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ACADEMY of ECONOMICS and FINANCE JOURNAL

Volume 8

Table of Contents

2017

An Empirical Examination of Renewable Energy Investments in Europe.

Joseph Farinella and Mohamed Taieb Haouari Fellahi, University of North Carolina Wilmington

Abstract

Each year, approximately 6.5 million premature deaths are due to CO_2 emissions and global warming, (World Energy Outlook 2015). Most governments have agreed to decrease their reliance on traditional energy and use more renewable energy. In the 21st century, global investment in renewable energy increased substantially going from $1,360 to $5,100 billion in the last decade, (IPCC, 2011). In this study, we examine the factors that affect investments in renewable energy in France, Germany, Italy, Spain, and the United Kingdom from 2005 to 2014. The empirical results show that greenhouse gas emissions, environmental tax, energy consumption and fossil fuel support do not significantly affect investments in renewable energy. The price of oil has a significant and positive relationship to investments in renewable energy. The change in GDP, unemployment and exchange rates have a significant negative relationship to investments in renewable energy. The results are consistent with the notion that macroeconomic variables rather than government policies drive investments in renewable energy.

Introduction

Heat waves, floods, droughts, severe storms and wildlife extinction rates are increasingly grabbing newspaper headlines. These are some of the alarming effects of global warming which represent, according to the scientific community, the main health threat of the 21st century. The inconvenient truth of global warming is motivating the world to begin switching from traditional energy to renewable energy. Renewable energy refers to sustainable energy from the natural environment including bioenergy, solar, hydropower, wind, geothermal and ocean energy. Renewable energy is a clean and inexhaustible alternative.

In this study, we examine the factors that affect investments in renewable energy in France, Germany, Italy, Spain and the United Kingdom (BIG5) from 2005 to 2014. This period is particularly interesting for many reasons including political factors, world economic crisis, and plunging oil prices. The European Union is one of the biggest energy producers and consumers. In addition, the EU is attempting to reduce greenhouse gas emission by 20% from 1990 to 2020. Accordingly, the EU is trying to increase investments in renewable energy and is leading the fight against climate change. The EU has launched several policy measures, such as financial incentives, tax incentives and renewable portfolio standards in an effort to meet this goal. In spite of these efforts, Europe's investment in clean energy fell nearly 18% to $58.5bn in 2015, which represents the largest decline since 2006. It is important for governments and citizens concerned with Global warming to understand the factors affecting investments in renewable energy to make informed decisions.

In 2015 at the Paris climate summit, 195 countries committed to speed up access to renewable energy and advance the implementation of energy efficient policies. According to the International Energy Agency, renewable energy accounts for 3.5% of the total energy consumed in the world. Reliance on renewable energy will continue to grow in the future. According to the US Energy Information Agency, renewable energy accounted for 17% of the energy consumed in the U.S. in the first half of 2016. A study by the Department of Energy's National Renewable Energy Laboratory forecasts that 80% of the electricity in the U.S. will be from renewable energy by 2050.

The anticipated growth in renewable energy is possible with current technology such as; wind turbines, solar photovoltaics, concentrating solar power, biopower, geothermal, and hydropower. According to Bloomberg New Energy Finance (2016), new investments in renewable energy rose from $9 billion in the first quarter of 2004 to $50 billion in the first quarter of 2015. In the 21st century, global investment in renewable energy started to increase substantially going from $1,360 to $5,100 billion in the last decade, (IPCC, 2011).

In this paper, we examine the factors that affect investments in renewable energy in the five largest European economies (BIG5) from 2005 to 2014. We are unaware of any studies examining these countries over this period. The growth in renewable energy investments, the economic crisis, and falling oil prices make this period particularly interesting. The factors that drive investments in renewable energy is important for policy makers and investors to understand.

Literature Review

Many believe that global warming mitigation and reducing carbon dioxide are sufficient reasons to invest in renewable energy. However, according to a study by Marques (2011) of 24 EU members, environmental concerns are not enough to

motivate the change from traditional energy to renewable energy. Ozcan (2014) conducted a survey of 17 investors in Turkey and finds that environmental awareness, long-term profitability, incentive systems and political stability are the most effective reasons to encourage renewable energy investments.

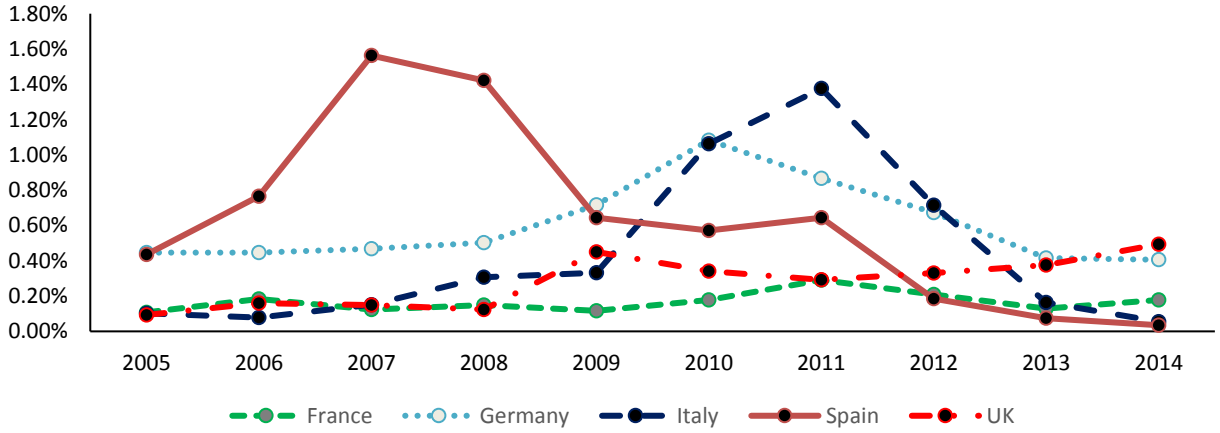
Henriques and Sadorsky (2008) test the relationship between stock prices of alternative energy companies, oil prices and technology stock prices from January 2001 – May 2007. The authors use a vector autoregression model and find that alternative energy stock prices is affected by shocks to technology stock prices but shocks to oil prices have little significant impact on alternative energy stock prices. Kahn (1996) finds that the main driver for developing green energies such as wind power turbines is the financing options. The results show that public financing tends to be a cheaper alternative for wind power development than private financing. In addition, the tax credit is a weak incentive to promote investments in renewable energy as long as the private financing remains the prevailing source. Nonetheless, public financing may not be cheaper than private due to the high risk associated with many renewable energy investments. A study by Masini (2012) examines the behavioral factors that drive investments in renewable energy. The study surveys 136 venture capitalist, private equity funds, asset managers, investments funds, commercial banks and energy companies in 2009. The author finds that investors want a proven technology and prefer short-term investment horizons. The authors find that a higher cost of capital and market uncertainty decreases investments in renewable energy.

Angelucci (2006) finds that Germany has one of the lowest production incentives and the biggest green investment market in Europe. The author concludes that in Germany market stimulus does not drive investments in renewable production, especially for electricity. Hofman (2012) conducts a survey of 60 investors and finds investor's decision regarding investing in renewable energy did not change after the recent economic crisis and subsidy cuts in several EU countries. A study by Most (2010), finds that policy measures and financial instruments lead to a decrease in renewable energy investments.

Another important area in the literature relates to the affect that investments in renewable energy have on economic growth. Menegaki (2010) performs a study of 27 European countries over a period of 10 years (1997-2007) to examine this issue. The author uses a random effect model with greenhouse gas emission, energy consumption and employment as independent variables in the model. The results show that there is no causality between renewable energy consumption and GDP. This lack of causality between renewable energies consumption and GDP shows the neutrality of renewables on economic growth. The authors believe that limited use of renewable energy across Europe may be driving the results.

Our study contributes to the existing literature in several important ways. The landscape of investing in renewable energy is changing quickly and there have been many significant changes in political agreements and economic variables that affect investments in renewable energy. Our study examines the Big 5 EU countries from 2005 – 2014, during this period these countries have been among the leaders in renewable energy. In addition, we provide a comprehensive study that examines the impact that government policies and macroeconomic variables have on investments in renewable energy.

Figure 1: Renewable energy new investment relative to GDP



Source: Bloomberg New Energy Finance

Methodology

The sample consists of data for France, Germany, Italy, Spain and the United Kingdom (BIG5) from 2005 to 2014. Renewable energy new investment (RENI) is new investments in solar, wind and biofuels energies including energy efficiency but excluding hydropower, geothermal and ocean energies. RENI is collected from the Bloomberg terminal.

Figure 1 shows RENI as a percent of GDP in each country (RENIGDP), in million American dollars (US$) from 2005 – 2014. From 2005 – 2009, Spain had the highest RENIGDP but this figure decreases significantly after the financial crisis. Germany had a high RENIGDP over the entire period. Italy's RENIGDP is near the bottom until 2009, then increases from 2010 – 2012, and falls in 2013 and 2014. The United Kingdom and France RENIGDP is relatively low over the entire period.

The following model examines the factors that drive investments in renewable energy.

$$RENIGDP_{ti} = \alpha + \beta_1 INFL_{ti} + + \beta_2 UNEMP_{ti} + + \beta_3 ENECONS_{ti} + \beta_4 FFCONT_{ti} + \beta_5 ENVIRT_{ti} + \beta_6 FFSUP_{ti} \beta_7 CORPRD_{ti} + \beta_8 GOVRD_{ti} + \beta_9 STOCKP_{ti} + \beta_{10} OILP_{ti} + \Sigma\beta i\ CONTROLVAR_{ti} + \varepsilon_{i.} \quad (1)$$

Where the variables are defined as: $RENIGDP_{ti}$ is renewable energy investment (solar, wing, biofuels) as a percent of GDP for period t and country i, $INFL_{ti}$ is inflation, $UNEMP_{ti}$ is unemployment, $ENECONS_{ti}$ is energy consumption, $FFCONT_{ti}$ is fossil fuel contribution, $ENVIRT_{ti}$ is an environmental tax, $FFSUP_{ti}$ is fossil fuel support, $CORPRD_{ti}$ is corporate R&D expenditures, $GOVRD_{ti}$ is government R&D expenditures, $STOCKP_{ti}$ is the stock price, and $OILP_{ti}$ is brent crude oil price. The control variables include: growth in GDP (GDP_{ti}), productivity ($PRODTY_{ti}$), Green House Gas Emissions ($GHGEM_{ti}$), long-term interest rates ($INTERR_{ti}$), and exchange rate ($EXCHR_{ti}$).

Table 1: Descriptive statistics

Variable	**Mean**	**Std. Dev.**	**Minimum**	**Maximum**
RENIGDP	0.0042	0.0037	0.0003	0.0156
GDP	2464372	724217	1157276	3868291
GHGEM	474.986	182.224	238.092	841.251
INFL	1.9760	1.0728	-0.2880	4.4842
PRODTY	35744.2	3669.64	27869.0	46393.9
UNEMPL	9.7202	5.1673	4.7500	26.0900
OILP	81.8580	23.8007	45.5900	111.110
INTERR	2.6504	1.1563	0.5405	4.3310
EXCHR	0.7493	0.0361	0.6832	0.8049
FFCONT	76.4209	14.1318	46.2747	91.0669
ENECONS	6065104	1743919	3317000	9354304
ENVIRTAX	43645.1	15069.6	16848.8	68086.0
CORPRD	116.179	198.717	0.0601	794.624
GOVRD	52.8183	28.7253	8.5200	111.291
FFSUP	7785.98	11327.7	816.540	37284.7
STOCKP	10551.1	8719.23	3159.81	41434.0

Table 1 provides descriptive statistics for the variables used in the model. The minimum GDP is $1,157,276 million (Spain in 2005) and the maximum is $3,868,291 million (Germany in 2014). The lowest unemployment rate over the period is 4.75% (United Kingdom in 2005) and the highest is 26.09% (Spain in 2013). The price of Brent crude oil fluctuated over the period from $45.59 (2008) to $111.11(2012).

The correlations between the variables used in the regression model is examined. We find several variables that have high correlations: GDP has a high correlation with GHG emissions (0.7987), productivity (0.8175), energy consumption (0.9056),

environment tax (0.8334), corporate R&D (0.7011), and government R&D (0.6045). In addition, GHG emission has a strong correlation with energy consumption (0.9214), environment tax (0.7777) and private R&D (0.8434). Additionally, we note a high correlation between productivity and environment taxation (0.6605). Finally, there is a high negative correlation between fossil fuel support and fossil fuel contribution. To measure the severity of the multicollinearity among the independent variables, we calculate the variance inflation factor (VIF).

Table 2: Results from Ordinary Least Squares Regression: Full model

Variable	**Coefficient**	**T stat.**	**VIF**
Intercept	0.1037971		
GDP	-1.37E-08	-3.12*	64.27
GHGEM	6.5E-05	1.7***	309.77
INFL	-0.000317	-0.56	2.35
PRODTY	4.06E-07	0.99	14.32
UNEMPL	-0.00086	-4.18*	7.17
OILP	0.0000519	2.22**	1.95
INTERR	-0.000957	-1.1	6.35
EXCHR	0.065635	-2.98*	4.01
FFCONT	-0.000438	-2.06**	57.36
ENECONS	-3.54E-09	-0.98	253.03
ENVIRTAX	4.93E-08	0.57	10.89
CORPRD	-1.19E-06	-0.15	15.56
GOVRD	2.02E-05	0.63	5.34
FFSUP	-2.26E-07	-1.36	22.41
STOCKP	-1.00E-07	-1.07	4.21
R-squared 0.60	Adj. R-squared 0.43	F-Ratio 3.46*	

*significant at the 1% level, ** significant at the 5% level, *** significant at the 10% level

Results

Table 2 provides a summary of the results from the full model. The F-ratio is 3.46 (p-value 0.0013) and the R-squared 0.60 indicating the model has high explanatory power. The statistically significant variables and p-values are GDP (0.0037), GHG emissions (0.0991), unemployment (0.0002), oil price (0.0328), exchange rate (0.0053), and the fossil fuel contribution in the total energy production (0.0474). The resulting coefficients indicate that an increase in the GDP, unemployment, the exchange rate or the fossil fuel contribution decreases investments in renewable energy. In addition, an increase in greenhouse gas emissions and the Brent crude oil price increases investments in renewable energy.

As mentioned earlier, there is a strong correlation between several predictors and the VIF statistics indicate that multicollinearity is a problem. We observe that several drivers have a VIF higher than 5 especially the GDP (64.27), GHGEM (309.77), PRODTY (14.32), FFCONT (57.36), ENECONS (253.03), ENVIRTAX (10.89), CORPRD (15.59) and FFSUP (22.4).

Table 3: Results from Ordinary Least Squares Regression: Reduced model

Variable	**Coefficient**	**T stat.**
Intercept	0.4896	
GDP	-6.19E-09	-4.5*
UNEMPL	-0.000482	-3.62*
OILP	3.71E-05	2.04**
EXCHR	-0.04244	-3.42*
FFCONT	4.55E-05	1.29
R-squared 0.47	Adj. R-squared 0.38	F-Ratio 5.23*

*significant at the 1% level, ** significant at the 5% level, *** significant at the 10% level

In order to mitigate multicollinearity, we reduce the model and remove the non-significant variables (i.e. with the highest p-value) one at a time with high correlations. The results from the reduced model is in Table 3. The reduced model is statistically significant and presents RENIGDP as a function of the change in GDP, unemployment, Brent crude oil price, and exchange rate (€/$). The F-ratio of 5.23 is significant at the 1% level and the R-squared is 46.59%. The change in GDP (GDP), unemployment (UNEMPL), and exchange rate have an inverse relationship with RENIGDP, these variables are statistically significant at the 1% level. Consistent with our expectations, Brent crude oil price (OILP) has a positive coefficient and is significant at the 5% level. Intuitively, we expect an increase in oil prices to increase investments in renewable energy and a decrease in oil prices to decrease investments in renewable energy.

Conclusion

In this study, we examine the factors affecting new investments in renewable energies in France, Germany, Italy, Spain and the United Kingdom from 2005 – 2014. We find evidence that the growth in GDP, unemployment, and the Euro/Dollar exchange rate, have a negative relationship on investments in renewable energy. In addition, Brent crude oil prices, has a positive relationship with investments in renewable energy. This is consistent with our expectation since higher oil price would increase investments in renewable energy and lower oil prices would decrease investments in renewable energy. There is no statistical evidence that greenhouse gas emission, total energy consumption, fossil fuel contribution, long-term interest rate, government investments in R&D, fossil fuel support, and productivity have an impact on investments in renewables.

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References

Angelucci, Paolo. 2006. “Use of economic instruments in the German renewable electricity policy.” *Energy Policy*, 34: 3538–3548.

Böhringer, Christoph, Andreas Löschel, Ulf Moslener, and Thomas F. Rutherford. 2009. "EU climate policy up to 2020: An economic impact assessment." *Energy Economics*, 31: S295-S305.

Frankfurt School-UNEP Centre/BNEF and Bloomberg New Energy Finance. 2016. “Global Trends in Renewable Energy Investment 2016”, http://www.fs-unep-centre.org (Frankfurt am Main), Copyright © Frankfurt School of Finance & Management.

Henriques, Irene, and Perry Sadorsky. 2008. "Oil prices and the stock prices of alternative energy companies." *Energy Economics* 30: 998-1010.

Hofman, Daan M., and Ronald Huisman. 2012. "Did the financial crisis lead to changes in private equity investor preferences regarding renewable energy and climate policies?" *Energy Policy*, 47: 111-116.

IPCC, (2011). Summary for policy makers. Special Report on Renewable Energy Sources and Climate Change Mitigation Cambridge University press, Cambridge, UK and New York, NY, USA.

Kahn, Edward. 1996. "The production tax credit for wind turbine powerplants is an ineffective incentive." *Energy policy*, 24: 427-435.

Marques, António Cardoso, and José Alberto Fuinhas. (2011), "Drivers promoting renewable energy: A dynamic panel approach." *Renewable and sustainable energy reviews*, 15: 1601-1608.

Masini, Andrea, and Emanuela Menichetti. 2012. "The impact of behavioural factors in the renewable energy investment decision making process: Conceptual framework and empirical findings." *Energy Policy*, 40: 28-38.

Menegaki, Angeliki N. 2011. "Growth and renewable energy in Europe: a random effect model with evidence for neutrality hypothesis." *Energy Economics*, 33: 257-263.

Möst, Dominik, and Wolf Fichtner. 2010. "Renewable energy sources in European energy supply and interactions with emission trading." *Energy policy*, 38: 2898-2910.

Ozcan, Mustafa. 2014. "Assessment of renewable energy incentive system from investors' perspective." *Renewable Energy*, 71: 425-432.

United Nations Framework Convention on Climate Change. 2015. "Report of the Conference of the Parties on its twenty first session held in Paris on the 30 of November 30 to the 13 of December 2015.

World Energy Outlook (WEO) Special Report on Energy and Climate, 2015.

Medical Tourism: Whom Shall I Use?

Lydia L. Gan, Bishwa S. Koirala, and James R. Frederick, University of North Carolina at Pembroke

Abstract

This study estimates the effects of having knowledge about medical tourism on the choice of agents by consumers. This investigation employs a multinomial logit regression model to estimate the likelihoods of the choice of agents. A total of 964 observations were obtained from a survey conducted between 2011 and 2014. The results show that having such knowledge reduces the likelihoods of traveling abroad for knee replacement by 35.6 % and by 43.8% for stem-cell therapy. Further, being near retirement age, middle-income, proficient in a foreign language, of an ethnic minority, uninsured, and poor in health, also had significant effects.

Introduction

Medical tourism is an intriguing topic. When engaging in medical tourism, consumers participate in an expanding global healthcare market. Medical tourism is intricately connected to consumers' decision making, albeit in both emotional and financial ways. As in other service industries such as travel, insurance, home purchase, and investment, the role of an agent or middleman is extremely important in enhancing the total economic welfare generated by healthcare markets. Some of the basic questions confronted by consumers in the globalization of healthcare are: "Which healthcare provider and which destination country should I choose?" "Is the cost saving significant enough to offset the risks and difficulties?" and more importantly, "Can I expect the same or better quality of care as I receive in my home country?" These essential questions highlight the role of the middleman who can provide myriad of services to help consumers make better healthcare decisions. There are several middlemen, or agents, in the market for medical tourism. In this paper we will identify four main types of agents that potential medical tourists typically use to arrange their medical travel. We will also discuss the traits of consumers who would choose each of these four types of agent.

The first type of agent is a consumer acting on his or her own behalf to find doctors and make travel arrangements. Consumers who choose this tend to be familiar with the culture of the destination country. They might have been born in the country or have worked or travelled in the country previously. Fluency in a foreign language, particularly the language of the country, would certainly be beneficial. These individuals often rely on their previous experience or the advice of friends and family, especially if the latter are living in the destination country (Connell, 2011; Ormond, 2013).

The second type of agent is known as a medical tourism concierge. An industry has arisen to help medical tourists find and obtain medical care abroad. These concierges vary greatly in the kinds of services they provide for potential patients, but generally they will find a treatment provider for a patient and will make the travel arrangements and medical appointments for the patient. Gathering information about doctors and hospitals, countries, visa requirements and payment systems requires much time and effort on the part of the patients. The fact that the patients and the hospitals are often in different hemispheres adds to the difficulty in gathering information. The opportunity costs of this effort on the part of a single individual can be great. Medical tourism concierges can benefit from economies of scale by gathering this information and then sharing the fruits of their research with many client travelers.

The third type of agent is a third-party payer such as a health insurer or a self-insured employer. Such firms have been forced by rising health care costs to seek ways to reduce their outlays for treatment. In the U.S., for example, total health care expenditures rose by 5.8% in 2015, bringing the average per person to $9,990 (Centers for Medicare and Medicaid Services, 2016). As health care prices rose, the cost of health insurance premiums also rose, inducing many consumers to be uninsured or underinsured. Some third-party payers have been considering medical tourism as an attractive way to reduce their premiums. Indeed, some companies, such as Cross-Blue Shield of South Carolina, Hartford and Aetna now offer plans with medical travel options (Karuppan and Karuppan, 2011). Blue Cross-Blue Shield of California created a low-cost health insurance plan for patients who would receive most of their health care in Mexico (Vequist and Valdez, 2008). Even some smaller insurers and brokers offer similar plans for employers nationwide. A third-party payer could have the advantage of being trusted by its policy holders or employees. A third-party payer would share more of the liability in cases of medical malpractice abroad than an independent medical tourism concierge would. Thus, a third-party payer would have an incentive to select doctors and hospitals carefully.

The fourth type of agent is a domestic health care provider. There is an abundance of evidence that patients trust their doctors' recommendations, especially when they have an on-going relationship with their doctor (Al-Amin, Makarem and Pradhan 2011; Gooding, 1995; Javalgi, Rao and Thomas, 1991). Although it is somewhat rare in Western countries for doctors to recommend that patients seek medical care abroad, given the trust that patients have in their doctors, it is likely that many

patients would accept the advice of their physicians to do so. According to a study by Deloitte (2009), 40% of U.S. consumers would travel abroad on the recommendation of their doctors if they could cut their medical costs in half. There may be various reasons for a doctor to make such a recommendation. Crush and Chikanda (2015) found that doctors in countries that bordered on South Africa frequently advised their patients to seek treatment in South Africa, where the medical facilities were better. Similarly, Brouwer, van Exel, Hermand and Stroop (2003) found that Dutch doctors often advised their patients to go to Germany or Belgium where the waiting times for treatment were shorter.

Literature Review

The consumer characteristics we studied in this paper include whether the consumer has heard of medical tourism, and several demographic variables such as age, education, income, type of health insurance, location, health status, gender, marital status, ethnicity, and foreign language spoken.

Planning for a medical trip abroad requires massive information processing in the form of assessing and comparing quality and cost and making travel arrangements, which could lead to anxiety and uncertainties. So travelers value information acquired at the planning stage. Many potential medical tourists have heard of medical tourism from the experience of their friends and families (Connell, 2011; Ormond, 2013). Relative to those who have never heard of medical tourism, those who have heard of medical tourism tended to be more open-minded and better informed, and therefore they tend to and have more realistic expectations of the experience and outcomes of receiving health care abroad.

The typical medical tourist has been shown to be middle aged or in his or her 50s (Gan and Frederick, 2013; Milstein and Smith, 2006; Lunt and Carrera, 2010; MacReady, 2007). Nonetheless, there are many younger adults and some more elderly who use medical tourism. The more elderly medical tourists tend to be more concerned about their security (Hagen and Uysal, 1991), and about the political and social conditions in the foreign countries (You and O'Leary, 1999). They also preferred less stressful forms of travel (Romsa and Blenman, 1989). Between 2005 and 2010, the number of 45 to 64 year-olds who sought knee replacements in the U.S. rose by nearly fifty percent (U.S. Department of Health and Human Services, 2013). Some suggest that this is because this age group is less willing to allow their ill health to diminish their work or their social lives (Cameron, *et al.* 2014; Crooks, *et al.* 2012). In the United States, seventy-six percent of the tummy tuck procedures were sought by those between 30 to 54 years old (American Society of Plastic Surgeons, 2015). It may be true that younger consumers who seek cosmetic surgeries were affected by the appearance-conscious society common in the United States. For both of these reasons, we expect the younger consumers to be more likely candidates than the seniors to undergo cosmetic procedures. Cosmetic procedures are typically not covered by third-party payers and they also involve some degrees of treatment confidentiality. As such, when these younger consumers do seek such procedures abroad, we expect them to either travel on their own or go through medical tourism concierges.

Higher income groups tended to traveled abroad more often (Woodside and Pitts, 1976) perhaps due to having abundant of resources at their disposal. Having higher opportunity costs, higher income earners could well afford to hire a medical tourism concierge to facilitate their treatments and trip. Further, the more affluent are likely to value the confidentiality of treatment, especially when it comes to cosmetic surgeries (Horowitz and Rosensweig, 2008; Fried and Harris, 2007). Some studies have shown that middle income earners tend to be among the emerging medical tourists (Horowitz and Rosensweig, 2008; Milstein and Smith, 2006). Some found the relationship between income and the likelihood of receiving care abroad to be an inverted-U shape, peaking among the middle income earners but decreasing among the very low and very high income earners (Gan and Frederick, 2013; Karuppan and Karuppan, 2011).

Several studies have demonstrated a direct relationship between a lack of health insurance and the likelihood of travel for care abroad (De Gagne, Oh, So and Kim, 2014; De Jesus and Xiao, 2013; Su, Richardson, Wen and Pagan, 2010; Wallace, Mendez-Luck and Castañeda, 2009). Relative to the insured individuals whose treatments are often covered by their health plans, those who are uninsured or underinsured, and those whose insurance plans do not cover the procedure often would end up paying the full retail price. It is thus not surprising to find that the uninsured and the underinsured would be more inclined than the insured to seek medical care abroad (Gan and Frederick, 2013; Karuppan and Karuppan, 2011).

In empirical studies, the effect of health status on the likelihood of traveling for care has been mixed; it tends to be related to the severity of the illness. One study showed that individuals with "fair" or "poor" health were less sensitive than those in "excellent" health to treatment-related variables that are related to seeking care abroad (Gan and Frederick, 2013). Others had found poor health and disability to be key impediments for traveling (De Jesus and Xiao, 2013; Fleischer and Pizam 2002). In contrast, some studies demonstrated that individuals with poor health were more inclined to travel more frequently to Mexico to seek care (Su *et al.* 2010; Landeck and Garza 2002). By the same token, individuals who have excellent health would presumably have less need to contact their domestic doctors and insurers, let alone travel abroad for care. So, we expect them to be more likely to use a medical concierge or to go on their own.

Many researchers have found a positive link between proficiency in a foreign language and seeking medical care abroad. For instance, studies have found that Mexican immigrants experienced language and cultural barriers when accessing medical services in the United States (Ku and Matani, 2001; Wallace *et al.*, 2009). Another study demonstrated that Hispanics who spoke little English were more inclined than individuals who spoke good English to travel to Mexico or any Latin American country (De Jesus and Xiao, 2013). This is further supported by Escobedo and Cardenas (2006) who found a direct link between low proficiency in English and obtaining medical services in Mexico. They also found that Hispanic Americans were nearly twice as likely as non-Hispanics individuals to seek care in Mexico. Similarly, De Gagne, *et al.* (2014) studied healthcare experiences of Korean immigrants in North Carolina and found language barriers among the major hurdles to obtaining medical care in the U.S., resulting in uninsured individuals opting to seek care in their native country.

Methodology

Data Collection

This study uses survey data conducted by street intercept at diverse locations in North Carolina and in western Illinois from June 2010 to May 2014. The locations were urban and suburban, in affluent neighborhoods and in poor neighborhoods. They included malls and other shopping places, parks, laundromats, semi-pro baseball arenas, and schools. Data were collected by student workers who had been trained to administer the questionnaires. The students were told not to volunteer information. A total of 964 observations were obtained from the field survey. For most variables, missing values were replaced by the mode, but missing values for income and education were imputed from a multinomial logistic model using the other independent variables.

Table 1: Descriptive Statistics.

Variable	*count*	*%*	*Variable*	*count*	*%*
Agent (for knee replacements)			Marital status		
1 On my own	118	12.2	Single, never married, other	529	54.9
2 MT concierge	269	27.9	Married	344	35.7
3 Insurance co. or employer	168	17.4	Divorced or separated	71	7.4
4 U.S. doctor or hospital	409	42.4	Widowed	20	2.1
Agent (for tummy tucks)			Foreign languages (these categories are not mutually exclusive)		
1 On my own	142	14.7			
2 MT concierge	271	28.1	Spanish	119	12.3
3 Insurance co. or employer	143	14.8	French	28	2.9
4 U.S. doctor or hospital	408	42.3	German	9	0.9
Agent (for stem-cell therapy)			Ethnic group		
1 On my own	110	11.4	White	531	55.1
2 MT concierge	295	30.6	African American	247	25.6
3 Insurance co. or employer	120	12.4	Native American	90	9.3
4 U.S. doctor or hospital	439	45.5	Hispanic, Asian, other, multi.	96	10.0
Heard			Age group		
Had not heard of MT	548	56.8	18 to 21 years	301	31.2
Had heard of MT	416	43.2	22 to 30 years	268	27.8
Education			31 to 40 years	126	13.1
High school or less	188	19.5	41 to 50 years	109	11.3
Associate's or some college	578	60.0	51 to 64 years	97	10.1
Bachelor's degree	122	12.7	65 years or older	63	6.5
Graduate or professional degree	76	7.9	Income group		
Community			Low less than $50,000/yr	555	57.6
Urban	221	22.9	Mid $50,001 - $100,000/yr	293	30.4
Suburban or small town	440	45.6	High $100,001/yr or more	116	12.0
Rural	303	31.4	Insurance status		
Gender			Uninsured	106	11.0
Male	434	45.0	Underinsured	69	7.2
Female	530	55.0	Well insured	789	81.8

N = 964.

Definition of Variables

The dependent variable, and the variable of interest, in this study was the type of agent that a potential medical tourist would choose to find a doctor and to plan the trip for medical care abroad (Agent). Three of the survey questions asked respondents to indicate which kind of agent they would use if they had decided to get a knee replacement, a tummy tuck, or stem-cell therapy abroad. The choices were

i. Nobody – I would find a doctor and arrange the trip myself (Agent-1),
ii. A facilitator who specializes in finding doctors and planning trips for medical care abroad (Agent-2), sometimes called a medical tourism concierge,
iii. My health insurance company or my employer (Agent-3), and
iv. My U.S. doctor or hospital (Agent-4).

The set of explanatory control variables had a total of twelve variables. The choice of explanatory variables was made based on the foregoing review of the literature. The control variables were grouped into five different categories. The first category included demography related categorical variables: *Married* (1 if currently married, 0 if single, divorced, widowed, or other), respondent health status, *HStatus* (Good/Excellent=1, Fair/Poor = 0), three age-group 0/1 dummy variables (*Age41-50*, *Age51-64*, and *Age 65+* with ages 40 or younger being the baseline group), two 0/1 dummy variables for income brackets (*HighIncome* if household income per year was greater than $100,001, and *MidIncome*, if household income per year was between $50,001 and $100,000, with incomes less than $50,000 being the baseline group). The second category considered whether a foreign language was spoken. The base category was respondents who spoke no language other than English. This category included three 0/1 dummy variables for respondents who spoke French (*FrenSpeak*), German (*GerSpeak*) and Spanish (*SpanSpeak*). This coding accommodated respondents who spoke more than one foreign language. Respondents were also asked about their health insurance coverage. They were classified as being well insured (*WellIns*) if they had employer-provided group health insurance, Medicare, TriCare or other military health insurance. They were classified as being underinsured (*UnderIns*) if they did not have any of the previous types of health insurance, but did have individually purchased health plans, minimed health plans, or Medicaid. Respondents who were uninsured formed the baseline group. The literature also identified ethnic identity as another variable which could have an effect on the choice of an agent while travelling abroad for medical care. This study used dummy variables for two ethnic groups: *Blacks* and *Whites*. The baseline ethnic groups included American Indians, Hispanics, Asians and multiracials. The fourth category of variables controlled in this analysis included the types of community the respondent belongs to: if a respondent lived in an urban area (*Urban*) (1 if urban, 0 otherwise). The last, but the most important explanatory, variable in this study was whether an individual had heard (*Heard*) about medical tourism (1 if the respondent had heard of medical tourism, 0 otherwise). The definitions and descriptive statistics of these variables are provided in Table 1.

Empirical Method

This study used a multinomial logit (MNL) model to analyze the effects of *Heard* and the demographic variables on the choice of agent. But first, a possible selection bias needed to be addressed. Because potential medical tourists who did not visit the survey sites were excluded from the survey, the street-intercept method does not result in a true random sampling of the population of all potential users of medical tourism. Thus, it is likely that there was some degree of selection bias. In particular, the variable *Heard* (whether the respondent had previously heard of medical tourism) would have been susceptible to this bias. A propensity score adjustment was used to correct for the selection bias due to non-probability sampling that is associated with this variable (Rosenbaum and Rubin, 1983; Couper, 2000; Fricker, 2008, pages 195-216.). Either a logit or a probit estimation technique may be applied to get a corrected propensity score, and this study implemented a logit estimation technique. A logit estimates the odds of some event happening (e.g. the event that Y = 1). The logit is defined as the logarithm of the ratio of the probability that the event will occur to the probability that the event will not occur. In the context of this study, the odds of having heard of medical tourism E [Y_i] = Pr (Y_i = 1) are given by

$$\Pr\ (Y_i = 1) = \frac{\exp\{\beta' X_i\}}{1 + \exp\{\beta' X_i\}} \qquad (1)$$

In equation (1), Y_i represents the variable *Heard*, X_i represents a vector of attributes that explains the odds and β is a vector of corresponding coefficients. The subscript i represents a respondent, i = 1 to 964.

