginning of the study.

Being Indian is not significant at any level that suggests that their real wage does not vary significantly from native real wage. Based on the major difference between Indian and Chinese immigrants and the previous literature, one possible explanation for the different patterns between Chinese and Indian immigrants is that Indian immigrants' proficient English skills help them earn the same with natives in the U.S. labor market. There is an apparent assimilation for Chinese immigrants from 1995 to 2010 and the longer time they stay in the United States, the less their income gap is. It may be because they obtain and improve their English skills throughout the assimilation process.

Education attainment, usual hours worked per week, and being married are statistically significant at all levels. They also have positive effects on income for all natives and immigrants. Age is also significant at the 1 percent level and increases the income for age groups from 25 to 50 but have a slightly negative impact on the income of the age group from 50 to 65.

Because the coefficient does not accurately imply the percentage change in real income, all coefficients for Indian and Chinese variables are adjusted following Step 4. Figure 1(see Appendix) shows the impact of being Indian or Chinese immigrants in terms of percentage changes on their real income compared to natives. Chinese immigrants' earnings are almost twenty percent lower than those of natives but increase very fast, while Indian immigrants' earnings are approximately the same with those of natives.

## V. CONCLUSIONS

The research examines whether there is an income gap in the beginning year and an income convergence in the final year for the selected cohorts of Indian and Chinese immigrants in the United States. Figure 1 is derived from adjusted coefficients for Indian and Chinese variables and proves the assimilation theory that Chinese and Indian immigrants do have an economic assimilation over the time from a lower wage level. Insignificant levels of being Indian and the different patterns of Indian and Chinese immigrants in Figure 1 are strongly supported by the fact that English proficiency facilitates and accelerates immigrants' assimilation. Education attainment being significant at all levels with a positive impact on income is explained by human capital theory. Higher degrees lead to higher income as well as assimilation for immigrants. The changes in coefficients of age match the age earnings profile that the increase in age positively affects earnings until around 45 to 50 years and then negatively affects earnings in a small amount.

All the results are consistent with findings in previous studies, and can be explained reasonably and logically by them. The research broadens the paper of Beenstock, Chiswick, & Paltiel (2010) which focuses on the assimilation of all kinds of immigrants in Israel, and the paper of Wu (2012) which focuses on the economic assimilation of Chinese immigrants in the United States. Results indicate the same conclusion that both of these articles present. This conclusion demonstrates that immigrants have a disadvantage at first but assimilate into the host country eventually.

My results regarding the impact that language proficiency has on economic assimilation are similar to the results in the studies of Bleakley and Chin (2010) and Beenstock, Chiswick, and Paltiel (2010). Their research concludes that language proficiency is significant in assimilation. This suggests that the different patterns of economic assimilation between Indian and Chinese immigrants, in this paper, may be explained by their different English proficiency levels.

The research papers of Barringer, Takeuchi, and Xenos (1990) and Vigdor (2008) have the same results, which indicate that high educational attainment increases the rate of economic assimilation for Asian immigrants. This paper narrows their researches down to two major Asian groups. Chiswick (1978) presents that age first increases income and then decreases it. The results in this paper match Chiswick's results regarding the relationship between age and income exactly. The research improves Chiswick's study (1978) by including multiple years of data to eliminate most biases proposed by Borjas (2009) and Wu (2012).

Human capital and age have a significant impact on Indian and Chinese immigrants' earnings.

Both immigrants would reach income parity with natives but Indian immigrants would assimilate faster. By applying cross-sectional data and following three groups of cohorts from 1995 to 2010, the analysis in this paper yields results that support the hypotheses. The most important findings of this study is that there is economic assimilation for Chinese immigrants; and that language proficiency plays a relatively important role in that assimilation.

Moreover, the study suggests that immigration policies should strive to attract immigrants with higher degrees and higher English proficiency. These immigrants can assimilate into the United States society faster and contribute to the economic development greater than the average level of natives and thus, such policies should be carried out continually. Besides, new policies should be implemented to assist new and highly educated immigrants to obtain or improve their English skills so that they can assimilate more easily and faster, and contribute sooner to the economy. Both of these policy implications are consistent with the conclusions and indications in Beenstock, Chiswick, and Paltiel's paper (2010) that argues that it is better for Israel to accept more highly educated immigrants and teach immigrants about more skills.

Finally, there are still some limitations in the study. Only four survey years are researched in the paper so the lack of sufficient data may cause biases in the regression results. Another limitation is caused by the bias about location because most Indian and Chinese immigrants in this study live in metropolitan areas, and their income tends to be higher than people who live in rural areas. Besides, there are many factors, other than language proficiency, which leads to the income parity between Indian immigrants and natives. Even though previous studies show that language proficiency is a significant factor, it might or might not be the reason that causes the difference in assimilation between Indian and Chinese immigrants. Future studies could be helpful by including more data and controlling for home locations and English proficiency levels of Chinese and Indian immigrants.