Having made this adjustment, the MNL regression was conducted with the likelihood of choosing a given agent as the dependent variable and the estimated probability of *Heard* as one of the independent variables. "My US doctor or my US hospital" (*Agent-4*) was the base category for the dependent variable. The MNL model of the probability is given by the following equation:

$$\Pr(A_i = j \mid M) = \frac{\exp(\varphi_j' Z_i)}{\sum_{k=1}^{M} \exp(\varphi_k' Z_i)} \quad (2)$$

where, Pr ($A_i = j \mid$ M) is the probability that the Agent (A_i) chosen by respondent *i* is of type *j* given that there are *M* possible choices. The index *k* stands for one of the *M* choices. Z_i represents a vector of explanatory variables that excludes the variables in X_i but includes Pr ($Y_i = 1$) from equation (1). Both φ_j and φ_k are vectors of parameters (Greene, 2003, p. 721).

Empirical Results

The results of logit regression, Equation 1, are presented in Table 2. The logit regression estimation showed that having some education above the high school level increases the odds of having heard about medical tourism. However, if the responded is a male, the odd of hearing about medical tourism goes down. The estimated propensity scores were used as a control variable in the multinomial logit (MNL) regression model (Equation 2) for all three different types of treatment – knee replacement, tummy tucks and stem cell therapy – while estimating the likelihoods that an individual would choose the various agents. The estimated coefficients from the MNL model and their corresponding estimated marginal effects are presented in Table 3. The dependent variable in all regressions was the logit of choosing a given type of agent for hypothetical medical care abroad.

Table 2: Results of Logit for Propensity Score Matching Estimation.

Variables	*Coefficients*
MALE	0.4184***
	(0.1313)
EDULEVEL	0.2951
	(0.1681)
Intercept	-0.2871
	(0.1679)

Dependent variable: *HEARD*. (Standard errors are in parentheses.) * p < 0.10, ** p < 0.05, *** p < 0.01. N = 964

The results show that if an individual has heard about medical tourism (*Heard* = 1), it has various kinds of effects on the likelihood of choosing a given agent to obtain medical treatments abroad. These effects differ with the treatment and with the choice of agent. This study found that when an individual has heard about medical tourism, the logits of his or her relative likelihood of choosing *Agent-1*, *Agent-2* and *Agent-3* for knee replacement are reduced by 2.80, 2.50 and 3.69 units, respectively, compared to the base reference case – my U.S. doctor or my U.S. hospital (*Agent-4*) (See Table 3). However, the marginal effect is negative and significant (p = .0679) only for *Agent-3* – health insurance company or employer. This result shows that when an individual has heard of medical tourism, the likelihood of choosing the health insurance company or employer to undertake a knee replacement abroad decreases by 35.6%. In contrast to the knee replacement, the MNL regression coefficient on *Heard* is positive for tummy tucks, though it is significant only for *Agent-1* relative to *Agent-4*. This finding implies that the relative likelihood that an individual will find a doctor and arrange a trip to undertake tummy tuck treatment abroad on his or her own was 3.25 units higher relative to the base case. However, the marginal effect was not significant. In contrast, when considering a stem cell treatment abroad, the study found that having knowledge of medical tourism significantly reduced the relative likelihood of using *Agent-3* (my health insurance company or employer) by 4.92 units compared to *Agent-4*. The corresponding marginal effect was also negative and highly significant, suggesting that the likelihood of going abroad for a stem cell treatment through one's own health insurance company or employer is reduced by 43.8% if an individual has heard about medical tourism.

This study found that other variables were also strongly related to the likelihood of choosing certain agents to travel for care abroad. Among the demographic variables, we controlled for the effect of age, using consumers aged 40 years or less as the baseline group. This study found that the different age group effects differed for each treatment and with the choice of agent. It was discovered that only the variable *Age41-50* was negatively and significantly related to the choice of a medical tourism

concierge (*Agent-2*) for all three kinds of treatment being considered. The corresponding marginal effects of *Age41-50* on the likelihood of using *Agent-2* for knee replacements and for stem-cell therapy were also found to be significant, but not for tummy tucks. When it came to knee replacements, this age group also had a negative and significant effect on the relative likelihood of choosing one's own health insurance company (*Agent-3*), against the baseline case (*Agent-4*). However, the coefficient for the variable *Age51-64* was positive and significantly related to the likelihood of going on one's own (*Agent-1*) for knee replacement and for tummy tucks relative to the base case, *Agent-4*. Furthermore, the marginal effects were positive but significant only for knee replacement. This implies that if an individual is of age 51 to 64, his or her likelihood of going abroad on his or her own for knee replacement increases by 12.9% compared to the recommendation made by his or her U.S. doctor or hospital (*Agent-4*). Further, the variable *Age51-64* also appeared to be positive and significant in explaining the relative likelihood of choosing one's own health insurance company to undertake tummy tuck treatment abroad against the reference case. The corresponding marginal effect was 12.4%. This suggests that when thinking about getting a tummy tuck abroad, being in the 51-to-64 year old age group makes the effect of an insurance company's recommendation relative to that of a U.S. doctor or hospital 12.4% greater than if the consumer had been in the 40-or-less age group.

Table 3: Multinomial Logistic Regression Coefficients and Marginal Effects.

		MLR Coefficients			MLR Marginal Effects		
Variable	Agent	Knee Repl.	Tummy Tuck	Variable	Agent	Knee Repl.	Tummy Tuck
Intercept	1	0.738	-0.461	0.023			
		(0.710)	(0.695)	(0.716)			
	2	1.660***	0.323	0.842			
		(0.566)	(0.750)	(0.529)			
	3	1.284*	0.339	1.285*			
		(0.666)	(0.834)	(0.777)			
Urban	1	0.439*	0.055	-0.131	0.046	-0.009	-0.010
		(0.256)	(0.245)	(0.274)	(0.028)	(0.069)	(0.024)
	2	-0.009	-0.024	0.015	-0.022	-0.028	0.015
		(0.207)	(0.265)	(0.192)	(0.037)	(0.073)	(0.038)
	3	0.110	0.373	-0.210	0.007	0.046	-0.020
		(0.229)	(0.289)	(0.265)	(0.031)	(0.054)	(0.023)
SpanSpeak	1	0.472	-0.213	0.447	0.053	-0.021	0.052
		(0.314)	(0.309)	(0.313)	(0.037)	(0.089)	(0.036)
	2	-0.089	-0.358	-0.272	-0.041	-0.051	-0.084*
		(0.265)	(0.328)	(0.260)	(0.044)	(0.045)	(0.043)
	3	0.162	0.143	0.389	0.017	0.049	0.047
		(0.291)	(0.352)	(0.306)	(0.040)	(0.115)	(0.036)
FrenSpeak	1	0.402	-0.907*	-0.207	0.013	-0.115	-0.038
		(0.654)	(0.552)	(0.798)	(0.065)	(0.234)	(0.051)
	2	0.395	-0.896	-0.352	0.029	-0.071	-0.137*
		(0.501)	(0.610)	(0.553)	(0.093)	(0.165)	(0.074)
	3	0.635	-0.156	1.463***	0.070	0.081	0.271***
		(0.547)	(0.619)	(0.487)	(0.088)	(0.357)	(0.102)
GerSpeak	1	0.047	14.785	-0.113	0.009	0.121	0.032
		(1.171)	(1111.641)	(1.118)	(0.117)	(0.175)	(0.132)
	2	-0.257	14.714	-1.417	0.057	0.052	-0.200*
		(0.914)	(1111.641)	(1.107)	(0.143)	(0.163)	(0.107)
	3	0.155	14.313	-0.873	0.035	-0.029	-0.046
		(0.930)	(1111.641)	(1.209)	(0.140)	(0.111)	(0.078)
MidIncome	1	-0.107	-0.002	0.099	-0.019	-0.018	-0.005
		(0.258)	(0.231)	(0.260)	(0.023)	(0.060)	(0.023)
	2	0.171	0.186	0.3674**	0.029	0.043	0.070*
		(0.187)	(0.245)	(0.177)	(0.035)	(0.054)	(0.036)
	3	0.173	-0.103	0.186	0.019	-0.020	0.004
		(0.216)	(0.284)	(0.249)	(0.030)	(0.042)	(0.024)
HighIncome	1	0.093	-0.124	0.361	0.011	0.005	0.039

Table 3: Multinomial Logistic Regression Coefficients and Marginal Effects.

		MLR Coefficients				MLR Marginal Effects	
Variable	Agent	Knee Repl.	Tummy Tuck	Variable	Agent	Knee Repl.	Tummy Tuck
		(0.350)	(0.316)	(0.342)	(0.035)	(0.106)	(0.039)
	2	-0.097	-0.104	-0.113	-0.026	0.009	-0.045
		(0.267)	(0.337)	(0.259)	(0.047)	(0.083)	(0.048)
	3	0.093	-0.383	0.242	0.017	-0.032	0.025
		(0.308)	(0.418)	(0.346)	(0.044)	(0.041)	(0.038)
Married	1	-0.214	-0.120	-0.388	-0.009	0.048	-0.026
		(0.289)	(0.272)	(0.296)	(0.027)	(0.210)	(0.026)
	2	-0.304	-0.339	-0.198	-0.048	-0.032	-0.018
		(0.227)	(0.297)	(0.215)	(0.041)	(0.060)	(0.042)
	3	-0.135	-0.564*	-0.340	-0.001	-0.046	-0.023
		(0.260)	(0.332)	(0.302)	(0.035)	(0.036)	(0.028)
Whites	1	-0.664**	-0.047	-0.661**	-0.058**	0.010	-0.062**
		(0.284)	(0.286)	(0.286)	(0.027)	(0.071)	(0.027)
	2	-0.079	0.072	0.006	0.024	0.040	0.034
		(0.229)	(0.299)	(0.219)	(0.040)	(0.089)	(0.042)
	3	-0.372	-0.473	-0.278	-0.037	-0.059	-0.020
		(0.263)	(0.330)	(0.292)	(0.035)	(0.071)	(0.028)
Blacks	1	-0.717**	-0.291	-0.341	-0.047**	0.043	-0.027
		(0.314)	(0.307)	(0.311)	(0.024)	(0.322)	(0.025)
	2	-0.549**	-0.628*	-0.174	-0.078*	-0.065	-0.029
		(0.264)	(0.332)	(0.249)	(0.043)	(0.071)	(0.047)
	3	-0.187	-0.618*	0.076	0.011	-0.031	0.019
		(0.284)	(0.352)	(0.314)	(0.038)	(0.041)	(0.032)
Age41-50	1	0.206	0.089	0.344	0.056*	0.075	0.062*
		(0.295)	(0.278)	(0.297)	(0.033)	(0.154)	(0.034)
	2	-0.716***	-0.667**	-0.627***	-0.118***	-0.145	-0.128***
		(0.248)	(0.315)	(0.235)	(0.039)	(0.174)	(0.040)
	3	-0.522*	0.312	-0.245	-0.046	0.060	-0.010
		(0.276)	(0.332)	(0.310)	(0.033)	(0.103)	(0.029)
Age51-64	1	0.803**	0.947**	0.503	0.129**	0.029	0.078
		(0.381)	(0.457)	(0.399)	(0.059)	(0.359)	(0.053)
	2	-0.253	0.599	-0.262	-0.062	-0.072	-0.055
		(0.329)	(0.490)	(0.305)	(0.053)	(0.293)	(0.055)
	3	-0.493	1.546***	-0.687	-0.070*	0.124*	-0.057*
		(0.401)	(0.515)	(0.493)	(0.039)	(0.073)	(0.031)
Age65+	1	-1.112*	2.230***	-0.786	-0.057	0.214	-0.039
		(0.657)	(0.767)	(0.654)	(0.038)	(0.485)	(0.044)
	2	-0.792**	1.592**	-0.765**	-0.083	-0.060	-0.107*
		(0.378)	(0.800)	(0.371)	(0.059)	(0.374)	(0.060)
	3	-1.150**	1.545*	-0.786	-0.093**	-0.035	-0.042
		(0.495)	(0.890)	(0.543)	(0.041)	(0.193)	(0.039)
UnderIns	1	-0.154	-0.076	-0.095	-0.003	0.041	-0.004
		(0.313)	(0.316)	(0.315)	(0.028)	(0.170)	(0.028)
	2	-0.471*	-0.296	-0.194	-0.089**	-0.036	-0.040
		(0.262)	(0.335)	(0.247)	(0.042)	(0.048)	(0.046)
	3	0.075	-0.372	0.077	0.037	-0.028	0.016
		(0.293)	(0.362)	(0.320)	(0.042)	(0.031)	(0.033)
WellIns	1	-0.684**	0.195	-0.555*	-0.049	0.124	-0.038
		(0.298)	(0.304)	(0.299)	(0.031)	(0.221)	(0.030)
	2	-0.524**	-0.322	-0.349	-0.070	-0.065	-0.039
		(0.246)	(0.321)	(0.234)	(0.046)	(0.065)	(0.047)
	3	-0.270	-0.565*	-0.414	0.002	-0.072	-0.023

Table 3: Multinomial Logistic Regression Coefficients and Marginal Effects.

		MLR Coefficients			MLR Marginal Effects		
Variable	Agent	Knee Repl.	Tummy Tuck	Variable	Agent	Knee Repl.	Tummy Tuck
		(0.285)	(0.344)	(0.310)	(0.037)	(0.080)	(0.031)
HStatus	1	0.394	-0.086	0.237	0.057	0.028	0.040
		(0.302)	(0.317)	(0.313)	(0.037)	(0.144)	(0.035)
	2	-0.323	-0.537	-0.523*	-0.072	-0.096	-0.114***
		(0.284)	(0.367)	(0.275)	(0.045)	(0.094)	(0.044)
	3	-0.033	0.153	0.159	0.0002	0.048	0.031
		(0.308)	(0.362)	(0.327)	(0.0414)	(0.108)	(0.037)
Heard	1	-2.800*	3.252**	-1.624	-0.129	0.465	-0.047
		(1.554)	(1.487)	(1.574)	(0.148)	(0.726)	(0.146)
	2	-2.498**	2.251	-1.439	-0.234	0.013	-0.077
		(1.209)	(1.628)	(1.129)	(0.227)	(0.847)	(0.227)
	3	-3.687***	0.834	-4.919***	-0.356*	-0.196	-0.438***
		(1.436)	(1.837)	(1.729)	(0.195)	(0.697)	(0.166)

Notes: n = 964 * p < 0.10, ** p < 0.05, *** p < 0.01. Two-tailed p values. (Numbers in parentheses are standard errors.)
Agent 1: on my own.
Agent 2: medical tourism concierge
Agent 3: U.S. health insurance company or employer
Agent 4: U.S. doctor or hospital

Similar kinds of mixed effects were observed for individuals over the age of 65 (*Age65+*). If an individual was 65 or above, his or her likelihood of choosing any of the agents is reduced relative to the reference case, *Agent-4*, for knee replacement. The results showed that the likelihood of choosing *Agent-3* for knee replacement abroad was reduced by 9.3% if an individual was of age 65 or older compared to the 40 or less age group. While analyzing the likelihood of getting the tummy tuck treatment abroad, this study found that the coefficient on *Age65+* variable was positive and significant in explaining all agents against the base agent. The results showed that the relative likelihood of going abroad by choosing *Agent-1*, *Agent-2* and *Agent-3* increased by 2.23, 1.59 and 1.54 units, respectively against *Agent-4*. However, their corresponding marginal effects were not significant. In contrast, the results for stem cell therapy suggest that the likelihood of choosing *Agent-2* was decreased by 0.76 relative to the base case when the consumer was 65 years of age or older rather than 40 or less. The corresponding marginal effect is significant with a negative sign, which suggests that the probability of choosing *Agent-2* decreases by 10.7% if an individual is sixty five or older.

This study also controlled for the effect of income. The only significant effects of income were found for stem cell treatment abroad. The result showed that an individual with income between $50,001 and $100,000 per year (*MidIncome*) had a relative likelihood of choosing a medical tourism concierge (*Agent-2*) for stem cell treatment abroad that was 0.36 units greater than the likelihood of individuals whose incomes were $50,000 per year or less. The corresponding marginal effect suggests that if an individual has a yearly income between $50,001 and $100,000, his or her likelihood of choosing a medical tourism concierge for stem-cell treatment abroad increases by 7.0%. Similarly, under the language types, this study found that individuals who speak languages other than English have different perspectives on choosing the agent relative to individuals who do not have foreign language skills. The results showed that when an individual can speak French, the relative likelihood of choosing *Agent-2* to go abroad for stem cell treatment is reduced by 13.7%. In contrast, the likelihood of choosing *Agent-3* for stem cell treatment increases by 27.1% if an individual speaks French. Furthermore, for the same treatment, when an individual was German speaking it reduced the likelihood of choosing *Agent-2* by 20.0% compared to *Agent-4*. The study used two ethnic variables – African Americans (*Blacks*) and White Americans (*Whites*) *vs.* others (*Other*) as a reference group to control for the effect of ethnicity. This study finds that being a white American reduced the relative likelihood of going abroad for knee replacement on one's own (*Agent-1*) against the reference case by 5.8%. Similarly, this reduction is 6.2% for stem cell treatment. Similar kinds of findings were observed for African Americans (*Blacks*). The results showed that being an African American reduced the relative likelihoods of choosing *Agent-1* and *Agent-2* by 4.7% and 7.8%, respectively, for knee replacement compared to *Agent-4*. This study found only one significant effect for *Married* and that effect was a weakly significant effect of a married individual being less likely to choose *Agent-3* compared to *Agent-4* for tummy tuck. However, the marginal effect is not significant. The study detected no significant effects of being married on other treatments and agents.

Given the dominating role of health insurance in any treatment in the U.S., this study categorized health insurance coverage into three levels: Well insured (*WellIns*), under-insured (*UnderIns*) and uninsured (*UnIns*). This study found that both well insured and under-insured individuals were less likely to go abroad for any kind of treatment using any kind of agent than the uninsured were. The results showed that if an individual was well insured (*WellIns*), it reduced the relative likelihood of

choosing *Agent-1* and *Agent-2* against the reference case for knee replacement by 0.68 units and 0.52 units, respectively. However, the corresponding marginal effects were not significant. Likewise, if an individual was under-insured (*UnderIns*), it reduced the relative likelihood of choosing *Agent-2* relative to *Agent-4* by 0.47 units for knee replacement and the corresponding marginal effect of the *UnderIns* variable is 8.9%. This study found that if a person was healthy (*HStatus* = 1) it reduced the relative likelihood of choosing *Agent-2* by 0.52 units for his or her stem cell treatment abroad compared to the base agent. Its marginal effect showed that the likelihood of choosing *Agent-2* was reduced by 11.4% if a person was healthy. In this study, the health status of an individual remains insignificant for other treatments and other agents. Further, while looking at the effect of location, this study found a weak and positive effect on the choice of agent for knee replacement. The results showed that if an individual was living in an urban area (*Urban*), the relative likelihood of choosing *Agent-1* increased by 0.44 units compared to *Agent-4* for knee replacement. But the corresponding marginal effect was not significant. Further, the location variable was not significant for other treatments, nor for other agents.

Discussion

Several studies have documented the demographics of consumers who use medical tourism, but few have linked them to the choice of agents given certain treatments. The contribution of this study is that it looks at potential medical tourists who have no experience in medical tourism, and asks their choice of agent if they go.

Relative to those who have heard about medical tourism, surprisingly our results show that those who have never heard of medical tourism tended to be more open-minded with choosing all three types of agents other than their own domestic physicians. Individuals who have "never heard" of medical tourism can certainly rely on medical tourism concierges or insurance companies to help them overcome information and expectation barriers. This applies especially to medically necessary and routine procedures such as knee replacements that are typically insurable but considered expensive when done in the U.S. (on average $42,000 per knee). The "never heard" individuals were similarly open to trusting their insurers or employers to arrange for stem cell therapy which is not as readily available within the U.S. This study implies that individuals who have not heard of medical tourism are actually more inclined to travel abroad for either knee replacement or stem cell through either their insurance companies or employers. This is an important piece of information for policy makers as well as insurance companies and employers from the stand point of marketing medical tourism.

Our results discover that younger **c**onsumers (less than 40 years old) were more likely than older ones (41-50 years old and those above 65 years old) to choose all three other agents relative to their own domestic doctors to arrange for knee replacement. Being heathier and more mobile, younger consumers naturally have less contact with their physicians. They also tend to be more open-minded and prone to risk taking. Thus, when it comes to medically necessary and yet relatively routine procedures such as knee replacements, it is not surprising that the younger ones were more willing to arrange their own travel or use services provided by medical tourism concierges or their own insurers or employers. The fact that they are in their mid-career may motivate them to travel abroad for faster care so as to return to normal work life. On the other hand, the seniors (65 years old or above) were expected to be less willing than the younger ones to endure the hardship of traveling outside the country to get such procedure which are readily available domestically and are typically covered by the insurers. Our results confirm that those above 65 years old were less inclined to go through any agents other than their own physicians when seeking this procedure abroad. The effects are particularly significant with not choosing their insurers or employers – perhaps due to the fact that most of them may have been retired and they could easily get such elective procedure done domestically by their doctors through the Medicare scheme. Statistics show that knee replacement is among the most common inpatient surgery for Medicare beneficiary (Centers for Medicare and Medicaid Services, 2016).

When it comes to tummy tucks, relative to those who were less than 40 years old, surprisingly consumers above 51 years old tended to facilitate themselves or use a concierge service. Being a commonly sought cosmetic procedure by potential medical tourists, tummy tucks are typically not covered by health insurance plans. Since older consumers who seek cosmetic surgery abroad tend to value their privacy, we expect that they would prefer to be their own agents or use the service of a medical tourism concierge. The only exception being the near-retiring age of 51-64 years old who strongly rely on their insurers or employers even for cosmetic procedures – perhaps some of them were thinking of tummy tucks as a medically necessary treatment for obesity.

Our results further showed that middle income earners tended to rely on medical tourism concierges to arrange for stem cell therapy. The fact that medical tourists tended to be of middle-income earners is indeed supported by numerous studies as mentioned previously. Stem cell therapy to treat type II diabetics is a treatment that is not readily available in the U.S., being unapproved by the Food and Drug Administration (FDA), thus rendering it uninsurable by the U.S. insurers or employers. The fact that middle to high income earners have higher opportunity costs explains why they would seek such concierge service to help them overcome the high search costs of selecting an appropriate healthcare provider and arranging for a medical trip

abroad. There are numerous U.S. medical tourism concierges who advertise for stem cell therapy on their websites. Mexico and China appear to be among the more popular destinations to which they refer their clients.

When it comes to knee replacements, the uninsured were more inclined than the well-insured to arrange the trip by themselves or choose a medical tourism concierge. The uninsured were also more likely than the underinsured to choose a concierge service to facilitate the same treatment. The fact that the uninsured were a prominent group among the medical tourists has been supported by much previous research, as discussed earlier.

Our results demonstrated that relative to the whites or the blacks, other ethnic groups (Hispanics, Asians, multiracial, and others) tended to arrange their own treatment for knee replacements. The "other ethnic groups" in this study were also more inclined than the whites to self-facilitate in stem cell therapy. Some of the "other ethnic groups" were foreign-born nationals. Naturally they would be familiar with healthcare systems of their native countries. On the other hand, "other ethnic groups" in this study were also more likely than the blacks to use medical tourism concierges to arrange for both knee replacements and tummy tucks, and likewise with choosing their insurers or employers in arranging for tummy tuck.

Our results showed that those who spoke a foreign language such as French or German were less likely than those who spoke only English to use a medical tourism concierge service to arrange for stem cell therapy. However, French speakers were more likely to choose their insurance companies or their employers to arrange for the same treatment. Those who spoke a foreign language also tended to be foreign-born international students or those who were prone to having foreign travel experience, which may explain why they were more inclined to trust agents or insurers (relative to their domestic doctors) to facilitate stem cell therapies abroad, possibly having prior experience with healthcare systems outside the U.S. or it may simply be their preference to seek care in foreign healthcare settings in which their familiar languages were spoken (De Gagne, *et al*., 2014; Ku and Matani, 2001; Wallace, *et al*., 2009).

Individuals who self-reported themselves in good health were also less inclined than those who reported having poor health to rely on a medical tourism concierge to arrange for stem cell therapy. Since those in poor health may be less able to act on additional health information (Hsieh and Lin, 1997), it is not surprisingly that they would choose such middleman service to help them cross the information and travel hurdles.

The study found that the urban (vs. other locations) dwellers were more inclined to self-facilitate when it comes to knee replacement. This could be because knee replacements are often advertised on websites of medical tourism concierges more so than tummy tucks or stem cell therapies, and the urban dwellers are exposed to more media and internet advertising. This result is supported by Karuppan and Karuppan (2011) who found cosmopolitan individuals among the likely potential medical tourists.

Conclusion

The future trend of the medical tourism market can take many forms and shapes. The ease of communication and transportation through globalization and easy access to information through the Internet (Henderson, 2004) will continue to motivate the experienced and younger consumers to travel on their own regardless of treatment type. The older consumers will continue to seek cosmetic surgeries abroad on their own as they had been doing even before the practice of medical tourism became commonplace. Plagued by rising health care costs and the growing number of uninsured and underinsured, the insurance companies and employers are expected to play a greater role in advising consumers to seek alternative health care providers outside the country. Threatened by having to share the liability in cases of malpractice, third-party payers would do well to emphasize the high quality of care or the reputations of the practitioners when searching for healthcare providers to be included in their global network, though some have simply resorted to offering complications insurance as an additional protection. Medical tourism concierges, on the other hand, are faced with intense competition not only from traditional third-party payers, but also from the foreign healthcare providers – many times armed with their highly specialized international patient centers or marketing arms that target medical tourists. As the market matures and becomes more competitive, and unless staffed by more qualified healthcare professionals to advise potential consumers, the role of the medical tourism concierges may be reduced to trip planning such as procuring visas, accommodation reservation, airport pick-ups, etc.

Many reputable U.S. hospitals already have partnerships with hospitals in destination countries – Johns Hopkins has partnerships with hospitals in India, Singapore, and Turkey. Harvard Medical International has collaborations with hospitals in more than thirty countries, and Cleveland Clinic operates in hospitals in Canada and Austria (Cohen, 2010). This trend will probably intensify as competition fuels and globalization continues. The question is whether current partnerships between Western hospitals and medical tourism hospitals in the developing countries will cause domestic doctors to recommend patients to travel outside their country for care in the future. Most argue that the U.S. healthcare providers would want to practice protectionism to keep the healthcare revenues within the country. Yet "free trade" has appeared in many facets. In many of these hospital partnerships, Western doctors actually visit the foreign hospitals and perform surgeries there (Holliday, *et al.*, 2015). Many times these hospitals share management protocols and seek second opinions in both directions through

teleconferencing or perhaps through satellites in the future. The world is not round anymore – it is flat. Globalization of healthcare may render domestic healthcare providers less competitive as it continues to bring specialization and efficiency to serve the global humanity.

References

Al-Amin, Mona., Suzanne C. Makarem, and Rohit Pradhan. 2011. "Hospital Ability to Attract International Patients: A Conceptual Framework." *International Journal of Pharmaceutical and Healthcare Marketing* 5(3): 205-221.

American Society of Plastic Surgeons. 2015. Plastic Surgery Statistics Report. Retrieved Feb 1, 2017 from https://d2wirczt3b6wjm.cloudfront.net/News/Statistics/2015/plastic-surgery-statistics-full-report-2015.pdf

Brouwer, Werner., Jan Van Exel, Bert Hermans, and Arjen Stoop. 2003. "Should I Stay or Should I Go? Waiting Lists and Cross-border Care in the Netherlands." *Health Policy* 63(3): 289-298.

Cameron, Keri, Valerie A. Crooks, Vera Chouinard, Jeremy Snyder, Rory Johnston, and Victoria Casey. 2014. "Motivation, Justification, Normalization: Talk Strategies Used by Canadian Medical Tourists Regarding Their Choices to Go Abroad for Hip and Knee Surgeries." *Social Science & Medicine* 106: 93-100. doi:10.1016/j.socscimed.2014.01.047

Centers for Medicare & Medicaid Services. 2016. Retrieved March 9, 2017 from https://www.cms.gov/research-statistics-data-and-systems/statistics-trends-and-reports/nationalhealthexpenddata/nhe-fact-sheet.html

Cohen, Glenn I. 2010. "Protecting Patients with Passports: Medical Tourism and the Patient-Protective Argument." *Iowa Law Review* 95(5): 1467-1567.

Connell, John 2011. *Medical Tourism*. Wallingford, UK: CABI.

Couper, Mick P. 2000. "Review: Web Surveys: A Review of Issues and Approaches." *Public Opinion Quarterly* 64(4): 464-494.

Crush, Jonathan, and Abel Chikanda. 2015. "South–South Medical Tourism and the Quest for Health in Southern Africa." *Social Science & Medicine* 124: 313-320. doi:10.1016/j.socscimed.2014.06 .025

De Gagne, Jennie C., Jina Oh, Aeyoung So, and Suksun Kim. 2014. "The Healthcare Experiences of Koreans Living in North Carolina: A Mixed Methods Study." *Health & Social Care in the Community* 22(4): 417-428. doi:10.1111/hsc.12098

De Jesus, Maria and Chenyang Xiao. 2013. "Cross-Border Health Care Utilization among the Hispanic Population in the United States: Implications for Closing the Health Care Access Gap." *Ethnicity & Health* 18(3): 297-314. doi: 10.1080/13557858.2012.730610

Deloitte, (2009), "Medical tourism: Updates and implications." Retrieved March 8, 2017 from http://www.coa.org/docs/DeloitteStudyMedicalTourism_111209_web.pdf

Escobedo Luis G., and Victor M. Cardenas. 2006. "Utilization and Purchase of Medical Care Services in Mexico by Residents in the United States of America, 1989-1999." Rev Panam Salud Publica 19(5): 300-304.

Fleischer, Aliza, and Abraham Pizam. 2002. "Tourism Constraints among Israeli Seniors." *Annals of Tourism Researc*h 29(1): 106-123.

Fricker, Ronald. D., Jr. 2008. *Sampling Methods for Web and E-mail Surveys*. SAGE Publications, Ltd.

Fried, Bruce J., and Dean M. Harris. 2007. "Managing Healthcare Services in the Global Marketplace." *Frontiers of Health Services Management* 24(2): 3-18.

Gan, Lydia L., and James R. Frederick. 2013. "Medical tourists: Who Goes and What Motivates Them?" *Healthcare Marketing Quarterly* 30(4): 177-194.

Gan, Lydia L., and James R. Frederick. 2011. "Medical Tourism Facilitators: Patterns of Service Differentiation." *Journal of Vacation Marketing* 17(3): 1-19.

Gooding, Sandra . 1995. "The Relative Importance of Information Sources in Consumers' Choice of Hospitals." *Journal of Ambulatory Care Marketing* 6(1): 99-108. doi: 10.1300/j273v06n01_07

Greene, William H. 2003. *Econometric Analysis*. Upper Saddle River: Prentice Hall.

Hagen, L. A. R., and Muzaffer Uysal. 1991. "An Examination of Motivations and Activities of Pre-Retirement (50-64) and Post-Retirement (65-98) Age Groups for a Touring Trip." In *Proceedings of the 22nd Annual Travel and Tourism Research Association Conference*, Long Beach, California, June 9-13: 381-386.

Henderson, Joan C. 2004. "Paradigm Shifts: National Tourism Organizations and Education and Healthcare Tourism. The Case of Singapore." *Tourism and Hospitality Research* 5(2): 170-180.

Holliday, Ruth, David Bell, Olive Cheung, Meredith Jones, and Elspeth Probyn. 2015. "Brief Encounters: Assembling Cosmetic Surgery Tourism." *Social Science & Medicine* 124: 298-304. doi:10.1016/j.socscimed.2014.06.047

Horowitz, Michael D., and Jeffrey A. Rosensweig. 2008. "Medical Tourism vs. Traditional International Medical Travel: A Tale of Two Models." *International Medical Travel Journal*: 1-14.

Hsieh, C. R., and S. J. Lin. 1997. "Health Information and the Demand for Preventive Care among the Elderly in Taiwan." *Journal of Human Resources* 32(2): 308-333.

Javalgi, Rajskekhar G., Edward G. Thomas, and S. R. Rao. 1992. "Consumer Behavior in the U.S. Pleasure Travel Marketplace: An Analysis of Senior and Nonsenior Travelers." *Journal of Travel Research* 31(2): 14-19. doi: 10.1177/004728759203100203

Karuppan, Corinne M., and Muthu Karuppan. 2011. "Who are the Medical Travelers and What do They Want?: A Qualitative Study." *Health Marketing Quarterly* 28: 116-132. doi: 10.1080/07359683.2011.545339

Ku, Leighton, and Sheetal Matani. 2001. "Left Out: Immigrants' Access to Health Care and Insurance." *Health Affairs* 20(1): 247-256. doi: 10.1377/hlthaff.20.1.247

Landeck, Michael, and Cecilia Garza 2002. "Utilization of Physician Health Care Services in Mexico by U.S. Hispanic Border Residents." *Health Marketing Quarterly* 20(1): 3-16.

Lunt, Neil, and Percivil Carrera. 2010. "Medical Tourism: Assessing the Evidence on Treatment Abroad." *Maturitas* 66(1): 27-32. doi: 10.1016/j.maturitas.2010.01.017

MacReady, Nora. 2007. "Developing Countries Court Medical Tourists." *World Report* June 2, 370(9584): 1849-1850. Retrieved from http://www.thelancet.com

Milstein, Arnold, and Mark Smith. 2006. "America's New Refugees – Seeking Affordable Surgery Offshore." *The New England Journal of Medicine* 355(16): 1637-1640. doi: 10.1056/NEJMp068190

Rosenbaum, Paul R., and Donald B. Rubin. 1983. "The Central Role of the Propensity Score in Observational Studies for Causal Effects." *Biometrika* 70(1): 41-55.

Ormond, Meghann. 2013. *Neoliberal Governance and International Medical Travel in Malaysia*. London: Routledge. doi:10.4324/9780203077566

Romsa, G., and M. Blenman. 1989. "Vacation Patterns of the Elderly German*." Annals of Tourism Research* 16(2): 178-88. doi: 10.1016/0160-7383(89)90066-2

Su, Dejun., Chad Richardson, Ming Wen and Jose A. Pagan. 2010. "Cross-Border Utilization of Health Care: Evidence from a Population-Based Study in South Texas." *Health Services Research* 46(3): 859-876. DOI: 10.1111/j.1475-6773.2010.01220.x.

U.S. Department of Health and Human Services. 2013. "Health, United States, 2012: With Special Feature on Emergency Care." Table 115. U.S. Government Printing Office Washington, DC.

Vequist, David G., and Erika. Valdez. 2008. "Medical Tourism Economic Report: Monterrey, Mexico." *Medical Tourism Magazine* 4(June): 21.

Wallace, S. P., C. Mendez-Luck, and X. Castañeda. 2009. "Heading South: Why Mexican Immigrants in California Seek Health Services in Mexico?" *Medical Care* 47(6): 662–669. http://doi.org/10.1097/MLR.0b013e318190cc95

Woodside, Arch G., and Robert E. Pitts. 1976. "Effects of Consumer Life Styles, Demographics, and Travel Activities on Foreign and Domestic Travel Behavior." *Journal of Travel Research* 14(3): 13-15. doi: 10.1177/004728757601400304

You, Xinran and Joseph T. O'Leary. 1999. "Destination Behavior of Older UK Travelers." *Tourism Recreation Research* 24(1): 23-34.

The Sinuous Dragon: Economic Freedom and Economic Growth in China

Joshua Hall and Yang Zhou, West Virginia University

Abstract

With sinuous reforms and economic openness over the last four decades, China has enjoyed substantial economic development. Though still a developing country, its GDP per capita has grown over 10% annually, from $183(US) in 1977 to $7,590 (US) in 2014. This miracle in economic growth is attributed by some to a series of pro-market policies and reforms. Although the general trend is greater economic freedom, China has experienced brief periods of decreasing or stagnant economic freedom that correspond with slowdowns in the growth rate. In this paper we trace these changes in economic freedom in China and discuss prospects for future improvement.

Introduction

For nearly 40 years China has enjoyed substantial economic development through a freer economic environment and has become the second largest economy in the world. In December of 1978, the Third Plenary Session of the 11th Central Committee of the Communist Party of China (CPC) was held in Beijing. This event is largely recognized as the beginning of China's economic reforms and the opening up of its economy. Before that, the policies of China had largely been antithetical to markets, with China having GDP per capita of only $70 (US) in 1961. Lackluster growth and social strife was the impetus for Mao Zedong, chairman of the Communist Party of China, to initiate the Cultural Revolution in 1966 (Howden and Zhou, 2015). In 1978, however, incremental economic reforms and the opening of China to foreign markets began, which almost immediately led to growth. However, since the late 1970s, China has enjoyed substantial economic growth, and the average annual growth rate is almost 10%, though the growth has been slowing down in recent years.

Modest reforms in the agricultural sector is a good example of the importance of economic freedom. In 1978, 18 farmers in the village of Xiaogang in the Anhui Province of eastern Middle China pioneered the "household contract responsibility system" whereby remuneration was linked to output, not to the number of hours worked, and local officers and farmers were held responsible for the profits and losses of the operation (Krusekopf, 2002). This was the beginning of introducing some semblance of private property into the agricultural sector, even though land could not officially be owned by individuals. Farmers no longer worked in less productive collective units but rather were responsible for their own contracted lands. As a result, rice, wheat, and corn production increased significantly since 1980 (Howden and Zhou, 2015).

Similarly, in 1979 China started reforming state-owned enterprises (SOEs), which constituted the majority of China's economy (Ping, 2000). Many SOEs were reintegrated and contracted out. This privatization process introduced more vigorous competition and more economic freedom to the economy, contributing to the growth (Allen et al., 2005). While significant reform has occurred, there is still considerable state involvement in utilities and banking. Lardy (2014) estimates that SOEs accounts for one third of GDP and held nearly half of the loans from financial institutes to enterprises. So while private enterprises have been started and become a large part of the economy, many economic decisions are still made collectively (Coase and Wang, 2012).

Given the large role economic freedom has played in improving economic outcomes and well-being (Hall and Lawson, 2014), it is important that the marketization of China continue. In this paper we use the widely-cited *Economic Freedom of the World* (EFW) index by Gwartney et al. (2015) to detail how China has improved in economic freedom since 1980. The EFW index rates and ranks country's based on whether a country's laws and policies impede individual autonomy in economic affairs. Using third-party data, they place countries on a 0 to 10 scale, with higher values denoting higher levels of economic freedom. For example, China had a score of 3.74 in the EFW in 1980, 4.43 in 1990, 5.78 in 2000, and peaked at 6.25 in 2013. While a large increase in economic freedom, China is still not in the top 100 countries in the world in terms of economic freedom (Gwartney et al., 2015).

Within the overall index, the authors divide economic freedom into five areas: Size of Government, Legal Systems and Property Rights, Sound Money, Freedom to Trade Internationally, and Regulation of Credit, Labor and Business. We will study each of these in turn. We use these areas to organize our discussion of China's changes in economic freedom. Our second section is on size of government, the following section on legal system and property rights, and so on. We conclude with some remarks related to the relationship between political and economic freedom and the opportunities for future economic reforms.

Size of Government

Size of government is an area in the EFW index because as government gets larger it is substituting public decision-making for private decision-making. For example, as the as government consumption as a percentage of total consumption rises, more decisions are being made collectively. This does not mean that government consumption cannot be used for productive activities, just that it reduces economic freedom.

The size of government area of the EFW index is comprised of four components, one of which is the average of two sub-components. The components and their scores for the size of government Area can be seen in Table 1. For a full description of all the components and sub-components, along with sources, we point the reader to the data appendix of Gwartney et al. (2015). Before delving into the data it is important to note that zeros represent the lowest possible score for that component and empty spaces reflect an absence of data for that component. For example, data on transfers and subsidies as a percentage of GDP was not available for China until 2005.

Table 1: China's Scores in the Size of Government Area of the EFW Index, 1980-2013

Year	***1980***	***1985***	***1990***	***1995***	***2000***	***2005***	***2010***	***2013***
Government Consumption	5.25	5.73	5.94	6.07	4.28	3.87	3.63	3.71
Transfers and subsidies						8.29	8.29	8.29
Government enterprises and investment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00
Top marginal tax rate		6.00	5.00	6.00	6.00	6.00	6.00	6.00
(1)Top marginal income tax rate		6.00	5.00	6.00	6.00	6.00	6.00	6.00
(2)Top marginal income and payroll tax rate							6.00	6.00

Source: Gwartney et al. (2015).

From Table 1 we see that much of the data for China has been constant over the years, with the exception of government consumption as a percentage of total consumption. In 1980, China received a score of 5.25. That had fallen to 3.71 by 2013, reflecting an increase in government consumption relative to private consumption. The large role of SOEs is reflected in the zero score for government enterprises and investment from 1980 to 2010, with a small increase to 2.00 in 2013. The increase in government consumption seems to coincide with the major Chinese tax reform that occurred in 1994 (Mun-Heng and Qian, 2005). The reform made China's tax system more systematic and efficient, leading to a surge in fiscal revenue to the central government. Prior to reform, the central government's share of fiscal revenue was below 33%, but by 1996 it was over 50%. This dramatic increase in government consumption, while reducing economic freedom, reflects the enormous spending on infrastructure that has occurred throughout China over this time period.

The other subarea which has largely not changed but is ripe for improvement is government enterprises and investment. According to Gwartney et al. (2015), countries receive a zero as long as government investment exceeded 50% of total investment. The zero score prior to 2013 reflects the large role of the Chinese government in the banking and financial sector. While SOEs were propped up during the sub-prime crisis, observers feel that accession to the WTO will hasten reform of SOEs by hardening the budget constraint faced by SOEs (Tian and Xia, 2017).

Legal System and Property Rights

Though China has slowly increased it economic freedom, it has not occurred in the area of quality of the legal system and protection of property rights. The rule of law and strength of property rights are notoriously difficult to measure and the primary way to do so is through survey data, which largely did not exist prior to 2000. For that reason, Table 2 starts in 2000, when the data used by the EFW in this area came online as the World Bank's *Doing Business* and the World Economic Forum's *Global Competitive Report* began to be regularly published.

There are nine variables in this area reflecting the role of government in protecting private property and treating individuals equally before the law. There are a couple of important things to note in Table 2. The first is that the score on protection of property rights has improved from 3.22 in 2000 to 5.81 in 2013. While quite an improvement, this is still quite low by international standards. To put it in perspective, in 2013 they scored just above Kuwait on this measure and below Zambia, Brunei Darussalam, and Macedonia. OECD countries like Finland, Norway, and the United Kingdom all have scores above 8.5.

It might seem surprising that regulatory restrictions on the sale of real property is so consistently high. We believe that the incentive for the Chinese government to continue perform well in this area is that it relies on real estate development to stimulate the economy and collect revenues by selling the land use rights (Pan et al., 2015). The remainder of the components

Table 2: China's Scores in the Legal System and Property Rights Area of the EFW Index, 1980-2013

Year	***2000***	***2005***	***2010***	***2013***
Judicial independence	3.34	3.92	4.89	4.98
Impartial courts	4.18	4.03	5.21	4.71
Protection of property rights	3.22	4.95	6.74	5.81
Military interference in rule of law and politics	7.34	5.00	5.00	5.00
Integrity of the legal system	6.67	7.50	6.67	5.83
Legal enforcement of contracts		6.73	6.73	6.07
Regulatory restrictions on the sale of real property		8.27	8.27	8.45
Reliability of police		5.08	5.95	5.50
Business costs of crime		4.92	6.77	6.34

Source: Gwartney et al. (2015).

of the legal structure and property rights have not changed much over the 2000-2013 time frame. Overall, China's economic freedom in this area is still quite low by international standards, suggesting a lot of room for improvement. In particular, the legal intervention in Chongqing Municipality by Bo Xilai from 2008 to 2012 and his trial in 2012 highlights some of the troubles that China has had with respect to maintaining the rule of law (Self, 2015; Zhou, 2017).

Sound Money

The sound money area of the EFW index gives higher scores for countries that keep inflation low and stable, do not greatly increase the money supply, and do not place restrictions on foreign currency bank accounts (Table 3). Like most countries in the world, China has improved its monetary policy with respect to reducing inflation over the past thirty years. In particular, China received only a 7.97 in 1985 on the component for inflation in the most recent year, but a 9.47 score in 2013. Similarly, monetary growth has risen from a 6.00 in 1980 to almost 10.00 in 2013. Freedom to own foreign currency bank account has improved from a zero (not allowed) from 1980-1995 and since 2000 they have scored a 5.00, which indicates that foreign currency bank accounts are available domestically, but not abroad.

Table 3: China's Scores in the Sound Money Area of the EFW Index, 1980-2013

Year	***1980***	***1985***	***1990***	***1995***	***2000***	***2005***	***2010***	***2013***
Money growth	6.00	8.14	9.18	7.63	8.90	9.05	8.57	9.98
Standard deviation of inflation	9.48	8.64	8.86	8.09	8.63	9.04	8.63	8.58
Inflation: Most recent year	9.24	7.97	8.86	7.36	9.95	9.64	9.34	9.47
Freedom to own foreign currency bank accounts	0.00	0.00	0.00	0.00	5.00	5.00	5.00	5.00

Source: Gwartney et al. (2015).

Despite improvements in this area and the fact that China is doing very well compared to developed countries, there are some points of concern with respect to monetary freedom. First, the inability to hold foreign currency bank accounts abroad. Making that change would give China a 10.00 on that component and an extremely high overall rating in this area. Second, the People's Bank of China has been injecting a lot of liquidity into the economy that may show up in the official inflation statistics or in terms of overvalued assets (Deng et al., 2015). Third, the People's Bank of China is not an independent central bank and political influences might divert the bank from a sound money policy should economic growth slow (Bell, 2013). Fourth, the growth of the shadow banking system in China creates significant financial risk that could lead to the type of systemic risk that contributed to bailouts in the United States (Li et al., 2014). Last but not least, facing the growing depreciation pressure of the Chinese Yuan, the Central Bank has been imposing stricter regulations on buying and exporting foreign currencies in the last months.

Freedom to Trade Internationally

Voluntary exchange is at the core of economic freedom. Individuals should have the right to exchange what they honestly produce with other individuals in society. In practice, while governments sometimes obstruct internal trade, the majority of restrictions on voluntary exchange occur when governments artificially impede exchange with individuals in other countries. Table 4 shows the components of this area of the EFW index for China from 1980 to 2013. As can be seen in the table, China has improved considerably in this area. In fact, it is the primary driver of the country's overall increase in economic freedom.

This area of the EFW index is made up of four components, three of which have sub-components. They main components are: tariffs, regulatory trade barriers, black market exchange rates, and controls of the movement of capital and people. The biggest mover has been tariffs, which rose dramatically following up the opening of the Chinese economy in 1978. China's mean tariff rate was so high in 1980 that it almost received a zero. In 2013 it received a score of 8.02. Similarly, it used to receive a zero on the standard deviation of tariff rates, but now receives a 6.95. Revenue from trade taxes has declined as a percentage, however, that has more to do with the growth of China's trade sector than to other reforms.

The other big mover in the trade area is in black market exchange rates, where China went from a score of 5.00 in 1980 to a perfect 10.00 today. Despite all the improvements in the tariff and black market exchange components, there still remains a lot of room for improvement in the other trade components. In particular, capital controls and freedom of foreigners to visit are among the lowest scores in the world. Many short-term foreign visits are for current or future exchange purposes and raising the costs of visiting through visa applications reduces the economic freedom of Chinese citizens as it prevents them from interacting with others individuals with whom they would like to interact.

Table 4: China's Scores in the Freedom to Trade Internationally Area of the EFW Index, 1980-2013

Year	***1980***	***1985***	***1990***	***1995***	***2000***	***2005***	***2010***	***2013***
Tariffs	3.15	2.72	3.16	3.90	7.81	7.96	8.13	8.10
(1)Revenue from trade taxes (% of trade sector)	6.20	3.33	7.53	9.20	8.86	8.81	9.35	9.33
(2)Mean tariff rate	0.10	2.10	1.94	2.50	8.86	8.16	8.08	8.02
(3)Standard deviation of tariff rates			0.00	0.00	5.72	6.91	6.97	6.95
Regulatory trade barriers				4.63	6.01	6.02	6.38	6.34
(1)Non-tariff trade barriers				4.63	4.35	5.14	5.86	5.77
(2)Compliance costs of importing and exporting					7.66	6.91	6.91	6.91
Black market exchange rates	5.00	7.80	0.00	8.60	10.00	10.00	10.00	10.00
Controls of the movement of capital and people	0.00	2.00	5.00	4.91	2.71	2.56	2.19	2.48
(1)Foreign ownership/investment restrictions				4.82	4.66	6.71	6.35	6.25
(2)Capital controls	0.00	2.00	5.00	5.00	0.77	0.77	0.00	0.77
(3)Freedom of foreigners to visit						0.20	0.22	0.42

Source: Gwartney et al. (2015).

A sub-component with almost zero movement is capital controls. In 1980, China received a 0.00 and today it receives a 0.77. In practice, this means that there have been considerable restrictions on the areas where foreign capital can invest. For example, while foreign commercial banks can operate in China, the scope of business is limited. Explicit limitations are placed on foreign ownership levels in those controlling shares strategic industries, since the Party seems uncomfortable with the owning of these industries by foreign capitals (Szamosszegi and Kyle, 2011). Other key sections, like energy industry, communications, infrastructure and etc., are closed to foreign investors and monopolized by SOEs. According to Song et al. (2014), removing capital controls would accelerate productivity growth as well as output growth.

Regulation of Credit, Labor, and Business

China's performance in the area of regulation of credit, labor, and business was poor in the 1970s and 1980s, but has improved since 1990. Table 5 shows the three components of this area of the EFW index for China from 1980 to 2013, all of which have several sub-components. Among the three components, credit market regulations have the largest improvement. In 1990, this component scored zero. By 1995 it had risen to 4.60 and 7.21 in 2013. As noted earlier, foreign restrictions on owning banks are numerous, this is reflected by the low (2.0) score on the ownership of banks sub-component. The remaining two sub-components under credit market regulations, the amount of credit available to the private sector (as a percentage of total credit) and interest rate controls/negative real interest rates, both have been on high levels post 2000: in 2013, the former one scored 9.63, and the second one scored 10.

Business regulations have also been recovering since a drop in the 2000s. China scored a 4.57 in 1995, which increased to 6.25 in 2000. It declined to 3.88 in 2005, however, and had only recovered to its 2000 level in 2013. Administrative requirements and bureaucracy costs are the two main reasons for the 2000s Drop. Meanwhile, most of the other sub-components have been improving over time, which creates a less regulated environment for business in general. Overall, however, the Chinese economy is still highly regulated compared to most other countries in the EFW index, especially components related to the rule of law, like extra payments/bribery/favoritism.

Table 5: China's Scores in the Regulation of Credit, Labor, and Business Area of the EFW Index, 1980-2013

Year	***1980***	***1985***	***1990***	***1995***	***2000***	***2005***	***2010***	***2013***
Credit market regulations	0.00	0.00	0.00	4.60	6.46	7.06	6.76	7.21
(1)Ownership of banks	0.00	0.00	0.00	0.00	0.00	2.00	2.00	2.00
(2)Private sector credit				9.81	9.39	9.18	9.28	9.63
(3)Interest rate controls/negative real interest rates	0.00	0.00	0.00	4.00	10.00	10.00	9.00	10.00
Labor market regulations			3.16	4.54	4.66	4.98	5.66	5.63
(1)Hiring regulations and minimum wage				5.80	4.37	8.90	8.90	8.90
(2)Hiring and firing regulations			4.30	4.30	5.10	5.27	5.45	5.98
(3)Centralized collective bargaining	4.49	4.49	5.18	6.21	7.67	7.44	7.10	6.40
(4)Hours Regulations				6.42	6.18	6.70	10.00	10.00
(5)Mandated cost of worker dismissal						1.56	2.52	2.52
(6)Conscription	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Business regulations				4.57	6.25	3.88	5.61	6.29
(1)Administrative requirements					7.60	3.96	4.89	5.09
(2)Bureaucracy costs				4.78	5.40	2.00	4.67	4.67
(3)Starting a business				6.05	6.52	8.08	8.42	8.99
(4)Extra payments/bribes/favoritism				2.87	5.49	5.52	5.11	4.99
(5)Licensing restrictions						3.52	5.04	6.92
(6)Tax compliance						0.23	5.54	7.07

Source: Gwartney et al. (2015).

Labor market regulations also have slowly improved over time. Overall, China's score on the labor market regulations component of the EFW index has increased from 3.16 in 1990 to 4.98 in 2005 to 5.63 in 2013. One reason for the slow improvement of this component is China's new labor contract law implemented in 2008 (Li and Freeman, 2015). Cheung (2008) argues that the hiring and firing regulations of this new labor law restrict the freedom of employers to freely hire and fire employees and the minimum wage restricts economic freedom too. Similarly, the required two years of military conscription is a large constraint on the labor of young Chinese workers and why the country receives a zero for that sub-component. While still fairly low, there is a bright spot. Hours regulations have improved to a 10.00 from a 6.42, suggesting a significant loosening on restrictions on the number of hours individuals can work.

Concluding Thoughts

China's economic miracle since late the 1970s is promoted by its economic reform and opening up, which has enabled the people to be more and more involved in the market process of division of labor, nationally and internationally. China is evidence that a little bit of economic freedom goes a long way. However, economic freedom has not improved much in the last fifteen years, which has the potential to stifle continued economic progress. In other words, the reform dividend has started to disappear.

In addition, economic freedom is the foundation of political freedom, and political freedom, in turn, promotes economic freedom and economic growth. The two complement each other, and jointly promote the development of social civilization and overall development. According to "Hayek-Friedman hypothesis", economic freedom can exist in both politically free and unfree societies, while those which are not economically free are generally not politically free (Lawson and Clark, 2010). Although there have been societies which are not economically free but politically free, most of them have diverged to other combinations or are currently on the path of divergence. The politically free but not economically free society is considered as an unstable equilibrium (Hayek, 1944; Friedman, 1962). China's path in the last four decades has not been a violation of the "Hayek-Friedman hypothesis" path. Its political freedom is still at an extremely low level.

It is difficult to forecast China's path. Perhaps the path of Taiwan, which had both economic and political reforms in 1980s after its economic growth for decades, will be followed by mainland China, though this mirror with the prevalence of populism and inefficiency in politics is still not a perfect example. However, the history of the last forty years does tell that part of the chains constraining this sinuous dragon have been removed in short order. It is not too bold to expect another round of significant growth if more chains are released.

References

Allen, Franklin, Jun Qian, and Meijun Qian. 2005. "Law, Finance, and Economic Growth in China." *Journal of Financial Economics* 77: 57-116.

Bell, Stephen. 2013. *The Rise of the People's Bank of China*. Cambridge: Harvard University Press.

Cheung, Steven. 2008. *The Economic System of China*. Hong Kong: Arcadia Press.

Coase, Ronald, and Ning Wang. 2012. *How China Became Capitalist*. New York: Palgrave Macmillan.

Deng, Yongheng, Randall Morck, Jing Wu, and Bernard Yeung. 2015. "China's Pseudo-Monetary Policy." *Review of Finance* 19: 55-93.

Friedman, Milton. 1962. *Capitalism and Freedom*. Chicago: University of Chicago Press.

Gwartney, James D., Robert A. Lawson, and Joshua C. Hall. 2015. *Economic Freedom of the World: 2015 Annual Report*. Vancouver: Fraser Institute.

Hall, Joshua C., and Robert A. Lawson. 2014. "Economic Freedom of the World: An Accounting of the Literature." *Contemporary Economic Policy* 32: 1-19.

Hayek, Friedrich August. 1944 (Reprint 2014). *The Road to Serfdom*. New York and London: Routledge.

Howden, David, and Yang Zhou. 2015. "Why Did China's Population Grow so Quickly?" *The Independent Review* 20: 227-248.

Krusekopf, Charles C. 2002. "Diversity in Land-Tenure Arrangements under the Household Responsibility System in China." *China Economic Review* 13: 297-312.

Lardy, Nicholas R. 2014. *Markets over Mao: The Rise of Private Business in China.* Washington DC: Peterson Institute for International Economics.

Lawson, Robert A., and Jeff R. Clark. 2010. "Examining the Hayek–Friedman Hypothesis on Economic and Political Freedom." *Journal of Economic Behavior & Organization* 74: 230-239.

Li, Xiaoying, and Richard B. Freeman. 2015. "How Does China's New Labour Contract Law Affect Floating Workers?" *British Journal of Industrial Relations* 53: 711-735.

Li, Jianjun, Sara Hsu, and Yanzhi Qin. 2014. "Shadow Banking in China: Institutional Risks." *China Economic Review* 31: 119-129.

Mun-Heng, T. O. H., and L. I. N. Qian. 2005. "An Evaluation of the 1994 Tax Reform in China using a General Equilibrium Model." *China Economic Review* 16: 246-270.

Pan, Jiun-Nan, Jr-Tsung Huang, and Tsun-Feng Chiang. 2015. "Empirical Study of the Local Government Deficit, Land Finance and Real Estate Markets in China." *China Economic Review* 32: 57-67.

Ping, Xinqiao. 2000. "On Genetic Decision upon the Proportion of State-owned Economy." *Economic Research Journal* 7: 16-23. (In Chinese)

Self, Ben. 2015. "The Bo Xilai Trial and China's Struggle with the Rule of Law." *Washington University Global Studies Law Review* 14: 155-180.

Song, Zheng, Kjetil Storesletten, and Fabrizio Zilibotti. 2014. "Growing (With Capital Controls) Like China." *IMF Economic Review* 62: 327-370.

Szamosszegi, Andrew, and Cole Kyle. 2011. *An Analysis of State-owned Enterprises and State Capitalism in China*. Washington DC: Capital Trade, Incorporated for US-China Economic and Security Review Commission.

Tian, Ye, and Min Xia. 2017. "WTO, Credible Commitments, and China's Reform of State-owned Enterprises." *Economic and Political Studies* 5: 1-21.

Zhou, Yang. 2017. "Do Ideology Movements and Legal Intervention Matter: A Synthetic Control Analysis of the Chongqing Model." *European Journal of Political Economy*. https://doi.org/10.1016/j.ejpoleco.2017.03.010.

A Transatlantic Analysis of Immigration and Economic Growth

Jennifer Kuklenski, University of Southern Mississippi

Abstract

Time series, OLS regression analysis of panel data was employed to estimate immigration's impact on economic growth in OECD countries between 2000-2010. Two regression analyses were conducted on one small sample of six European countries (full data was available) and one larger sample of eighteen European and North American countries (missing observations where estimated using mean imputation). The analysis controlled for other factors influencing economic growth, such as unemployment, inflation, human capital investment, infrastructure investment, research and development, and trade. Both regressions resulted in statistically significant immigration estimates, similar in magnitude, indicating a positive correlation between immigration and economic growth.

Introduction

This study examines the effect of immigration on economic growth in the United States, Canada, and Europe. Evidence indicates that benefits of immigration include access to new markets, greater efficiency, increased innovation and increased aggregate national income (Bellini *et al*. 2009; Borjas 1995; Page 2007). Alternatively, immigration may depress wages for low-skilled native workers and cause large wealth transfers away from native workers since property owners and investors reap most of the benefits associated with the increase in national income (Borjas 1995). The majority of the existing literature examining the link between immigration and economic growth is focused regionally, such as cities in the U.S. or regions in Europe, which means few if any meaningful conclusions can be drawn at an international level. This paper seeks to add to the existing literature by providing a transatlantic analysis of immigration and economic growth.

This paper employs time series, OLS regression analysis of panel data to estimate the impact of immigration (measured by the percentage of the population that is foreign-born) on economic growth (measured by GDP per capita) for two samples of OECD countries between the years 2000-2010. The null and alternative hypotheses state that immigration either does not affect economic growth or does affect economic growth, in a positive direction. The analysis controls for other relevant factors influencing economic growth, such as unemployment, inflation, human capital investment, infrastructure investment, research and development, and trade. The results indicate a positive correlation between the percentage of the population that is foreign-born and economic growth, as measured by GDP per capita.

Literature Review

Immigration is one of the most contested issues on the policy agenda in contemporary democracies. It is increasingly framed as a negative phenomenon, with public officials arguing that immigrants steal jobs from natives and depress wages. Some of the literature supports these arguments. Borjas (1995), for instance, finds that immigration may lead to depression of average worker wages. However, a more recent survey of the economic literature suggests that most groups of natives actually enjoy significant wage increases as a result of immigration, with only the lowest skilled groups suffering mild wage decreases, while prices are simultaneously kept down (Dustmann, Glitz and Tommaso 2008; Greenstone and Looney 2010).

Additionally, anti-immigrant actors argue that immigrants "steal" jobs from natives. However, scholarship suggests that unskilled immigrants complement a largely skilled native labor force (Dustmann, Glitz and Tommaso 2008). Indeed, some industries, such as farming in developed economies, could not compete with foreign rivals without the cheap labor afforded through immigration. In fact, Borjas (2001, 32) later contended that low-skilled immigration "greases the wheels" of the labor market. Efficiency gains result because immigrants equalize variation in marginal product of labor of assorted sub-markets, thus capturing positive wage effects from the "immigration surplus" (Dustmann, Glitz and Tommaso 2008, 490).

Low-skilled immigrants also tend to be more mobile than natives and Hanson (2012) highlights that this mobility helps dampen fluctuations in the economy, easing the burden on native workers when unemployment rates rise. Additionally, scholars have noted that immigrants are often entrepreneurial. In the United States, immigrants are thirty percent more likely to start a business, which in turn creates jobs (Greenstone and Looney 2010). Thus, immigration may lead to a greater number job opportunities for natives (Damelang and Haas 2012).

Evidence also indicates that immigration increases the total national income. Borjas (1995, 11) finds that the total contribution of immigrants to native incomes may be upwards of $55 billion and although such predictions may be slightly exaggerated (and are meager in context of large, advanced economies such as found in the U.S.), he stresses that immigration introduces new interactions between firms and workers, allowing both to gain knowledge for free. Moreover, the presence of foreign workers allows firms to access overseas markets and a number of studies have shown that increases in trade produces external returns in a nation's aggregate economy (Helpman and Krugman 1985). That said, Borjas (1995) cautions that total national income tends to increase when immigrants enter the country, property owners and investors reap most of the benefits associated with the increase in national income and although efficiency may increase, there are large wealth transfers away from native workers.

Immigration has also been linked to greater efficiency via better problem solving and greater technological developments due to increased innovation. Ottaviano and Peri (2006) argue that immigrants may possess skills that are complementary to natives because immigrants may perform different tasks or bring different abilities and skills to the same task. According to Alesina and La Ferrara (2005), productivity associated with skill complementarities are most important in regions where the production process is diversified, which is generally the case in advanced economies, such as those found in OECD countries.

Evidence from the U.S. and Europe suggests that on average, native citizens are more productive in heterogeneous environments (Bellini *et al*. 2009; Ottaviano and Peri 2006). For instance, Bellini *et al*. (2009) find that the diversity resulting from immigration produced potential benefits by increasing the variety of skills, goods, and services available for production, consumption, and innovation. Although very few studies explore the impact of immigration at an international level, the literature provides evidence that immigration may have a positive impact on economic growth, particularly in developed economies. Thus, the following research question is explored: *Does immigration affect economic growth in countries with advanced economies?*

Data and Methodology

A national time series, panel-data OLS regression procedure, controlled for heteroscedasticity, was used to test the following null and alternative hypotheses:

H_0: Immigration does not affect economic growth in selected countries.
H_1: Immigration positively affects economic growth in selected countries.

Drawing from previous studies of economic growth, the following model was developed:

$$GDPPC_{it} = \beta_0 + \beta_1 FORPOP_{it} + \beta_2 UNEMP_{it} + \beta_3 TRADE_{it} + \beta_4 EDUC_{it} + \beta_5 INFSTR_{it} + \beta_6 RAND_{it} + \beta_7 INFLAT_{it} + \alpha_i + \varepsilon_{it},$$

where *t* indicates time, *i* indicates entity, and α is the control for fixed country effects. The dependent variable measuring economic growth is annual GDP per capita. The independent variables include the annual percentage of the population that is foreign born, unemployment rate, balance of trade, government expenditure on education, inland infrastructure investment, research and development expenditure, and inflation.

Since high unemployment has been associated with economic stagnation, and neoclassical growth theories emphasize labor inputs in output growth, lower levels of unemployment are expected to be positively correlated with economic growth. Neoclassical growth theory also underscores the importance of technological progress; thus, research and development expenditure is also expected to have a positive relationship with economic growth. Human capital is also a determinant of economic growth (Barro 1991). Since human capital cannot be directly measured, it is indirectly measured by government expenditure on education. It is assumed that higher levels of government education expenditure leads to greater human capital accumulation, which will in turn result in greater economic growth. Economic growth may also be driven by investment in public infrastructure (Krauth 2004), since infrastructure is necessary to facilitate ease of transfer of goods and services. As previously discussed, trade is positively associated with economic growth. However, it is expected that countries with a positive trade balance will have better growth outcomes. Inflation may also influence growth outcomes and it is expected that higher levels of inflation will negatively affect economic growth. Finally, immigration is measured by the annual percentage of the population that is foreign born. A detailed description of each variable can be found in Appendix B.

The data used in this analysis is drawn from OECD and World Bank indicators for the years 2000-2010. The impact of immigration seems to be most contested in countries with advanced economies, therefore the sample includes 18 OECD countries. The study is limited in that it does not include OECD countries outside of Europe or North America. This is due to large amounts of missing data for countries such as South Korea, Japan, Australia, and New Zealand, inclusion of which would arguably strengthen the analysis. The sample does, however, include countries with significant variation on the dependent and

independent variables. The countries and the average values for each variable over the ten-year period under study are listed in Appendix A.

Note that even for some of the included countries, data was missing for a few of the variables. Two procedures were employed to account for this issue. First, complete case analysis of the six countries with full data for each variable was carried out. Two problems with this method arise: 1) the units (countries) with missing values may systematically differ from those with complete observations, leading to biased estimates and 2) since many variables are included in the model, there are fewer complete cases (smaller *n*), which reduces the statistical power (Gelman and Hill 2006; Roderick and Rubin 2002). Examination of the descriptive statistics suggests that the first problem may not be an issue – the missing data does not seem to be systematic (i.e. there does not appear to be any pattern among countries with missing data). The inference is that list-wise deletion would not produce biased slope estimates since the missing observations do not appear to be a function of the outcome variable (Roderick and Rubin 2002).

However, bias may result because some of the largest immigrant-receiving countries are now eliminated from the sample (France, Germany, and the U.S.) and it thus becomes a regional study (since Canada and the U.S. have been eliminated from the sample). Additionally, there is no way to ensure unbiased estimates and a smaller-*n* is still a problem – analysis of only six European countries likely does not yield generalizable results. Thus, mean imputation was used to estimate the missing observations for the larger sample. In the case of a random missing value – only one observation was missing for a specified variable – the mean of the before and after reported data was calculated and imputed into the dataset. In the case of a series of missing values – two or more observations missing in a row – the mean of the reported data for the ten year period was calculated and inserted for the missing observations. If data was mostly missing for one or more variables, the country was removed from the dataset.

The advantage of mean imputation is that it allows for complete case analysis, even when missing values are an issue. However, this method can distort variable distributions, leading to underestimated standard deviations (Gelman and Hill 2006). Additionally, mean imputation weakens covariance and correlation estimates because the relationship between variables is distorted (Humphries 2010). Table 2 displays the OLS regression estimates for the six and eighteen country samples.