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## VII. APPENDIX

| Table 1: Descriptive Statistics for Three Cohorts Followed in 1995 and 2010 | | | | | | |
|---|---|---|---|---|---|---|
| Variable | 1995 (Age 25 - 50) | | | 2010 (Age 40-65) | | |
| | Natives | Indians | Chinese | Natives | Indians | Chinese |
| Mean of Real Income | 39303.36 | 54077.8 | 40466.47 | 52990.83 | 74865.51 | 67905.17 |
| Percent HS | 70.7% | 25.8% | 43.8% | 65.0% | 25.3% | 40.7% |
| Percent Bachelors | 20.2% | 25.8% | 23.5% | 21.7% | 27.8% | 24.4% |
| Percent Masters | 6.6% | 27.2% | 21.1% | 9.7% | 32.1% | 21.5% |
| Percent Professionals | 1.6% | 12.6% | 2.4% | 1.8% | 6.9% | 2.7% |
| Percent Doctors | .9% | 8.6% | 9.2% | 1.7% | 7.9% | 10.7% |
| Mean of Age | 37.10 | 36.32 | 37.95 | 50.36 | 49.64 | 49.64 |
| Mean of Hrs Worked | 40.90 | 43.94 | 40.00 | 40.50 | 39.97 | 40.51 |
| Percent Married | 69.1% | 84.1% | 82.5% | 72.4% | 91.0% | 84.1% |
| Total | 39895 | 151 | 251 | 40100 | 277 | 410 |
| Source: IPUMS CPS (1995&2010) | | | | | | |

| Table 2: CPI Data Used for Each Survey Year | |
|---|---|
| Survey Year | CPI |
| 1995 | 152.4 |
| 2000 | 172.2 |
| 2005 | 195.3 |
| 2010 | 218.1 |

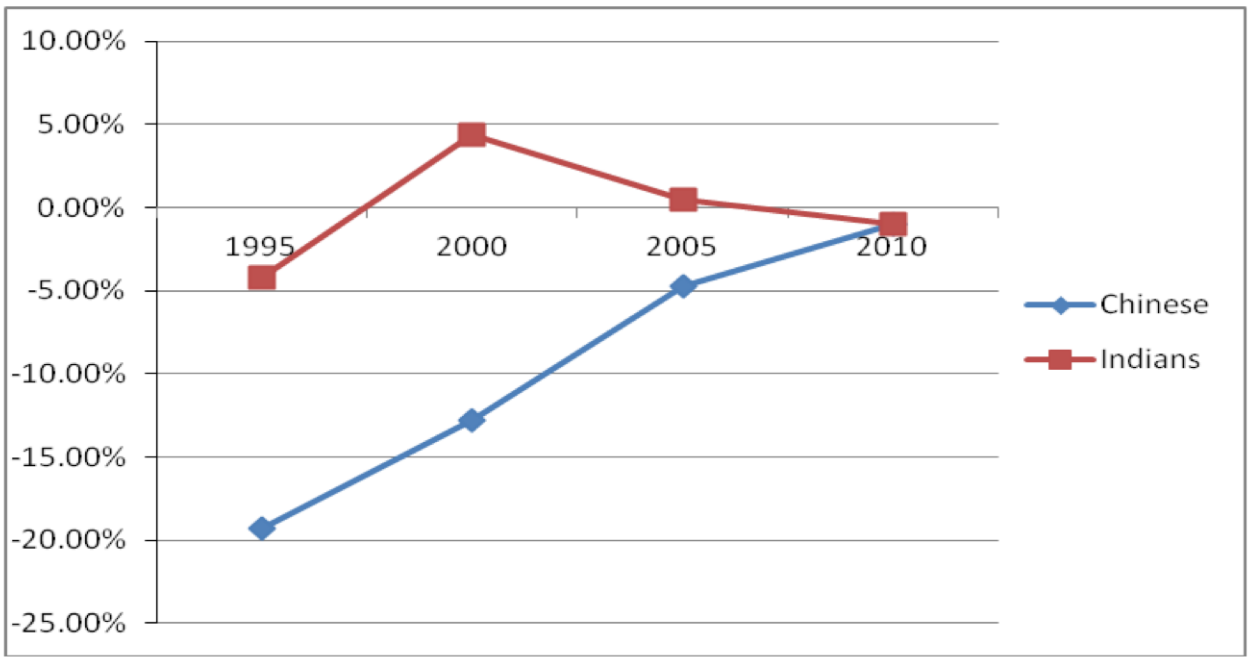
| Table 3: Variables, Definitions and Expected Signs | | |
|---|---|---|
| Variable | Description | Expected Sign |
| Dependent | | |
| LnRealInc | Natural log of real wage and salary income | |
| Independent | | |
| Country of Origin Indian | 0=Non-Indian immigrants or natives<br>1= Indian Immigrants | Unknown |
| Chinese | 0=Non-Chinese immigrants or natives<br>1= Chinese Immigrants | Unknown |
| Educational Attainment Bachelors | 0=No Bachelor's degree<br>1 = Bachelor's degree | Positive |
| Masters | 0=No Master's degree<br>1 = Master's degree | |

| Table 3: Variables, Definitions and Expected Signs | | |
|---|---|---|
| Professionals | 0=No Professional School degree<br>1 = Professional School degree | |
| Doctors | 0= No Doctorate degree<br>1 = Doctorate degree | |
| Age | A person's age at last birthday | |
| Uhrswork | Usual hours worked per week (last year) | |
| Marital Status<br>Married | 0=Not currently married<br>1= Curently married | |

| Table 4: Regression Results for Natives, Indian and Chinese Immigrants (t-Statistics in Parentheses) | | | | |
|---|---|---|---|---|
| Variables | 1995 | 2000 | 2005 | 2010 |
| (Constant) | 7.594***<br>(275.319) | 8.083***<br>(248.002) | 8.347***<br>(282.311) | 8.587***<br>(235.224) |
| Chinese | -.214***<br>(-3.930) | -.137**<br>(-2.381) | -.048<br>(-1.243) | -0.10<br>(-.237) |
| Indian | -.043<br>(-.613) | 0.043<br>(.591) | .005<br>(.109) | .011<br>(.214) |
| Bachelors | .435***<br>(40.220) | .426***<br>(37.139) | .419***<br>(45.006) | .435***<br>(41.8008) |
| Masters | .575***<br>(33.217) | .548***<br>(31.574) | .584***<br>(43.981) | .567***<br>(39.599) |
| Professionals | .595***<br>(17.424) | .728***<br>(19.922) | .969***<br>(34.199) | 1.033***<br>(32.711) |
| Doctors | .613***<br>(14.032) | .697***<br>(17.051) | .777***<br>(25.575) | .858***<br>(27.397) |
| Age | .015***<br>(24.769) | .007***<br>(11.281) | .002***<br>(3.120) | -.003***<br>(-4.950) |
| Uhrswork | .045***<br>(115.258) | .043***<br>(99.881) | .042***<br>(122.357) | .042***<br>(109.523) |
| Married | .123***<br>(13.089) | .132***<br>(13.173) | .180***<br>(21.087) | .182***<br>(19.372) |
| Adjusted R Square | .319 | .296 | .312 | .317 |
| Sample Size | 40297 | 34281 | 49341 | 40787 |

***Significant at the 1 percent level
**Significant at the 5 percent level
*Significant at the 10 percent level
t-Statistics are reported in parentheses

Figure 1: Percentage Difference of Real Income for Indian and Chinese Immigrants Compared to Natives




# Analysis of the Influences of Inflation, Measured by Percentage Change in CPI, and Other Economic Variables on Stock Performance

**Wei Zhang**

## I. INTRODUCTION

In today's increasingly interconnected world, nothing exists independently in a vacuum, which is also true for stock prices of all the stocks traded in the economy. Even back in the 1970s, Castanias (1979) admits that the stock price distribution has been a popular topic. The author challenged the widely accepted opinion that security price changes in competitive security markets are inter-temporally interdependent. Castanias initiates my exploration of what factors influence the so called invisible hand that controls prices in the stock market.

This paper aims to explore the correlation between how some macroeconomic and microeconomic variables, especially the Consumer Price Index (CPI), predict stock performance. CPI is an index measuring the price level of goods and services consumers buy, with social security benefits and inflation tied to this index (Little, 2012). This study derives the expected return in the stock market as a result of fluctuations in percentage change in CPI, which is defined as inflation.

Comincioli (1995) uses the stock market performance as a leading economic indicator. He explores the linkage between the leading economic indicator S&P 500 index in predicting the domestic Gross Domestic Product (GDP) and he uses the Granger-causality tests to prove there exists a causal relationship between stock prices and the economy. Comincioli and this study both try to determine the causality relationship between the overall economy and stock market, but the sequence in the causality relation is reversed for on this paper. This paper will aim to determine how the economy determines the stock market return rather than the other way around as described by Comincioli. Later, this paper elaborates on the effects of percentage change in CPI in stimulating the fluctuations in stock price, which is not covered by Comincioli. It will be further explored in this paper how significant inflation is as an indicator of the economy and whether this key figure can be used by investors to determine whether to purchase stock. It is, therefore, hypothesized that inflation is a significant figure and negatively correlated to the stock return.

From there, a theoretical foundation is created, which can potentially help prospective or current investors make their investment decisions. Investors are anxiously waiting for economic reports regarding some key economic factors every month or quarter in the hope of deriving the forecasts of stock return and deciding when to enter or exit the market. There is an old saying that exists, which states that an invisible hand in the economy controls the changes in the stock market. The purpose of this paper is to further explore the effect of inflation in moving this market over time. Hopefully that would shed some light upon how some key indicators like inflation, influence investor decisions concerning stocks.