Table 1: OLS Estimates for Six and Eighteen Country Samples

Independent Variable	GDPPC (6-country sample)	GDPPC (18-country sample)
Foreign Population (annual percentage)	1658.198 * (763.64)	1549.821 * (568.341)
Unemployment rate (percent unemployed)	-549.515 (361.986)	-410.199 * (151.525)
Balance of trade	274.765 (356.221)	88.573 (154.498)
Government education expenditure	743.564 (648.209)	-602.604 (808.276)
Inland infrastructure investment	432.678 (1747.562)	3494.458 * (1775.093)
R&D expenditure	7592.747 (6856.919)	6049.911 (4440.441)
Inflation	-59.483 (329.456)	16.349 (167.808)
R^2	.778	.284

* *Statistically significant at 5% level based on two-tailed t-test*

Results from both OLS regressions indicate the percentage of the foreign born population is positively correlated with economic growth, as measured by GDP per capita. It is interesting that although the estimates of nearly all other independent variables differ radically between the six- and eighteen-country samples, the estimates for the foreign-born population variable are similar in both regressions. Moreover, the coefficients were statistically significant for both. In the six-country regression analysis, foreign born population was the only statistically significant variable. A one-unit increase in percentage of the foreign-born population results in a GDP per capita increase of approximately $1658.20. Once the sample is expanded to include all eighteen countries, the results indicate a one-unit increase in the foreign-born population percentage leads to a slightly smaller GDP per capita increase of $1549.82. Both numbers are fairly large, though the impact of these values would vary from country to country depending on standard of living.

In the expanded sample regression, unemployment and inland infrastructure were also statistically significant. They both display the expected signs, with increased unemployment reducing GDP per capita and increased investment in infrastructure spending increasing GDP per capita. However, the R-squared is low for the expanded sample regression, indicating that little variation in GDP per capita is explained by the model for the eighteen-country sample. The R-squared is much higher for the smaller sample. The F-statistic p-values were 0.0000 for both regressions, suggesting the model was good. Thus, the lower R-squared may have been observed for the larger sample because the mean estimation method for missing observations reduces variability (Humphries 2010).

Although the results for both regressions allow rejection of the null hypothesis in favor of the alternative – immigration positively affects economic growth in selected countries – this conclusion is less than satisfying. It is unnerving that so few of the independent variables were statistically significant, particularly as this finding counters prominent theories of economic growth. It is possible that the data used for some or all of the independent variables does not accurately measure the concept. It is also possible that expansion of the sample with different (complete) data, rather than using mean estimation techniques, would lead to more promising estimates. Note that multivariate imputation was also attempted in STATA to account for the missing data in the large sample; however, the procedure did not appear to work, likely due to researcher error. Two methods will be used to address the aforementioned limitations as this research moves forward: First, complete data will be sought out via additional sources. Second, if missing data still exists, a second attempt at multivariate imputation will be completed after additional research has been conducted on the method.

Conclusion

Immigration is one of the most contested issues in contemporary democracies. It is increasingly framed as a negative phenomenon, with public officials pointing to scholarship that suggests immigration may depress wages for low-skilled native workers and cause large wealth transfers away from native workers since property owners and investors reap most of the benefits associated with the increase in national income (Borjas 1995). Additionally, anti-immigration actors argue that immigrants "steal" jobs from natives. However, the literature suggests that unskilled immigrants complement a largely skilled native labor force and some industries, such as farming in developed economies, could not compete with foreign rivals without the cheap labor afforded through immigration (Dustmann, Glitz and Tommaso 2008). Evidence also indicates that the economic benefits of immigration include greater efficiency, access to new markets, increased innovation, and increased total national income (Bellini *et al*. 2009; Borjas 1995; Page 2007).

The literature exploring immigration's effect on economic outcomes primarily examines regions within countries (such as U.S. cities) or major metropolitan areas in specific geographic regions (such as Europe). Few, if any, meaningful conclusions have been drawn at an international level. This paper begins to fill that void by providing a transatlantic analysis of immigration and economic outcomes. Time series, OLS regression analysis of panel data was employed to estimate the impact of immigration (measured by the percentage of the population that is foreign-born) on economic growth (measured by GDP per capita) for OECD countries between the years 2000-2010. Because complete data could not be obtained for all OECD countries included in the transatlantic sample, two regression analyses were conducted – one with a small sample of six European countries (where full data was available) and one larger sample of eighteen European and North American countries (where missing observations where estimated using mean imputation).

The analysis controlled for factors that influence economic growth, such as unemployment, inflation, human capital investment, infrastructure investment, research and development, and trade. The null hypothesis that immigration does not affect economic growth was rejected in favor of the alternative – that immigration does affect economic growth, in a positive direction. For both regression analyses, the estimates for the foreign-born population variable were statistically significant and similar in magnitude. In the six-country regression analysis, foreign born population was the only statistically significant variable. A one-unit increase in percentage of the foreign-born population results in a GDP per capita increase of approximately $1658.20. In the expanded sample regression, the unemployment rate and infrastructure investment rate were also statistically significant. Both estimates displayed the expected signs, with unemployment increases correlated with decreases in GDP per capita, and increases in infrastructure correlated with increases in GDP per capita. In the expanded sample, a one-unit increase in the percentage of the foreign-born population was correlated with a GDP per capita increase of $1549.82, slightly smaller than was found for the six-country sample.

Although the results indicate a positive correlation between the percentage of the population that is foreign-born and economic growth, this conclusion is drawn with caution. There are several methodological limitations involved in this study. The first issue concerns data limitations; the ability to obtain complete data for all countries in the sample was not possible and conducing a complete case analysis on only six countries reduces the statistical power of the estimates (Gelman and Hill 2006; Roderick and Rubin 2002). Estimating the missing observations via mean imputation causes additional problems, since the distribution of the variables, the standard deviations, and the relationships between variables may be distorted (Gelman and

Hill 2006; Humphries 2010). Those limitations accepted, the conclusions drawn warrant further analysis. Finding complete data for a greater number of countries is necessary to determine if the limitations have significantly affected the outcome of this analysis.

References

Alesina, Alberto and Eliana La Ferrara. 2005. "Ethnic Diversity and Economic Performance." *Journal of Economic Literature* XLIII: 762-800.

Barro, Robert J. 1991. "Economic Growth in a Cross Section of Countries," *The Quarterly Journal of Economics* 106(2): 407-443.

Bellini, Elena, Gianmarco I.P. Ottaviano, Dino Pinelli and Giovanni Prarolo. 2009. "Cultural Diversity and Economic Performance: Evidence from European Regions." Fondazione Eni Enrico Mattei (FEEM) Working Paper 63.2009: 1-29.

Borjas, George J. 1995. "The Economic Benefits from Immigration." Journal of Economic Perspectives 9(2): 3-22.

Borjas, George 2001. "Does Immigration Grease the Wheels of the Labor Market?" Brooking Papers on Economic Activity. Accessed 5 October 2016: http://www.oecd.org/eco/growth/24741853.pdf.

Borjas, George. 2003. "The Labor Demand Curve is Downward Sloping: Reexamining the Impact of Immigration on the Labor Market," *Quarterly Journal of Economics* 118(4): 1335-1374.

Damelang, Andreas and Anette Haas. 2012. "The Benefits of Migration: Cultural Diversity and labour market success." *European Societies 14*(3): 362-392.

Dustmann, Christian, Albrecht Glitz, and Tommaso Frattini. 2008. "The Labour market impact of immigration," *Oxford Review of Economy Policy* 24(3): 477-494.

Gelman, Andrew and Jennifer Hill. 2006. *Data Analysis Using Regression and Multilevel/Hierarchical Models.* New York, NY: Cambridge University Press.

Greenstone, Michael and Adam Looney. "Ten Economic Facts About Migration." Policy Memo, The Hamilton Project, Brookings Institute. Accessed August 1, 2016. https://www.brookings.edu/wp-content/uploads/2016/06/09_immigration.pdf.

Hanson, Gordon H. 2012. "Immigration and Economic Growth," *Cato Journal* 32(1): 25-34.

Helpman, Elhanan and Paul R. Krugman. 1985. *Market Structure and Foreign Trade*. Cambridge, MA: MIT Press.

Humphries, Mellissa. 2010. "Missing Data and How to Deal: An Overview of Missing Data." PowerPoint Presentation. Accessed November 13, 2016. https://liberalarts.utexas.edu/prc/_files/cs/Missing-Data.pdf.

Krauth, Brian. 2004. "Chapter 1: Neoclassical growth theory." Lecture presentation. Simon Fraser University. Accessed February 1, 2017. http://www.sfu.ca/~bkrauth/econ808/808_lec1.pdf.

Little, Roderick J. and Donald Rubin. 2002. *Statistical Analysis with Missing Data*. John Wiley & Sons, Inc: Hoboken.

Ottaviano, Gianmarco I.P. and Giovanni Peri. 2006. "The Economic Value of Cultural Diversity: Evidence from U.S. Cities," *Journal of Economic Geography* 6: 9-44. http://dx.doi.org/10.1093/jeg/lbi002.

Page, Scott E. 2007. *The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies*. Princeton, NJ: Princeton University Press.

Appendix A

Ten-Year Average Values (2000-2010) and Percentage Change between 2000 and 2010

Country	Variables							
	GDPPP (US dollars)	FORPOP (% of total population)	UNEMP (% of labor force)	TRADE (Million US dollars)	EDUC (% of GDP)	INFRSTR (share of GDP)	RAND (% of GDP)	INFLAT (annual %)
Austria	39,196 (+12,338)	15.5% (+5.09%)	5.1% (+1.29%)	3.35 (+1.94)	11.7% (-0.26%)	0.93% (0%)	2.54% (+0.85%)	2.17% (-.58%)
Belgium	37,088 (+11,010)	13.6% (+4.59)	8.5% (+1.20%)	3.71 (-0.84)	13.3% (+0.12)	0.48% (-0.1%)	2.09% (+0.13)	2.35% (-0.49%)
Canada	38,898 (+10,802)	20.5% (+2.5%)	7.8% (+1.23%)	3.08 (-6.29)	13.6% (-0.04%)	0.85% (0.8%)	2.14% (-0.03%)	2.29% (-0.94%)
Czech Republic	24,679 (+10,704)	5.9% (+2%)	7.9% (-1.55%)	1.19 (+4.95)	10.3% (+0.41%)	1.6% (+0.5%)	1.32% (+0.5%)	2.94% (-2.49%)
Denmark	38,807 (+12,273)	7.3% (+1.95%)	5.4% (+2.84)	5.87 (-0.6)	16.8% (-0.42%)	0.58% (0%)	2.82% (+0.55%)	2.33% (-0.63%)
Estonia	18,108 (+11,404)	18.8% (-2.44%)	11.35% (+2.1%)	-4.78 (+9.6)	15.9% (-1.12%)	1.0% (+0.5%)	1.1% (+0.9%)	4.61% (-1.04%)
Finland	36,198 (+11,856)	3.84% (+1.97%)	9.2% (-1.41%)	5.97 (-7.91)	13.6% (+2.76%)	0.62% (+0.2)	3.74% (+0.48)	1.89% (-2.16%)
France	34,178 (+9,931)	12.2% (+1.59%)	9% (+0.63%)	-0.18 (-1.37)	11.5% (-0.72)	0.97% (0%)	2.31% (+0.09%)	1.88% (-0.17%)
Germany	36,686 (+13,499)	12.8% (+0.48)	9.6% (-0.79%)	4.82 (+4.93)	11% (+0.64%)	0.79% (-0.84%)	2.74% (+0.32%)	1.7% (-0.37)
Great Britain	38,269 (+7,406)	10.4% (+3.3%)	6.2% (+2.2%)	-2.8 (-1.3)	14.2% (+0.9%)	0.74% (+0.1%)	1.85% (-0.03%)	2.2% (+2.5%)
Hungary	19,147 (+9,508)	3.8% (+1.55)	8.1% (+5.45)	-0.77 (+8.98)	11.5% (-0.64%)	1.3% (+0.4%)	1.1% (+0.35)	6.6% (-4.9%)
Ireland	43,059 (+13,879)	14.3% (+8.31%)	6.76% (+9.52)	14.2 (+2.84)	14% (-4.1%)	1% (0%)	1.4% (-1.89%)	3.1% (-4.6%)
Netherlands	42,460 (+13,247)	11.8% (+1.1%)	3.9% (+1.5%)	8.52 (+1.7)	12.7% (+0.45)	0.68% (0%)	1.9% (-0.1%)	2.3% (-1.04%)
Norway	53,180 (+22,026)	9.6% (+4.9%)	3.8% (+0.2%)	15.8 (-5.58)	17.7% (-0.18%)	0.8% (+0.3%)	1.74% (+0.05%)	2.3% (-0.67%)
Slovakia	19,341 (+13,276)	15.6% (+5.47%)	16.9% (-4.37%)	-3.8 (+1.12)	10.5% (+2.4%)	1.1% (0%)	0.59% (-0.02%)	5.59% (-11.1%)
Spain	31,182 (+10,670)	11.7% (+9.45%)	13.3% (+5.9%)	-3.79 (+1.77)	11.8% (-0.12%)	1.5% (+0.4%)	1.2% (+0.47%)	3.1% (-1.6%)
Sweden	39,206 (+11,937)	1.4% (+3.45%)	7.1% (+3.65%)	7.12 (-0.4)	14.3% (+0.34%)	0.8% (+0.3%)	3.86% (-0.55%)	1.6% (+0.12%)
United States	47,540 (+11,883)	13.2% (+1.88%)	6.5% (+5.7%)	-4.75 (+0.22)	16.7% (-3.39%)	0.7% (0%)	2.89% (+0.12)	2.7% (-1.74%)

Note: The percentage change for each variable between the years 2000 and 2010 are displayed in parentheses below the average values.

Appendix B

GDPPC: Data for gross domestic product per capita derived from the OECD data bank and measures the expenditures on final goods and services minus imports. The indicator was measured in USD per capita in million USD at prices and PPPs. Citation: OECD (2016), Gross domestic product (GDP) (indicator). doi: 10.1787/dc2f7aec-en (Accessed on 19 October 2016).

FORPOP: Data for foreign-born population derived from the OECD data bank and covers all people who migrated from their country of birth to their current country of residence. This indicator was measured as a percentage of the total population. Citation: OECD (2016), Foreign-born population (indicator). doi: 10.1787/5a368e1b-en (Accessed on 2 November 2016).

UNEMP: Unemployment data derived from the OECD data bank and measures the number of unemployed people as a percentage of the labor force. This indicator does not include those who have become discouraged and stopped looking for work. Citation: OECD (2016), Unemployment rate (indicator). doi: 10.1787/997c8750-en (Accessed on 22 October 2016).

TRADE: Trade data derived from the OECD data bank and measures the change in ownership of material resources and services between one economy to another. The indicator was calculated by subtracting a country's annual imports (measured in million USD) from a country's exports (measured in USD). Citation: OECD (2016), Trade in goods and services (indicator). doi: 10.1787/0fe445d9-en (Accessed on 2 November 2016).

EDUC: Education spending is the proxy for human capital development. Data was obtained from the OECD data bank and covers expenditure on schools, universities, and other public and private education institutions, as a percentage of GDP. Citation: OECD (2016), Education spending (indicator). doi: 10.1787/ca274bac-en (Accessed on 22 October 2016)

INFSTR: Infrastructure investment covers spending on new transport construction and improvement of existing networks. Data for inland infrastructure investment derived from the OECD data bank and includes spending on road, rail, inland waterways, maritime ports, and airports, taking account of all sources of financing. This indicator is measured as a share of GDP. Citation: OECD (2016), Infrastructure investment (indicator). doi: 10.1787/b06ce3ad-en (Accessed on 2 November 2016).

RAND: Research and Development expenditure is the proxy for technological advancement and covers current and capital expenditures (public and private) on creative work undertaken systematically to increase knowledge and the use of knowledge for new applications. The measurement covers basic research, applied research, and experimental development. The data is derived from the World Bank data bank. Citation: World Bank Group. (2016). Research and development expenditure (% of GDP). Stable URL: http://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?view=chart. (Accessed on 2 November 2016).

INFLAT: Inflation data is derived from the World Bank and is measured by the consumer price index, annual percentage change in cost to average consumer acquiring a basket of goods and services that may be fixed or changed yearly. The calculation used here is the Laspeyres formula. Citation: World Bank Group. (2016). Inflation, Consumer Prices (Annual %). Stable URL: http://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?view=chart. (Accessed 2 November 2016).

Impacts of Recent Shocks on Long Island's Tourism: A CGE Model

Sheng Li, Richard Vogel, and Nanda Viswanathan, Farmingdale State College-SUNY

Abstract

Coastal Tourism and recreation on Long Island are creating significant economic impacts in the regional economy. This study focuses on Long Island's tourism development. Using a CGE model, the impacts of three potential shocks are evaluated; 1) an increase in the number of visitors, 2) lower fuel prices and 3) the appreciation of US dollars. Both an increase in the number of visitors and a decrease in fuel prices led to significant positive impacts on tourism related industries. The appreciation of the dollar led to a negative impact on the regional economy.
Keywords: Shocks, Coastal Industries, Tourism, Simulation, Long Island, CGE Model

Introduction

Marine and coastal based activities are important factors in Long Island's economy. Accurately evaluating the tradeoffs inherent in natural resource development are essential in order to ensure the sustainability of these activities within the regional economy (Barbier and Heal, 2006). Coastal resources and ecosystems contribute significant economic benefits to regional economies especially in terms of coastal tourism and recreational services (Remoundou et al. 2009) and result in population growth, land development, expansion of businesses and industry, as well as improvement of aquatic ecosystems.

Coastal tourism is considered to be one of the most important sustainable services for the regional development in the coming decades (Gayle, 2002, Kirkley 2009). It contributes over $10 billion in economic impact to Long Island's economy. The pass-through results from the connections between coastal industry and the larger economy may significantly affect the region's economic and ecosystem growth. In 2013, over 9 million overnight visitors to Long Island annually generating approximately $5.1 billion in spending in (Matejka, 2014). Overall, tourism supports more than 70,000 jobs or 5.9 percent of all jobs on Long Island and is responsible for generating nearly $638 million in state and local tax dollars. Based on a 4.3 economic multiplier, tourism spending generated $27.4 billion in economic impacts on Long Island in 2011 (Table 1).

Table 1 Tourism Economic Impact, 2011

Tourism Economic Impact	Direct Sales, (Billion)	Labor Income, (Billion)	Employment (1000)	Local Taxes, (Billion)	State Taxes, (Billion)
Long Island	5.3	2.7	74.7	0.3	0.3
New York City	38.7	20.0	367.5	2.8	2.1
NYS	59.2	30.3	726.7	4.2	3.2

A number of studies have demonstrated the role of tourism in locally sustainable development such as Butler (1999) and Page and Dowling (2002). Tourism development is a dynamic process of matching the resources to the demands and preferences of actual or potential tourists' (Liu, 1994). Kronbak (2011) suggests that investment in sustainable tourism could play a significant role in creating a green economy. It can support conservation through private reserves, communal conservancies, and contributions to public protected areas with associated environmental costs (Buckley, 2010; Buckley, 2012). In some cases, tourism may contribute to a broader cultural understanding by creating the awareness for and respect of the diversity of cultures and ways of life. (UNCSD NGO, 1999). Recent research suggests the concepts of "sustainable tourism" or "eco-tourism," which can improve both the sustainable growth of tourism's contribution to the economy and society and the sustainable use of resources and the environment (Lee 2013; Fennell 2014)

The purpose of this study is to investigate the sustainable development of Long Island's coastal industries and specifically focuses upon coastal tourism related industries. A CGE model was constructed to make a quantitative assessment of the sectoral contributions and the linkages between current marine and coastal economic activities. Three scenarios in terms of recent shocks are incorporated into the simulations: 1) an increase in the number of visitors/tourists; 2) a decrease in fuel prices, and 3) a significant appreciation of the US Dollar respecting major Counties since 2014. The primary SAM data are generated from

IMPLAN using 2014 data and disaggregating sectors related to tourism, such as, food and beverage, lodge, recreation, transportation, and tourism related trade and services.

Modeling Specification and Calibration

The structural model is based on traditional Keynesian economic theory, following closely a regional CGE model developed by Washington State University (Waters et al. 1997; Julia-Wise et al. 2002). We assume all economic agents (consumers, producers, and institutions) are optimizing their behavior in the economy and trace the impact of shocks through effects on output, prices, sales, employment, income, and revenues. The model simulates the economy in which quantities and prices adjust and feedback to clear product and factor markets in response to the shocks.

Production and Supply

We assume producers are maximizing profits by an optimal allocation of output between the local market and exports, including the rest of the U.S (RUS) and the rest of the world (ROW) using a constant elasticity of transformation (CET) aggregation function. The production function is specified in a Leontief-CES function. Primary factors (labor, capital, and other inputs) are assumed to substitute through the function (Winchester et al., 2006). Then, the production technology in the sectors is represented by

$$QA_a = \left(\frac{ad_a}{1-tb_a-\sum_c ica_c^a}\right) * \left(\sum_F \delta_F^a \, QF_F^{a-\rho_a}\right)^{-\frac{1}{\rho_a}} \tag{1}$$

Where: the subscript *a* represents activities, *F* factors, and *c* represents the commodities; QA_a is the quantity in activity *a*; QF_F^a is the quantity of factor *F* demanded by activity a. While $ad_a, tb_a, \delta_F^a, \rho_a, ica_c^a$ are the parameters in the function and represents the shift parameter for production function, indirect business tax rate, share parameter for production function, exponent for production function, and quantity of *c* as intermediate input per unit of activity *a* respectively.

Domestic supply is derived from an Armington CES function, which is used to distribute state produced goods and imported goods for both firms and households. We allow for imperfect substitution between locally produced goods and imported goods. Equilibrium in the factor market requires that the demand for factors equal the supply. The export supply function is derived from a constant elasticity of transformation (CET) function. The value of exports is specified as a function of the ratio of local level and international export prices (Holland et al. 2006). The output transformation CET equation is specified as:

$$QX_c = \alpha r_c^{\,q}[\kappa_c QE_c + (1-\kappa_c)QD_c^{\,\eta_c}]^{\frac{1}{\eta_c}} \tag{2}$$

Where QX_c is the quantity of regional supply which provides from QE_c, composite export quantity, and QD_c, the quantity of regional output supplied to regional demanders. αr_{ce} is a shift parameter for the supply transformation function; κ_c is share parameter for the supply transformation function; η_c is the exponent for the supply transformation function.

Demand

Final demand and intermediate demand are comprised of mixed commodities from both locally produced and imported goods. The optimal locally produced commodities and imported commodities are derived from a CES function to form composite commodities. The commodity composite demand equation is:

$$QQ_c = \alpha q_c\left[\mu_c QM_c^{-\tau_c} + (1-\mu_c)QD_c^{-\tau_c}\right]^{\frac{1}{-\tau_c}} \tag{3}$$

Where QQ_c is the composite quantity supplied to regional demanders. QM_c and QD_c are the quantity of regional output supplied to regional demanders and composite import quantity. αq_c, μ_c, and τ_c represent shift parameter for the Armington demand function, share parameter for the Armington demand function, and exponent for the Armington demand function.

The demand for input factors is derived from the first-order conditions of profit maximization taking into account the net price. Capital is assumed to be fixed within any given period and could be moved across the industries in response to different rental rates in the economy (Alavalapati et al., 1998).The factor demand is specified as:

$$WFDIST^a{}_F * WF^F = \left(\frac{PVA_a * ad_a}{1-tb_a-\sum_c ica_c^a}\right) * \left(\sum_F \delta_F^a \, QF_F^{a-\rho_a}\right)^{-\frac{1}{\rho_a-1}} \delta_F^a * QF_F^{a(-\rho_a-1)} \tag{4}$$

Where $WFDIST$ is the factor price distortion factor; WF^F is the average wage or rental rate for a factor. PVA_a is the value added price.

Households and Government

Households in this model are disaggregated into nine categories following IMPLAN and are assumed to maximize utility subject to a budget constraint. Households demand is derived using a linear expenditure function (Stone-Geary utility function) (Stone 1954; Zhang et al. 2005) as:

$$QH_c^H = \chi_c^H + \beta_c^H * (NYH_H - \sum_{cc} \chi_c^H * (PQ_c * (1 + tc_c))/((1 + tc_c) * PQ_c) \quad (5)$$

Where QH_c^H is the household H's consumption on commodity C. NYH_H and PQ_c are the net household income and composite commodity price, respectively. The parameters χ_c^H, β_c^H, and tc_c are the subsistence level parameter for a Stone-Geary utility function, marginal budget share parameter for a Stone-Geary utility function, and the consumption tax rate. Household demand is closely related to our assumption of an increase in regional tourism. Those demands will be affected by the household's income, price of tour.

Households receive income by supplying factors of production; import tariff revenues transferred to them by their domestic governments, and transfers of other property and labor revenue from outside of the local economy (Decaluwe et al., 2010). Household disposable income is computed net of household residential property taxes and federal income taxes. Savings by households are modeled as a constant proportion of household disposable income (after-tax income). Total savings are the sum of household savings and foreign savings.

The government account was divided into two accounts: 1) federal, and 2) state and local combined. State and local government expenditures are treated as endogenous and are assumed to be driven by state and local tax revenues. State and local tax revenues include payroll taxes, direct household taxes, and indirect business taxes.

We apply the Keynesian closure in this model and assume that labor supply is mobile across sectors, while capital is assumed fixed in the region, but mobile between sectors. Factor Prices are institutionally fixed. Thus the labor market clears through adjustments in the level of employment in the regions. Investment is fixed and exogenous, and the model balances saving-investment accounts through endogenous saving flows. The local supply of labor is assumed to be perfectly elastic, but it might vary in the long run. The local supply of capital is assumed to be perfectly inelastic in the short term. The structure of the Long Island CGE Model is shown in Figure 1.

Based on the structural model, the model needed to be calibrated to Long Island using the 2014 symmetric Social Accounting Matrix (SAM) tables produced by IMPLAN. 536 IMPLAN industry sectors were aggregated into 14 production sectors. Because of the limitations and inaccuracies associated with using unrevised IMPLAN data, we also collected some data from Tourism Economics (2010). The Long Island SAM is used for the CGE model to disaggregate Long Island's economy into nine general sectors, including Agriculture, Construction, Utilities, Wholesale and Retail Trade, Mining, and Quarrying, Processed Food, Manufacturing, Services, and Miscellaneous. Sectors related to the tourism sectors are isolated into five industries as Retail Food and Beverage Stores, Lodge, Recreation Amusement, Transportation, and Other Trade and Services. Overall, the Long Island SAM include a total of 14 aggregated production sectors producing 14 commodities; 3 value-added sectors (labor, capital, and indirect business taxes); 2 government sectors (combined state and local government and federal government); 9 household categories (classified by income level); a savings-investment account; and two accounts for imports and exports to the RUS and ROW.

Some specific parameter values for the model equations were calibrated in the CGE model. Parameters, such as the elasticities of substitution, transformation, and some demand elasticities are specified based on previous research (Bilgic et al. 2002). Additional parameters, such as the share and shift parameters are determined by solving the given equations by substituting the value of the SAM with the base-year data and the exogenous parameters.

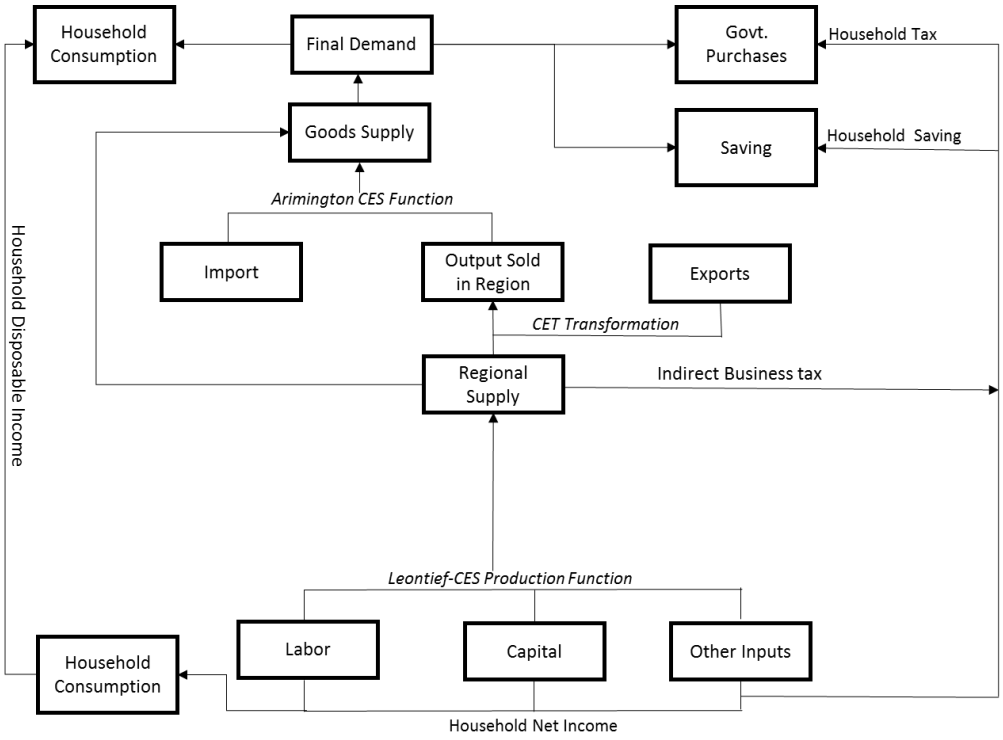

Figure 1. The Structure of Long Island CGE Model

Simulation and Results

Scenario Design

To identify the economic impacts of recent shocks on tourism in the Long Island, a series of three simulations are carried out. The choice of simulations are reflected in the current economic situation or the forecasting trend based on the given data in the study area. Tourism plays a major role in stimulating economic activities for the coastal economy given its significant induced effects (Matejka, 2014).

The *first scenario* assumes a growth of tourism by a 10% increase in tourism expenditures. The assumption is intended to examine the impact of the expansion of the tourist industry on the economy of Long Island. The potential of the tourism industry in promoting growth, creating jobs and generating revenue for the government has been widely discussed by pioneering studies (Narayan 2004; Sugiyarto et al. 2003). The direct effect of the expansion of tourism is expected to raise real incomes, increase the marginal product, and employment in the tourism sectors (Kweka, 2004). Tourism development will increase the domestic demand for goods and services as increased real income, which is associated with higher local prices. That increase of expenditure also leads to impacts on the trade sectors and raise the imports of goods and services.

The *second scenario* forecasts the effects of a steep decrease in fuel price, which in the simulation matches the situation from 2014 where the average fuel price fell by 20%. Lower fuel prices might have significantly affected both tourism and non-tourism based sectors. Reduced costs in public transportation, private vehicle, and recreational activity are associated with more supply, which leads to a lower price in most of the related markets (Allen, et. al 2009). Outputs in the most tourism-related sectors are expected to expand as traveling cost are reduced.

The *third scenario* estimates the impacts of an average 20% appreciation of the US dollar with respect to other major countries since 2014. A strong dollar may result in fewer individuals choosing the U.S. as a destination in the first place. International visitors tend to stay longer and spend more rather than American tourists, meaning that they have an outsized impact on the U.S. tourism economy. Those effects might be made up from increasing imports and domestic demands in other sectors as substitutes. Thus, the impact of the exchange ratio on tourism is uncertain.

Simulation Results

The model is calibrated to 2014 as the benchmark year and solved by GAMS. Results from the simulation scenarios are presented in Tables 2 through Table 6. Table 2 lists the baseline (2014) values for the key variables examined in the experiments. In the baseline, all commodity prices are assumed to be 1.0. Tourism related sectors including food and beverage, lodge, recreation, transportation, trade and services related to tourism contributed over 4 billion outputs and 37 thousand jobs. Food and beverage and transportation as the two largest sectors of the tourism industry produced half of the outputs. Lodge and trade and services offered over 5 thousand jobs which closely followed the dominate sector, food and beverage. Mean household income was approximately 90 thousand dollars in these areas which was much higher than the national level (51 thousand dollars). Local government revenue was approximately 73 billion dollars, and for the whole industry 160 billion dollars. Simulation results from the three scenarios for the whole of Long Island are presented in Table 2. The impacts from the simulations are reported as a change from the 2014 baseline values for commodity price, industry output, employment, trade, household income, and government's revenue, and GDP.

Table 2 Baseline Values for Output, Trades, Employment, Labor Income, Capital Income, and Household Income, Governments Revenues and GDP in the Long Island CGE Model (Million $).

	Value of Output	Lab	Capital
Food and Beverage	1292.6	17,982.9	200.4
Lodge	549.8	5,395.9	114.3
Recreation	377.4	4,448.9	57.5
Transportation	1,180.7	3,632.1	178.1
Trade & Services Related to Tourism	786.9	5,050.5	199.3
Agriculture	305.7	2,785.8	113.8
Construction	20,526.9	113,438.9	4,175.0
Utilities	4,623.3	5,244.2	526.3
Mining &Quarrying	359.6	2,092.4	52.5
Processed Food	2,871.4	9,930.0	183.2
Manufacturing	30,927.6	67,059.6	4,378.2
Miscellaneous	33,029.5	262,610.7	3,958.9
Other Trade & Services	187,056.00	1,235,696.2	47,956.1
Household	Lab Income	Cap Income	Household income
<$10,000	63.4	25.2	1,238.9
$10,000–$15,000	81.7	21.2	948.7
$15,000–$25,000	558.7	141.4	3,323.2
$25,000–$35,000	1,000.1	227.5	3,875.0
$35,000–$50,000	2,448.2	528.6	6,610.1
$50,000–$75,000	6,758.7	1,353.5	14,275.8
$75,000–$100,000	9,240.6	1,995.5	18,170.7
$100,000–$150,000	20,748.5	5,195.2	39,584.7
> $150,000	45,529.3	21,279.5	99,227.5
Federal government revenue			45,178.2
State government revenue			72,956.1
GDP			159,627.6

Scenario 1 Table 3 shows that in response to a 10% growth in the trips' expenditure, output and employment in the tourism-related sectors increased by 2.0% and 2.5% on average, respectively. Associated prices in those sectors rose slightly by 0.3%

as results of increased demand. Among the five tourism industries, the growth in the expenditures affected the food and beverage sector relatively more than other sectors, with 6.6% and 8.0% increase in output and employment respectively. A notable result is the lodge sector indicated small changes in output, employment and price corresponding to the trips' growth. This may be the result of the fact that the lodging sector is relatively small on Long Island relative to the greater New York metropolitan tourism sector and particularly New York City (Manhattan). Additionally, a large number of visitors to Long Island tend to be day trippers. The non-tourism sectors changed slightly (less than 0.1%) due to increasing demand by tourism industries. Aggregated impacts on output, employment and price are 0.6%, 1.0%, and 0.06% in those sectors. Incomes of all nine classes of households increased in scenario 1. The growth was largest for the higher-income household levels (over 0.1%). Interestingly, the lower household income category is associated with fewer gains in income. The overall increase in income is about 0.82%. Total federal government revenue and state government revenue grew by 0.16% and 1% with 0.13% growth in GDP.