## II. THEORETICAL FRAMEWORK

There are several existing theories used in theoretical framework in order to support the research for exploring the factors influencing the stock price and to test my hypothesis that inflation and other macro- and micro-economic factors have a significant effect when predicting stock price. The following is a description and literature review for each of them:

### A. Inflation Theory

Inflation is measured by percentage change in CPI as calculated below (The World Bank, 2012):

$$\text{Inflation} = (CPI_{t+1} - CPI_t)/CPI_t * 100$$

To take into effect the role of CPI in influencing stock performance, inflation is used. Inflation can be a result of demand pull or cost push. The former possibility is a positive sign to the overall economy as the increasing

demand brings prosperity to the economy. The latter possibility is perceived as a negative because the cost push can be driven by an unnatural force, such as the Oil Crisis in the 1970s, which would take tremendous time and effort for the market to adjust from such negative effect. Beyond the two historical possibilities, the recent inflation can be simply as a result of the Federal Bank's excessive printing of cash and flooding the market. Beyond the effects of the invisible hand behind inflation, inflation itself can send mixed signals to the stock market as well. Some companies are good at transferring the pricing pressure to customers, such as those in the consumer staple and energy industry. However companies compete in a global market and a discretionary sector may find it difficult to react to inflation. As a result, their investors end up paying more into their stocks but for less.

Abdullah and Hayworth (1983) aim to examine the relative contributions of a set of variables in the fluctuations of stock prices, especially Consumer Price Index (CPI), and they found that inflation has a significant impact on stock return. Chatrath, Ramchander, and Song (1997) study the correlation between the stock price and inflation in the case of India. Despite a number of articles on the stock return and economy in Europe and North America, the authors choose to approach the subject from the angle of a developing country such as India. The article provides limited support regarding the linkage between the real economy activity and inflation. However, the authors bring up inflation as a determinant of the overall economy and this indicates the importance to apply data adjusted for inflation. Their finding informs me that in order to explore the relationship between inflation and stock return, I must have the data adjusted for inflation in case inflation is not embedded in the stock return composite. Chang, Yeung, and Yip (2000) aims to use employment, CPI, and housing statistics in determining the stock price indexes to provide some guidance to investors. Although Chang, Yeung and Yip's regression model fails eventually in building a connection between the economic indicators like inflation and stock price index, it lends partial support to the hypothesis regarding the change in CPI variable in forecasting the investment return and it points out the practical use of the results from the research that confirms my research area.

In addition, Fama and Schwert (1977) estimate the extent to which various assets are hedges against the expected and unexpected components of the inflation rate within the period of 1953 to 1971. They extend the research from stock market to other income-producing assets and give us a comprehensive picture in the investment horizon. Fama and Schwert (1977) arrive at an "anomalous result" that common stock returns were negatively related to the expected component of the inflation rate. This finding demonstrates that the data used was adjusted for inflation to yield convincing results.

Overall, the inflation theory supports the hypothesis that inflation would have a negative impact on the stock return.

### B. Aggregate Demand and Aggregate Supply Model

Continued from the Inflation Theory, aggregate demand and aggregate supply theory show that different types of inflation can have different effects on the real economy. For example, demand pull inflation is usually associated with an increase in real GDP. Cost push inflation, on the other hand, is often associated with decreases in real GDP. Cost push is shown by a leftward shift in the Aggregate Suppy (AS) curve while demand pull is shown by a rightward shift in the Aggregate Demand (AD) curve. Therefore, cost push inflation can be shown to cause output to fall. The prospect of recession should lead to a decline in the value of stocks. A little bit of demand pull inflation, on the other hand, would result in a short term increase in production. Stock markets may act favorably to low levels of demand pull inflation. However, extremely rapid demand pull inflation can cause significant inefficiencies in the economy. These inefficiencies, in turn, could have an adverse effect on the value of stocks. This model is important as it brings to the hypothesis that there is a threshold beyond or above, which the effect of inflation would be virtually opposite.

Tobin (1965) aims to explore the roles of monetary factors in determining the capital intensity of an economy. Tobin (1965) uses the Cobb-Douglas model to determine the relationship between the capital production and rate of return. This paper gives a good description of the Aggregate Demand of Money.

### C. Capital Asset Pricing Model

Roll (1977) provides a critique on the works done on the Capital Asset Pricing Model (CAPM). Below is the equation for the CAPM:

$$\overline{r}_a = r_f + \beta_a \left(\overline{r}_m - r_f\right)$$

Where:
$r_f$ = Risk free rate
$ß_a$ = Beta of the security
$\bar{r_m}$ = Expected market return

CAPM measures the relationship between expected return and actual return of securities. From the equation listed above, the higher expected return and the higher actual return. The expected high return can possibly draw the investors away from engaging in the consumption market when investors are deciding how to allocate their limited resources to make the maximum return. We usually conceive the risk free rate as the rate of return on the one-year year treasury. This paper is unique in the sense that it concludes the only testable hypothesis is that the market portfolio is mean variant efficient. All other hypotheses tested to arrive at the model are merely mathematical exercise that does not serve any practical use. This paper provides a pessimistic view in considering whether there are any factors that are strong enough to predict the asset price, including stocks. However, it provides a useful theoretical framework of the asset pricing model.

In addition, the risk free rate and the expected market return would reflect inflationary expectations. When Beta is different from 1, changes in inflationary expectations would affect the price of the security. CAPM alone emphasizes the importance of risk free rate, denoted by the one-year treasury rate in deciding the actual return. The empirical model of this paper incorporates the one-year treasury rate as a factor that influences the stock performance. For all these elements incorporated, CAPM proves to be an effective model to be used.

### D. Time Value of Money (TVM)

When professional analysts calculate the net present value of expected future cash flow, they will always discount the cash flow expected to receive to the present value, assuming the economy is in a long-run inflating stage. This is also why a majority of people prefer to receive the money today rather than in the future with the same amount, just as why people will be paid interest for having money in the savings account. Meanwhile this is what investors are considering when making their investment choices: whether to spend the money today in consumer products or invest it somewhere with a positive expected return. This is how behavior in finance comes into play. The Time in Value of Money (TVM) Theory is a continuation of the Inflation Theory as it suggests the higher inflation leads to the lower future value. Thus TVM Theory supports the hypothesis that inflation has a negative impact on the stock market. Below is the equation used to represent TVM and its effect on future value:

$$F = P (1 + i)^n$$

Where:
F = future value
P = present value
*i* = reflects the time value of money including anticipated inflation
n = number of periods

A counter argument to this is that if the time value of money increases, investors would prefer to hold assets like stocks instead of money. The increased demand for stock will increase their prices. The idea is that inflation causes shifts away from assets that are sure to lose value with inflation, like money held in savings or even treasuries and bond in some cases, to assets that have a chance of appreciating in value like stock. However, this paper uses the supporting side of inflation theory and to see to what extent it can support the hypothesis.

## III. DATABASE AND EMPIRICAL MODEL

The database applied is from Robert Shiller's United States stock price data for a time period from 1871 to 2012. Robert Shiller is an American economist, who explored in depth the correlation between economic factors and stock performance since the early 1980s while Bulmash and Trivoli (1991) investigate the relationship between the stock price and the national economic indicators. The authors proved how the existence of the relationship will lead to the use of the stock price index as an indicator in overall economy. Bulmash and Trivoli apply a time series data in exploring the relationship between the performance of stock market and overall economy.

The database is obtained through the website of Yale University Economics Department originally in Excel format. I hereby provide the link to retrieve the data for your reference: www.econ.yale.edu/~shiller/data/chapt26.xls. The data is appropriate as Shiller has traced the historical stock prices all the way to 1871, which is very rare and highly valuable for stock data and including both micro- and macroeconomic variables.

An OLS regression is used in addition to the S&P composite index, calculated as an index of the stock (equity) prices of the weighted average market

capitalization to be my dependent variable.

Hondroyiannis and Papapetrou (2001) study industrial production, interest rates, exchange rates, performance of the foreign stock market, oil prices, and stock returns to examine whether economic activity movements affect the performance of the stock market for Greece. This paper provides one of the most comprehensive lists of economic indicators listed that could potentially be the variables chosen in my research. Although this paper only examines the big picture of Greece, the indicators such as interest rate and industrial production shed some light on the situation of United States and also give me some insight in the choice of variables.

Inflation is calculated as a percentage change in CPI and use inflation as a key independent variable. A statistic description shows the possible convergence of the inflation and stock return graphs when combined together as their high and low points to some extent correspond.

The one-year treasury rate and its P/E ratio would be crucial to the model as well as explained by the CAPM. Besides that, the ten-year bond return and its P/E ratio are used to find how investors are making the trade-off decision of whether investing in short-term or long-term investment products. P/E ratios in both cases are derived from past data and show investors' expectation for future return. The higher the P/E, the higher expectation the investors have for its future return. It can also be argued that high P/E means certain investment product is overvalued and that tend to draw investors away from the treasury and bond and possibly bring investors back to the stock market. In that case, P/E ratios send mixed signals to the market. Additionally, all the variables, if necessary, are converted to 2005 dollars to adjust for inflation to examine movements in real terms.

In order to explore deeper into the effects of inflation, it is assumed that investors are smart enough to forecast the correct inflation and their predicted inflation for the next year is the actual inflation. In that way, inflation is incorporated for the next year as one independent variable which would help explain the stock performance. To better assess the change in the stock return, the dependent variable is changed to "Percentage Change in S&P Index".

Beyond the original hypothesis, the correlation between the inflation and stock return might be a piecewise function where inflation within a different range would have a range of effects on stock return. Inflation is categorized into Deflation(i<0), Low Inflation(0<=i<=.05), Moderate Inflation(.05<=i<=.1), and Hyperinflation(i>.1). Each of them is coded as dummy variable with "1" means the individual year is in that inflation category and "0" means it is not. This leads to Model B1.