Table 3 Change from Baseline Values under Scenario of a 10% Increase in Tours, Output, Labor, Price, Household Income, Governments Revenues, and GDP.

	Price	Value of Output	Employment
Food and Beverage	0.84%	6.62%	8.02%
Lodge	0.01%	0.05%	0.04%
Recreation	0.14%	1.41%	1.77%
Transportation	0.41%	1.78%	2.77%
Trade & Services	0.04%	0.09%	0.11%
Agriculture	0.00%	0.01%	0.02%
Construction	0.03%	0.10%	0.14%
Utilities	0.02%	0.00%	0.10%
Mining &Quarrying	0.00%	0.04%	0.10%
Processed Food	0.00%	0.20%	0.29%
Manufacturing	0.00%	0.09%	0.17%
Miscellaneous	0.01%	0.16%	0.18%
Household	Household Income		
<$10,000	0.02%		
$10,000–$15,000	0.02%		
$15,000–$25,000	0.05%		
$25,000–$35,000	0.07%		
$35,000–$50,000	0.10%		
$50,000–$75,000	0.13%		
$75,000–$100,000	0.14%		
$100,000–$150,000	0.15%		
> $150,000	0.14%		
Federal government revenue	0.16%		
State government revenue	0.13%		
GDP	0.20%		

Scenario 2 Table 4 presents the results of simulations for the impact of a 20% decrease in fuel prices. This shock affected most of the industries on Long Island including all tourism related sectors. The reduction of fuel prices (gasoline) had a direct and positive impact on output and employment in the transportation sector of 5.4% and 12.4% respectively. Other tourism-related sectors were big winners in this scenario as well. For example, output increases in food and beverage, lodge, recreation, and trade and services are 0.61%, 1.12%, 0.77%, 5.39%, and 0.58% respectively. Growth in employment across those sectors were also significant, showing increases of 0.83%, 1.96%, 1.13%, 12.35%, and 0.97%, respectively. Besides, agriculture,

utilities, mining &quarrying, processed food, manufacturing, and miscellaneous also benefited from the lower fuel price in output and employment. Prices declined in most of the sectors as a result of lower production costs, e.g. -1.52% in transportation. Total household income increased by 3.79%, and most of the increases are concentrated in the middle and higher income households. Increases in federal government revenue (0.73%) were triple those of local government (0.3%) and GDP grew by 0.94%.

Table 4 Change from Baseline Values under Scenario of a 20% decreasing in Fuel Price, Output, Trade, Labor, Price, Household Income, Governments Revenues, and GDP.

	Price	Value of Output	Lab
Food and Beverage	-0.01%	0.61%	0.83%
Lodge	-0.08%	1.12%	1.96%
Recreation	-0.04%	0.77%	1.13%
Transportation	-1.52%	5.39%	12.35%
Trade & Services	0.07%	0.58%	0.97%
Agriculture	0.00%	0.66%	1.89%
Construction	-0.77%	-0.14%	1.06%
Utilities	-0.06%	0.88%	1.61%
Mining &Quarrying	-1.02%	3.58%	8.62%
Processed Food	-0.02%	0.74%	1.05%
Manufacturing	-0.05%	0.84%	1.55%
Miscellaneous	0.00%	0.79%	0.97%
Household	Gross household income		
<$10,000	0.07%		
$10,000–$15,000	0.11%		
$15,000–$25,000	0.22%		
$25,000–$35,000	0.33%		
$35,000–$50,000	0.47%		
$50,000–$75,000	0.60%		
$75,000–$100,000	0.65%		
$100,000–$150,000	0.68%		
> $150,000	0.66%		
Federal government revenue	0.73%		
State government revenue	0.29%		
GDP	0.94%		

Scenario 3 Table 5 provides the estimated impact of the appreciation of the US dollar on tourism, and other sectors. Tourism related sectors are significantly affected by the appreciation. The value of output fell in all of the sectors at lower prices, which were associated with a reduction in employment. International visitors tended to stay shorter and spend less on Long Island and domestic demand did not fully make up for that loss. The value of output also declined in most of the other sectors except some specific industries, e.g. utilities and processed food as these industries rely primarily on the domestic market. Foreign imports could substitute for the domestic imports. The average increase in foreign imports across most sectors is about 21%, compared with the 2.8% decline in domestic imports. Exports were restricted by the appreciation of US dollar, and the average reduction in those sectors was over 16.5%. Household income fell in all the groups, especially in the higher income levels. The total impact in household income was approximately 10% along with a 2.3% reduction in GDP.

Table 5 Change from Baseline Values under Scenario of a 20% increasing in US Dollar Index, Output, Trade, Labor, Price, Household Income, Governments Revenues, and GDP.

	Price	Value of Output	Employment	Foreign imports	Domestic imports	Foreign Exports	Domestic exports
Food and Beverage	-0.52%	-1.00%	-0.79%		-2.05%		6.74%
Lodge	-0.01%	2.00%	3.51%		-1.55%		-0.45%
Recreation	-0.50%	-1.45%	-1.22%		-2.20%	-17.65%	-9.57%
Transportation	-1.87%	-5.21%	-7.24%	22.4%	-3.65%	-18.94%	-5.11%
Trade & Services	-0.73%	-2.56%	-3.19%	24.3%	-2.45%	-18.83%	1.08%
Agriculture	-2.53%	-1.12%	-0.69%	25.9%	-1.40%	-17.08%	2.06%
Construction	-1.10%	-0.98%	0.12%		-2.35%	-15.18%	0.55%
Utilities	-0.75%	2.82%	8.09%	25.1%	-1.95%	-13.74%	-1.46%
Mining &Quarrying	-2.69%	-3.59%	-3.88%	22.2%	-3.80%	-17.70%	-1.30%
Processed Food	-0.92%	9.63%	15.31%	25.6%	-1.60%	-9.71%	1.44%
Manufacturing	-3.62%	-3.58%	-3.36%	17.2%	-7.00%	-16.79%	4.41%
Miscellaneous	-1.78%	-3.13%	-3.44%	22.7%	-3.45%	-19.32%	6.66%
Household	Gross Income						
<$10,000	-0.18%						
$10,000–$15,000	-0.29%						
$15,000–$25,000	-0.56%						
$25,000–$35,000	-0.84%						
$35,000–$50,000	-1.20%						
$50,000–$75,000	-1.52%						
$75,000–$100,000	-1.64%						
$100,000–$150,000	-1.72%						
> $150,000	-1.66%						
Federal government revenue	-1.77%						
State government revenue	-0.21%						
GDP	-2.34%						

Conclusions

In this study, we applied a CGE model to examine the effect of shocks in tourism. Endogenous impacts on commodity price, output, employment, income distribution and government revenue are measured in the study area. Tourism related industries showed the most favorable impacts from an increase in tourist expenditures and lower fuel prices. The impacts associated with more visitor trips tended to be relatively large in percentage terms for tourism sectors compared with non-tourism related-industries. The overall changes in GDP from the shock are up to 1percent in this region and may be a result of the stagnation of other industries and their replacement by tourism, such as construction sectors. The impact on household income is parallel to the change in GDP. This implies tourism related industries are closely associated with high value-added activities.

Sustainable development is an important concern for most coastal areas. Several studies have focused on how to balance regional economic development and the ecosystem (Arrow et al. 1995; Tallis et al. 2008). In our study area, tourism appeared to generate significant employment and income impacts in related industries and to the whole economy, leading to further growth of Long Island's coastal industries. Our finding suggests policy makers should give due consideration to the overall

economic development when deciding on a tourism development strategy. Some fishery-dependent regions and communities should be given more attention to foster greater sustainable development.

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References

Alavalapati, J. R., Adamowicz, W. L., & White, W. A. (1998). A comparison of economic impact assessment methods: the case of forestry developments in Alberta. Canadian Journal of Forest Research, 28(5), 711-719.

Allen, David, Ghialy Yap, and Riaz Shareef. "Modelling interstate tourism demand in Australia: A cointegration approach." Mathematics and Computers in Simulation 79.9 (2009): 2733-2740.

Arrow, K., Bolin, B., Costanza, R., & Dasgupta, P. (1995). Economic growth, carrying capacity, and the environment. Science, 268(5210), 520.

Barbier, E. B., & Heal, G. M. (2006). Valuing ecosystem services. The Economists' Voice, 3(3).

Bilgic, A., King, S., Lusby, A., & Schreiner, D. F. (2002). Estimates of US regional commodity trade elasticities of substitution. Journal of Regional Analysis and Policy, 32(2), 31-50

Buckley, R. (2012). Sustainable tourism: Research and reality. Annals of Tourism Research, 39(2), 528-546.

Buckley, R. (2010). Conservation tourism. CABI.

Butler, R. W. (1999). Sustainable tourism: A state-of-the-art review. Tourism geographies, 1(1), 7-25.

Clancy, A. 2008. "Fishing Industry on Long Island is Thriving." Long Island Business News, May 2, 2008.

Coleman, F. C., & Williams, S. L. (2002). Overexploiting marine ecosystem engineers: potential consequences for biodiversity. Trends in Ecology & Evolution, 17(1), 40-44.

Cooke, S. J., & Cowx, I. G. (2006). Contrasting recreational and commercial fishing: searching for common issues to promote unified conservation of fisheries resources and aquatic environments. Biological conservation,128(1), 93-108.

Cowx, I. G. (2002). Analysis of threats to freshwater fish conservation: past and present challenges. Conservation of Freshwater Fishes: Options for the Future., 201-220.

Decaluwé, B., Lemelin, A., & Bahan, D. (2010). Endogenous labour supply with several occupational categories in a bi-regional computable general equilibrium (CGE) model. Regional Studies, 44(10), 1401-1414.

Fennell, D. A. (2014). Ecotourism. Routledge.

Gayle, D. J. (2002). Island tourism and sustainable development: Caribbean, Pacific, and Mediterranean experiences. Greenwood Publishing Group.

Hilborn, R., Quinn, T. P., Schindler, D. E., & Rogers, D. E. (2003). Biocomplexity and fisheries sustainability. Proceedings of the National Academy of Sciences, 100(11), 6564-6568.

Holland, D., Bhattacharjee, S., & Stodick, L. (2006). Assessing the Economic Impact of Minimum Wage Increases on the Washington Economy: A General Equilibrium Approach (No. 2006-12).

Jennings, S., & Kaiser, M. J. (1998). The effects of fishing on marine ecosystems. Advances in marine biology, 34, 201-352.

Jorgensen, C., Enberg, K., Dunlop, E. S., Arlinghaus, R., Boukal, D. S., Brander, K., ... & Pardoe, H. (2007). Ecology-Managing evolving fish stocks.Science, 318(5854), 1247-1248.

Julia-Wise, R., Cooke, S. C., & Holland, D. (2002). A computable general equilibrium analysis of a property tax limitation initiative in Idaho. Land Economics, 78(2), 207-227.

Kirkley, J. (2009). The NMFS Commercial Fishing & Seafood Industry Input/Output Model (CFSI I/O Model). Prepared for the National Marine Fisheries Service (NMFS). Virginia Institute of Marine Science.

Kronbak, L. G., & Vestergaard, N. (2011). Towards a green economy: Pathways to sustainable development and poverty eradication. Fisheries Investing in Natural Capital.

Kweka, J. (2004, March). Tourism and the economy of Tanzania: A CGE analysis. In CSAE conference (pp. 21-22).

Laugen, A. T., Engelhard, G. H., Whitlock, R., Arlinghaus, R., Dankel, D. J., Dunlop, E. S. and Nusslé, S. (2014). Evolutionary impact assessment: accounting for evolutionary consequences of fishing in an ecosystem approach to fisheries management. Fish and Fisheries, 15(1), 65-96.

Lee, T. H. (2013). Influence analysis of community resident support for sustainable tourism development. Tourism Management, 34, 37-46.

Liu, Z. H. (1994). Tourism development–a systems analysis. Tourism. The State of The Art, Chichester: John Willey & Son, 21-30.

Majetka, K. 2014. Personal communication with Kristen Matjeeka, Director of Marketing and Communications, Long Island Visitors and Convention Bureau and Sports Commission

Narayan, P. K. (2004). Economic impact of tourism on Fiji's economy: empirical evidence from the computable general equilibrium model. Tourism Economics, 10(4), 419-433.

Remoundou, K., Koundouri, P., Kontogianni, A., Nunes, P. A., & Skourtos, M. (2009). Valuation of natural marine ecosystems: an economic perspective. Environmental Science & Policy, 12(7), 1040-1051.

Page, S. J., & Dowling, R. K. (2002). Ecotourism. Harlow.

Pauly, D., Christensen, V., Guénette, S., Pitcher, T. J., Sumaila, U. R., Walters, C. J. and Zeller, D. (2002). Towards sustainability in world fisheries. Nature, 418(6898), 689-695.

Stone, R. (1954). Linear expenditure systems and demand analysis: an application to the pattern of British demand. The Economic Journal, 64(255), 511-527.

Sugiyarto, G., Blake, A., & Sinclair, M. T. (2003). Tourism and globalization: economic impact in Indonesia. Annals of Tourism Research, 30(3), 683-701.

Sumaila, Ussif Rashid, et al. "Fuel price increase, subsidies, overcapacity, and resource sustainability." ICES Journal of Marine Science: Journal du Conseil 65.6 (2008): 832-840.

Tallis, H., Kareiva, P., Marvier, M., & Chang, A. (2008). An ecosystem services framework to support both practical conservation and economic development. Proceedings of the National Academy of Sciences, 105(28), 9457-9464.

Thrush, S. F., Hewitt, J. E., Cummings, V. J., Dayton, P. K., Cryer, M., Turner, S. J., ... & Wilkinson, M. R. (1998). Disturbance of the marine benthic habitat by commercial fishing: impacts at the scale of the fishery. Ecological Applications, 8(3), 866-879.

Tourism Economics (2010). "The Economic Impact of Tourism in New York. 2010 Calendar Year, Long Island Focus." Found at http://www.iloveny.com/includes/content/docs/media/New-York-State-Tourism-Impact-Report-2010-long-island.pdf

UNCSD NGO, (1999). "Sustainable Tourism: A Non-Governmental Organization Perspective, Commission on Sustainable Development", Seventh Session, Paper # 4, New York

Waters, E. C., Holland, D. W., & Weber, B. A. (1997). Economic impacts of a property tax limitation: A computable general equilibrium analysis of Oregon's measure 5. Land Economics, 72-89.

Winchester, N. (2012). The impact of border carbon adjustments under alternative producer responses. American Journal of Agricultural Economics, 94(2), 354-359.

Zhang, J., Alavalapati, J. R., Shrestha, R. K., & Hodges, A. W. (2005). Economic impacts of closing national forests for commercial timber production in Florida and Liberty County. Journal of Forest Economics, 10(4), 207-223.

State-Level Pull Factors in Immigrant Location Choice

Richard D. McGrath and Justin Farquhar, Armstrong State University

Abstract

This research investigates the effect of state-level macroeconomics and occupational pull factors that influence the initial location decisions of newly documented permanent residents in the United States using a cross-section analysis of data from the contiguous 48 states for the year 2012. In addition to regional and occupational fixed effects, wages, the importance of the occupation in the state economy and the size of the immigrant population in the state are statistically and economically significant in the location decisions of immigrants. State-level macroeconomic characteristics may be statistically significant, but are much less economically important.

Introduction

In 2012, slightly more than one million immigrants obtained legal permanent resident status in the United States, adding to the foreign-born population which is estimated by the Congressional Budget Office in 2013 to be approximately 13% of the United States' population. Of these immigrants, approximately 80.6 percent achieved legal permanent resident status as immediate relatives of U.S. citizens or through family preference and refugee/asylum programs. The remaining 19.4 percent entered though employment-based preferences, the diversity program or other visa programs. (U.S DHS, 2015)

The purpose of this research is to examine the state-level economic pull factors that may affect the location choices of newly documented immigrants to the United States, primarily those who entered on employment or diversity visas. These location decisions can be very different from family-based immigration and refugee resettlement, which are socially driven or are not under the control of the immigrant. For those whose migration to the United States is mostly economic, the authors posit that location specific factors such as the strength of the state economy and the relative success of the immigrants chosen occupation in that state are driving factors of location choice.

Understanding how these pull-factors affect immigrant location choices may inform policy-makers decisions about how they might influence location decisions to benefit the local community. Research has shown that increases in working-age immigrants populations are correlated with increases in tax revenues per capita along with reductions in government debt and expenditures per capita (Storesletten 2000). Furthermore, a 2012 Fiscal Policy Center Report found that immigrants are 10% more likely to become small business owners than U.S. born workers. Indeed, an understanding of the factors that attract these high-skill immigrants could allow state and local governments to create incentives to bring these people to places that desire accelerated economic growth (Scott et. al. 2005).

A review of the relevant literature related to this research is followed by a discussion of the economic model and data, the empirical results, and the authors' statement on our conclusions, the limitations of this work, and possible extensions.

Review of Pertinent Literature

The main focus of this research is to determine the effects of several economic indicators on the location choices of recent immigrants to the U.S. Previous research has established a link between economic factors and the initial settlement patterns of immigrants, though the exact effect is often unclear. For instance, the average manufacturing wage and unemployment rate have been shown to play only a minor role in immigrants' decisions on where to live, with the exception of those immigrants who come to the U.S. on employment-based visas (Zavodney 1999). Further confirming this result, Jaeger (2000) found that, while all immigrants are responsive to changing labor market conditions, immigrants admitted on employment-based visas were more responsive than immigrants admitted on any other type of visa. The literature also shows that foreign-born men tend to live in areas where wages are higher than average (Bartel 1989). This responsiveness by immigrants to labor market conditions suggests that immigrants tend to concentrate in areas that are experiencing economic growth and can therefore better absorb new entrants to the labor market (Orrenius and Zavodney 2010).

Others argue that economic factors do not appear to play a significant role in the location choices of immigrants (Filer 1992). Some researchers have found wage differentials across geographic regions are a very weak influence on immigrants' migration decisions (Perloff et. al. 1998). These results suggest migration costs are likely to be high and serve as a deterrent unless significantly higher wages are available upon moving. Borjas (2001) observes that immigrants will seek out places where they have the greatest economic opportunities available to them, provided migration costs do not rise.

In addition to the economic factors mentioned above, other factors such as culture, availability of government assistance, and geographic location have also been considered in the literature. Some researchers have concluded that, rather than economic

indicators, a pre-existing population of immigrants is the main determinant of the initial location choice made by new arrivals to the U.S. (Bartel 1989, Zavodney 1999), implying that state and federal governments may not be able to effectively influence location choices of immigrants. Indeed, once immigrants have moved to a locale that already has a strong immigrant presence, they are less likely to move again (Kritz and Nogle 1994). This could be related to chain migration, where immigrants will sponsor their family members to come to the U.S., in which case the new arrivals would have no choice but to move to a location where immigrants are already present.

Geographical considerations appear frequently in the previous literature. Borjas (2006) hypothesized that there would be some degree of endogeneity between an area that was experiencing economic growth and an increase in the immigrant population simultaneously. He thought it would be difficult to determine whether the immigrants were following the growth, or causing it. In order to disentangle these effects, Borjas (2006) controlled for specific regions in his model. Other research has controlled for states that share a border with Mexico, and while this was geared more toward measuring illegal immigrants' movements, the idea of controlling for geography is still relevant here (Winegarden and Khor 1991). Similarly, Leerkes et. al. (2012) examined the effect of the relative restrictiveness of particular states to illegal immigration on their migration choices. Their results indicated that there is a strong negative relationship between the level of internal border control and the number of illegal residents within a state.

Some research has also focused on the availability of welfare and its effect on the location choices of immigrants and has found that it did not play a role in the location choices of immigrants (Zavodney 1997 and 1999). This result could be due to the lack of welfare programs available to immigrants; because they are excluded from so many programs, immigrants often would have no reason to put any stock into welfare availability. In contrast to these findings, Dodson (2001) found that the availability of welfare has a strong positive correlation with the number of immigrants that choose a particular state as their initial residence. These works are important to the context of the present research, but will be left for future research.

In addition to the literature on original immigrant location choice, the literature on the determinants of internal migration of U.S. citizens is also relevant. The factors that affect the migration decisions of U.S. citizens may also play a role in determining where a new legal immigrant would choose to locate. The research literature on internal migration decisions shares many explanatory variables with the immigration literature. Employment prospects and regional wage differentials have been considered by Treyz, et. al. (1993) and Greenwood (1985). The effect of local amenities is also considered in the internal migration literature. Graves (1983) suggests the number of amenities that could enter a preference function is virtually unbounded. Graves employed relative rent as an amenity proxy, and found it served fairly well as a proxy for amenities, in general. Graves also notes that using a single proxy reduces concerns about multicollinearity that may be associated with including various amenity variables.

Most research in this area uses state-level or regional data, although some, such as Scott et. al. (2010), use data on metropolitan statistical areas. The research conducted herein will analyze immigration in specific occupational sectors of the 48 contiguous United States in order to use occupation-specific employment data to evaluate whether decisions are related to variations in employment prospects by occupation.

Model and Data

The model assumes that immigrants in a particular occupational sector will make initial location choices upon obtaining legal permanent residency in a manner that maximizes the value of the location decision with respect to their standard of living. The variables we consider to be of interest are pull-factors that attract an individual to a particular location, including state-level macroeconomic variables and occupation-specific variables that signal greater opportunity. The influence of push-factors, which characterize the reasons individuals emigrated from their points of origin, are not evaluated in this model. This excludes from our consideration such issues as refugee status, asylum seeking, or economic conditions in the country of origin. The social factors that drive family-based immigration are also indirectly excluded from this analysis by the structure of the dependent variable.

The dependent variable is the share of total employment in particular occupational sector in a state that is comprised of newly documented permanent residents. This immigrant share is explained as a function of five categories of variables: fixed effects for each occupational category that account for missing variables specific to the occupation, regional dummy variables to control for differences in geographic preferences across all occupations, categorical variables for the proportion of immigrants in a state control for general network effects of immigrants using the prior presence of other immigrants as a signal for location choice, state-level macroeconomic variables that represent the economic conditions of the state, and occupation-specific variables that represent the relative strength of that occupation within the state.

$$\text{Occupational Immigrants} = f(\text{Occupational sector fixed effect, Region, Immigrant population, State macro-economy, Occupational prospects}) \quad (1)$$

The unit of measurement for an individual observation in the data set is a single occupational sector in each of the contiguous 48 states in the United States for the year 2012. The descriptions of the specific variables used in the estimation of the model can be found in Table 1. The dependent variable, Occupational Immigrants, is the proportion of employees in a particular employment sector per 100,000 employees in that sector. For example, in the state of Georgia, there were 1,141 newly documented legal permanent residents who were reported to enter the Service Occupations in 2012 out of 720,470 total employees in that sector. The value of the dependent variable for that observation is 0.158.

Table 1: Definition of Variables

Occupational Immigrants	New immigrants in occupational sector per 100,000 employees in sector.
Service Occupations	Occupational sector fixed effect, 1=True, 0-False
Sales and Office Occ.	Occupational sector fixed effect, 1=True, 0-False
Farming, Fishing, Forestry	Occupational sector fixed effect, 1=True, 0-False
Construction, extraction, maint., repair	Occupational sector fixed effect, 1=True, 0-False
Prod., transport, and material moving	Occupational sector fixed effect, 1=True, 0-False
Management, Prof, Related Occ.	Occupational sector fixed effect, (default sector)
Midwest	Regional designation for the state, 1=True, 0-False
Northeast	Regional designation for the state, 1=True, 0-False
South	Regional designation for the state, 1=True, 0-False
West	Regional designation for the state, (default region)
State Pop >20% Immigrant	Control for social pull factors, 1=True, 0-False
State Pop 14-20% Immigrant	Control for social pull factors, 1=True, 0-False
State Pop 9-14% Immigrant	Control for social pull factors, 1=True, 0-False
State Pop <9% Immigrant	Control for social pull factors, (default percent immigrant)
State Unemployment Rate	Macroeconomic pull factor, expressed as a decimal.
GSP Per Capita	Gross State Product per capita, macroeconomic pull factor
Rent/Wage Ratio	Average two-bedroom rent / average occupational wage, instrument for cost of living, expressed as a decimal.
Average Wage	Average annual earnings per worker in the occupation sector
Occupation Jobs Per Thousand	Occupation share of jobs in the state economy, as jobs per 1,000 workers.
Three-Year Employment Growth	Three-year growth rate of employment in occupation, as a decimal.

There are six occupational sectors reported by DHS in the annual immigration data. Management, professional and related occupations is the default occupation that is excluded from the model, hence the interpretation of each of the remaining five occupation sectors listed in Table 1 is interpreted relative to the managerial, professional and related occupations category. Three regional variables in Table 1 are Midwest, Northeast, and South, with West excluded as the default region in the analysis. States are placed in one of four categories with respect to the proportion of state population that is foreign-born. These variables are used as proxies for network effects and unmeasured concepts of social acceptance of immigrants. The percentage of a state's population that is foreign born is expected to be correlated with increased current immigration, as suggested by Bartel (1989). A population less than 9 percent immigrant is the default, with three categorical variables for immigrant percentages of 9-14%, 14-20% and greater than 20%.

The variables of particular interest in this analysis fall into two categories, state macroeconomic characteristics and occupational variables with each state. The state macroeconomics characteristics include the state unemployment rate, with an expected negative coefficient; gross state product per capita with an expected positive coefficient; and the ratio of the average two-bedroom rental rate to the annual wage rate in the occupation sector, with a coefficient that is theoretically indeterminate in sign. The rental/wage ratio may be interpreted as a cost of living measure, but may also, as suggested by Graves (1983), be a proxy for the value of local amenities. The occupational variables include the average wage in the occupation sector, the share of jobs in the state that are categorized in that occupation, and the three-year growth rate of employment in that sector, which are all expected to have positive coefficients. A positive coefficient on Employment Growth would confirm the hypothesis that immigrants follow job growth, (Borjas, 2001).

Table 2: Descriptive Statistics

	Mean	*Minimum*	*Maximum*	*Std.Dev.*
Occupational Immigrants	0.196	0.006	1.402	0.230
Service Occupations	0.181	0	1	0.386
Sales Occupations	0.177	0	1	0.383
Farm, Fish, Forestry Occupations	0.162	0	1	0.369
Construction Occupations	0.117	0	1	0.322
Production and Transportation Occupations	0.181	0	1	0.386
Midwest	0.253	0	1	0.435
Northeast	0.177	0	1	0.383
South	0.343	0	1	0.476
State Pop >20% Immigrant	0.064	0	1	0.245
State Pop 14-20% Immigrant	0.102	0	1	0.303
State Pop 9-14% Immigrant	0.215	0	1	0.412
State Unemployment Rate	0.073	0.031	0.111	0.017
GSP Per Capita	41641	28944	61183	7481
State Rent/Wage Ratio	0.282	0.119	0.788	0.104
Average Occupation Wage	38834	20610	84600	15379
Occupation Jobs Per Thousand	174.6	0.454	390.9	105.9
Three-Year Occupation Employment Growth	-0.054	-0.475	0.876	0.118

Descriptive statistics for the variables used are provided in Table 2. Data for the variables in this analysis were extracted and calculated from the documents listed in the data sources section of the references. The range and coefficient of variation of the dependent variable suggests that there is significant variability across states within each occupation sector to be explained. The means of the regional variables indicate there is sufficient variability in employment-based immigration among regions to warrant the inclusion of region dummy variables. Perloff, et. al. (1998) found that earnings differentials are not a strong incentive for internal migration, but substantial differences in wages may affect decisions of new arrivals. The state unemployment rate variable is likely to be economically important at the extremes with a range from the lowest state unemployment rate at 3.1 percent to the highest at 11.1 percent. The standard deviation of the unemployment rate is larger than one might expect for a normal distribution. GSP per capita is likely to have a distribution that is not very different from normal given the range and the standard deviation. Variability in the rent to wage ration is likely to be wider across occupations than it is across states, and requires some caution in its interpretation. A similar concern may also be expressed for the occupational jobs per thousand. The three year growth rate of employment varies by both occupation and state.

Empirical Estimation and Results

Cross sectional data for 2012 was used to characterize six employment groups for the 48 contiguous states, which yielded 288 total observations. Of these 288 observations, 21 observations were not used due to disclosure restrictions on key variables. The use of the employment groups allows for a broader sample with more variability to improve the robustness of the model while also accounting for the effects of differing levels of education among workers, as in Borjas (2006). The model was estimated using White corrected standard errors to correct for heteroskedasticity.

The model provides some insight into factors that explain location choices of new immigrants. Results are presented in Table 3. The R-squared and adjusted R-squared are 0.830 and 0.0.819, respectively. Due to the number of fixed effects in the model for both occupations and geography, it is instructive to consider how the fixed effects alone predict the dependent variable. An estimation using only the fixed effects to estimate the dependent variable results in an R-squared of 0.484 and an adjusted R-squared of 0.442. The variables of interest in this model increases the explanatory power by approximately 35 percent relative to the fixed effects.

The fixed effects for the five occupations shown suggest that these occupations generate proportionally higher immigration rates than managerial, professional, and related occupations. Service, agricultural, and production/transportation occupations draw relatively higher proportions of new immigrants compared to sales and construction. The fixed effects for the regions suggest that the South and Midwest are similar to one another and, other things equal, higher in immigration than the Northeast and the West. As expected, based on the previous literature, higher current proportions of immigrants in a state tend to be correlated with higher levels of new immigrants, as shown by the magnitudes of the three population coefficients. The standard errors of these coefficients are such that they are significantly different from one another.

Table 3: Estimation of Regression, Occupational Immigrants as a Function of Sector Fixed Effects, Region and Social Control Variables, State-Level Macroeconomic Variables, and Occupational Variables.

	Coefficient	*Std.Error*	*t-Stat*	*Prob.*	
Constant	-1.063	0.160	-6.629	0.000	***
Service Occupations	0.628	0.101	6.199	0.000	***
Sales Occupations	0.317	0.080	3.971	0.000	***
Farm, Fish, Forestry Occupations	0.684	0.111	6.174	0.000	***
Construction Occupations	0.292	0.075	3.869	0.000	***
Production and Transportation Occupations	0.553	0.083	6.641	0.000	***
Midwest	0.029	0.017	1.730	0.085	*
Northeast	-0.001	0.029	-0.028	0.977	
South	0.028	0.016	1.705	0.090	*
State Pop >20% Immigrant	0.385	0.078	4.943	0.000	***
State Pop 14-20% Immigrant	0.209	0.030	7.000	0.000	***
State Pop 9-14% Immigrant	0.107	0.020	5.443	0.000	***
State Unemployment Rate	-0.918	0.415	-2.211	0.028	**
GSP Per Capita	-3.07E-06	1.13E-06	-2.715	0.007	***
State Rent/Wage Ratio	0.097	0.185	0.526	0.599	
Average Occupation Wage	1.84E-05	2.79E-06	6.598	0.000	***
State Occupation Jobs Per Thousand	0.001	0.000	4.073	0.000	***
Three-Year Occupation Employ Growth	0.157	0.050	3.115	0.002	***

Note: Statistically significant at the 1 percent (***), 5 percent (**) and 10 percent (*) level.

The fixed effects should be interpreted in relation to the mean, minimum and maximum values of the dependent variable, as well as the standard deviation of the dependent variable. The region fixed effects for the South and Midwest are statistically significant, but are only one-eighth the magnitude of the standard deviation of the dependent variable. This suggests that they are statistically significant but not economically meaningful.

The effect of having a large immigrant population in a state is statistically significant and economically important. Having a state population that is between 14 and 20 percent foreign born indicated a nearly full standard-deviation increase in the percentage of immigrants who choose a particular state. Having a state population that is more than 20 percent foreign born indicates an increase in immigration of more than 1.5 standard deviations.

As expected, a higher unemployment rate seems to deter immigration, other things equal, but the effect is small relative to the variation in immigration across states and occupations. A one standard deviation increase in unemployment (1.7 percent) results in a decrease in the dependent variable of less than 1/14 of a standard deviation. This may suggest that occupational considerations are more important than the general unemployment rate in the state. The wage to rent ratio is statistically insignificant and economically unimportant. This is likely a result of the wage to rent ratio being somewhat occupation-specific and possibly a non-linear relationship. Rent to wage ratios that are substantially above 30 percent may be somewhat of a deterrent, but those below 30 percent may not factor in household decisions. The interaction of this variable with occupation may be of interest in the future.

The coefficient on per capita GSP is significant, but with a surprising direction. A per capita GSP that is one standard deviation above the mean suggests a decrease in immigration of less than 1/10 of one standard deviation. Although this is a statistically significant effect, it is not economically meaningful. The sign may, however, suggest some relationship between the strength of state economies and the extent to which opportunities are available to immigrants, that is, a demand issue rather than a supply issue.

The occupation-specific variables provide more predictable results than the macroeconomic variables. Average wages that are above average by one standard deviation are correlated with an increase in immigration of more than one standard deviation. The effect of occupational density (State Occupation Jobs per Thousand) is also economically important, but not as large as the wage effect. In states where a particular occupation sector is a large part of the economy, immigrants are substantially more likely to choose that state when moving to the US. A one standard deviation increase in this variable causes an increase in immigration of more than one-half of one standard deviation. The employment growth variable is statistically significant, but has a small economic importance. This effect is similar in magnitude to the effect of changes in the unemployment rate. The importance of the occupation in the local economy seems to be more economically significant than the recent growth of the occupation.

Conclusion

Immigrants are a substantial portion of the U.S. population, and are an important driver of growth in the economy. For those immigrants who gain permanent legal residency based on employment considerations rather than by family prioritization, occupational issues have effects of varying economic importance. Wages, the importance of the immigrant's occupation in the state's economy, and the network effects of a large immigrant population seem to draw a higher proportion of immigrants. State-level macroeconomic characteristics and employment growth are statistically significant but less important for initial location decisions.

There are limitations to this research. The effects of occupation may be confounded with some of the economic variables. Other variables may have non-linear or non-monotonic relationships to the dependent variable that require more complex specifications. Finally, the point in time chosen for this analysis will affect the interpretation of results. Immigration occurs within a national and global economic and political climate that makes a cross-section analysis instructive, but limited.

These limitations suggest avenues for additional research. Panel analysis or a repetition of the analysis for other years may give us a better perspective on the stability of these results. Policy variables under the control of state governments to either encourage or discourage immigration might allow a more direct discussion of the policy-relevance of these results, or even the ability of government to affect location choices of immigrants to new areas or in less popular occupations.

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References

Bartel, Ann P. 1989. Where Do New U.S. Immigrants Live? *Journal of Labor Economics* 7(4): 371-391.

Borjas, George J. 2001. Does Immigration Grease the Wheels of the Labor Market? *Brookings Papers on Economic Activity* 2001(1): 69-119.

Borjas, George J. 2006. Native Internal Migration and the Labor Market Impact of Immigration. *Journal of Human Resources* 41(2): 221-258.

Dodson III, Marvin E. 2001. Welfare Generosity and Location Choices among New United States Immigrants. *International Review of Law and Economics* 21(1): 47-67.

Filer, Randall. 1992. The Effect of Immigrant Arrivals on Migratory Patterns of Native Workers. *Immigration and the Workforce: Economic Consequences for the United States and Source Areas,* University of Chicago Press: 245-270.

Fiscal Policy Institute. 2012. Immigrant Small Business Owners: A Significant and Growing part of the Economy. Available at http://www.fiscalpolicy.org/immigrant-small-business-owners-FPI-20120614.pdf.

Graves, Phillip E. 1983. Migration with a Composite Amenity: The Role of Rents. *Journal of Regional Science,* 23(4): 541-546.

Greenwood, Michael J. 1985. Human Migration: Theory, Models, and Empirical Studies. *Journal of Regional Science,* 25(4): 521-543.

Jaeger, David A. 2000. Local Labor Markets, Admission Categories, and Immigrant Location Choice. *Manuscript,* College of William and Mary.

Kritz, Mary M. and Nogle, June Marie. 1994. Nativity Concentration and Internal Migration among the Foreign-Born. *Demography* 31(3): 509-524.

Orrenius, Pia M. and Zavodney, Madeline. *Beside the Golden Door: U.S. Immigration Reform in a New Era of Globalization.* Washington, D.C.: Ther American Enterprise Institute Press.

Perloff, Jeffrey M.; Lynch, Lori; and Gabbard, Susan M. 1998. Migration of Seasonal Agricultural Workers. *American Journal of Agricultural Economics* 80(1): 154-164.

Scott, Darren M.; Coomes, Paul A.; and Izyumov, Alexei I. 2005. The Location Choice of Employment-Based Immigrants among U.S. Metro Areas. *Journal of Regional Science* 45(1): 113-145.

Storesletten, Kjetil. 2000. Sustaining Fiscal Policy through Immigration. *Journal of Political Economy,* 108(2): 300-323.

Treyz, George I; Rickman, Dan S.; Hunt, Gary L.; and Greenwood, Michael J. 1993. The Dynamics of U.S. Internal Migration. *The Review of Economics and Statistics,* 75(2): 209-214.

Winegarden, C.R. and Khor, Lay Boon. 1991. Undocumented Immigration and Unemployment of U.S. Youth and Minority Workers: Econometric Evidence. *The Review of Economics and Statistics* 73(1): 105-112.
Zavodney, Madeline. 1997. Welfare and the Locational Choices of New Immigrants. *Economic Review: Federal Reserve Bank of Dallas:* 2-10.
Zavodney, Madeline. 1999. Determinants of Recent Immigrants' Locational Choices. *International Migration Review* 33(4): 1014-1030.

Data Sources

Bravve, Elina, Megan Bolton, Linda Couch, and Sheila Crowley. 2012. *Out of Reach 2012*, National Low Income Housing Coalition.
Congressional Budget Office. 2012. *A Description of the Immigrant Population-2013 Update,* available at http://www.cbo.gov/publication/44134.
University of New Mexico Bureau of Business and Economic Research. 2012. *Real Per Capita Gross Domestic Product by State,* available at http://bber.unm.edu/econ/st-gdp5.htm.
U.S. Bureau of Labor Statistics. 2012a. *Civilian Labor Force and Unemployment by State and Selected Area, Seasonally Adjusted,* available at http://www.bls.gov/news.release/laus.t03.htm.
U.S. Bureau of Labor Statistics. 2012b. *Local Area Unemployment Statistics: Census Regions and Divisions,* available at http://www.bls.gov/lau/laurd.htm.
U.S. Bureau of Labor Statistics. 2012c. *Local Area Unemployment Statistics: Unemployment Rates for States,* available at http://www.bls.gov/lau/lastrk12.htm.
U.S. Bureau of Labor Statistics. 2012d. *Occupational Employment and Wage Estimates,* available at http://www.bls.gov/oes/oes_dl.htm.
U.S. Department of Homeland Security (2015) *Profiles on Legal Permanent Residents; 2012,* available at http://www.dhs.gov/profiles-legal-permanent-residents-2012-state.

Is There A Behavioral Zoo?

Glenn Pettengill and George Chang, Grand Valley State University

Abstract

Fama and French (1992 and 1993) begin a revolution in the finance discipline by identifying through empirical analysis two additional common risk factors. Ever since this time, researchers have sought to identify additional common risk factors using the same empirical analysis employed by Fama and French. They have been quite successful! Indeed, Cochrane (2011) in his presidential address to the American Finance Association refers to a "zoo" of new factors. Supporting this view, Harvey, Liu and Zhu (2015) note that researchers have empirically identified 316 factors tested as common risk factors. In this paper we argue that extant behavioral explanations provide explanations for of these empirically identified factors. Prompting the question: "Is There a Behavioral Zoo?" Such a zoo would not necessarily need thinning. If one were to answer in the affirmative to this question, one must address the empirical evidence used to support the existence of common risk factors.

Introduction

Numerous researchers have identified common risk factors based on empirical time-series relationship between factors and portfolio returns. Indeed, Cochrane (2011) in his presidential address to the American Finance Association refers to a "zoo" of new factors. Harvey, Liu and Zhu (2015) identify 316 factors that have been tested as possible common risk factors and argue that the discipline needs to identify the few relevant factors. As Harvey, et. al. suggest, the current uncertainty as to appropriate risk factors is untenable, but how should the discipline select appropriate factors from the zoo? Surely there are not hundreds of common risk factors. There must be a flaw in the way in which common risk factors are identified. To examine this issue, it may be well to ask: how did the discipline arrive at this point?

For decades the discipline accepted the premise of the Capital Asset Pricing Model that the market was efficient and paid only for a single systematic risk: exposure to excess market return. Further, it was universally held that the level of exposure to this systematic risk factor was measured by market beta. Thus, market beta alone should differentiate returns between assets. Empirical studies, however, clearly showed that a host of firm-specific characteristics affected security returns. Chief among these factors were size (small-firm securities have higher return than justified by market beta risk) and book-to-market ratios (value securities have higher returns than justified by market beta risk). Market beta, it became clear, provides an incomplete explanation of return behavior for equity securities.

Thus, the discipline faced a dilemma. Either the discipline could jettison the belief in a single common risk factor, requiring a search for additional risk factors. Or, the discipline could jettison the belief in market efficiency, requiring the development of behavioral explanations for return patterns unexplained by market beta. In general, the discipline elected to pursue the former solution and sought to identify additional common risk factors. It is this search that has produced a "zoo" of factors.

The direction which the discipline pursued was directed in part by Fama and French (1992) where they argue that market beta has no effect on returns but that both size and the Book-to-Market ratio affect returns. Based on the presumption of market efficiency they conclude that both size and the book-to-market ratio proxy for a common risk factor. Fama and French (1993) introduce their famous three factor model which includes the market factor and two additional factors to measure the influence of size and value. For reference, we show the model in Equation (1):

$$R_i = RF + \beta_1 (R_m - RF) + \beta_2 SMB + \beta_3 HML \quad (1)$$

Recently, this process of model extension was supplemented by the presentation of two empirically tested models with theoretical support, albeit limited. Hou, Xue and Zhang (2015) propose a new multifactor model influenced by the q-theory of investment. Their four factor model includes two factors, the market factor and the size proxy factor, from the Fama-French three factor model and two new factors. Both of the additional factors take the form used in the Fama-French three-factor model. One of the new factors is the return of a portfolio long in a portfolio of high ROE securities and short in a portfolio of low ROE securities. The second additional factor is the return on a portfolio long in securities of firms making low levels of investments minus the return on a portfolio of securities of companies making high levels of investments. Independently, Fama and French (2015a), motivated in part by intuition from the dividend discount model propose a new five-factor model. This model includes all three factors from the original three-factor model and adds two factors which are associated with levels of profitability and investment activity, similar to those in the Hou, Xue and Zhang model. Both models are supported by extensive

empirical testing. But one must ask the question how is one to choose between these two models and any model containing additional factors such as the momentum or liquidity factor. Adding to the uncertainty, Fama and French (2015b) explore the correct measures to explore the profitability factor. The search for the "correct" set of common risk factors appears quixotic.

In this paper we argue that there are two primary explanations for the creation of the zoo of factors: 1) Because of the firm belief in market efficiency, behavioral explanations of the relationship between factors and returns have been dismissed and theoretical vetting of factors has been limited or non-existence; and 2) As a consequence, the main criteria to award the common risk factor designation has been a time series relationship with portfolio returns. We argue that these studies have been conducted with inadequate inspection of the strength of the relationship between the factor and portfolio returns.

Validation of Common Risk Factors

Validating Risk Factors: Necessary and Sufficient Conditions

The tenant that an empirical time-series association between portfolio returns and a factor identifies a common risk factor rests on twin premises: First, investors are only paid a premium over the risk-free rate for holding risk. Second, the market is efficient. If both of these hold then an empirically identified relationship between a factor and returns must indicate the discovery of a risk factor. But surely there are not hundreds of common risk factors. Clearly the empirical time-series relationship is only a necessary but not a sufficient condition for identifying a common risk factor.

Surely some stronger rationale should exist before a factor is designated a common risk factor. There should be a theoretical rationale explaining how a particular factor measures risk. What would explain the finding of some many risk factors? Clearly not all of these factors have a claim to being designated common risk factors based on theoretical considerations. Clearly there must be behavioral explanations for the association of many of these factors with returns.

Although an empirical time-series association between a common risk factor and portfolio returns should be found, additional empirical evidence should link portfolio returns and attributes of the common risk factor. If the measurement of exposure to a common risk factor across portfolios is adequate two results should occur: There should be a positive *ex-post* association between the level of exposure to the risk factor and portfolio returns. Further, there should a positive *ex-post* association between the level of exposure to the risk factor and portfolio variation. The supposed higher level of risk should result in both higher returns and higher risk on an *ex post* basis.[1]

In the remaining portion of this section we examine the extant literature for discussion of theoretical considerations and *ex-post* empirical analysis of the four factors in the Carhart four-factor model. We compare risk-based and behavioral explanations of the association between these four factors and returns. We also review analysis of the relationship between the factors and *ex-post* measures of risk and return.

The Market Factor

There is clear theoretical support for the identification of the market factor as a common risk factor. The remaining risk of the security is systematic, part of the investing system and cannot be eliminated. The theoretical construct of the CAPM holds that there is only one systematic risk, market risk, the risk that a security's return will be affected by general market movements. Although one may argue that the CAPM does not hold, we know of no credible argument that variation in market returns is not an important source of systematic risk for securities.[2] Thus, if there is empirical evidence of an *ex-post* relationship between market beta and return and empirical evidence of a time-series relationship between portfolio returns and the market factor, the market factor would seem to meet the qualifications of a risk factor.

Chan and Lakonishok (1993) show that portfolio betas accurately predict a portfolio's response to extreme up and down market movements. And, Fama and French's (1993) report that the market factor is essential to explaining time-series variation in portfolio returns certainly strongly suggests a link between market betas and returns.[3] Pettengill, Sundaram and Mathur (1995) find a significantly positive relationship between beta and returns in up markets and a significantly negative relationship between beta and portfolio returns in down markets in the U.S. market.[4] Recently, Bollen (2010) shows a strong relationship between beta and returns relying on a technique that does not require separating returns into up and down markets. Thus, although one may doubt the validity of the CAPM, it seems clear that the market factor is a common risk factor.

Finally, it is clear that the market factor shows a significant time-series relationship with portfolio returns. Fama and French (1993, page 5) indicate that the size and book-to-market factors "alone cannot explain the large difference between average returns on stocks and one-month bills." Thus they indicate that, despite their continued assertion that no cross-sectional relationship exists between market beta and returns, the market factor is required to adequately explain time-series variation in portfolio returns.

The Momentum Factor

As with the size and the value effects, the momentum effect was identified before any suggestion that there is systematic risk factor based on momentum. Carhart (1997) studying the return pattern of mutual funds found that momentum persisted after adjusting returns for the factors in the three factor model. Following, Fama and French's (2004) indication that they found that they also found that momentum persisted in returns following adjustment for these factors, it became common to risk-adjust returns using a four factor model as shown in equation (2), where UMD is a factor measuring the return to a portfolio long in securities with positive momentum (Up securities) and short in securities with negative momentum (Down securities)

$$R_i = RF + \beta_1 (R_m - RF) + \beta_2 SMB + \beta_3 HML + \beta_4 UMD \quad (2)$$

This factor seems uniquely identified empirically. We know, however, of no attempt extant in the literature which provides a theoretical validation of this factor as a risk factor. On the other hand, there are a number of behavioral explanations for the momentum phenomenon.

Two studies, Chan, Jegadeesh and Lakonishok (1996) and Hong, Lim and Stein (2000), find a tendency for momentum in securities to result from the market's underreaction to positive earnings announcements. Further, Hong and Stein (1999) provide a rationale for a momentum pattern in stock returns following positive earnings announcements by postulating two sets of investors: "newswatchers" and "momentum traders." The practitioner literature argues that momentum results from herding behavior (see for example Jacobs (2000)) Daniel, Hirshleifer and Subrahmanyam (1998) provide a behavioral explanation that is more consistent with this finding and with the discussions in the practitioner literature. They argue that investor overconfidence when confirmed by market events leads to medium-term return momentum but longer-term reversal consistent with the overreaction effect of De Bondt and Thaler (1983, 1985).

The behavioral finance literature cites evidence of herding behavior consistent with stock momentum. In a study of return dispersion for U.S. equity securities Christie and Huang (1995) conclude that herding is present in extreme market conditions where stock momentum exists. More recently, Caparrelli, D'Arcangelis, and Cassuto (2004) study the herding effect using data from the Italian Stock Exchange, and find evidence consistent with Christie and Huang's conclusion. Evidence of herding behavior is not limited to extreme market conditions.

There is strong evidence that a time series relationship based on momentum results from behavioral forces. It seems to us that casual analysis would dismiss the notion that the momentum factor represents a systematic risk factor. High momentum securities show a temporary relationship to past returns rather than a long-term relationship to a systematic risk factor. In intermediate periods winners repeat but in longer time periods winners turn to losers. Momentum securities may have higher risk, but the risk comes from the probability that at some point the herding behavior that is causing the momentum will exhaust moving the security price with negative returns to a more sustainable level. Likewise, it seems strange to consider securities with negative momentum to have low risk based on low exposure to the momentum factor. These securities for whatever reason, (e.g. loss of market share) are experiencing negative returns which continue over intermediate time periods. These securities are experiencing some form of financial difficulty, how can they possibly be considered low-risk securities?

The Value Mimicking Factor

The attribution to risk of any correlation between the HML factor and portfolio returns is less certain than for the market factor as no theoretical construct exists to suggest a linkage. If one may accurately identify HML as a risk factor, the underlying association between high BtM ratios and returns, the value premium, must clearly be due to risk. There is ample reason to argue that the empirically observed tendency for stocks with high BtM ratios to have relatively high returns is due to behavioral factors rather than risk. Stocks with high BtM ratios are commonly referred to as value stocks and stocks with low BtM ratios are commonly referred to as growth stocks. Consider the following: a new startup company with very little book value wealth would certainly be deemed a growth company based both on a low BtM ratio and the nature of its growth prospects. Is such a company less risky than a typical Fortune 500 company with book value representing past profitability but with seemingly lower growth potential, which would tend to have much higher BtM ratios and thus be deemed value companies? Of course, such examples are suggestive rather than hard empirical evidence. But empirical evidence is available suggesting that the link between returns and high BtM ratios results from behavioral factors rather than payment for high risk.

If the value premium exists because value securities are riskier than growth securities realized return variation ought to be greater for value securities than for growth securities. Chan and Lakonishok (2004) compare the annual return variation of value stocks versus growth stocks in the Russell 1000 and 2000 index respectively over the period 1979 thorough 2002. They show that growth stocks exhibit substantially higher realized return volatility than value stocks. Moreover, they report that

realized downside risk is also stronger for growth stocks than value stocks. Woodley, Jones and Reburn (2011) also find that growth portfolios (portfolios with low BtM ratios) have higher annual return variation than value portfolios (portfolios with high BtM ratios). In addition, Pettengill, Chang and Hueng (2015) find that a portfolio of growth mutual funds has significantly higher return variation than a portfolio of value mutual funds. Collectively, these studies provide conclusive evidence that growth securities have higher realized risk than value securities providing an indication that the value premium is not due to risk payments.

The case against a risk-based explanation for premium is strengthened by a behavioral explanation for this premium provided by Lakonishok, Shleifer and Vishny (1994) (LSV). They criticize Fama and French's (1992) risked-based explanation for the value premium as resulting from a "metaphysical" version of the risk story that higher returns to an investment strategy must necessarily reflect risk payments. LSV argue that the value premium results from investor behavior.

The historic behavior of returns to high BtM securities should be consistent with payment for risk. If returns to a class of securities result from a payment to risk, the payment should be general to that class of securities. If high BtM securities as a class are risky securities and these securities receive payment for this risk, then high returns should be the norm for high BtM securities. Such is not the case. Piotroski (2000) finds that average returns are higher for high BtM securities but that median returns are not higher for high BtM securities. High returns for high BtM securities are made to selected high BtM securities. Piotroski reports that over the period 1976 through 1996 the use of nine accounting variables identifies which high BtM securities will have high returns. Because the three of the nine accounting variables are designed to identify less risky value firms, Piotroski states that his findings argues against the payment for risk explanation of the value premium. Likewise, payment ought to be consistent across times of the year. Loughran (1997) argues against a risk-based explanation of the value premium on the basis that high BtM securities outperform primarily in January.

In opposition to the arguments of LSV and others cited above, arguments have been made describing a risk-based story for the value premium. Fama and French (1995) did provide a connection between risk and a high BtM ratio arguing that corporations close to bankruptcy would have high BtM ratios. Certainly this subset of high BtM ratio securities would be high risk securities. Empirical studies by Dichev (1998) and Campbell, Hilscher and Szilagyi (2008), however, find that the value premium is not explained by payment for financial distress. In conclusion, a large body of empirical evidence is inconsistent with the assumption that high BtM securities have higher returns because of payment for risk. Further, LSV provide strong empirical evidence in support of a behavioral explanation of the value effect.

Because the weight of empirical evidence appears to argue against a risk-based explanation for the positive relationship between BtM ratios and returns, strong empirical evidence between the HML factor and portfolio returns is required to validate the HML factor as a risk factor. To our knowledge there is no cross-sectional study indicating a link between the HML beta and returns. And we note a confounding issue which should impact any such investigation. As portfolio beta loadings on the market factor increase one would expect greater fluctuation in the returns to that portfolio. The returns for that portfolio would tend to go down more in down markets and up more in up markets relative to portfolios with lower loadings. This assertion may be made because almost universally portfolios will load positively on the market factor. The same relationship is not expected with portfolio loadings on the HML factor. In general, one would expect value portfolio to load positively on the HML factor and growth portfolios to load negatively on the HML factor. It is the absolute value of the loading which will determine the amount of return variation added to the portfolio. Thus, both low and high BtM portfolios should have return variation increased due to sensitivity to this factor. So, not only is the requirement of a direct positive relationship between sensitivity to the factor and returns unproven, there is a presumption against this relationship.

The Size Mimicking Factor

On its face, the argument that value firms are riskier than growth firms seems implausible. Such is not the case with the comparison between large and small firms. Unlike comparisons between value and growth firms, historic return variation for small firm securities is certainly greater than the historic return variation for large firm securities. For example, Ibbotson reports that from 1926 to 2012, the standard deviation in annual returns for small-firm securities is 32.3% as compared to 20.2% for large-firm securities with commensurate differences in mean annual returns. Furthermore, unlike comparisons between value and growth firms, the presumption that small-firm securities have higher risk than large-firm securities seems quite plausible. Still, the risk-based explanation of the size effect is, at best, incomplete.

In his recent survey article on the size effect, van Dijk (2011) identifies the lack of a theoretical based explanation as one of two critical issues that argue against the acceptance of the risk-based explanation of the size premium. Van Dijk notes that a number of authors have suggested that small-firm securities experience higher distress risk (see for example, Vassalou and Xing (2004)), but empirical tests of this and similar hypotheses have been met with mixed results. The second critical issue challenging the risk-based explanation of the size effect, according to van Dijk, is the extremely strong seasonal bias in the payment to size. Virtually all the premium paid to size is paid in the month of January. It seems contrary to reason that the

premium paid to size represents a payment for risk on the basis of a presumption of market efficiency if this payment is inefficiently paid primarily in one month of the year.

Recently, Hur, Pettengill and Singh (2014) have argued that the size premium is not a payment for risk. They note that the distress risk explanation of the size effect implies that payment for distress risk ought to occur in up market periods, not in down market periods where distress risk ought to depress the price of securities with such risk. They find that, given the influence of the market beta, the relationship between size and returns is significant only in down markets. In addition, echoing van Dijk's concern over the seasonal nature of the size effect, they find a size effect in January regardless of the market state. In months other than January, a small-firm effect exists in down markets, but a large-firm effect exists in up markets. Further, they suggest that if payment to size is based on systematic risk some other explanation should be developed such as payment for idiosyncratic risk. Thus, the argument that the size premium represents a payment for systematic risk is weakly supported at best.

Knez and Ready (1997) present additional empirical findings casting doubt on a risk-based explanation of the size effect. They show that the size effect depends on the return patterns of outliers. Rather than an effect emanating from a consistent exposure to a risk factor that is generally higher with small firms, the small-firm effect arises from unusual returns for a minority of small firms. Consistent with this finding, De Bondt et. al. (2016) show that a large-firm effect exists for most of the year. In the month of January small-firm securities have significantly higher mean and median return than do large firms. But in the other eleven months of the year large-firm securities have significantly higher median returns, while small-firm securities continue to have higher mean returns. In the last quarter of the year the large-firm effect is particularly pronounced. They provide a behavioral explanation.

Even if one accepts that the size premium is a payment for risk, one may still argue that the SMB factor employed by the Fama-French model does not capture this risk and that the beta measure of sensitivity to that factor does not measure risk. The same difficulty identified with the factor loading on the HML factor is repeated here. Small firms are expected to load positively and large firms are expected to load negatively on the SMB factor. The model predicts a direct relationship with return ascribed to risk, but the expected variation depends on the absolute value of the factor loading. Unlike the factor loading on the HML factor, empirical tests of the cross-sectional impact of the factor loading on the SMB factor have been conducted. Such tests question the role of the SMB variable as a risk factor. Ferson and Harvey (1999) show that factor loadings on the return to the SMB portfolio have no predictive power for portfolio returns in the presence of a set of macro-economic variables. Further, Daniel and Titman (1997) show that factor loadings on the returns to the SMB portfolio have no predictive power for portfolio returns in the presence of the variable directly measuring a security's size. Thus, the required relationship between the factor loading and cross-sectional portfolio returns is unsupported.

Time-Series Validation of Common Risk Factors

Expected Time-Series Relationship Between Portfolio Returns and Factor Values

Just as we argued for the need of general criteria to establish a factor as a common risk factor, we suggest the need for expected relationship between time-series portfolio returns and common risk factors to guide our analysis. We suggest the following ought to be true to identify a factor as a common risk factor: 1) The factor needs to provide economically important explanation for return variation of portfolios formed under any criteria. 2) The factor needs to provide explanatory power consistently over time. 3) The factor should provide consistent and rational factor loadings on portfolios formed under various conditions. 4) And key, the causation for any time-series correlation between the factor and portfolio returns should come from the factor.We use extant empirical results to compare the relationship of portfolio returns and the momentum factor. We then present new empirical evidence concerning the relationship the time-series relationship between portfolio returns and the three factors from the Fama-French three-factor model. Specifically, we use the Fama-French size-value portfolios in our analysis. Our results support the role of the market factor as a common risk factor but questions the roles of SMB and HML as common risk factors.

The Momentum Factor

The momentum literature explains momentum behavior with both overreaction and under reaction explanations, but does not offer risk-based explanations of momentum. Consistent with the overreaction explanation the behavioral literature offers strong evidence of herding behavior. Because the risk-based case for the momentum factor is weak, we examine time-series evidence for the momentum factor using extant studies.

The momentum factor associates with Carhart's (1997) study of mutual fund return performance. Carhart sorts mutual funds into deciles based on the previous year's performance. He then regresses monthly portfolio returns on factor returns

using two models. The first model is the CAPM and the second model is a four-factor model which consists of the Fama-French three-factor model augmented by a momentum return, PR1YR.[5] The additional variable represents the return of the mutual fund portfolio for the prior year.

Carhart's result which we report in Table 1 shows the clear influence of investor herding in the significance of adding a momentum factor. Outside of the extreme deciles, which include the mutual funds that are holding securities showing strong momentum, the market factor explains virtually all of the variation in portfolio returns. For portfolio 1 where securities held by the mutual funds have shown strong positive momentum the market factor explains 83.4% of the variation. For portfolio 10 where securities held by the mutual funds have shown strong negative momentum the market factor explains 85.1% of the variation. For portfolios 4 through 7 where securities held have shown the least momentum, the market factor explains over 95% of the variation in returns. When held securities have continuing momentum the market factor is unable to provide as complete of an explanation of return variation. The returns of mutual funds holding securities with strong momentum are influenced by momentum, which may be captured by a momentum factor, in addition to market fluctuation.

Table 1: Momentum Decile

Portfolio	CAPM Adj. R-sq	4-Factor Model Adj. R-sq	Increase from CAPM to 4-Factor
1 (high)	0.834	0.933	0.099
2	0.897	0.955	0.058
3	0.931	0.963	0.032
4	0.952	0.971	0.019
5	0.960	0.970	0.010
6	0.958	0.968	0.010
7	0.959	0.967	0.008
8	0.951	0.958	0.007
9	0.926	0.938	0.012
10 (low)	0.851	0.887	0.036

In the last column of Table 1 we show the increase in explanatory power from adding the momentum, size and value factors. For portfolios with low momentum the increase in R-squareds is 1% or less. The increase in R-squareds is most significant for the portfolio of mutual funds holding securities with strong positive momentum. Our focus in this section is on the momentum factor. It appears that the momentum factor explains variation in returns only for variation occurring from the influence of securities that have experienced extreme returns. The momentum factor is not a common risk factor. The momentum factor simply measures the behavioral phenomenon of investor herding. The size and value factors would appear to have very little impact on returns on portfolios formed on the basis of past returns. We hold that the relatively small increase in r-squared for most of the portfolio deciles weakens the risk-based explanation for a momentum factor. Consider also the implication of the risk-adjustment using the UMD factor as shown in equation (2). This factor identifies that funds with negative momentum have low risk. If the securities within these funds are experiencing low returns because of negative market information, on what bases could these securities possibly be considered to be low risk securities?

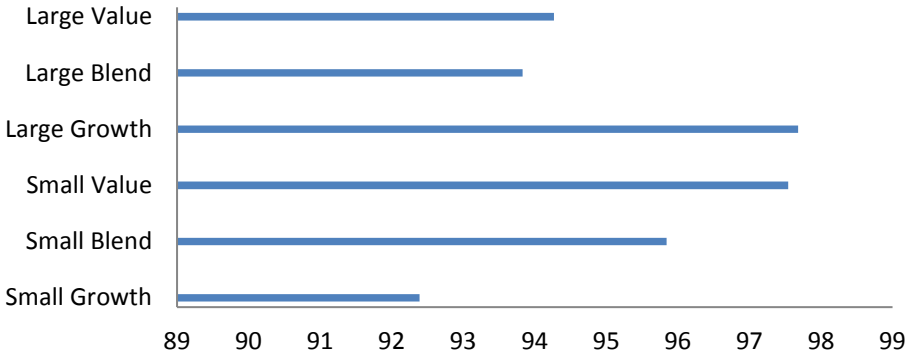
Fama-French Size-Value Portfolios

Fama and French (1993) first applied their three-factor model to explain the variability of return on twenty-five portfolios formed by classifying securities based on the security's market value and BtM ratio. One may argue that formation of portfolio on the basis of size and value biases results toward finding a relationship between factors designed to measure risk associated with size and value. Of course, the original purpose of using such a formation procedure was to show the ability of the three-factor model to provide an explanation of return variation left unexplained by CAPM. With this potential bias in mind, we begin our time-series investigation with the same general portfolio formation procedure. We examine six size-value portfolios: Large-firm value, Large-firm blend, Large-firm growth, Small-firm value, Small-firm blend and Small-firm growth. We gather data from the Ken French website for both portfolio and factor returns over the period July 1927 through December 2012. For the market factor we use the CRSP value-weighted index. Portfolio returns are analyzed against each of the factors individually and against all possible combinations of the three factors.

Explanatory Power from the Three Factors Combined

Because the three-factor model introduced by Fama and French (1993) explained nearly all of the return variability of twenty-five size-value portfolios, in effect explaining the size and value premiums, the model became the standard for explaining portfolio return variability in time series analysis. The validity of the model is also accepted on this basis by practitioners. Thus, we begin our analysis looking at the results from equation (1) where all three factors are included. Figure 1 shows the percent of return variation explained by the three factors for the six size value portfolios over the period July 1927 through December 2012. Consistent with previous findings the three factors together explain over 90% of the return variation in the size-value portfolios. For the large-growth portfolio and for the small-value portfolio over 97% of the return variation is explained by the three factors. Even for the small-growth portfolio, which has the most unexplained variation, a highly significant 92.39% of the return variation is explained.

Figure 1: R-Squared values from regressing Fama-French, Size-Value Portfolio returns against the Fama-French Three-Factor model over the period July 1927 through December 2012

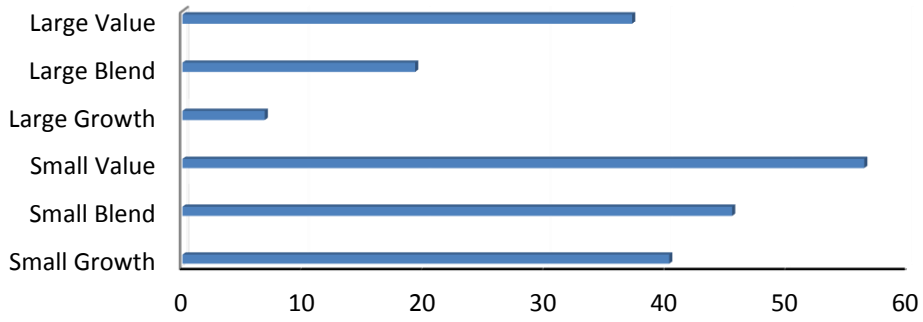


Explanatory Power from the SMB and HML Factors Combined

Fama and French (1993, p. 5) indicate that among their main results is the finding that the SMB and HML factors explain a large variation of the return variation in size-value portfolios without the market factor. But for their twenty-five size-value portfolios the r-squares range from 65% for the small growth portfolio to only 6% for the large value portfolio. And in general the r-squares for the large firm portfolios are small. Fama and French note that given the value classification explanatory power increases with size and given the size classification explanatory power increases as the portfolios move from value to growth. We suggest that such variation argues against our first requirement for validating common risk factors using time-series portfolio returns that factors provide important economic explanation of return variation for all portfolios. The SMB and HML factors ability to explain return variation seems to concentrate on small-firm and growth portfolios.

In Figure 2 we report the r-squares from regressing the returns of the six size-value portfolios against the SMB and HML factors. Our results are similar to those reported by Fama and French. R-squares range from 6.80% to 56.39% across the six portfolios. Comparing the results from Figures 1 and 2 clearly show why the market factor was included in the three-factor model despite Fama and French's (1993) continued assertion that market beta does not explain cross-sectional returns. In all cases the explanatory power is greatly increased by including the market factor, adding credence to the assertion that the market factor is a common risk factor.

Figure 2: R-Squared values from regressing Fama-French, Size-Value Portfolio returns against only the SMB and HML factors over the period July 1927 through December 2012

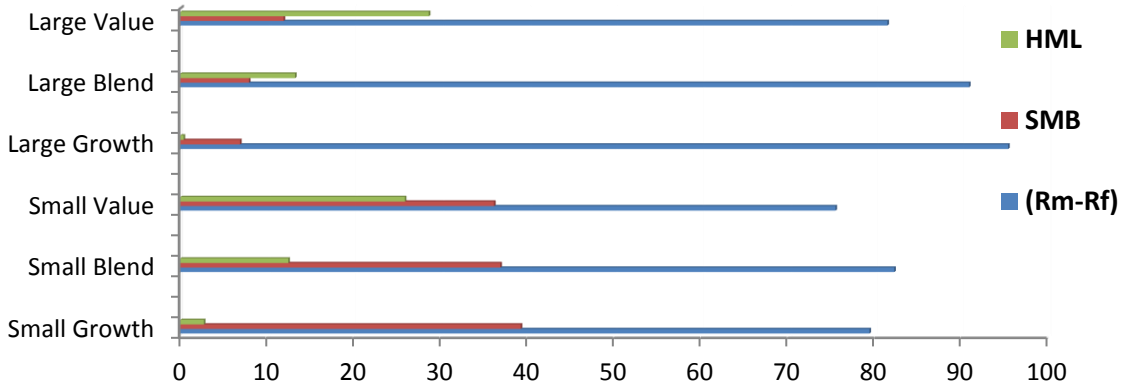


Our results also emphasize the inconsistent nature of the explanatory power of the SMB and HLM factors. Explanatory power is always greater for the small-firm portfolio relative to the large-firm portfolio. If SMB and HLM are common risk factors, influencing all securities, why is the explanation so much stronger for small firms versus large firms? The difference in explanatory power based on size is consistent with the findings reported by Fama and French. Comparisons of explanatory power between value and growth portfolios for our data are inconsistent with that reported by Fama and French. Our results show that these two factors explain substantially greater variation in value than in growth given size, especially for the large-firm portfolio. We analyze data from July 1927 through December 2012 and Fama and French analyze data from July 1963 through December 1991, suggesting inconsistency of the factors explanatory power over time. Perhaps a more critical question is the lack of generality of explanatory power for the SMB and HLM factors. We explore this qualification more fully in the next subsection when we report regression results with portfolio returns run separately on each factor.