Model A

Return on S&P Composite= ß0 + ß1 (Rate of Inflation)+ ß2 (Rate of Inflation for the next year) + ß3(One-year treasury return)+ ß4(P/E of one-year)+ ß5 (Return on Ten-year bond)+ ß6 (P/E of ten-year bond)+μ

Model B

Percentage Change on S&P Composite= ß0 + ß1 (Low Inflation)+ ß2 (Moderate Inflation) + ß3(Deflation)+ + ß3(Hyperinflation)+μ

## IV. RESULTS

### A. Model A

In the initial model, the Return on S&P Index is used as the dependent variable and is used to run the regression against one/ten-year interest rates, P/E ratio of one/ten-year interest rate, and inflation rates for current/the next year The adjusted R square is .571 as shown in Table 1, indicating that this model explains more than half of the data variation. Below is the regression result for Model A1 in which the dependent variable is Return on S&P Composite Index.

Return on S&P Composite = -674.455+ 29.049 (Rate of Inflation)-14.019(Rate of Inflation for the next year) -55.721(One-year treasury return)+ ß4(P/E of one-year)+ 93.579(Return on Ten-year bond)+ 36.139(P/E of ten-year bond)+μ

Just as hypothesized, the one-year interest rate has a negative impact on stock return. This further supports the reasoning that treasury and stocks as investments go in opposite directions and investors have to make the trade-off choice. The result for ten-year bond rate has a negative impact on stock return which goes against the original guess. The explanation for that is a ten-year bond as an investment might not share the same investor market as the stocks. In that case, ten-year bond serves only as an overall economic indicator, without competition for investors with stocks.

Results also show that P/Es of one/ten-year both have a positive impact on stock return. This can be explained by the earlier reasoning that the value of P/E is in line with investors' expectations regarding certain investments. In this case, the possible negative side of P/E on stocks is not demonstrated by the results. One thing to pay attention to is the P/E for one year is insignificant in explaining the stock return index. This could be a result of a combination of a negative correlation between one-year treasuries and stocks return plus a positive correlation between one-year treasury return and corresponding P/E.

Ironically, the key variables measured, the inflation for the current year and expected inflation for the next year, are found to be insignificant in explaining the stock return index. Moreover, Graph A with S&P Index against rate of inflation demonstrates clearly a positive linear relationship between the two. However, Graph B shows there is hardly a relationship between the S&P Index and the expected inflation for the next year assuming investors are smarts enough to predict accurately the inflation for the next year. The dots in Graph B end up all over the place. This can be explained by the prediction ability of investors are highly over-estimated.

### B. Model B

The positive linear relationship demonstrated in Graph A goes against the hypothesis. In order to explore deeper the effects of inflation and focus on the relative changes rather than the absolute value, the "Percentage Change on S&P Composite Index" is used as the dependent variable. A comparison of the mean dummy variables of inflation ratios within different range extends my research on the effects of inflation on stock performance. Based upon the descriptive results, it is found that 41.8 percent of the years from 1871 to 2011 have hyperinflation, where inflation is over 10 percent. Interestingly, the next largest group, those years with deflation, represents 37.6 percent of the entire 141 years. The years which we considered having healthy inflation (Low/Moderate Inflation) merely represents 20.6 percent. The Descriptive Results are shown in Table 2 and the regression results for Model B1 and B2 are in Table 3.

Deflation (i<0)
Low Inflation (0<=i<=.05)
Moderate Inflation (.05<=i<=.1)
Hyperinflation (i>.1)

Model B1
Percentage Change on S&P Composite=.211-.193(Low Inflation) -.142 (Moderate Inflation) -.343(Deflation) +μ

Model B2
Percentage Change on S&P Composite=.049 + .172 (Hyperinflation)-.171 (Deflation) +μ

In Model B1, just as expected, deflation would be detrimental to the stock market. Declining prices, if they persist, generally create a series of negative events such as falling profits, closing factories, shrinking employment and incomes, and increasing defaults on loans. All these would lead to a stock return to go down. Low Inflation and Moderate Inflation also negatively impact stock performance. Although the common saying is that a slight and healthy inflation would be good to the economy, it does not work in the stock market in this case. A one-digit percentage inflation ratio can be detrimental to the stock market especially when the companies fail to transfer the pricing pressure to consumers and this is usually the case for companies in the discretionary sector. One thing to notice here is the variable Hyperinflation is automatically excluded when running this regression.

In order to find out the impacts of Hyperinflation on stock market, Model B2 is used to run the regression of only Hyperinflation and Deflation against the Percentage Change in S&P Index. Hyperinflation shows to be positively correlated to stock return. This can be explained by the inflation can be derived from the rapid demand pull that results in increasing supply of money. Over the past 141 years, Hyperinflation is overall beneficial to the stock market.

The original hypothesis that inflation negatively impacts stock return is partially correct from the results. The function between inflation and stock market is a piecewise function where inflation would have impacts of different magnitude and direction when the value of inflation changes. Inflation would have a positive impact on stock return when inflation exceeds 10 percent, otherwise inflation would be detrimental to the stock return.