Explanatory Power from Individual Factors

Figure 3 reports the r-squares from the regression of the returns of the six size-value portfolios individually on each of the three factors over the period July 1927 through December 2012. When examined on an individual basis the importance of the market factor as a common risk factor is clearly evident. As shown in Figure 2, in all cases the return variation explained by the market factor is greater than the return variation explained by either of the other two factors individually or combined. The lowest percent of the variation explained by the market factor is 75.39% for the small value portfolio. For the large growth portfolio the market factor alone explains 95.36% of the return variation. One may be tempted to ask: if the three-factor model is validated by explaining 90% of the variation in size-value portfolios is the CAPM validated because the market factor explains at least 75% of the return variation and in some cases over 90% by itself? This dominance of the market factor is also reported by Carhart (1997) showing that the market factor explains the vast majority of the variation in return variation of portfolios created on the basis of return momentum.

Figure 3: R-Squared values from regressing Fama-French, Size-Value Portfolio returns against each of the factors individually over the period July 1927 through December 2012



An instructive contrast exists between the relative ability to explain small versus large portfolios between the market factor and the combination of the SMB and HML factors. The market factor explains more of the variation for the large-firm portfolios than for the small-firm portfolios. We argue that this is consistent with the behavior of a common risk factor. Because, as shown by relative return annual return variation reported by Ibottson and quoted above, small-firms have greater idiosyncratic risk, one should expect a common risk factor to explain less of the return variation for portfolios containing small-firm securities versus a portfolio containing large-firm portfolios. This relationship is exactly what is found for the market factor. Because the reverse is found for the combined effect of the SMB and HML factors as reported above, this relationship raises questions as to their common risk status. Examination of the SMB and HML factors individually will show the derivation of this bias.

As shown in Figure 3, the SMB factor when used as the single factor explains a moderate amount of the variation in the small-firm portfolio but very little of the return variation in the large-firm portfolio. A common risk factor should explain return variation in both small and large firms. This concern is increased because the SMB factor explains more of the variation in the portfolios with the greatest idiosyncratic risk. This relationship raises questions about the direction of causation between the factor and portfolio returns. An issue we identify above as a critical issue in providing the designation of a common risk factor.

The SMB factor is measured as the return to small-firm portfolios minus the return to large-firm portfolios. Because the return variation is much greater for small-firm portfolios, this variation will have a dominant influence on the variation in the SMB portfolio. Thus, the correlation coefficient (r) will be much stronger between the returns of the small-firm portfolios and

the SMB factor than for the returns of the large-firm portfolios and the SMB factor. Thus, the coefficient of determination (r-square) will be much stronger for the returns of the small-firm portfolio and the SMB factor than for the returns of the large-firm portfolio and the SMB factor. This explanation has significant implications for the questions of whether the SMB factor should be considered a common risk factor or not. A common risk factor should cause variation in portfolio returns. The relationship that we have just identified shows that portfolio returns are causing variation in the SMB factor arguing against considering the SMB factor as a common risk factor. The SMB factor was accorded the status of a common risk factor because it appeared to explain the size anomaly. In fact, the variation in the returns of the size portfolios is causing the change in the SMB factor to correlate with the small-firm portfolio returns.

This spurious correlation is shown by the loadings of the returns of small-firm and large-firm portfolios on the SMB factor. One would expect the small-firm portfolios to load positively and the large-firm portfolios to load negatively. But as shown in Table 2, large-firm portfolios as well as small-firm portfolios load positively on the SMB factor. These results follow from the strong influence of the return variation of the small-firm portfolios on the SMB factor. The value of the SMB factor is positive, not because of extraordinarily low returns to large-firm securities. Rather the SMB factor is positive when market returns are high in general an effect that is felt more keenly with small-firm securities. Thus, when SMB is positive both small-firm portfolios and large-firm portfolios tend to have high returns. Because large-firm portfolios tend to have large returns when the SMB factor is positive, the factor loading on the SMB factor for large-firm portfolios is positive. When the market factor is included the influence of generally high market returns on the SMB factor loading for large firms is reduced and some large-firm portfolios show negative factor loadings. We argue that this influence does not correct the basic causation problem with the SMB factor. The causation is still flowing from the portfolio returns to the factor instead of from a common risk factor to portfolio returns.

Table 2: Coefficients for the SMB factor from regressing Fama-French, Size and Book-to-Market Portfolio returns against the Fama-French Three-Factor model over the period January 1979 through December 2012.

Factors/Portfolios	*Small Growth*	*Small Blend*	*Small Value*	*Large Growth*	*Large Blend*	*Large Value*
SMB Alone	1.03	1.03	0.81	0.23	0.23	0.26
SMB with Market	0.65	0.76	0.52	-0.09	-0.06	-0.02

The HML factor provides inconsistency similar to that found for the SMB factor in explaining return variation across portfolios. As shown in Figure 3 the HML factor explains a moderate amount of the return variation in value portfolios, less than half of that amount for blend portfolios and almost none of the return variation of the growth portfolios. The HML factor explains only 2.71% for the variation in the small-growth portfolio and a much smaller 0.37% of the variation in the large-growth portfolio. Indeed, the adjusted r-square for this regression is negative. The HML factor, as with the SMB factor, does not appear to be a risk factor common to all types of portfolios.

Explanatory Contribution of the HML and SMB Factors Added to the Market Factor

Figures 4(a) and 4(b) show the result of adding the SMB and HML factors when the influence of the market factor is already considered. In general, the contributions of the SMB and HML factors may be characterized as modest and inconsistent. As shown in Figure 4(a), when adding the SMB factor to the market factor the r-squares of the small-firm portfolios increase by at least 10% but by less than 15%. Thus, the SMB factor registers a modest increase in explained variation for these portfolios, but as argued above the question of causation should be raised. The additional explanatory power coming from the SMB factor when added to the market factor for large-firm portfolios appears to be consistent with sampling error. For all three large-firm portfolios the additional explanatory power is always less than 1%. Surely a common risk factor would have more impact than that. A similar story exists for the HML factor. As shown in Figure 4(b), adding the HML factor to the market factor causes a moderate increase for value portfolios, but almost no increase for the growth portfolios. At the extreme, adding the HML factor to the market factor in explaining return variation of the small-growth portfolio increases explained variation by only 0.05%. It should be noted that the combined influence of the SMB and HML factors does increase the explained variation in the small-value portfolio by over 20%.

Figure 4 (a): R-Squared values from regressing Fama-French, Size-Value Portfolio returns against the Fama-French Three-Factor model over the period July 1927 through December 2012

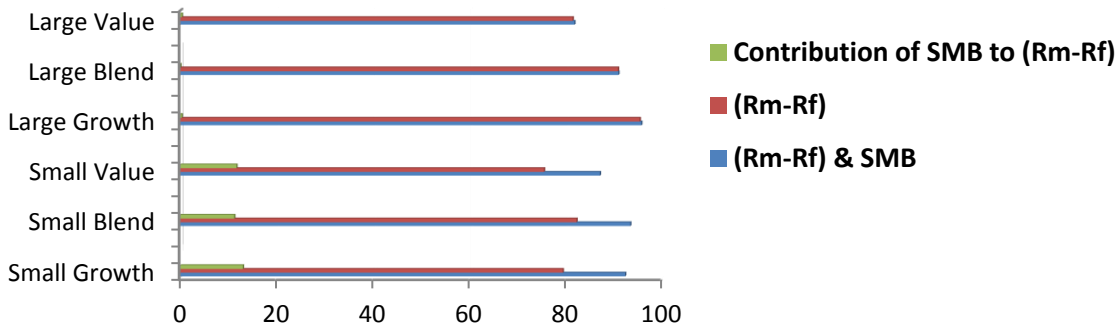
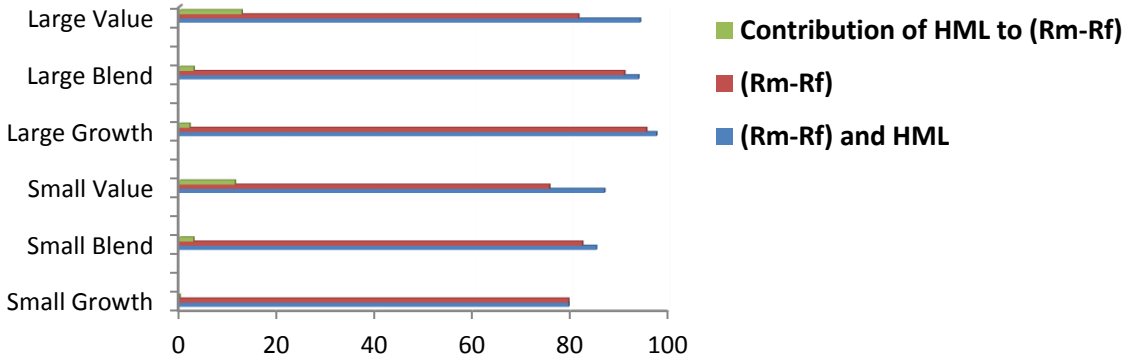


Figure 4 (b): R-Squared values from regressing Fama-French, Size-Value Portfolio returns against the Fama-French Three-Factor model over the period July 1927 through December 2012



Conclusion

This paper is motivated by the ever increasing number of proposed common risk factors. We argue that possible explanation of these empirical findings is that behavioral factors create relationship between a host of factors and portfolio returns. We examine the four factors in the Carhart model and find strong arguments in favor of a behavioral explanation for the association between momentum, size and the BtM ratio and returns. In addition, we examine the evidence from time-series relationships that has been used to identify these factors as common risk factors. We argue that extant empirical findings are inconsistent with designating the momentum factor a common risk factor. We present new empirical evidence relative to the other three factors and our led to the conclusion that the size and BtM variables are not proxy for common risk factors.

We find that the momentum, value and size factors provide small additional explanatory power to portfolio return variation. We find that this contribution varies across portfolios and time, inconsistent with the behavior of a common risk factor. In particular for the SMB factor we show that causation runs from portfolio returns to the factor. A common risk factor should cause change in portfolio returns rather than respond to changes in portfolio returns. In contrast the market factor provides strong explanatory power for portfolio variation which is consistent across time and portfolios. We are not arguing for the validity of the CAPM. We simply argue that the "zoo" is primarily a behavioral zoo. We do not deny the possibility that other risk factors may affect returns, but we have argued that for the frequently used, momentum, value and size factors, a behavioral explanation seems much more consistent. Indeed, in very few cases have factors been supported with convincing theoretical arguments.

An obvious problem is that our conclusions argue against standard procedures for risk-adjusting returns using the three-factor model. We argue that this result is desirable in that, current procedures, if our conclusions are correct, bias against the performance of value and small-firm portfolio managers. Uncertainty as to how to correctly risk-adjust performance has led to the use of market-adjusted returns. Indeed the common practice to measure the performance of mutual funds by against category averages is a manifestation of this concern. Of course, both of these procedures leave variation in risk unaccounted. We such suggest that researchers can and should use the market factor to risk-adjust. Again, we are not arguing for the validity of the Capital Asset Pricing Model, but simply for the importance of the market factor as a common risk factor. Researchers may often wish to explain return variation rather than to risk-adjust returns. Of course, in this case the market factor is important, but so are many other factors such as firm size. We see no benefit from using the SMB factor instead of using a firm size variable directly. Researchers and practitioners may also seek to predict return behavior. In that case a multi-factor model such as the Barra model seems ideally suited. Researchers may wish as well to consider the influence of idiosyncratic and downside risk.

Notes

1. We recognized on an *ex-ante* basis a security's exposure to systematic risk rather than historic total variation in returns is the appropriate measure of risk when considering the addition of a security to a portfolio. But if this measure of exposure to systematic risk is effective, it must, by definition, result in greater variation in total return.
2. We recognize Roll's (1977) critique that proxies such as the S&P 500 Index are not perfect measures of the market identified in the CAPM.
3. It seems paradoxical to claim a time series relationship in absence of a cross-sectional relationship. If the market factor explains portfolio time series returns, that relationship identified in this explanation is measured by market beta. If portfolio market betas are consistent over time as shown by Fama MacBeth (1973) then a cross-sectional relationship between beta and returns is a mere identity. Indeed, the same assumption of rational pricing within a market that is used to argue that size and value proxy for risk requires the argument that a cross-sectional relationship between beta and returns must exist given a time series relationship between the market factor and portfolio returns.
4. They also report a significant relationship between market betas and portfolio variation.
5. As we report in Equation (2) above as Carhart's model was adopted by other researchers to risk-adjust returns, the variable PR1YR was replaced by the variable UMD. The UMD factor is more consistent with the size and value factors of SMB and HML. The UMD factor represents the return to a portfolio long in securities with positive momentum and short in securities with negative momentum.
6. We also conduct regressions for all possible combinations. Because of space and focus considerations we only report results for the simple regressions here. Full results are available from the author.

References

Banz, R.W., 1981, "The Relation Between Return and Market Value of Common Stocks," *Journal of Financial Economics* 9, 3-18.

Basu, S., 1983, "The Relationship Between Earnings Yield, Market Value and Return for NYSE Common Stocks: Further Evidence," *Journal of Financial Economics*, 12, 129-156.

Bollen, B., 2010, "The Security Market Plane," *Applied Financial Economics*, 20, 1231-1240.

Campbell, J., Hilscher, J. and Szilagyi, J., 2008, "In Search of Distress Risk," *The Journal of Finance*, 63, 2899-2939.

Carhart, M., 1997, "On Persistence in Mutual Fund Performance," *Journal of Finance*, 52, 57-82.

Chan, K. C. and Lakonishok, J., 1993, "Are the Reports of Beta's Death Premature?," *The Journal of Portfolio Management*, Summer, 19, 51-62.

Chan, K. C. and Lakonishok, J., 2004, "Value and Growth Investing: Review and Update," *Financial Analyst Journal*, January/February, 71-86.

Chen, N. F., Roll, R. and Ross, S., 1986, "Economic Forces and the Stock Market," *The Journal of Business*, 59, 383-403.

Cochrane, John H., 2011, "Presidential address: discount rates," *Journal of Finance*, 4, 1047-1108.

Daniel, K. and Titman, S., 1997, "Evidence on the Characteristics of Cross Sectional Variation in Stock Returns," *The Journal of Finance*, 52, 1-33.

Dichev, I., 1998, "Is the Risk of Bankruptcy a Systematic Risk," *Journal of Finance*, 53, 1131-1147.
Dijk, M., 2011, "Is Size Dead? A Review of the Size Effect in Equity Returns," *Journal of Banking and Finance*, 35, 3263-3274.
Elsas, R., El-Shaer, M. and Theissen, E., 2003, "Beta and Returns Revisited Evidence from the German Stock Market," *International Financial Markets, Institutions and Money*, 13, 1-18.
Fama, E. and French, K., 1992, "The Cross Section of Expected Stock Returns," *The Journal of Finance*, 47, 427-465.
Fama, E. and French, K., 1993, "Common Risk Factors in the Returns on Stocks and Bonds," *Journal of Financial Economics*, 33, 3-56.
Fama, E. and French, K., 1995, "Size and Book-to-Market Factors in Earnings and Returns," *The Journal of Finance, 50, 131-155.*
Fama, E. and French, K., 2004, "Profitability, Investment and Average Returns," *Journal of Economic Perspecitves*, 18, 25-46.
Fama, E. and French, K., 2014, "Five-Factor Asset Pricing Model," *working paper*.
Fama, E. and J. MacBeth, 1973. Risk, return, and equilibrium: Empirical tests. *Journal of Political Economy* 81, 607-636.
Ferson, W. E. and C. R. Harvey, 1999, Conditioning variables and the cross section of stock returns, *Journal of Finance* 54, 1325-1360.
Fletcher, J., 1997, "An Examination of the Cross-sectional Relationship of Beta and Return: UK Evidence," *Journal of Economics and Business*, 49, 211-221.
Harvey, C., Liu, Y. and Zhu, H., 2013, . . . and the Cross-Section of Expected Returns, *working paper.*
Hou, K., Xue, C. and Zhang, L., 2012, "Digesting Anomalies: An Investment Approach," *working paper.*
Hur, J., Pettengill, G. and Singh, V., 2014, "Market States and the Risk-Based Explanation of the Size Premium," *Journal of Empirical Finance*, 28, 139-150.
Ibbotson, SBBI, Classic Yearbook, 2014, Morningstar Inc.
Knez, P. J. and M. J. Ready, 1997, "On the Robustness of Size and Book-to-Market Ratio in Cross-Sectional Regressions," *"The Journal of Finance,* 52, 1535-1582.
Lakonishok, J., Shleifer, A., and Vishny, R., 1994, "Contrarian Investment, Extrapolation, and Risk," *The Journal of Finance*, 49, 1541-1578.
Lintner, J., 1965, "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," *Review of Economics and Statistics*, 47, 13–37.
Loughran, T., 1997, "Book-to-Market across Firm Size, Exchange, and Seasonality: Is There an Effect?," *Journal of Financial and Quantitative Analysis*, 32, 249–268.
Pettengill, G., Chang, G. and Hueng, J., 2015, "Comparing Value and Growth Mutual Funds: New Evidence," *Financial Services Review*, 23, 341-359.
Pettengill, G., Sundaram, S. and Mathur, I., 1995, "The Conditional Correlation Between Beta and Returns," *Journal of Financial and Quantitative Analysis*, 30, 101-116.
Piotroski, J., 2000, "Value Investing: The Use of Historical Financial Statement Information to Separate Winners from Losers," *Journal of Accounting Research*, 38, 1-41.
Reinganum, M., 1981, "Misspecification of Capital Asset Pricing: Empirical Anomalies Based on Earnings' Yields and Market Values," *Journal of Financial Economics*, 9, 19-46.
Roll, R, 1977, "A Critique of the Asset Pricing Theory's Tests, A critique of the asset pricing theory's tests, Part I: On past and potential testability of the theory," *Journal of Financial Economics*, 4, 129–176.
Rosenberg, B., Reid, K., and Lanstein, R., 1985, "Persuasive Evidence of Market Inefficiency." *Journal of Portfolio Management*, 11, 9-17.
Swedroe, L., 2014, "Improving on Fama-French," www.etf.com.
Vassalou, M., and Y. Xing, 2004, "Default Risk in Equity Returns," *The Journal of Finance*, 59, 831-868.
William G. Christie and Roger D. Huang, 1995, "Following the Pied Piper: Do Individual Returns Herd around the Market?" *Financial Analysts Journal*, Vol. 51, No. 4, 31-37
Woodley, M., Jones, S., and Reburn, J., 1985, "Value Stocks and Accounting Screens: Has a Good Rule Gone Bad?," *Journal of Accounting and Finance*, 11, 87-104.

Impact Investing and Cost Of Capital Effects

Marc Sardy and Richard Lewin, Rollins College

Abstract

Some firms rely too heavily on high-priced equity to generate funds for impact-related projects and too little on a balanced leverage approach. Some research suggests positive effects on a firm's cost of capital that produce lower costs of equity, while others show that a firm's cost of debt may not be lowered significantly. This paper examines determinants of the cost of capital related to impact investments, and develops a model to explain implications for firm behavior. We consider endogenous and exogenous factors that drive the cost of capital and posit what impact-projects do to influence a firm's cost of capital.

Introduction

It is often considered that additional debt yields poorer bond ratings and more risk associated with a firm. Several researchers have suggested that all forms of borrowing increase leverage and thus, beyond a point, will lower the credit rating of the firm. Hence most forms of debt are bad for the firm beyond a certain point, usually specified by the debt covenants on the firm's debt issuances. However, this blurs together all different forms of corporate borrowing from project-related finance, inventory, or operations finance through impact based finance. Many of the different uses of a firm's cash are for the purpose of extending/sustaining existing businesses or establishing new business units. Where impact investing veers away from this traditional approach is that firms are making investments in existing operations to improve their efficiency or make the product or process more sustainable. In the short-run debt levels will thus rise and possibly drive the credit rating of the firm down and thus ratchet up its cost of capital.

The cost of capital represents the key decision-making variable in the net present value decisions that management use to determine whether or not to move forward with various projects. The cost of capital is weighted between several different potential sources of funds: equity issuances, debt issuances and hybrid preferred equity issuances. Cost of equity can be driven up or down by the rate of return forgone by selling an additional share of stock. For example; if a share is expected to get a 12% return then the investor would be forgoing 12% on that share if they were to sell it. Internally the firm is also giving up a potential 12% return by issuing shares. Usually the main investor to suffer the loss is not the firm itself but the existing shareholders, who find themselves diluted down and thus left with a lower rate of return, see Barton (2011). Drivers to the cost of equity are higher/lower earnings, higher/lower taxes, and higher/lower debt levels. Drivers for the cost of debt are extraordinary firm borrowing or retirement of existing debt. There is a class of bonds that are not considered investable grade bonds that may fall somewhat outside the scope of the cost of debt as they are not anchored or secured to firm assets. However, these rates are extremely high and in many cases firms will avoid the use of this type of floating debt or debenture as a way of financing operations, because the cost of servicing this debt is extremely high and thus reduces the flexibility of the firm should an economic downturn reduce earnings. Therefore if we consider the traditional accounting equation:

$$\text{Assets} = \text{Liabilities} + \text{owners' Equity} \tag{1.1}$$

If we increase liabilities without proportional increase in assets, owners' equity must decline. However, assets under impact investment may take the form of capital improvements or process improvements which may not immediately seem like a decrease in cost to operations unless a higher level of profitability is immediately identified. This lead-lag arrangement warrants further analysis.

Equity Metrics

The cost of equity is based on the CAPM equation where the return on the individual stock is a function of the risk-free rate, the beta related to the stock times the market risk premium or the difference between the market and the risk-free rate:

$$R_i = R_f + \beta(R_m - R_i) + e \tag{1.2}$$

Beta is related to the covariance of the stock with the market over the variance of the stock market proxy. The more out of phase the stock is with market movements, the larger the covariance and thus the larger beta. However, in periods where market

volatility or variance are extremely large relative to the covariance of the stock, data will actually decline and thus the relationship between the stock and the risk-free rate becomes a lot closer, i.e. the cost of equity would decline:

$$\beta = \frac{Cov(R_i, R_m)}{Var(R_m)} \tag{1.3}$$

Changes in the return of the stock may be driven by the underlying data and market rates of return. With regards to the return, "a rising tide raises all boats", so when the market rises so too does the rate of return on an individual stock provided the data is at parity of one, or greater. However the more stable returns are, or the more stable the risk-free rate is, perhaps the lower the cost of equity may become. This may turn up in a lower volatility and ultimately lower covariance, thus yielding a lower beta, driving the required return on equity down. The overall effect would drive the cost of capital for the firm closer to the cost of debt. Impact investments may have the effect of reducing the volatility of returns after all news and information of firms making internal impact investments accounted for and may have a more positive to neutral effect on the share price but only very rarely would be expected to have a negative impact on the share price. Conversely, new product ideas can create instability, as markets waits to see how the effectiveness of the new product plays out. This might have the effect of causing more volatility in the share price and perhaps higher covariance which would lead to a higher beta.

Debt Metrics for Impact Investments

Consider that the overall debt of the firm is the sum of these three types of debt components:

$$K_t = W_oK_o + W_pK_p + W_iK_i \tag{1.4}$$

Where W_o, W_p and W_i are the respective weights associated with operations, projects and impact investments. Thus the overall firm's debt profile is a function of these weighted costs of debt. Depending on the firm, higher cost of capital may be associated with some forms of these. Thus, the cost of debt (determined by the weighting of each of these ratios) may be higher or lower depending on the type of risks the firm is willing to take. Even though these impact investments might lead to a more profitable firm, managers may be unwilling to make these kinds of investments as it is unclear whether or not shareholders will recognize the value to the firm of impact investment and the resulting improved approach to profitability.

Managers faced with this decision may choose the more conservative approach and not make these kinds of impact investments. At present, much of this can be seen from the strong approach that firms take towards corporate social responsibility or CSR. More often this is seen as a marketing expense or a way to improve the profile of the organization in the public eye, rather than an opportunity for real process improvements and long-term cost cutting.

Consider that debt has several components, the cost of debt related to funding existing operations K_o, this type of debt is often replacing older (which may be expiring due to the lifespan of specific) bonds. Many firms use various methods from sinking fund provisions to callable bonds to raise capital to finance cash flow shortfalls or existing operational demands.

Another type of debt may be project related debt K_p which carries a higher inherent level of risk as it is related to new projects which are ultimately new forms of businesses that may be generated by the firm. The reason these projects often carry a higher level of risk is that in many cases they are used to extend the existing business model of the firm into new product innovations, new product lines or product adaptations to maintain the competitive position of existing output. The risk level associated with them comes from the untested nature of these investments. Often when trying to establish the net present value of these projects, the "cost of capital" used is not necessarily the firm's cost of capital, but rather the cost of capital associated with similar risky projects. So, the threshold for these projects to move forward is often higher than investments in enhancements to existing operations. Quite often this disadvantages the firm which may decide that a project is too risky to move forward. Thus the cost of capital assigned to it may be so high that net present value is negative, even when the firm's cost of capital would have had a project looking positive and worthy of moving forward. The problem with this approach for the firm is that many good projects or new projects may be passed over by more conservative management, in choosing to use a higher cost of capital rather than the firm's true cost of capital. At face value this seems prudent as it takes a much more conservative approach to addressing the pitfalls of new business models. However, older firms with more conservative outlooks may choose to turn down many profitable projects as a result. This can be seen time and time again in the history of business in dominant industries such as the steel industry, where investments in mini-mill technology were deemed costly and untested; thus many firms refused to participate in investments in the new technologies which ultimately led to their downfall. At this point we should add that sunk costs also played an important role. Counter intuitively firms may be unwilling to make additional investments where they had a high degree of sunk costs since they often already had high levels of debt associated with those.

There are others types of debt K_i we might call impact debt which relates to process or product system improvements that will ultimately lead to a change in the existing operations or products. These might take the form of an investment of operations for product improvements which would have a longer-range decrease in cost and increase in profitability. For example, assume a firm makes an impact investment in solar power or wind power generation to decrease costs and improve operational efficiency. Initially it registers as a higher level of debt. In the near to midterm, the profitability and cost decreases associated with this kind of investment will make the competitive position and the profitability of the product significantly better. Or consider another type of impact investment where a firm like Apple makes an investment in lower-cost recycled materials to decrease the weight of the laptop, or better battery technology to improve the lifespan of laptop batteries, thus lowering the carbon footprint of every user of its computers. The former will lead to higher profitability in the product, the latter is a value proposition to the consumer. This value proposition may not immediately have an impact on the bottom line of the firm. However, consumers will respond to the improved product profile and sustainability of that product.

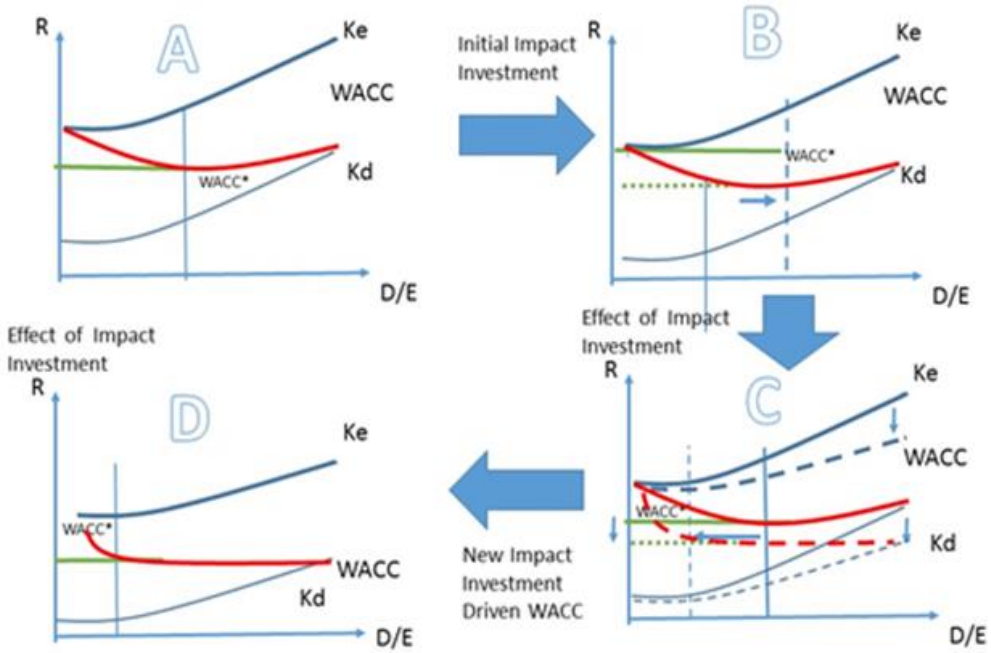
Profitability of Impact Firms

As the profitability of the firm increases there will be a parallel increase in the share price as the retained earnings contribute to increasing the equity of the firm. Higher profitability of the firm will eventually lead to a lower cost of capital. Thus, these impact investments raise the level of debt of the firm on the balance sheet, but yield better earnings on the income statements and higher contributions ultimately go back to owner's equity. The timing of the increase in debt and the subsequent increase in equity may have a short or longer-term effect: initially we might see a decline in owner's equity related to the increase in debt associated with these impact improvements followed by a subsequent rise in owner's equity directly related to the increase in operational efficiency or product/process improvement. The increase in owner's equity in many cases may be significantly higher than the decrease associated with the debt. An increase in profitability will ultimately lead to a lower debt to equity ratio.

With the lower debt to equity ratio we would ultimately see a decrease in the cost of capital associated with the decline in the debt-to-equity ratio. So in the short run, we would see an increase in the cost of capital as initial debt investment was made. The firm's cost of capital may reflect the higher riskiness and the lower availability of debt as a means of financing the firm. As the cost improvements demonstrate themselves to be more valid, and the proportional rise in equity more prominent, cost of capital should decline.

Cost of Capital Implications

Figure 1: Impact Investment Effects on WACC



Initially as demonstrated in Figure 1 graph A, the optimal weighted average cost of capital is shown as WACC*. When an impact investment is made to the firm the debt level is raised and therefore the debt to equity ratio changes as a higher percentage of the firm is leveraged, as seen in graph B. However, as the investment makes the firm more profitable, earnings as well as perhaps retained earnings increase. Thus, the equity of the firm increases and debt to equity decreases. As the firm increases its equity position it may fundamentally change its ability to service debt and also change the shape of its cost of debt curve; this will also change the shape of the WACC curve. In Graph C we see these fundamental changes to the WACC curve. Ultimately, the WACC shifts along its curve to a newer lower optimal as the firm has structurally changed its WACC through modifications to debt costs and associated equity costs. In Graph D we see this change where the new WACC* is at a new lower optimal.

Revenue-generating ventures designed for positive social impact

Impact investing is built on the belief that financial tools and private capital can play a powerful role in solving the massive global challenges of our day, and that capital markets should work for good as well as profit. Impact investing is about using markets and money for social good. Although it is possible for impact investors to achieve social impact along with market rate returns, it is not easy to do, see Bugg-Levine and Emerson (2011). One of the unfortunate characteristics of imperfect impact investing markets is their inability to attract the large majority of socially neutral investors who demand a market return. The majority of investors and finance institutions are either unable, or unwilling, to sacrifice financial performance for having an outstanding impact. According to the Global Impact Investing Network (2010), the market for impact capital, currently sized at $60 billion, could grow over the next decade to $2 trillion, or 1% of global invested assets. It is estimated that over $1tn (£615bn) of social investment funds could be unlocked around the world, giving welcome impetus to the idea that the power of enterprise can be harnessed to benefit - rather than hinder - society as a whole.

That claim is made by many social impact investment funds and a recent US study back this up, asserting that the majority of social impact investing produces market-rates of returns. Using calendar-time portfolio stock return regressions, Mozzafar, Serafeim, and Yoon (2015) find that firms with good performance on material sustainability issues significantly outperform firms with poor performance, suggesting that investments in corporate sustainability are shareholder-value enhancing. Those businesses which prioritized financial goals over social goals were much more likely to experience high rates of growth and have even greater social impact, Cohen and Sahlman (2013). Though the sample was relatively small, the trend was quite strong as the more likely entrepreneurs were to favor financial goals, the faster their companies grew. The ventures that grow fastest are likely to be the ones that have the most frictionless business models.

A more robust strategy is to design business models that align financial and social goals as closely as possible to minimize tradeoffs and reduce friction. When tradeoffs must be made, social and financial goals must be married in a way that minimizes the firms' willingness to prioritize financial goals over social ones and maximizes the long-term sustainability of the business. Investing in sustainability has usually met, and often exceeded, the performance of comparable traditional firms' specific investments, see Clark, Feiner and Viehs (2015). Morgan Stanley (2015a), for example, reviewed a range of studies on sustainable investment performance and examined performance data for 10,228 open-end mutual funds and 2,874 Separately Managed Accounts (SMAs) based in the United States and denominated in US dollars. In the scope of the review, the company ultimately found that investing in sustainability has usually met, and often exceeded, the performance of comparable traditional investments. This is on both an absolute and a risk-adjusted basis, across asset classes and over time. There is a positive relationship between corporate investment in sustainability and stock price and operational performance, based on a review of existing studies, see Clark, Feiner, and Viehs (2014).

So, according to Brest and Born (2013), when can investors expect both to receive risk-adjusted market-rate returns on their investments and to have real social impact? Can investors both make a difference and make money as claimed by many impact investment funds? Estimating the expected financial return from an investment is a difficult but familiar exercise. One recent study by Morgan Stanley (2010) asserts that most of what it estimates to be a $4 billion impact investing market in the US, as confirmed by Pacific Community Ventures (2015), involves investments producing market rate returns. Non-concessionary investors are not willing to make any financial sacrifice to achieve their social goals. Non-concessionary impact investors are especially likely to have investment impact in conditions of imperfect information—for example, in social or environmental niche markets where impact investment fund managers or other intermediaries have special expertise or intelligence on the ground.

One of the unfortunate characteristics of imperfect impact investing markets is their inability to attract the large majority of socially neutral investors who demand market returns. Where such returns seem plausible, a respected institution can signal to other investors that a particular investment or an entire sector that others may have thought dubious is actually worthy of consideration. According to Strom (2011) "the main reason for investing in EcoTrust Forest in this way is to demonstrate that sustainable forest practices can generate a profit so that mainstream investors will become more interested in it." Motivated

investors may be particularly interested in identifying these opportunities and thus may be able to have impact even at non-concessionary rates. This is the most likely explanation for asserting the double-bottom-line success of firms like Elevar Equity. Elevar Equity generates "outstanding investment returns by delivering essential services to disconnected communities underserved by global networks." The forthcoming analysis of impact investing funds by Clark, Emerson and Thornley (2016) should further illuminate this returns space.

Investors at large may be unjustifiably skeptical that enterprises that are promoted as producing impact value are likely to yield market-rate returns. Impact investing typically does not take place in large capitalization public markets, but rather in domains subject to market frictions. While some of these frictions impose barriers to socially neutral investors, socially motivated impact investors may exploit them to reap both social benefits and market-rate financial returns. The counterfactual argument is that ordinary, socially neutral investors would have provided the same capital in any event. Under the additionality criterion for impact, how can an impact investor expect market returns and still provide capital benefits to the enterprise? What is less clear is how and when investors expecting market returns (or better) have investment impact. Yet much of the impact investment space is occupied by funds that promise their investors both socially valuable outputs and at least market returns. Most so-called "double-bottom-line" impact investors are non-concessionary. El Ghoul, Guedhami, Kwok, and Mishra's (2011) findings support arguments in the literature that impact enhances firm value. Based on a sample of 2,809 U.S. firms over the period 1992 to 2007 impact investments exhibit lower cost of equity capital after controlling for other firm-specific determinants, as well as industry and fixed year effects. Accordingly, impact investment 'substantially contributes to reducing firms' cost of equity which were robust to a battery of sensitivity tests'. Capital is a tool and market rates of return and high impact are expected. A binary focus could be applying 19th century science to a quantum world, where a binary approach causes you to misperceive both risk and opportunity. It may represent a set of outmoded narrow lenses that will cause any investor using them to underperform and not create all the blended value (s)he would have otherwise.

Consider two firms, one firm (firm a) which chooses to borrow in order to make an investment in solar or wind power for factories and other installations. Another firm (firm b) which chooses to make an investment in a new untested product line. While the marketing material and other related information may make the "firm b" look incredibly appealing with a new product on its way. The product may not be successful or may not be received by the market in the way the firm expects, so justifiably the cost of capital for this firm will rise as the risk level of the projects will translate into higher rates of interest or a higher cost of equity. However, "firm a" which has invested in technology to reduce existing costs will see cost improvement across the board directly related to that investment. So "firm b" with its new product may find it harder to meet the debt service on the interest of the nonperforming or riskier product line. Meanwhile, "firm a" will more than likely be able to meet the debt service and improve their financial position through ongoing costs saving. "Firm a" might be considered to have made an impact investment that might not necessarily be attractive to mainstream investors. While "firm b" may be considered to have made exactly the kind of investment expected by those same mainstream investors.

When we consider high impact investing practices that focus on internal efforts of firms to improve their people, products, health and wealth with respect to their firm (Herman, 2010) these firms tend to outperform other firms that are only bottom-line focused. More recently, investment capital flows have shown that these kinds of decisions have become more attractive to mainstream investors as they have identified that these practices lead to higher profit margins and stronger market positions. The group of investors unwilling to see these kinds of improvements as value-added to the bottom line are shrinking daily, Bonini and Schwartz (2014).

Some countries like the UK have gone beyond firm-related impact investments to social bonds and other forms of investable instruments that track performance based on some kind of societal impact. One example is bonds related to recidivism rates of prison inmates. As the recidivism rate drops and the former inmates are able to more effectively integrate back into society the cost of managing those individuals born by the state significantly declined. Thus, the bond pays at higher rates of return to those that had invested in the debt instruments, which ultimately led to programs that help reduce recidivism further.

Perspicacity, or discerning opportunities that ordinary investors do not see, means someone with distinctive knowledge about the risk and potential returns of a particular opportunity may make an investment that others would pass up. These capital benefits enable the enterprise to experiment, scale up, or pursue impact objectives to an extent that it otherwise could not. Perspicacity may hold the key to achieving both market returns and social impact, as evidenced by pioneering firms like Bamboo Finance among many others who are achieving both commercial returns and impact. A report conducted by Deutsche Bank Climate Change Advisors, Fulton et al. (2012), that was based on more than 100 academic studies found impact strategies to be correlated with superior risk-adjusted returns at a securities level. In social or environmental niche markets impact investment fund managers or other intermediaries have special expertise or intelligence on the ground. Assuming that, at the time of an investment, the enterprise can productively absorb more capital, then an investment has impact if it provides more capital, or capital at lower cost, than the enterprise would otherwise obtain.

The enterprise itself has impact only if it produces social outcomes that would not otherwise have occurred. For example, socially neutral investors, motivated only by profit, have contributed to the social impact of telecommunications companies in both the developed and developing world. Socially neutral investors are indifferent to the social consequences of their

investments. Many endowments invest in a socially neutral manner, as do individuals who invest through money managers or funds whose only mandate is to maximize financial returns. These are non-concessionary investments, which expect risk-adjusted market returns or better. Impact investing may be defined capaciously, as actively placing capital in enterprises that generate social or environmental goods, services, or ancillary benefits (such as creating good jobs), with expected financial returns at or above market. By hypothesis, an ordinary market investor, who seeks market-rate returns, would not provide the required capital on as favorable terms. Impact investors can invest on a spectrum ranging from risk-adjusted market returns at one end to highly concessionary investments at the other. Any individual investor may take a range of return positions depending on the investment in question. Having investment impact means capitalizing an enterprise beyond what would happen otherwise. If an enterprise offers risk-adjusted market rate returns, why aren't more ordinary, non-concessionary commercial investors funding it? Understanding the barriers to their doing so may hold the key to scaling up socially valuable enterprises. To reach scale, the impact investing sector needs to be more attractive to the large majority of non-concessionary investors' impact investing as a stage of its developmental process.

On the firm side, making impact investments might initially lead to higher costs of capital which may make it much more difficult for the firm to raise capital needed for other projects. However, they will invariably see a decrease in the cost of capital in the long run. Yet, if it were clearer to investors at the outset that the firms were choosing to make these kinds of internal impact investment, perhaps the cost of capital would not rise at all, but instead would decline consistently with the productive use of such capital internally.

Conclusions

Impact investing is about using markets and money for social good as well as producing market-rate returns. This outperformance may come in the form of reduced risk, reduced volatility, or business growth. "risk-adjusted" market rates of financial return, social and environmental factors are major drivers of investment risk mitigation and success. Investing in companies that are proactively responding to critical social and environmental factors will outperform (investing in) companies that lag behind in addressing these issues.

Internally to the firm, making impact investments may initially lead to higher costs of capital which may make it more difficult for the firm to raise capital for other projects or impact investments. There will be a decrease in the cost of capital over the long run. The decline will come as a direct result of the investment in projects with the highest firm-related impact and the efficiencies gained by making these investments.

In the scope of our review, we ultimately found that investing in sustainability has usually met, and often exceeded, the performance of comparable traditional investments. Evidence within the literature supports this is on both an absolute and a risk-adjusted basis, across asset classes and over time. Ultimately, we believe that sustainable investing is simply a smart way to invest, and our review of sustainable investing performance shows that preconceptions regarding subpar investment performance are out of step with reality as postulated by Fitzgerald (2016). The ideal outcome for most enterprises that initially rely on concessionary capital is that they eventually yield market returns and attract socially neutral investors.

References

Alsford, Jessica, Victoria Chapelow, Richard Felton, Eva Zlotnicka. 2015. 'Embedding sustainability into valuation', Institute for Sustainable Investment, Morgan Stanley.

Barton, Dominic. 2011. 'Capitalism for the long term', *Harvard Business Review*.

Bonini, Sheila, Stephen Schwartz. July 2014. 'Profits with Purpose: How Organizing for Sustainability can benefit the bottom line', McKinsey on Sustainability and Resource Productivity.

Brest, Paul, Kelly Born. Fall 2013. 'When Can Impact Investing Create Real Impact?' *Stanford Social Innovation Review*.

Bugg-Levine, Anthony and Jed Emerson. 2011. *Impact Investing: Transforming How We Make Money While Making a Difference*, Jossey-Bass, San Francisco.

Clark, Cathy, Jed Emerson and Ben Thornley. 2014. 'Success in Impact Investing Through Policy Symbiosis' Huffington Post article http://www.huffingtonpost.com/ben-thornley/success-in-impact-investi_b_4849740.html

Clark, Cathy, Jed Emerson and Ben Thornley. October 13, 2014. *The Impact Investor: Lessons in Leadership and Strategy for Collaborative Capitalism*, Jossey-Bass.

Clark, Gordon, Andreas Feiner and Michael Viehs. 2015. 'From the Stockholder to the Stakeholder: How Sustainability can drive financial performance,' Smith School of Enterprise and University of Oxford and Arabesque Asset Management.

Clark, Gordon, Andreas Feiner, and Michael Viehs. 2014. "How Sustainability Can Drive Financial Outperformance."

Cohen, Ronald, William A. Sahlman. January 17, 2013. 'Social Impact Investing Will Be the New Venture Capital', *Harvard Business Review*.

El Ghoul, Sadok, Omrane Guedhami, Chuck C.Y. Kwok, and Mishra, Dev R. September 2011. 'Does Corporate Social Responsibility Affect the Cost of Capital?' *Journal of Banking and Finance*, Vol. 35, Issue 9, pp. 2388-2406. Available at SSRN: http://ssrn.com/abstract=1546755

Fitzgerald, Patrick. January 2016. 'Sustainable capitalism: there is no trade-off', working paper. http://www.slideshare.net/DanFitzgerald7/sustainable-capitalism-there-is-no-tradeoff-january-13-2016-dan-fitzgerald.

Fulton, Mark, Bruce M. Khan, and Camilla Sharples. 2012. *Sustainable Investing: Establishing Long-Term Value and Performance*, DB Climate Change Advisors, Deutsche Bank Group, www.dbadvisors.com

Herman, Paul R. 2010. *The HIP Investor: Make Bigger Profits by Building a Better World*, John Wiley and Sons.

Khan, Mozzafar, George Serafeim, and Aaron Yoon. March 2015. "Corporate Sustainability: First Evidence on Materiality," Harvard Business School, Working Paper.

Strom, Stephanie. November 24, 2011. "To Advance Their Cause, Foundations Buy Stocks," *The New York Times*.

'Sustainable Reality', Institute for Sustainable Investment, Morgan Stanley, March 2015. http://www.morganstanley.com/ideas/sustainable-investing-performance-potential/.

'The Business Case for Sustainable Investing, Institute for Sustainable Investment, Morgan Stanley, April 2015. http://www.morganstanley.com/ideas/business-case-for-sustainable-investing.

'The New Math of Sustainable Investing', Institute for Sustainable Investment, Morgan Stanley, October 2015. http://www.theatlantic.com/sponsored/morgan-stanley/the-new-math-of-sustainable-investing/506/

http://www.sustainablebrands.com/digital_learning/research_report/stakeholder_trends_insights/sustainable_reality_understanding_perfo

'Investing for Impact: Case Studies Across Asset Classes'. 2010. Bridges Ventures, The Parthenon Group and Global Impact Investing Network, p.3.

'Impact Investments: An Emerging Asset Class'. 2010. JP Morgan, The Rockefeller Foundation and the Global Impact Investment Network (GIIN).

Woelfel, Tom, Ben Thornley, and Beth Sirull. July 2012, *Market for social impact investing by private equity funds stands at $4 billion in the United States*. http://www.pacificcommunityventures.org/reports-and-publications/marketfor-social-impact-investing-by-private-equity-funds-stands-at-4-billion-in-theunited-states/

Does Fiat-to-Bitcoin Exchange Activity Lead to Increased User-to-User Bitcoin Transaction Activity?

David C. Vitt, Farmingdale State College

Abstract

I exploit the ``perfect ledger'' feature of Bitcoin to find the degree to which Bitcoin-to-fiat exchange activity is associated with increased user-to-user transactions on the Bitcoin network with two distinct but complementary methodologies. First, I use an instrumental variable strategy to estimate the elasticity of user-to-user Bitcoin transaction activity with respect to fiat-to-Bitcoin exchange activity. Secondly, I use vector autoregression to determine the dynamic effects of fiat-to-Bitcoin exchange innovations in user-to-user Bitcoin transactions. In both approaches I find strong evidence of speculative hoarding of Bitcoin via the weak transmission of fiat-to-Bitcoin exchange activity to user-to-user Bitcoin network transactions.

Introduction

Bitcoin, a relatively new digital ``currency'', revealed to the world in (Nakamoto 2008), has attracted attention as much for its violent volatility as it has for the innovative features it brings to the table. It has proponents that praise the system as a cash alternative and a cure-all for people who view financial systems with contempt. Many critics of the system claim that Bitcoin's popped bubbles of the past were driven by speculative demand, and that this same speculation drives variation in the price today.

Bitcoin's most economically interesting feature is its "perfect ledger" which allows for investigations into speculative demand in a more straightforward manner than currencies without such a ledger. The perfect ledger is a record of all user-to-user Bitcoin transactions to have occurred from the beginning of Bitcoin until a few minutes before the ledger is requested. Ownership of a Bitcoin is demonstrated by proof of rightful acquisition through this perfect ledger. Given this feature, it's possible to see whether increases in activity at exchanges that convert fiat to Bitcoin correspond to increases in Bitcoin transactions between Bitcoin users. A strong relationship between exchange activity and user-to-user transaction activity would be a signal of a strong transaction demand for Bitcoin, a signal of health for this system. Alternatively, a weak relationship between exchange activity and user-to-user transaction activity would suggest a strong speculative demand. If people are buying and not using the currency in transactions, then presumably the buying strategy was with the expectation to hold and sell at a higher price. In this paper, I develop empirical tests of this strength between exchange volume and transaction volume.

The remaining sections of this paper go as follows. I briefly review the literature that explores Bitcoin and describe my contribution in light of what has been accomplished. Then I review the data and the empirical strategy to test the relationship of interest. I present my results and discuss the conclusions that can be drawn, followed by concluding remarks.

Related Literature

As an entrant in the digital asset space, Bitcoin's history of rigorous empirical research is relatively short. I will briefly review what has been accomplished so far in order to introduce my contribution to the empirical literature on Bitcoin.

Regarding the validity of Bitcoin as an investment as opposed to a speculative vehicle, (Baek & Elbeck, 2014) make a comparison of Bitcoin's volatility to the volatility of the stock market. They find that the volatility of Bitcoin's detrended ratio (DR), as measured by the standard deviation (SD) of the DR, is 26 times more volatile than the SD of the S&P 500's DR. To identify determinants of Bitcoin's monthly returns, the authors use a regression to find that returns are driven internally driven primarily by buyers and sellers as opposed to being influenced by fundamental economic factors. The evidence for returns being driven by internal factors is also supported by the new literature on speculative bubbles in Bitcoin as in (Cheah & Fry, 2015) and (Fry & Cheah, 2016).

(Urquhart, 2016) conduct the first formal tests of the efficiency of Bitcoin ala (Fama, 1970). They find evidence that the Bitcoin market is not weakly efficient over a similar sample period to the one I will use. This inefficiency in the Bitcoin market can be trouble when considering that it implies that the Bitcoin exchange rate, at any moment in time, does not reflect the best possible valuation of Bitcoin as an investment vehicle, perhaps too heavily discounting future risks or rewards. The lack of weak efficiency in the Bitcoin market also suggests that technical analysis or swing trading may yield positive profits in expectation. (Zhang, 2010) find that the volatility of markets for individual stocks are exacerbated by the presence of traders executing strategies based on swings. For Bitcoin to gain the esteem of investors and make strides towards an efficient market, it needs to transition away from the volatility that has earned it a reputation.

My contribution to the empirical literature rests on these preliminary investigations. I introduce an innovation by proposing a fundamental on which to assess the value of Bitcoin: the relationship between fiat-to-Bitcoin exchange activity and user-to-user Bitcoin transaction activity. If the rising dollar price of Bitcoin stems from an increase in transaction demand for Bitcoin, and not from speculative demand, then changes in fiat-to-Bitcoin exchange volume should be strongly correlated with changes in user-to-user Bitcoin transaction volume. Alternatively, if the rising dollar price of Bitcoin stems from an increase in speculative demand, then variation in exchange volume will not be a significant determinant of user-to-user transaction activity. That is, Bitcoin users would be buying and holding with expectation to reverse the position in the future, as opposed to using the recently purchased Bitcoin in a transaction for goods or services, and therefore exchange activity would never induce transaction activity. I bring these alternative hypotheses to the data in order to determine the importance of transaction demand relative to speculative demand for this new digital asset.

Data

Daily data on the total user-to-user Bitcoin network transaction volume, the total fiat-to-Bitcoin exchange volume, and the volume weighted average dollar price of Bitcoin were collected from www.blockchain.info via the API on www.quandl.com. The time frame of interest, constrained by data availability on exchange activity is from 08/17/2010 to 1/26/2017. For clarity, when I refer to transaction volume, I am referring to the dollar market value of the Bitcoins that are exchanged between various wallets on the Bitcoin network. This measure represents the market value of transaction activity between users, between users and firms, as well as firm to firm transaction activity, all of which I describe as user-to-user Bitcoin transaction volume or transaction activity. When I refer to exchange activity, I am referencing the dollar market value of fiat-to-Bitcoin transactions on the major exchanges tracked by www.blockchain.info.

Methods

First, to get a sense of the relationship between fiat-to-Bitcoin exchange activity and user-to-user Bitcoin transaction activity, I consider a naive empirical strategy without instruments and without regard for the potential non-stationarity of each series.

$$\ln(transaction\ volume_t) = \theta_0 + \sum_{n=0}^{p} \beta_n \ln(exchange\ volume_{t-n}) + g * \mathrm{t} + \varepsilon_t \quad (1)$$

In equation (1), *Transaction Volume* is the market value of user-to-user Bitcoin transactions for each day, deflated by the exchange volume weighted average dollar price of Bitcoin for each day. The purpose of this deflation transformation is to attribute the temporal variation of the series to variation in the use of Bitcoin for transactions. It strips out the confounding effect of variation in the dollar price of Bitcoin. *Exchange Volume*, the independent variable of interest, enters as distributed lag of order p. This covariate is the daily market value of fiat-to-Bitcoin transaction activity at the major Bitcoin exchanges tracked by Blockchain.info during the sample period. This variable is also deflated by the volume weighted average dollar price of Bitcoin for the same concerns regarding adjusting nominal variables to reflect real economic fundamentals. Included in specification (1) is a linear trend with coefficient g to capture the influence of unobserved determinants of user-to-user Bitcoin transaction activity that correlate with the passage of time. A residual error term is included to represent the influence of unobserved determinants of transaction volume.

There are many possible sources of endogeneity in a naïve specification like (1). As an example, consider an idea like the law of one price (LOP) in the digital realm: in the presence of arbitrage the price of goods denominated in Bitcoin would be the same as identical goods denominated in dollars, once the exchange rate between dollars and Bitcoin is accounted for. Should LOP fail to hold, then price differences between otherwise identical dollar denominated goods and Bitcoin denominated goods would provide incentive for arbitrageurs and expenditure minimizing consumers to be active in Bitcoin. This would make price differences a confounding variable in specification (1), as the arbitrage opportunities implied by the differences would have a causal relationship with both exchange volume as well as transaction volume. It is for omitted variable concerns like this that an instrumental variables approach is necessary in order to provide more credibility about the point estimates.

In light of this threat to identification, I propose an instrument that has recently been introduced to the finance literature. Google, through the product Google Trends, reports a time series index of the search volume for specific keywords. The index itself is reported as the total query volume for the search phrase in question as a fraction of the total number of search queries. Google then normalizes the maximum query share to 100. (Choi & Varian, 2012) show the utility of this data source for predictive purposes like forecasting sales at motor vehicle and parts dealers, unemployment claims, and tourism draw. Relating

to use in financial time series, (Da, Engelberg, & Gao, 2011) use Google Trends data as a measurement of investor attention and find evidence that increases in the search volume index for stock tickers correlate highly with increases in stock prices and eventual reversals of the high prices.(Vitt, Mcquoid, Moore, & Sawyer, 2017) use searches for phrases like "gun ban" as predictive instruments for gun sales. Likewise, this investigation is not the first to use Google Trends as an instrumental variable.

Given the concerns regarding omitted variables determining both exchange volume and transaction volume, I adopt an instrumental variables strategy. I instrument for variation in fiat-to-Bitcoin exchange volume with variation in the Google search volume index for the phrase "how to get Bitcoin". To isolate this exogenous variation in exchange volume, my first stage specification is as follows:

$$\ln(exchange\ Volume_t) = \pi_0 + \pi_1 \ln(Bitcoin\ search\ intensity_t) + \pi_2 * \mathrm{t} + \varepsilon_t \quad (2)$$

My identification strategy relies on the idea that Google searches for the phrase "how to get Bitcoin" reflect the interest of those unfamiliar with the way Bitcoin works. Much like the previous literature on the utility of Google Trends for predictive power, I should find statistical evidence for the relevance of the Google. Regarding instrument excludability, I assume that all the incumbent users of the Bitcoin system are familiar enough with the way Bitcoin works that they need not search Google for "how to get Bitcoin". Rather, I assume they would enter keywords specific to problems or interests they may have, for instance "length of time for Bitcoin transaction confirmation" or "Satoshi Dice addresses" (gambling related). With this assumption in mind, I argue that search intensity for the keyword Bitcoin would represent the flow of entering participants, and that these searches would only impact user-to-user transaction volume through their effect on fiat-to-exchange transaction volume. Given this, my preferred second stage specification is as follows:

$$\ln(transaction\ volume_t) = \theta_0 + \sum_{n=0}^{p} \beta_n \ln(\widehat{exchange\ volume_{t-n}}) + \theta_1 * \mathrm{t} + \varepsilon_t \quad (3)$$

My instrumental variables strategy uses (2) for a first stage in order to estimate (3). The only difference between (1) and (3) is that (1) will represent the naïve approach, while (3) uses the plausibly exogenous variation in exchange activity isolated in (2) as an independent variable.

Finally, for a robustness check to complement the instrumental variables approach, I estimate a vector autoregressive process to examine the relationship between transaction volume and exchange volume. In doing so, I let the time path of *transaction volume* to be affected by current and past realizations of *exchange volume*, while also allowing for *exchange volume* to be influenced by current and past values of *transaction volume*. In this robustness check, I make no arguments regarding exogeneity. Drawing on the arguments made in (Sims, 1980) and (Sims, Stock, & Watson, 1990) regarding vector autoregressive processes, the purpose of this model is not for unbiased point estimates. Rather, I estimate this process to determine the dynamic interrelationship between *exchange activity* and *transaction activity*. For this purpose, my preferred VAR specification is:

$$x_t = A_0 + \sum_{i=1}^{p} A_i x_{t-i} + \epsilon_t \quad (4)$$

In the vector autoregression specification in (4) above, x_t is the (2×1) vector $(\ln(transaction\ volume_t), \ln(exchange\ volume_t))^T$, A_0 is a (2×1) vector of intercept terms, A_i is a (2×2) matrix of coefficients and ϵ_t is a (2×1) vector of error terms. The lag order, represented by p, will be chosen by comparing BIC values across models and selecting the model with the lowest value.

Results

To select the optimal lag order p in specification (1), I compared the AIC from various specifications of (1) with p varying from 0-7. The lowest AIC model, which appears in column 2 of Table 1, suggests that the inclusion of lagged values of fiat-to-Bitcoin exchange volume does not sufficiently increase the quality of the model. As such, I first examine the naïve specification in (1) with p =0. In all specifications, I use the Newey-West heteroscedasticity and autocorrelation consistent estimator for standard errors.

From the first column of Table 1, I find that nearly 30% of the variation in the user-to-user Bitcoin transaction volume is explained by the unobserved forces captured by the trend term. In column 2, I note that the elasticity of user-to-user transaction volume with respect to contemporaneous fiat-to-Bitcoin exchange volume is statistically significant and positive, but not very large. Interpreting the elasticity estimate goes as follows: for a 10% increase in the fiat-to-Bitcoin *exchange volume*, user-to-user Bitcoin *transaction volume* increases only 3.6%. In column 4 I include the lag of exchange volume in addition to the contemporaneous value of exchange volume. Notice that the cumulative long run effect of *exchange volume* on *transaction volume*, represented by $\hat{\beta}_0 + \hat{\beta}_1$, is highly similar to the marginal effect of exchange volume in column 2.

Table 1: OLS regression of user-to-user Bitcoin transaction volume on fiat-to-Bitcoin exchange volume

	(1)	(2)	(3)	(4)
	ln(transaction volume$_t$)	ln(transaction volume$_t$)	ln(transaction volume$_t$)	ln(transaction volume$_t$)
ln(exchange volume$_t$)		0.363***	0.368***	0.282***
		(0.0109)	(0.0108)	(0.0185)
ln(exchange volume$_{t-1}$)				0.110***
				(0.0194)
ln(bitcoin price$_t$)			0.0626***	0.0643***
R	0.302	0.537	0.545	0.553
AIC	4731.6	3767.4	3726.1	3783.2
Std. Error	HAC Consistent	HAC Consistent	HAC Consistent	HAC Consistent
Trend	Linear	Linear	Linear	Linear
Observations	2355	2355	2355	2354

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses, all models estimated with constant term and trend omitted from the table. Transaction and exchange volume are both normalized by the daily Bitcoin dollar price prior to estimation.

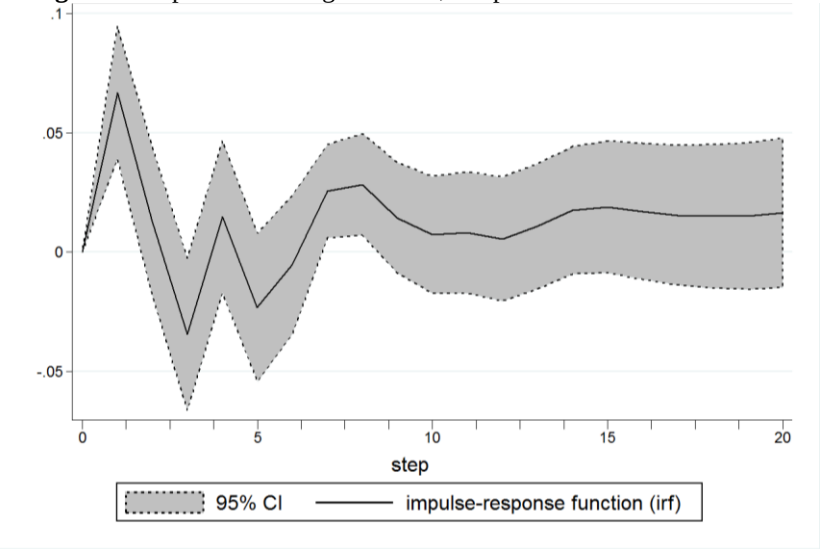
Table 2 presents the point estimates from the instrumental variable approach of estimating the system in (2) and (3). A model selection procedure based on AIC comparisons found that, against alternatives ranging from lag order 0-7, exchange volume entering only contemporaneously provided the highest quality model. Note that in each column, the first stage F statistic is higher than 10, suggesting that my point estimates are likely not biased by weak instruments. Of the candidate models presented in Table 2, the parsimonious model described in column 1 is the ideal model according to AIC evaluation. The elasticity estimate in this model suggests that for a 10\% increase in fiat-to-Bitcoin *exchange volume*, *transaction volume* increases by approximately 4%. This estimate is of similar magnitude to the OLS approach presented in (1) with corresponding point estimates in Table 1. Common across the results of these estimation strategies is the weak transmission of fiat-to-Bitcoin exchange activity to subsequent use user-to-user transaction activity.

Table 2: IV regression of user-to-user Bitcoin transaction volume on fiat-to-Bitcoin exchange volume

	(1)	(2)	(3)	(4)
	ln(transaction volume)	ln(transaction volume)	ln(transaction volume)	ln(transaction volume)
ln(exchange volume)	0.409**	0.361*	0.581***	0.579***
	(0.152)	(0.145)	(0.0363)	(0.0362)
ln(bitcoin price)			0.0172	0.0224
			(0.0187)	(0.0184)
R^2	0.412	0.425	0.265	0.266
AIC	3143.9	3092.0	3631.9	3628.7
Stage 1 F statistic	12.51	13.67	269.1	270.3
Std. Error	HAC Consistent	HAC Consistent	HAC Consistent	HAC Consistent
Trend	Linear	Linear	Linear	Quadratic
Instruments	Bitcoin Search Volume Index	Bitcoin Search Volume Index	Bitcoin Search Volume Index	Bitcoin Search Volume Index
Observations	2187	2187	2187	2187

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in parentheses, all models estimated with constant and trend omitted from the table. Instrumental variables are explained fully in the methods section. Transaction and exchange volume are both normalized by the daily Bitcoin dollar price prior to estimation.

Figure 1: Impulse: Exchange Volume, Response: Transaction Volume



In addressing the vector autoregression in (4), first I find that the optimal lag length based on minimizing BIC is $p = 7$ lags to include in the specification. Neither *transaction volume* nor *exchange volume* need be stationary, though I find evidence of stationarity both through a Dickey-Fuller test (p<0.000) as well as through a Philips-Perron test (p<0.000). Point estimates of the A_i are not central to the analysis, so they will appear in a web appendix. Figure 1 shows an impulse response function after estimation of (4). This function shows the dynamic response of user-to-user transaction volume to an innovation in fiat-to-Bitcoin exchange volume. An innovation refers to a shock to exchange volume not explained by previous values of transaction volume or exchange volume. Since the present value of each covariate depends on past values, the innovation to fiat-to-Bitcoin exchange volume has effects on user-to-user transaction activity that can be longer lasting than those in the instrumental variables specification of (3).

To understand the impulse-response in Figure 1, consider that at period 0 a unit shock to $\ln(transaction\ volume_t)$ occurs. In period 1, we see that this has an impact on $\ln(transaction\ volume_t)$, which rises by approximately 0.06. Notice the grey area in Figure 1 at period 1 represents the uncertainy regarding this point estimate. Zero is excluded from this conference interval, which suggests there is a significant but very small response. Since both covariates are in logarithms, this is a dynamic elasticity estimate, suggesting that the elasticity of user-to-user Bitcoin transaction volume with respect to exchange volume innovations is very small in this first period. In period 2 of the impulse response, the dynamic elasticity has a point estimate extremely close to zero, with the confidence interval suggesting that the elasticity could be either positive or negative. Statistical insignificance persists until period 7 and 8, when the elasticity is positive but extremely close to zero, and then returns to insignificance.

Conclusion

This study adds to the growing empirical literature on new and volatile digital assets like Bitcoin. Previous literature has focused on either quantifying the informational efficiency of Bitcoin, or on quantifying the volatility of Bitcoin relative to the stock market. My key contribution to this literature is to use Bitcoin's most innovative feature, a perfect ledger of transaction activity, in order understand whether there is a relationship between people buying into Bitcoin and transactions on the Bitcoin network.

To accomplish this task, I tested the hypothesis that transaction demand for Bitcoin will appear in the form of a strong relationship between fiat-to-Bitcoin exchange activity and user-to-user transaction activity. If users have the objective of using Bitcoin for consumption motives like expenditure minimization, as opposed to speculating on the market, then there should be strong evidence of fiat-to-Bitcoin exchange activity leading to transaction activity.

I used an instrumental variable strategy to measure the strength of this relationship and found it was weak. For a 10% increase in exchange volume, I find that transaction activity increases by only 3.6-4.0%. To supplement this instrumental variable approach, I estimated a vector autoregression to examine the interrelationship between exchange activity and

transaction activity. The conclusions that can be drawn from the VAR estimates were largely in agreement with the conclusions from the IV estimates: transmission of exchange activity to transaction activity is extremely weak.

These two methodologies are complementary and yield similar conclusions: there is not strong evidence that fiat-to-Bitcoin exchange activity corresponds to demand for transactions on the Bitcoin network. This lack of evidence for transaction demand suggests that speculative demand could largely be driving the activity at fiat-to-Bitcoin exchanges. Further attention to this speculative demand is warranted if the system is to live up to the high expectations held by its proponents.

References

Baek, C., & Elbeck, M. (2014). Bitcoins as an investment or speculative vehicle? A first look. *Applied Economics Letters*, *0*(0), 1–5. https://doi.org/10.1080/13504851.2014.916379

Cheah, E. T., & Fry, J. (2015). Speculative bubbles in Bitcoin markets? An empirical investigation into the fundamental value of Bitcoin. *Economics Letters*, *130*, 32–36. https://doi.org/10.1016/j.econlet.2015.02.029

Choi, H., & Varian, H. (2012). Predicting the Present with Google Trends. *Economic Record*, *88*(SUPPL.1), 2–9. https://doi.org/10.1111/j.1475-4932.2012.00809.x

Da, Z., Engelberg, J., & Gao, P. (2011). In Search of Attention. *The Journal of Finance*, *66*(5), 1461–1499.

Fama, E. F. (1970). Efficient Capital Markets : A Review of Theory and Empirical Work. *The Journal of Finance*, *25*(2), 28–30.

Fry, J., & Cheah, E. T. (2016). Negative bubbles and shocks in cryptocurrency markets. *International Review of Financial Analysis*, *47*, 343–352. https://doi.org/10.1016/j.irfa.2016.02.008

Sims, C. A. (1980). Macroeconomics and Reality. *Econometrica*. https://doi.org/10.2307/1912017

Sims, C. A., Stock, J. H., & Watson, M. W. (1990). Inference in Linear Time Series Models with some Unit Roots. *Econometrica*, *58*(1), 113–144.

Urquhart, A. (2016). The Inefficiency of Bitcoin. *Economics Letters*, *148*, 80–82. https://doi.org/10.1016/j.econlet.2016.09.019

Vitt, D. C., Mcquoid, A. F., Moore, C., & Sawyer, S. (2017). Trigger Warning : The Causal Impact of Gun Ownership on Suicide.

Zhang, X. F. (2010). The Effect of High-Frequency Trading on Stock Volatility and Price Discovery The Effect of High-Frequency Trading on Stock Volatility and Price Discovery. *MIT Sloan Working Paper*. Retrieved from http://mitsloan.mit.edu/groups/template/pdf/Zhang.pdf

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UNIVERSITY *of* NORTH CAROLINA WILMINGTON

DEPARTMENT *of* ECONOMICS AND FINANCE

601 South College Road
Wilmington, NC 28403-5945