## V. SUMMARY AND CONCLUSION

The purpose of this paper was to evaluate the inflation as a leading economic indicator and explore causal relationships inflation together with other economic variables and stock return.

The results indicated a concrete relationship between the inflation and stock market does exist. Inflation, whose value is within different ranges, would play different roles on stock market. Inflation exceeding 10 percent would be a good sign to the stock market while inflation with other value would drag down the stock return.

The policy implication is to have dual standards when considering the impacts of inflation on stock market. Deflation, low, and moderation inflation would be detrimental to the stock market and they are potential warning signs to investors looking to either enter the stock market or increase weight of stocks in their portfolio. Hyperinflation, on the other hand, is a result of demand pull in most cases although exceptions arise when Federal Reserve meaninglessly print extra cash. Inflation figure above 10 percent is considered a good time for investors to either increase current holdings of stocks or enter the stock market. Compared to the interest rate of short-term treasury and long-term bond, inflation is more effective in predicting stock return. This is demonstrated by the more than 20 percent increase in adjusted R square. Therefore, the returns on alternative investments are more crucial figures investors should look at. Overall, inflation serves as supplemental information investors shall look at when making investment decisions.

For future study, the third area should look at the reverse side of this research and explore the causality relationship between the stock return and various economic variables. The results in this paper show an overall good economy is no guarantee to equally good stock return. Can stock market and the overall economy be independent events without concrete relationship between the two? Hopefully future studies in this area would shed some light on this question.

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## VII. APPENDIX

| Table 1: Regression Results, Dependent Variable is S&P Composite Index on Stock Return | | |
|---|---|---|
| | | Model A |
| Hypothesized | Dependent Variable | Beta Values |
| NA | Constant | -674.455 (-8.115) *** |
| - | One-year interest rate | -55.721 (-3.673) *** |
| - | Ten-year interest rate | 93.579 (5.176) *** |
| + or - depending | P/E of one-year | 6.153 (1.140) |
| + or - depending | P/E of ten-year | 36.139 (7.223) *** |
| + or - depending | Inflation of current year | 29.049 (.228) |
| + or - depending | Inflation of next year (assuming the expected inflation-actual of next year) | -14.019 (-0.126) |
| Adjusted $R^2$ | 0.571 | |
| F | 29.791 *** | |
| Sample Size | 141 | |
| t-statistics in parentheses<br>*** Significance at the 0.01 level | | |

| Table 2: Descriptve Results of Inflation with Ranges | | | | |
|---|---|---|---|---|
| | Deflation | Low Inflation | Moderate Inflation | Hyperinflation |
| Standard Deviation | 0.4860777 | 0.3267847 | 0.2800347 | 0.4950617 |
| N | 53 | 17 | 12 | 59 |

| Table 3: Regression Results, Dependent Variable is Percentage Change on S&P Composite Index | | |
|---|---|---|
| | Model B1 | Model B2 |
| Dependent Variables | Beta Values | Beta Values |
| Constant | 0.211 (18.799) *** | 0.049 (2.904) *** |
| Low Inflation | -0.193 (-7.771) *** | N/A |
| Moderate Inflation | -0.142 (-4.974) *** | N/A |
| Deflation | -0.343 (-20.064) *** | -0.171 (-8.152) *** |
| Hyperinflation | Auto excluded | 0.172 (8.366) *** |
| Adjusted R2 | 0.742 *** | 0.739 *** |
| F | 135.023 *** | 199.626 *** |
| Sample Size | 141 | 141 |
| t-statistics in parentheses | | |
| * Signficance at the 0.1 level<br>** Significance at the 0.05 level<br>***Significance at the 0.01 level | | |

**Figure 1: Graph A**

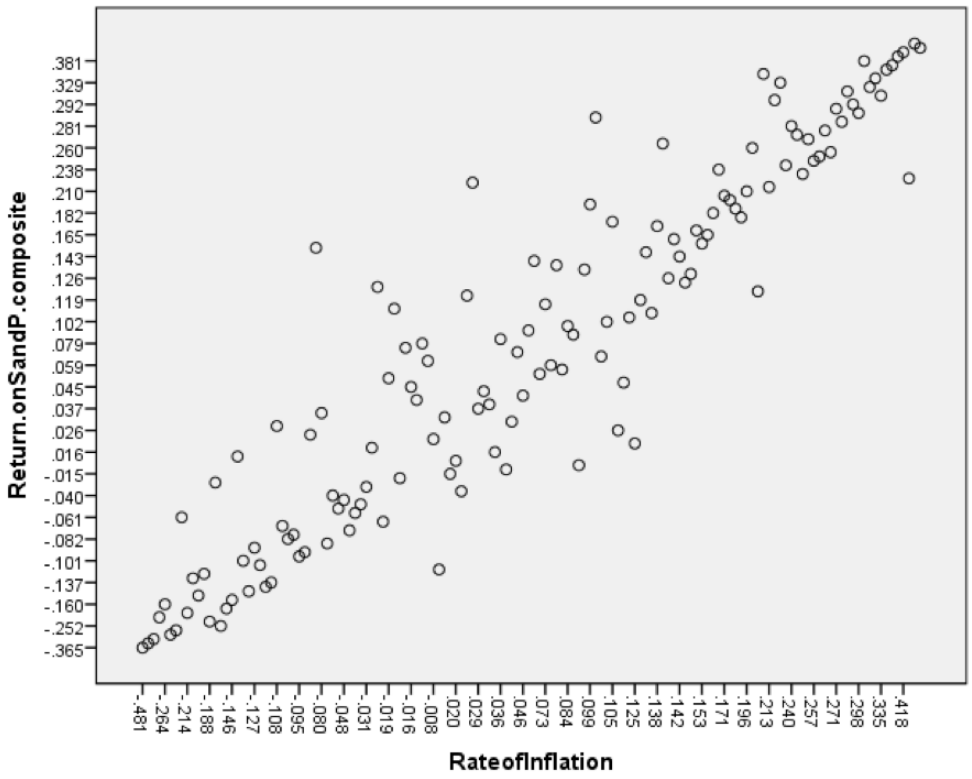
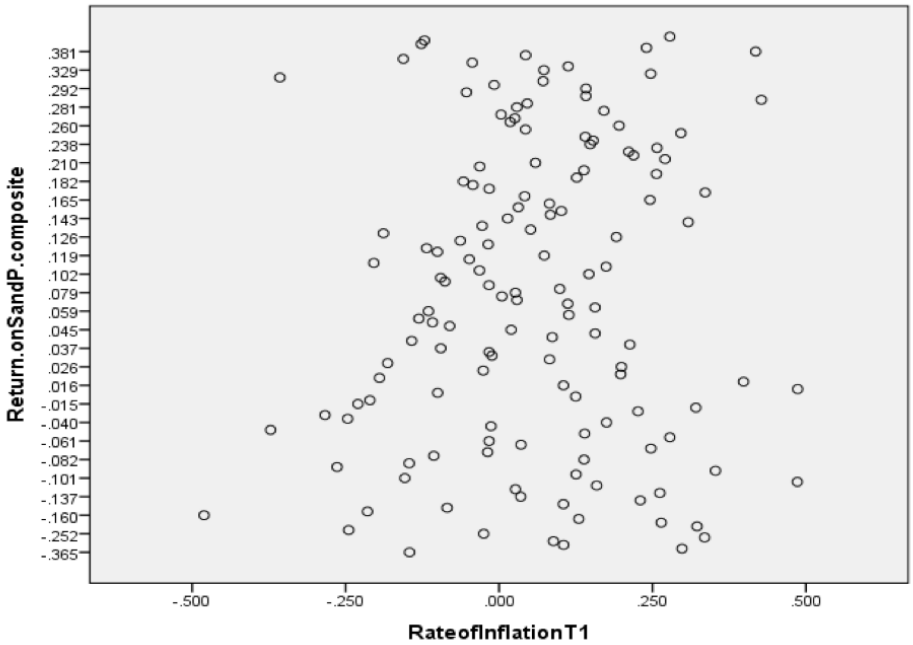



**Figure 2: Graph B**



# The Park Place Economist

*The Park Place Economist* was founded in 1993 and named after the street where it was started - Park Place Street. Throughout the years, the journal has published scholarly research articles in economics by Illinois Wesleyan University students. The published articles range from basic topical explorations to focused senior research projects. The journal is completely student-run.

At the beginning of the 2012 school year, the journal became a Registered Student Organization (RSO). Student Senate will allot the funding for the publication for the journal each year. Since the journal is now an RSO, students will meet throughout the year to complete the publication of the journal on their own time. The staff is not required to pay dues for membership and any Illinois Wesleyan University student can join. However, to submit an academic paper to the journal for publication, the article must have economic theory in the paper. This is the only limitation we have on students' work. This limitation has not stopped students from other disciplines from submitting their research.

There are several changes in the Department of Economics happening in the 2013 to 2014 school year. One of the biggest changes is that the whole department will physically be moving to the new classroom building, State Farm Hall, in the fall of 2013. There, economics and business students will have a new computer lab environment to conduct research in as well as new classrooms.

In order to enrich the economic community at Illinois Wesleyan University, former President Robert S. Eckley and other donors have made it possible for two of economic students to pursue summer research with professors this 2013 summer. In addition, the Robert S. Eckley Lecture in Economics was provided for in the 2013 spring semester. Illinois Wesleyan University welcomed Massachusetts Institute of Technology economist and best-selling author Daron Acemoglu on March 27th, 2013 to speak in front of the community on his book *Why Nations Fail: The Origins of Power, Prosperity, and Poverty*. The Robert S. Eckley Lecture in Economics will become an annual event at the university.

If you would like to become involved in *The Park Place Economist*, please contact:

Tara Gracer (tgracer@iwu.edu), President
Mark Giannis (mgiannis@iwu.edu), Vice President
Robert Leekley (bleekley@iwu.edu ), Advisor